WILEY

Patient Assessment

SAMPLER

Including:

"Examination of the Male Genitalia"
Physical Assessment for Nurses and Healthcare Professionals, 3rd Edition
Carol Lynn Cox

"Clinical Assessment of the Orthopaedic and Trauma Patient"
Orthopaedic and Trauma Nursing: An Evidence-based Approach to Musculoskeletal Care, 2nd Edition
Edited by Sonya Clarke and Mary Drozd

"Patient Assessment"
Acute Care for Nurses
Claire Boyd

"History taking and the newborn examination: an evolving perspective"
Examination of the Newborn: An Evidence-based Guide, 3rd Edition
Edited by Anne Lomax

"Assessing the female reproductive system"
Fundamentals of Assessment and Care Planning for Nurses
Edited by Ian Peate

"Cardiovascular Assessment"
Cardiac Care: A Practical Guide for Nurses, 2nd Edition
Edited by Angela M. Kucia and Ian D. Jones

Chapter 7

Examination of the Male Genitalia

Michael Babcock, Carol Lynn Cox, and Anthony McGrath

Introduction

Research indicates that patients may become embarrassed when discussing their genitals so it is important to try to put them at ease (Collins-Bride and Saxe 2013; Dains et al. 2012, 2015). It is essential that the sexual history and examination should be undertaken in a sensitive manner. Reassure the patient that the information shared will remain confidential. This will help encourage the patient to be more open and honest with you. The questions asked may be perceived by the patient as intrusive. The patient may feel that your questioning has no bearing on the symptoms or problem that they have. Take time and give clear explanations as to why you are asking certain questions. If you use careful questioning and tact, patients are more likely to provide you with answers that will assist in reaching a diagnosis. It is useful to begin by stating something like 'I am now going to ask you some questions about your sexual health and practices'. Try to determine the patient's risk of acquiring a sexually transmitted infection (STI). Depending on the problem you may wish to begin by asking general questions about sexual function, sexual history, duration of their relationships, and timing of their last sexual encounter. Ask whether it with a regular or casual partner, the contraceptive methods used, the number of sexual partners that they have had, and their sexual orientation. Ask about having sex with men and women or both. Ask if their partner has any symptoms. You can then ask about any previous STIs and any previous treatments that they may have had. If he previously had an STI, ask the patient about the symptoms he had. Ask about any previous sexual health check-ups. Ask about the use of injected drugs. Ask if the patient has had any vaccinations against hepatitis A or B. Ask if they have been tested for HIV, hepatitis, or syphilis (Ball et al. 2014a, b; Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Rhoads and Paterson 2013). See Figure 7.1 for a depiction of the male reproductive system.

Physical Assessment for Nurses and Healthcare Professionals, Third Edition. Edited by Carol Lynn Cox.

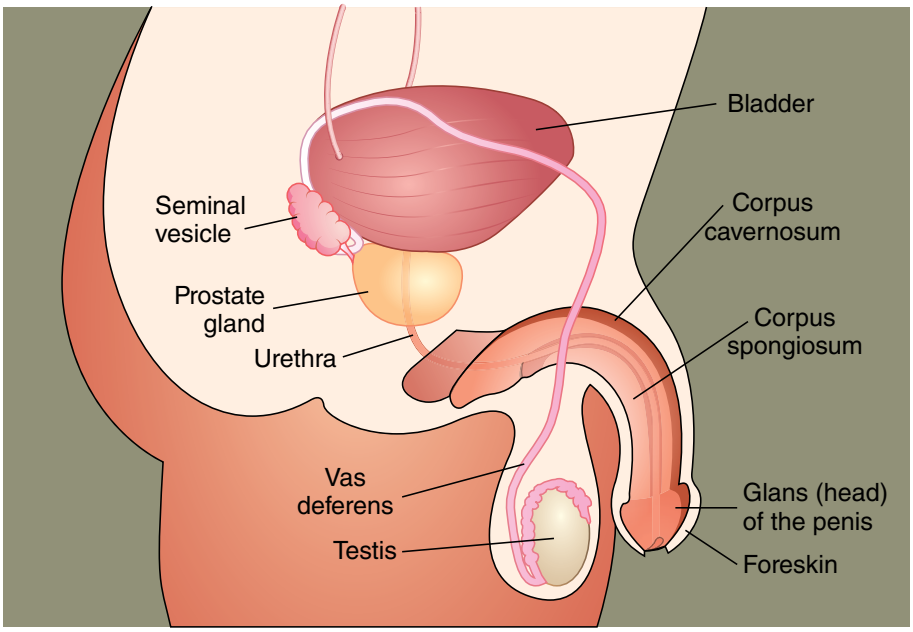


Figure 7.1 The male reproductive system.

General Examination

Important Symptoms to Consider

- urethral discharge
- warts
- ulceration
- testicular pain
- swelling
- ulceration
- rashes
- inflammation
- frequency and urgency
- hesitancy
- haematuria
- nocturia
- impotence
- loss of sexual desire
- infertility
- incontinence
- oliguria
- dysuria (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Seidel et al. 2010, Swartz 2014; Talley and O'Connor 2014)

Erectile Function

If the presenting problem is erectile dysfunction (ED) ask the following questions:

- Are you suffering from stress – in work or relationships?
- Are you afraid that sexual intercourse may cause cardiac problems?
- Do you drink alcohol? How much? How often?

- What medications do you take? Over the counter? Prescription and/or illicit drugs?
- Do you smoke? How much (number of cigarettes/packs per day)? How often? (Smoking, like alcohol, is a risk factor for ED.)

Note the distribution and amount of body hair, note size of testes as testosterone levels may be reduced.

Possible Sexually Transmitted Infection

- To assess the possibility of an STI ask questions about any discharge or dripping from the penis.
- If the patient has a penile discharge try to ascertain the amount, colour, and consistency.
- Ask if they have any other symptoms such as a temperature, rash, or pain.
- Tell the patient that STI's can affect any opening that comes into contact with sexual organs.
- Ask the patient about oral sex and anal sex and if he answers yes ask about the presence of sore throats, rectal bleeding, pain, itching, or diarrhoea.
- Ask about the presence of any sores, warts, swelling on the penis, or swelling in the scrotum/testicles.
- Ask if the patient has any concerns about HIV infection (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Tallia and Scherger 2013).

Examination of the Male Genitalia

The patient may lie down or you can ask him to stand whilst you carry out your inspection. Ask in a sensitive way before you proceed, e.g. 'I need to briefly examine you down below. Is that all right?' Then begin your examination by inspecting the penis and groin area. Some examiners recommend that the patient hold his penis during inspection rather than the examiner holding it.

Inspection

- Note the size, colour, shape, and the presence or absence of a prepuce (foreskin). The size of the penis is usually dependent on the patient's age and overall development.
- Note any abnormal curvatures.
- Examine penis – retract the prepuce (foreskin) to expose glans – it may be useful to get the patient to do this for you. Note the presence of any chancres, ulceration, or erythema and the presence of smegma, which is a cheesy white substance that accumulates normally under the foreskin.
- Examine and inspect the glans; look for the presence of warts, ulcers, nodules, or the signs of any inflammation. Examine the external urethral meatus. If you are a female examiner, ask the patient to squeeze it open gently in an anterior–posterior direction to open the external urethral meatus to inspect for discharge (normally you will find none). If you are a male examiner you will find it easier to do this yourself unless the patient expresses concerns regarding you doing this.
- Balanitis (inflamed glans of penis) should remind the examiner to check for diabetes.
- If any discharge is noted, take a swab and send it for microbiology examination.
- Inspect the skin around the groin for any excoriation or inflammation. Note the presence of any nits or lice – these can usually be found at the base of the pubic hairs.
- Lift up the scrotum to inspect the posterior surface.
- Note any obvious hernia.

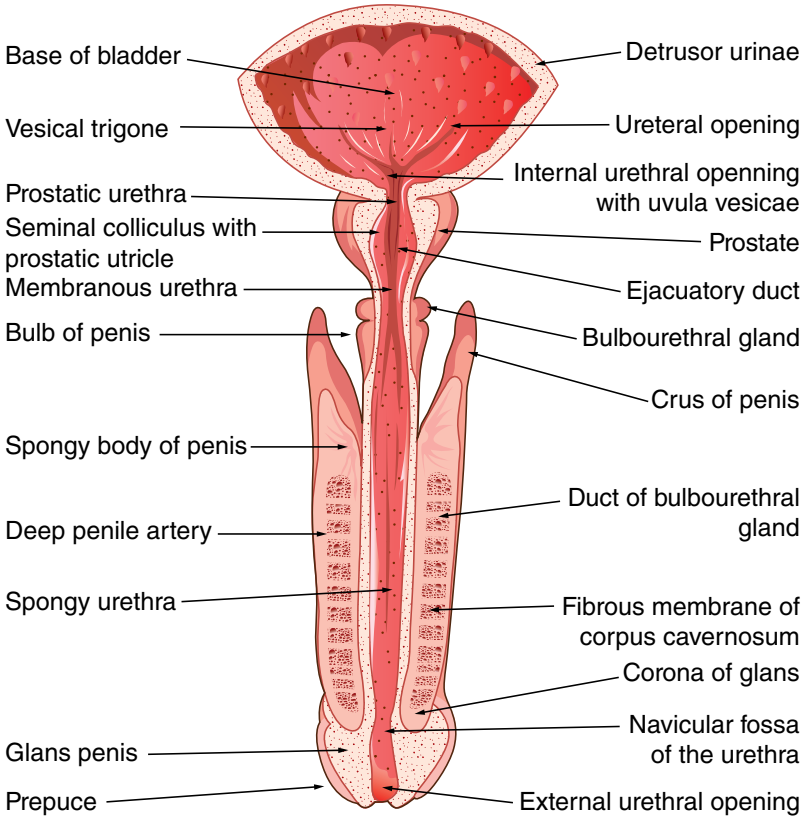


Figure 7.2 Longitudinal section of the penis and its relationship to the bladder and urethra.

- Examine scrotal swellings – Transilluminate to discern the presence of fluid.
- A poorly developed scrotum on one or both sides may suggest cryptorchidism (Cox 2010; Swartz 2014; Talley and O'Connor 2014).

See Figure 7.2.

Abnormalities of the Penis

- Priapism (persistent, usually painful, erection of the penis)
- Hypospadias or epispadias (birth defects where the urethra and urethral groove are malformed)
- Phimosis (tight prepuce that cannot be retracted over the glans). Note that this is normal in babies
- Paraphimosis (a tight prepuce that once retracted cannot be returned and oedema may occur) is common following the insertion of a catheter and the healthcare professional does not return the prepuce over the glans (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Rundio 2017; Seidel et al. 2010; Swartz 2014; Talley and O'Connor 2014).

Abnormalities of the Scrotum

- Cryptorchidism (undescended testis)
- Inguinal hernia
- Cystic swelling
- Varicocele (Occurs in about 8% of male population. It will feel like a bag of worms). Occurs because of varicosity of the veins of the pampiniform plexus.

- Epididymal cyst
- Hydrocele
- Scrotal swelling (common scrotal swellings include inguinal hernias, scrotal oedema, and hydroceles). Tender painful swellings may indicate acute orchitis, acute epididymitis, and torsion of the spermatic cord. Swelling in the scrotum can be evaluated by transillumination (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Rundio 2017; Seidel et al. 2010; Swartz 2014; Talley and O'Connor 2014).

Look for Signs of Syphilis – Primary, Secondary, and Tertiary

- Chancre (painless hard ulcer) seen in primary syphilis
- Skin rash, with brown sores about the size of a penny, the rash may cover the whole body or appear only in a few areas. It is almost always on the palms of the hands and soles of the feet and may be seen in secondary syphilis.
- Mild pyrexia, fatigue, headache, sore throat, patchy hair loss, and swollen lymph glands throughout the body. These symptoms may be very mild and, like the chancre of primary syphilis, will disappear without treatment.
- In tertiary syphilis, the brain, nervous system, heart, eyes, bones, joints can be affected. This stage can last for years and may result in mental illness, blindness, other neurological problems, heart disease, and death (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Seidel et al. 2010; Swartz 2014; Talley and O'Connor 2014).

Look for Signs of Gonorrhoea

- painful urination
- yellowish urethral discharge
- painful discharge of bloody pus from the rectum (Rectal gonorrhoea)
- throat infection can occur as a result of oral sex with infected partner

(Note that disseminated gonorrhoea can cause purulent arthritis – often of the knee joint.)

Look for Signs of Herpes

- Painful blisters or bumps in the genital or rectal area that crust over, form a scab, and heal.
- Patient complains of itching, burning, or tingling sensation in the genitals.
- Inguinal lymphadenopathy (swollen, tender lymph nodes).
- Headache.
- Muscle ache.
- Pyrexia.
- Penis discharge.
- Infection of the urethra causing a burning sensation.
- During urination (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Rundio 2017; Seidel et al. 2010; Swartz 2014; Talley and O'Connor 2014).

Look for Signs of HPV Infection

- Genital warts (condylomata acuminata) usually appear as small bumps or groups of bumps. They can be raised or flat, single or multiple, small or large, and sometimes cauliflower shaped.

Look for Signs of Chlamydia

- no symptoms in 70–80% of cases
- lower abdominal pain and burning pain during urination
- mucopurulent discharge from the penis
- tenderness or pain in the testicles
- burning and itching around the meatus
- rectal pain, discharge, or bleeding in patients who engage in anal sex

Palpation

Groin

- The spermatic cord, lymph nodes, and arteries occupy the groin.
- Swellings here are usually caused by hernias or enlarged lymph nodes.
- Palpate the groin to detect enlarged lymph nodes.
- Most people have small, shotty nodes. Most enlarged tender nodes arise from infection in the legs or feet. However, in some Afro-Caribbean men this is normal.
- If large nodes, palpate spleen carefully (*reticulosis* or *leukaemia*) (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Rundio 2017; Seidel et al. 2010; Swartz 2014; Talley and O'Connor 2014).

Hernia

When checking for the presence of hernia examine the patient standing and ask him to cough – enlargement of a groin swelling suggests a hernia (Figure 7.3).

- indirect (oblique) inguinal hernia: swelling reduced to internal inguinal ring by pressure on contents of hernial sac and then controlled by pressure over the internal ring when patient asked to cough; if your hand is then removed, impulse passes medially towards external ring and is palpable above the pubic tubercle
- direct inguinal hernia: impulse in a forward direction mainly above groin crease medial to femoral artery and swelling not controlled by pressure over internal ring
- femoral hernia: swelling fills out the groin crease medial to the femoral artery (Bickley and Szilagyi 2013; Dains et al. 2012, 2015; Japp and Robertson 2013; Jarvis 2015; Rundio 2017; Seidel et al. 2010; Swartz 2014; Talley and O'Connor 2014).

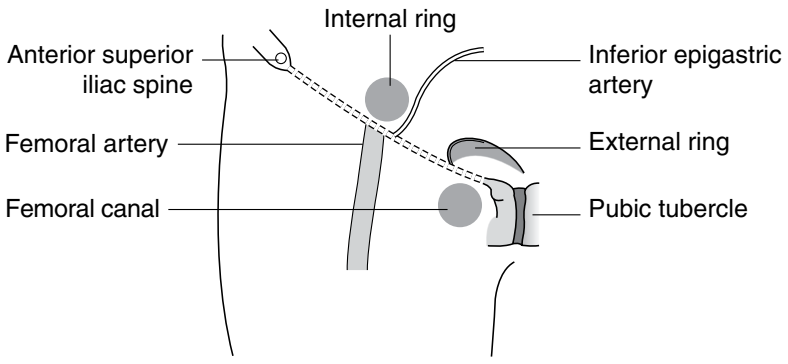


Figure 7.3 Checking for hernia.

Penis

Palpate the whole length of the penis to the perineum, and note the state of the dorsal vein. Note any hardened or tender areas. Hardness may indicate a urethral stricture or cancer whereas tenderness may indicate an infection.

Scrotum

- Ask 'Is your scrotum painful anywhere? Tell me if I hurt you'.
- Warm your hands, and remember to use gentle pressure.
- Palpate the scrotum for the testes and epididymis.
- Palpate each testes and epididymis with your thumb and 1st two fingers.
- Observe the patients face.
- *Note the size, shape, and consistency of each testis. Note any tenderness*.
- Tender and enlarged testes may occur with *orchitis* or *torsion of the testis. Multiple torturous veins may indicate a varicocele*.
- A large, soft swelling which transilluminates suggests *hydrocele* or an *epididymal cyst*. A hydrocele surrounds the testis; an epididymal cyst lies behind the testis.
- A large, hard, painless testis suggests testicular cancer, a potentially curable cancer with a peak incidence between the ages of 15 and 35 years.

Prostate Gland

Lay the patient on the left side with knees flexed to the chest or if he can, ask the patient to bend over the examination table.

Inspect anus for lumps, haemorrhoids, fissures, ulcers, inflammation, excoriation, and warts.

Explain to the patient that you will need to place your finger into his rectum to examine the prostate. This procedure may be uncomfortable but should not be painful. Say: 'I am going to put a finger into your back passage'.

With lubricant on glove, press your fingertip against the anal verge then gently slip forefinger into anal canal and then into the rectum. Inform the patient that he may feel the urge to pass urine but he will not. It helps to have the patient push whilst you insert your finger. Palpate the prostate gland on the anterior rectal wall. Check the size and character of the prostate. It should feel smooth and rubbery and be approximately the size of a walnut. Note any nodules or tenderness. A swollen tender prostate may indicate acute prostatitis whereas an enlarged smooth but firm prostate may indicate benign prostatic hypertrophy. Hard roughened areas are suggestive of cancer (Figure 7.4).

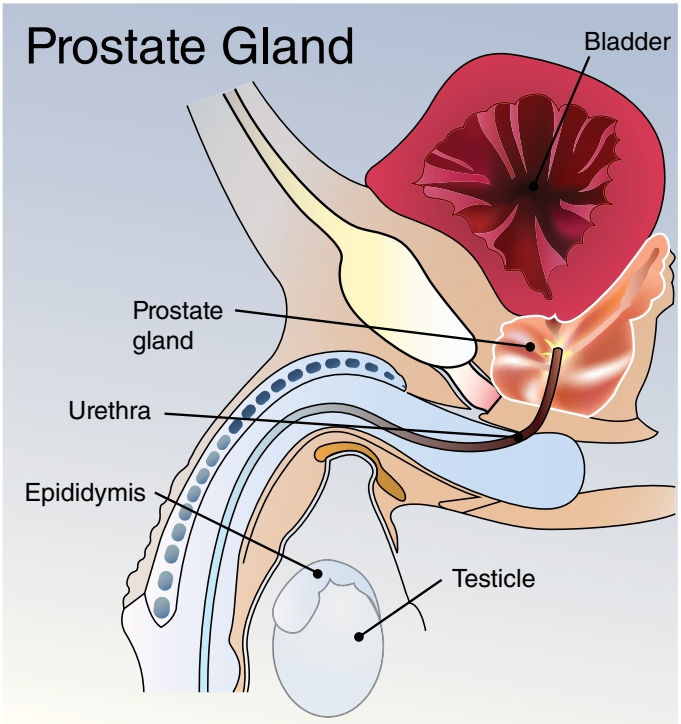


Figure 7.4 The prostate. *Source*: Courtesy of MedicineNet, Inc.

Case Study of a 54-Year-Old Obese Male with Erectile Dysfunction

Presenting Problem/History

A 54-year-old obese male presents to the primary care clinic asking for a prescription for sildenafil (Viagra). He has recently relocated to the area because of a job transfer. He is unmarried and has not been seen in the clinic before. He indicates that the only medication he has been taking is isosorbide mononitrate (Monoket). He says he has type II diabetes which is controlled by diet.

Subjective

(Note a review of systems [ROS] for ED should include depression and anxiety. Also consider whether the patient uses tobacco products. Does he have true ED or does he just have decreased libido?)

The patient indicates his overall health is fine. Family history reflects his father and mother had diabetes, suffered strokes, and died at the ages of 60 and 65. Siblings (Unremarkable except for one brother who also has diabetes.). A ROS reflects Integumentary (No complaint); Head and Neck (No complaint); Eyes, Ears, Nose, and Throat (No complaint); Cardiac (Chest pain on exertion); Respiratory (Shortness of breath with ambulation lasting more than five minutes); Abdominal (Complaints of bloating and heartburn); Genitourinary (Complaints of nocturia and erectile dysfunction); Musculoskeletal (Complaints of pain in both knees and back); Neurological (No complaints); Endocrine (Diabetes).

Objective

Observations reflect: T 98.6 F/37 C; BP 150/87; P 86; O2 Sat 99; HT 5′10″; WT 269; BMI 38.6 (Severely Obese).

Physical examination: H&N (WNL); EENT (WNL); Chest (Resp – BBS, Clear A&P) (CVS – Cardiac – S1 S2 no rubs, splits, or murmurs; apex 5th ISC MCL – no heaves or thrills; all pulses present); Abdo (Soft, nontender, normal bowel sounds); GU (Normal external make genitalia. The penis is uncircumcised. Smooth walnut-shaped enlarged prostate; urinalysis – unremarkable); MS (ROM WNL, crepitus in both knees); Neuro (WNL).

Differential Diagnosis

Obesity, angina, diabetes, erectile disfunction, and benign prostatic hyperplasia.

Assessment Including Labs/Other

ECG/EKG in clinic. Labs: PSA screen, CMP, Lipids, HbA1C, Thyroid Panel; FBC/CBC with Diff; B12; Folate; Ferritin; Vit D. Urinalysis. Routine CX-R A&P in clinic.

Diagnosis

Await referral reports, labs, and X-rays.

Treatment Plan

Obtain medical records from previous healthcare providers. Refer to orthopaedics for evaluation of both knees. Refer to Cardiology for cardiac evaluation. Refer to Urology for ED and enlarged prostate. Refer to nutritionist for dietary advice. Refer to diabetic nurse specialist (subsequent to lab results). Note that in the obese, weight loss and exercise are associated with improvement of ED.

Counsel the patient: Viagra is contraindicated with Monoket. Consider other options.

References

Ball, J., Dains, J., Flynn, J. et al. (2014a). *Seidel's Guide to Physical Examination*, 8e. St. Louis: Mosby.

Ball, J., Dains, J., Flynn, J. et al. (2014b). *Student Laboratory Manual to Accompany Seidel's Guide to Physical Examination*, 8e. St. Louis: Mosby.

Bickley, L. and Szilagyi, P. (2013). *Bates' Guide to Physical Examination and History Taking*, 11e. New York: Wolters Kluwer/Lippincott Williams & Wilkins.

Collins-Bride, G. and Saxe, J. (2013). *Clinical Guidelines for Advanced Practice Nursing - an Interdisciplinary Approach*, 2e. Burlington, MA: Jones and Bartlett Learning.

Cox, C. (2010). *Physical Assessment for Nurses*, 2e. Oxford: Wiley Blackwell.

Dains, J., Baumann, L., and Scheibel, P. (2012). *Advanced Health Assessment and Clinical Diagnosis in Primary Care*, 4e. St. Louis: Elsevier.

Dains, J., Baumann, L., and Scheibel, P. (2015). *Advanced Health Assessment and Clinical Diagnosis in Primary Care*, 5e. St. Louis: Mosby.

Japp, A. and Robertson, C. (2013). *Macleod's Clinical Diagnosis*. Edinburgh: Churchill Livingstone, Elsevier.

Jarvis, C. (2015). *Physical Examination and Health Assessment*, 7e. Edinburgh: Elsevier.

Rhoads, J. and Paterson, S. (2013). *Advanced Health Assessment and Diagnostic Reasoning*, 2e. Burlington: Jones and Bartlett.

Rundio, A. (2017). Men's health. In: *Lippincott Certification Review: Family Nurse Practitioner & Adult-Gerontology Nurse Practitioner* (ed. A. Rundio and W. Lorman), 224–238. New York: Wolters Kluwer.

Seidel, H., Ball, J., Dains, J., and Benedict, G. (2010). *Mosby's Physical Examination Handbook*, 7e. St. Louis: Mosby-Year Book.

Swartz, M. (2014). *Physical Diagnosis: History and Examination*, With Student Consult Online Access, 7e. London: Elsevier.

Talley, N. and O'Connor, S. (2014). *Clinical Examination: A Systematic Guide to Physical Diagnosis*, 7e. London: Churchill Livingstone, Elsevier.

Tallia, A. and Scherger, J. (2013). *Swanson's Family Practice Review*, 6e. St. Louis: Mosby.

7

Clinical Assessment of the Orthopaedic and Trauma Patient

Rebecca Jester

Royal College of Surgeons Ireland Medical University, Bahrain

Introduction

The aim of this chapter is to provide an evidence-based discussion of assessment of the orthopaedic and trauma patient. The chapter adopts a person-centred approach to the subject of assessment, as it is important to remember that, although a person's chief complaint will be a musculoskeletal problem, most are likely to have comorbidities and psycho/social issues that relate to their problem. Practitioners will be using their assessment skills throughout the patient's journey from initial presentation in primary care, emergency room or outpatient's department to ongoing evaluation following intervention or change in medical status. There has been a significant shift towards virtual consultations due to the COVID pandemic and this requires a change in how patient assessment is conducted. Throughout the chapter, where robust evidence exists, there will be critical application of research to approaches to assessment and examination. However, to date there is very little high-level evidence to support many aspects of patient assessment/clinical diagnostics within trauma and orthopaedics affirmed by a dearth of systematic reviews. Therefore, the information within this chapter is in the main based on evidence from the following sources: formal education, symposia, conference presentations, non-research publications, expert opinion and reflections on clinical experience (the author and other clinical experts).

Principles of Clinical Assessment

Clinical assessment can be defined as gathering both objective and subjective data for the purposes of generating differential diagnoses, evaluating progress following a specific procedure or course of treatment and evaluating the impact of a specific disease process. Examples of objective and subjective data can be found in Table 7.1.

There are some important key principles related to assessment, including:

- introducing yourself
- confirming the patient's identity
- explaining what the assessment is going to involve
- gaining the patient's consent for the assessment
- establishing if the patient wants a family member or carer to be present during the assessment
- good hand hygiene prior to and on completion of assessment/examination.

It is important to establish, either prior to or early in the assessment, if the patient has any degree of cognitive dysfunction. Communicating with patients with impaired cognition requires management of the immediate environment to reduce accessory noise and constant reorientation to what you are doing and why. It is also important to establish that the patient has the mental capacity to consent to the assessment before proceeding. People with learning disabilities often are not supported well in acute hospitals (Drozd et al. 2020). Thoughtful communication involves minimising healthcare jargon, use of pictorial aids if appropriate and including a family carer. These can all help to alleviate anxiety during the assessment process. Non-verbal and para-verbal communication play a key role in putting patients with cognitive impairment or learning difficulties at ease during the assessment and enhancing the accuracy and quality of information elicited during the assessment.

It is important to do the following:

- Ensure the patient is comfortable and their privacy and dignity are maintained at all times during the assessment. Patients of either sex should be asked if they would like a chaperone present during any physical examination and

Orthopaedic and Trauma Nursing: An Evidence-based Approach to Musculoskeletal Care, Second Edition. Edited by Sonya Clarke and Mary Drozd.

Table 7.1 Types of subjective and objective data

Subjective data	Objective data
History – dependent on accuracy of patient and/or family as historians	Radiographic and other clinical investigations such as blood tests, MRI and CT
Patient reported outcome measures, patients' subjective perceptions of their symptoms and the impact on their quality of life and functional ability, mental health status	Measurement of range of movement using goniometry Baseline observations such as blood pressure, weight, height, body mass index, temperature and heart rate
Pain assessment	Measurements of limb length and muscle strength Physical assessment including muscle, strength, palpation, auscultation and inspection Clinician measures, such as timed get up and go test

unless the patient refuses (this should be documented) a chaperone should always be present during intimate examinations of patients of the opposite sex. The name and signature of any chaperone should be clearly documented.

- Check the patient is not in pain, thirsty, hungry or needing the toilet prior to embarking on the assessment process. Also, be mindful not to overtire older or frail patients with prolonged questioning, examination and clinical investigations. Patients may require a break and the assessment process may need to be phased to accommodate their needs.
- When documenting the assessment ensure you record negative as well as positive findings. For example, 'Patient reports no locking or giving way of the knee joint'.

Models and Frameworks of Patient Assessment

It is important to adopt a systematic approach to patient assessment to avoid missing valuable information and to minimise repetition. Patient assessment should be interprofessional and a shared assessment document adopted. This approach enables the multidisciplinary team (MDT) to share information and avoid wasting the patient's time by several healthcare professionals attempting to collect the same information. Approaches to patient assessment will vary depending upon patient needs, for example whether the patient is presenting as an emergency with multiple trauma or a non-emergency with a painful joint/s or musculoskeletal dysfunction.

Emergency Presentation

The patient presenting in the emergency department (ED) with severe or multiple injuries must have an urgent and systematic assessment to identify life-threatening issues using the (C)ABCDE approach (Parker and Magnusson 2016):

- (C)atastrophic haemorrhage
- Airway with spinal protection
- Breathing
- Circulation
- Disability (neurological)
- Exposure and environment

In most healthcare organisations, these observations will be recorded on an early warning score (EWS) chart, such as the National Early Warning Score (NEWS2) (RCP 2017). See Chapter 16 for further detail regarding assessment of the patient following trauma.

Non-emergency, Elective or Planned Presentation

Within orthopaedic care, the medical model of assessment has predominated, with the main aim of the assessment being to understand the patient's chief complaint/problem and arrive at a differential diagnosis. Traditionally, this has been solely within the remit of the medical profession, but in recent years a growing number of specialist and advanced nurse and physiotherapy practitioners have taken on this role. The medical model comprises:

- taking a history to elicit the chief complaint or presenting problem
- observation and inspection
- physical examination using palpation, percussion and auscultation
- assessing movement and strength
- clinical investigations.

The medical model lends itself to the patient who is presenting with a clearly defined orthopaedic problem with minimal comorbidities or without complex social or psychological issues. However, many patients within the orthopaedic setting have more problems than just a single chief complaint and require a more person-centred rather than disease-centred approach to their assessment. The medical model of assessment tends to focus on the disease process rather than the impact of the disease on an individual and the ideology of holistic health assessment is to

review the individual as a whole, with a focus on their overall health needs rather than the disease.

There are several assessment frameworks or models that lend themselves to the person with multiple physical, social and psychological issues and which nurses may find useful to structure their assessment. Assessment is the first part of the nursing process (comprising assessment, planning, implementation and evaluation of care). Nursing models and theories seem to have lost favour in contemporary clinical practice, which has become mainly target-orientated, but it remains important that nurses promote a holistic approach to assessment and care. An overview of the assessment component of these nursing or psychological models is presented below.

Roy's Adaptation Model

This model, developed by Roy (1984), is based on four modes: physiologic, self-concept (including body image and self-concept), role function and interdependence. This model lends itself particularly well to patients who are in the restorative phase following musculoskeletal trauma or spinal cord injury or those suffering with chronic conditions such as back pain and arthritis (see Chapter 6 for further reading on rehabilitation). The model focuses on assessing the patient's behaviour and stimuli towards adaptation in each of the four modes. The physiologic mode includes:

- oxygenation
- nutrition
- elimination
- activity and rest
- skin integrity
- the senses
- fluid and electrolytes
- neurological function
- endocrine function.

The role function model includes:

- primary role (age, sex, development level)
- secondary role (relatively permanent positions requiring performance such as spouse, parent, sibling)
- tertiary role (freely chosen and relatively temporary such as employee, student).

The self-concept mode includes:

- the physical self
- body image
- body sensations
- the personal self, comprising self-ideal and self-expectancy
- the moral–ethical–spiritual self.

The interdependence mode is about support systems, both intrinsic and extrinsic to the individual, and their receptive/contributive behaviours.

Wellness Framework

The wellness framework (Pinnell and de Meneses 1986) can be used to provide a systematic approach to data collection during the assessment process. It focuses on health and wellness rather than disease or ill-health and uses the following categories:

- Degree of fitness: exercise patterns, muscle strength, muscle and joint flexibility, body proportions (fat and muscle).
- Level of nutrition: analysis of nutritional intake, patient's knowledge of healthy nutrition, sociocultural beliefs about diet.
- Risk appraisal/level of life stress: identification of patient's risk factors to health, identification of sources of stress to the patient, the patient's perception of stress and their coping patterns.
- Lifestyle and personal health habits: habits regarding health behaviours, regular health screening, dental checks, alcohol/drug/smoking consumption, sleep and weight management.

The role of the nurse in orthopaedic care must incorporate promotion of healthy lifestyles and supporting patients to minimise risk such as the link between obesity and joint problems, and the wellness framework lends itself well to this aspect of orthopaedic assessment.

Maslow's Hierarchy of Needs

Maslow (1954) first developed the theory of motivation and personality. From this seminal work, a hierarchy of needs can be used to structure the assessment process. The needs are arranged in a pyramid based on the premise that until the lowest or most fundamental needs of the individual are addressed, they are unable to move to higher levels of functioning. These levels of need are presented below in order (lowest to highest):

- Physiological (survival needs): assessment of oxygenation, nutrition status, fluid balance, body temperature, elimination, shelter (home conditions and support) and sex (assessing individual's concerns about resuming sexual activity following procedures such as spinal fusion or hip arthroplasty).
- Safety and security (need to be safe and comfortable): physical safety, i.e. assess risk of falls, pressure sores, infection, venous thromboembolism and pain assessment. Psychological security should be assessed in terms

of the patient's need for information and inclusion in decisions about their care and treatment.
- Love and belonging: elicit information about the patient's social and family support.
- Esteem and self-esteem: assess issues around body image, adaptation and coping, and elicit what the patient's goals are.
- Self-actualisation: assess the extent to which the patient's full potential is being reached, their levels of autonomy and motivation.

The Medical Model

History-taking

Taking a history has three principal functions:

- provision of data to inform decision making around differential diagnosis and treatment planning
- initiate a medium by which a therapeutic bond is formed between patient and practitioner
- create a forum for education.

The importance of thorough and accurate history-taking has been recognised for many years. It is very tempting for busy practitioners to try and steer the patient's presenting signs and symptoms to fit a particular disease pattern by asking leading questions, but this can lead to an inaccurate diagnosis (Flynn et al. 2015).

History-taking comprises 10 stages, which should be followed in order:

1) *Chief complaint*: Elicit the chief complaint, using an open-ended question such as 'What brings you here today'?
2) *History* of the chief complaint:
   - P Provocative or palliative: what makes it worse or better?
   - Q Quantity or quality: how often do you experience the problem?
   - R Region or radiation: is the problem localised or more diffuse?
   - S Severity or scale: how would you rate your problem?
   - T Timing: is there a particular time of the day or night associated with your problem? When was the onset of your problem and has it been constant or intermittent?
3) *Recapitulation*: Reaffirm with the patient at this stage that you have understood what their main problem is and the history of that problem as this allows any misconceptions to be resolved before proceeding further with the history.
4) *Family history*: Some musculoskeletal conditions have a genetic disposition, such as rheumatoid arthritis. A genogram is the most systematic and succinct way to record a family history.
5) *Past medical history*: This should include all major illnesses, surgery and treatments. Patients may often forget significant aspects of their past medical history and you may need to triangulate information with accessory information from the patient's notes, further questioning based on their medication and findings from inspection such as scarring indicating previous trauma or surgery.
6) *Psychosocial and occupational history*: Frequently musculoskeletal problems can be associated with patients' previous or current occupation, for example often severe osteoarthritis of the knee is related to occupations such as HGV driving, climbing up and down ladders or carpet fitting. Repetitive strain injury of the wrists and hands is often found in people who use computers for long periods of time on a daily basis. A social history will elicit what the patient's home situation is in terms of living accommodation and support from family and friends. This is very important for discharge planning and ascertaining if any adaptations to the home or work environment are needed to alleviate the patient's symptoms and increase independence.
7) *Review of symptoms*: Although the patient will be presenting with a chief complaint of a musculoskeletal problem/s, in certain situations, such as preoperative assessment, it is necessary to review all the body systems to rule out any comorbidities that may present as a risk during surgery/anaesthesia (see Chapter 5 for further detail on pre-operative assessment). The review of systems should also include a review of the individual in terms of rest and sleep patterns, smoking and alcohol habits. Table 7.2 provides guidance on reviewing the body systems. To review the systems in a systematic way it is best to take a head-to-toe approach.
8) *Allergies*: Ascertain if the patient has any known allergies to medications, dressings/adhesive or latex. Historically patients were tested for sensitivity to nickel, cobalt or chromium, but the clinical significance of metal sensitivities following prosthetic replacements is questionable and therefore routine metal allergy testing is no longer recommended. However, it is still important to question patients about metal skin sensitivity, specifically nickel, as the patient may have a skin reaction from clips or staples following surgery. The evidence base for the value of routine metal allergy testing is equivocal, as a study by Frigerio et al. (2011) concluded that objective determination of metal sensitivity at pre-operative assessment should be considered when planning joint arthroplasty as it would help the surgeon determine the most appropriate prosthesis.

Table 7.2 Review of systems

Body system	Example questions
Integmentary	Do you have any skin lesions, sores, unhealed wounds, pressure sores, rashes or fungal infections of nails?
Mental health/ psychological wellbeing	Do you currently suffer with anxiety or depression?
Neurological	Do you suffer with fits, faints, blackouts, headaches, muscle weakness/wasting or altered or loss of sensation?
Respiratory	Do you suffer with shortness of breath either at rest or on exertion or suffer with wheezing, bronchitis, asthma, chest infections or dry or productive cough?
Cardiovascular	Do you have any problems with chest pain, circulatory problems, leg ulcers, blood clots or varicose veins?
Musculoskeletal (The chief complaint will have been explored earlier in the history, but additional musculoskeletal problems may be present)	Do you have any joint pain, swelling, locking or giving way, limitations to movement, fractures or muscle/tendon/ ligament injury?
Gastrointestinal	Do you have any gastric bleeding, ulcers, abdominal pain, oesophageal reflux, loss of appetite or unintentional weight loss or gain? (Ascertain bowel habits and if there has been any recent change)
Genitourinary	Do you have any problems passing urine such as urgency, frequency, incontinence, hesitancy, nocturia or urine infection?

9) *Medications*: Include prescribed, over-the-counter and homoeopathic medicines. Patients can often be unsure of the names, doses and function of their medications so it is important to cross-verify with accessory information such as prescription printouts.
10) *Education*: This stage of the history-taking process facilitates the opportunity for the patient and/or their family if present to ask questions and also to provide health promotion advice. For example, if the patient reports smoking then smoking cessation advice can be provided. In addition, if the patient is obese or morbidly obese, information and support for weight reduction can be offered. It is also important to offer the patient and/or family member the opportunity to ask any questions or raise any issues they feel have not been covered during the history-taking/assessment.

Principles of Physical Examination

Based on information gained during the history, the practitioner can then be focused in the physical examination. Which body systems to include in the assessment will depend on both information from the history and the nature of the assessment. For example, if the patient is presenting post-operatively with deteriorating vital signs, a thorough examination of several systems, including cardiovascular, respiratory, neurological and abdominal, may be needed. If the patient is presenting in the orthopaedic or primary care clinic with a specific localised musculoskeletal problem then the examination can focus on the joint of concern, bearing in mind that musculoskeletal pain can often be referred and therefore it is important to include examination of joints above the specific site of the problem and to always compare both limbs. The important principle is to have a sound rationale for which systems and specific elements of systems you decide to include and exclude, and this should be documented within your assessment.

It is important to use all senses during assessment, including sight, smell, hearing and touch. There are several techniques used within physical examination: observation, inspection, palpation, percussion, auscultation and measurement.

Observation

The first step of assessing a patient is through observation of them. Observation involves the senses of sight, smell and hearing. A good tip is to start observing the patient as you approach them (or them you) to observe:

- how they rise from a chair, transfer from bed to chair, etc.
- facial expressions indicating pain/discomfort, anxiety or low mood
- use of a walking aid and if they are using it correctly
- gait analysis, e.g. Trendelenburg gait indicating a potential hip problem, stiff knee gait or a drop foot
- crepitus from movement of the joints or wheezing/rattles from the chest
- does the patient look flushed, hot, pale, sweaty or jaundiced?
- does the patient look well cared for or unkempt?
- smell of acetone from the breath indicating ketosis
- smell of urine or faeces.

Your initial observations should be recorded within the assessment and explored with the patient during the history.

Inspection

Inspection is much more detailed than general observation and focuses on detecting specific issues in musculoskeletal examination such as the presence or absence of swelling, bruising, scarring, skin discoloration, oedema, muscle wasting, alteration of shape, posture or deformity.

Inspection for swelling/s should note if it is localised or diffuse and confined to the joint or extending beyond the joint. Swelling confined to the joint itself can indicate either effusion due to excessive synovial fluid or non-pyogenic conditions such as rheumatoid or osteoarthritis. Swelling beyond the joint may indicate infection of the limb such as cellulitis, tumours, vascular or lymphatic problems. It is important to be precise in recording the location and extent of any swelling observed and to affirm by further questioning the onset, duration and pattern of swelling, e.g. intermittent, fluctuating in severity, relieving or exacerbating factors. There are specific tests to confirm swelling which are discussed under palpation and special tests.

Inspection should also include the identification of any bruising or abrasions suggesting recent trauma and scarring from previous surgery or trauma. Changes to skin colour should also be noted, specifically erythema (redness), which may indicate a localised response to trauma or infection, or pallor possibly indicating compromised vascular function. Any muscle wasting should be noted, usually indicating limited use due to pain or injury or impaired nerve supply (denervation). For example, muscle wasting of the quadriceps can be very common in patients with knee trauma or pathology, and wasting of the thenar eminence (of the thumb) in conditions of the hand/wrist such as carpal tunnel syndrome (median nerve compression). Inspection should also be used to detect deformity, altered posture or shortening, which can result from a congenital abnormality, trauma or destructive joint disease.

Palpation

Palpation should be used to detect changes in the temperature of the limbs/joints/spine and detect any tenderness. The back of the hand rather than the practitioner's palms should be used to detect localised or diffuse changes in temperature. Increased heat over a joint is indicative of inflammatory processes, whereas diffuse heat away from the joint may indicate a tumour or infection such as cellulitis. Coolness of a limb is generally indicative of arterial pathology such as atherosclerosis.

Identifying the exact location of tenderness is important in identifying precisely which underlying structures may be involved. Observing the patient for signs of distress or discomfort during palpation is important as is documenting precisely the exact location and extent of tenderness and/or alteration in skin temperature.

Assessing Movement

Many orthopaedic conditions result in loss or restriction of movement. Assessing the range of joint movement requires knowledge of the normal range possible (Chapter 4). Restriction in movement can be due to contraction of joint capsules, tendons and muscles or lodging of loose bodies between the articulations of the joint. A resultant fixed flexion deformity of the joint can occur, most commonly an inability to fully flex the joint. Movement of the joint controlled by the patient is known as active range of movement and passive movement is when the practitioner controls the movement of the joint; the latter being appropriate when the muscles responsible for movement of the joint are paralysed. It is important to observe and listen to the patient when conducting measurement of range of movement, observing for signs of pain and distress. There is an unequivocal evidence base regarding the best method of measuring range of joint movement.

Assessing Muscle Strength

Assessing strength of muscle contraction is indicative of the strength of each joint movement and therefore should be included within the examination process. A scale developed by the Medical Research Council 1975 is used to record muscle strength and is shown in Box 7.1.

Assessing for Shortening of the Lower Limbs

As part of examination of the hip and lower limb, it is important to determine the presence or absence of shortening (McRae 2010). True shortening, where the limb is physically shorter, may be caused by a number of pathologies, including loss of articular cartilages caused by arthritis, displaced hip fracture, dislocation of the hip, epiphyseal trauma and old fractures of the tibia or femur. In apparent shortening, the limb length is not altered but appears shorter because of contracture of the adductor muscles

Box 7.1 Medical Research Council Scale for Recording Muscle Power (Medical Research Council 1975)

0 = no muscle power
1 = flicker of activity
2 = movement with effect of gravity eliminated, i.e. in a place at right angles to gravity but not against resistance
3 = movement against gravity but not against applied resistance
4 = movement against applied resistance but less than full power
5 = normal power

resulting in tilting of the pelvis. To measure for true shortening the first stage is to ask the patient to lie flat on a couch with the pelvis positioned squarely and both legs stretched out as straight as possible with heels flat to the couch. In the normal patient, the heels and the anterior iliac spines are level. If a discrepancy is noted by this visual check, it is necessary to measure the limbs with a tape measure, which should be of material that does not stretch. Measure from the inferior edge of the anterior superior iliac spine to the middle of the medial malleolus and then extend the measurement down to the bottom of the heel with the ankle in the neutral position. Compare both sides and repeat the measurements until accuracy is assured. To measure for apparent shortening, measure between the umbilicus or xiphisternum down to the middle of both medial malleoli.

Gait Assessment

There are many causes of abnormal gait patterns, including neurological and musculoskeletal disorders. There are a number of orthopaedic conditions that may produce gait abnormalities, including Trendelenburg gait (waddling gait) due to hip pathology, stiff knee gait due to knee pathology and drop foot gait due to damage to the nerves responsible for dorsi-flexion of the foot. Gait analysis is most commonly undertaken by the physiotherapist or orthopaedic surgeon, but nurses working within specialist or advanced roles may carry out gait analysis as part of their assessments.

Special Tests

There are a number of specific tests that may be included as part of the examination of the patient. Clinical reasoning based on the patient history and prior aspects of the examination, including observation, inspection, palpation and measurement of motion, will determine if special tests are required to assist in making a differential diagnosis. The most common of these include testing for valgus instability of the knee joint using the anterior draw test, testing for varus instability using the Lachman test and the Trendelenburg test for weakness of the abductor muscles of the hip. The Trendelenburg test involves the patient standing on one leg and then the tilt of the pelvis on the opposite side is observed: if the pelvis drops below the horizontal plane then the test is said to be positive.

Assessing Deep Tendon Reflexes

Deep tendon reflexes are tested by gently tapping over a tendon using a patellar hammer and observing for movement of the associated muscles. When examining the spine for suspected prolapsed intervertebral disc, both the knee and ankle reflexes should be tested. When testing the knee reflex, the knee should be supported by the clinician's arm and the infra patellar tendon gently tapped, observing for contraction of the quadriceps. A diminished or absent contraction indicates a possible prolapse at the level of L3/L4. The ankle reflex is assessed by positioning the ankle in the mid position, knee bent and hip slightly externally rotated then lightly tapping the Achilles tendon and observing for plantar flexion of the foot. An absent or diminished ankle reflex is indicative of pathology at vertebrae S1/S2. It is important when assessing deep tendon reflexes that there is no muscle contraction in the area being assessed so the patient must be relaxed. Reflexes are recorded as follows:

0 = absent
+ = reduced
++ = normal
+++ = increased
++++ = increased with clonus

Clinical Investigations

Once the history and examination have been completed, the practitioner needs to decide what clinical investigations are needed to arrive at a differential diagnosis and/or treatment plan. Clinical investigations including X-rays, magnetic resonance imaging (MRI) and computed tomography (CT) scans or blood investigations have associated costs and risks to the patient, e.g. cumulative doses of radiation, and so should be requested only with a clear justification of their need. Nurses working in trauma and orthopaedics should have an understanding of the common investigations to offer support and explanation to the patient. Nurses working in specialist and advanced roles often undertake the requesting and interpretation of clinical tests within their scope of practice. The most common investigations include the following:

- Radiographic imaging (X-rays): This is the most commonly used diagnostic imaging in trauma and orthopaedics. AP and lateral views are the most frequently requested view, but other views include comparison images, oblique views, localised views and stress films. All clinicians requesting X-rays must undertake specific radiology safety training and be judicious in requesting X-rays in relation to the cumulative dose of radiation the patient is receiving.
- CT scan: This technique also uses beams of radiation, but provides a more detailed view of tissue slices from different angles and more detailed differentiation of different tissue types.
- MRI: Avoids any exposure to radiation, using high strength magnetic fields and electrical impulses to create detailed images of bone and soft tissue. MRI is increasingly used in the investigation of spinal problems such as suspected prolapsed intervertebral discs and damaged structures such as meniscal and ligament tears in the knee and shoulder.

- Ultrasound imaging: Regarded as being risk-free and comparatively inexpensive. Its main value is to detect fluid in and around joints and therefore it is useful in identifying heamarthrosis or the presence of infected or inflamed tissue.
- Dual-energy X-ray absorptiometry: A non-invasive scan to test the density of bones for diagnosis of osteoporosis.
- Common haematological investigations: These include full blood count (FBC) (which includes red and white cells and platelets) and tests for inflammatory processes including C-reactive protein (CRP), erythrocyte sedimentation rate (ESR) and plasma viscosity (PV). It should be noted that these markers of inflammation can also be present due to infection. Serum uric acid and serum calcium, phosphate and alkaline phosphate may also be requested.

Boxes 7.2 and 7.3 provide examples of the underpinning evidence for two modes of physical assessment.

Box 7.2 Evidence Digest: Goniometry

Goniometry has for many years been considered the gold standard in measuring the range of joint movement, indeed if performed correctly it provides a very accurate measure of joint motion. Watkins et al. (1991) reported that use of a long-armed goniometer (LAG) in measuring flexion and extension of the knee joint had greater accuracy and interrater reliability than visual estimations. The measurements are obtained by placing the parts of the measuring instrument along the proximal and distal bones adjacent to the joint concerned and the movement should be free of any muscle contraction. It is important to align the goniometer carefully with appropriate anatomical landmarks such as the greater trochanter of the femur and lateral malleous to measure the motion of the knee joint and to ensure the goniometer stays in position as the patient moves their joint. The measurement should be taken three times and the average range of movement recorded to 5° increments. However, new technologies are being introduced to further improve accuracy in measuring joint movement. A study by Hambly et al. (2012) compared the accuracy of the traditional LAG and a new novel smart phone application (iGoniometer) in measuring active knee flexion in a healthy adult population, and reported that the iGoniometer demonstrated high relative and absolute reliability, although they recommended that further evaluation was required on a population with knee pathology.

Box 7.3 Evidence Digest Assessment Findings

A 3-year prospective longitudinal study of 68 patients with osteoarthritis of the knee joint reported a significant correlation between diminished joint space width and patient-reported symptoms of pain, but found no correlation between increased osteophyte formation visible on X-ray and patient-reported symptoms (Fukui et al. 2010). An earlier study by Neogi et al. (2009) also reported a strong correlation between radiographic evidence of diminished joint space in patients with osteoarthritis knee and pain symptoms, but did not find a significant relationship between osteophyte changes on X-ray and patient-reported symptoms. This research emphasises the need to use self-reported outcome measures to gain the subjective perspective of the patient regarding the impact of the pathology on their quality of life and functional ability, and also their view on their health status following a particular treatment or procedure.

Assessing the Impact of Disease on the Individual

It is important, as part of the assessment process, to evaluate the impact of a particular disease on the individual to inform the treatment or management plan. There may be little correlation between what clinical investigations and examination reveal and the perception of the individual. Patients with severe osteoarthritic changes on X-ray may report minimal disruption to their activities of daily living. Conversely, patients with minimal radiographic changes may report their symptoms to be intolerable, with a dramatic impact on their quality of life and functional ability (Swagerty and Hellinger 2001). This is explored in more detail in Box 7.4.

Box 7.4 The Abbreviated Mental Test Score

- How old are you?
- What is the time to the nearest hour?
- Name the place.
- Recognition of two persons, e.g. a nurse and a doctor.
- Date and month of birth.
- Date of First World War (start or end).
- Queen's name.
- Count 20–1 backwards.
- Five-minute recall of a full street address.

Source: Qureshi and Hodkinson (1974). Reproduced with permission from Oxford University Press.

Self-reported outcome measures can be broadly categorised into general health-related quality of life (HRQoL) tools and disease-specific tools. HRQoL measures aim to measure the multifaceted nature of health, including physical, social and psychological health, and can be used across many different types of diseases and health issues (Jester et al. 2018). Their main limitation is that they lack the sensitivity to detect relatively small changes in health status for a particular disease process (Bowling 2001) and therefore should be used in conjunction with disease-specific measures. Examples of HRQoL measures include the Sickness Impact Profile, the Nottingham Health Profile and the Short-Form 36 Health Survey Questionnaire (SF36). There are many disease-specific self-report measures developed for patients with musculoskeletal conditions, including the Arthritis Impact Measurement Scale, the Oxford Hip and Knee Scores, the WOMAC index and the Harris Hip Score. The practitioner should ensure that any HRQoL or disease-specific measure used as part of the assessment process has undergone rigorous testing to ensure it is valid, reliable, sensitive, specific and patient-friendly.

Assessing Cognitive Function

A significant number of patients presenting with musculoskeletal problems may have a degree of cognitive dysfunction, which may already be noted in the patient's records. As part of a comprehensive assessment process, the nurse should ensure that cognitive dysfunction is detected and its cause investigated and managed. It should never be assumed that because a patient is elderly their confusion is due to dementia. It is vital to ascertain the onset of the patient's confusion, specifically if it is an established diagnosed problem due to dementia, head injury or stroke or whether there has been a recent onset. Acute confusional states must be thoroughly investigated by taking a history of the onset from the patient, if possible, family members or informal carers and then carrying out appropriate clinical investigations and observations to elicit the cause. Acute confusion (delirium) can be caused by many factors including urea and electrolyte (U&E) imbalance, sepsis, hyper- or hypoglycaemia, adverse reaction to prescribed medications, raised intracranial pressure and drug/alcohol related. The practitioner should inform the medical team of the onset of acute confusion and commence observations using the National Early Warning Score 2 (NEWS2) chart and Glasgow Coma Scale (Chapter 16) to determine if any vital signs fall outside of normal parameters. Then the practitioner, in collaboration with the medical team, should begin to collect information to contribute towards determining the cause of confusion including:

- blood tests for U&E, capillary blood sugar, liver function tests, blood cultures, CRP and ESR
- urinalysis for protein, ketones and glucose and send a midstream urine sample if a urine infection is suspected
- oxygen saturation rates
- accurate monitoring of fluid input and output
- review medication with medical and pharmacy team for possible interactions or adverse reactions.

Once delirium has been ruled out based on these investigations then the patient's cognitive status should be assessed using a valid and reliable tool such as the Abbreviated Mental Test Score (AMTS; Qureshi and Hodkinson 1974) or the Mini Mental State Examination (MMSE; Folstein et al. 1975). The AMTS comprises 10 items, as detailed in Box 7.4; the best possible score is 10/10 with each correct item scoring 1. The diagnostic cut-off point varies between authors, but generally <6 indicates cognitive dysfunction (Jester et al. 2011). Although widely used in clinical practice and well tested for their psychometric properties, both the MMSE and AMTS have their limitations as they are developed for a specific age and ethnic group. Explain to the patient why you are asking the questions comprising the MMSE and AMTS, and ensure privacy and an environment that has minimal background noise and disruption to get the best results.

Assessing Risk

An integral part of the assessment process is to assess the patient's risk of harm or injury, including risk of falls, pressure sores, malnutrition and venous thromboembolism. Specific risk assessment tools are presented and discussed within the related chapters of this text. However, the predictive accuracy of all risk assessment tools must be evaluated to ensure that the practice associated with them is evidence-based. Predictive accuracy is the ability of a tool to be both sensitive and specific to minimise the number of false positives (over prediction) and false negative (under prediction). A pilot study by Jester et al. (2005) found the predictive accuracy of two falls assessment tools (FRASE and STRATIFY) with older hip fracture patients to be poor, reporting Receiver Operator Characteristic scores to be 0.560 and 0.629, respectively, indicating significant over-prediction when using the tools.

Patient Assessment Using Telemedicine

The Covid-19 pandemic has necessitated that many patient assessments and examinations have moved from face-to-face patient/clinician interaction to virtual

approaches such as telemedicine. This requires a new set of competencies and skills, and also preparation of patients as well as clinicians to ensure assessment via telemedicine is effective. Tanaka et al. (2020) suggest that although a non-face orthopaedic examination may lack the important elements of palpation and dynamic testing, available resources can be utilised to optimise the quality and outcome of a patient's virtual assessment. Patients will normally undergo clinical investigations such as X-rays, MRI scans and blood tests, and complete any relevant patient-reported outcome measure questionnaires prior to the virtual assessment, so results are available during the consultation. It is important that patients are fully informed about what the virtual assessment will entail and give consent to this format of assessment. The most effective mode of virtual assessment is to use video cameras and microphones as observation is then possible during the assessment, rather than reliance on telephone or verbal consultation only. Patients as part of the preparation for the virtual assessment will need guidance on proper positioning of their camera, location, lighting and clothing to allow for appropriate visibility and examination of the affected body part (Tanaka et al. 2020).

As with face-to-face assessment, it is vital to confirm the patient's identity and to introduce yourself and explain the assessment process. History-taking can follow the same process as used for face to face. Assessing patient's gait is possible using the camera and assessing ROM is possible using a virtual goniometer on the computer screen.

Not all patients will have access to a computer with video and microphone or feel competent in using them so it is important to assess a patient's readiness for assessment using telemedicine. Palpation and auscultation/percussion are clearly not possible using telemedicine, but patients can be instructed on how to feel for radiating heat over a joint or cool extremities and inform the clinician.

Summary

This chapter has discussed best practice in assessment of orthopaedic and trauma patients. The content has included the traditional medical approach to assessment, including physical examination, but has also offered a number of alternative models rooted in nursing and psychology theory. The use of telemedicine to conduct patient assessment has also been discussed. Where available there has been critical application of research and the deficit of high-level evidence to underpin clinical assessment has been highlighted. Good assessment skills are fundamental to nursing practice as they generate data from which our care and treatment is planned and implemented.

Further Reading

Jester, R., Santy, J. and Rogers, J. (2021) Oxford Handbook of Orthopaedic and Trauma Nursing, 2. Oxford University Press, Oxford.

Cleland, S., Koppenhaver, S. and Su, J. (2020) Netter's Orthopaedic Clinical Examination: An Evidence-based Approach, 4. Elsevier, London.

References

Bowling, A. (2001). *Measuring Disease*, 2e. Maidenhead: Open University Press.

Drozd, M., Chadwick, D., and Jester, R. (2020). A cross-case comparison of the trauma and orthopaedic hospital experiences of adults with intellectual disabilities using interpretative phenomenological analysis. *Nursing Open* https://doi.org/10.1002/nop2.693.

Flynn, S., Pugh, H., and Jester, R. (2015). Clinical assessment in trauma and orthopaedic nursing. *International Journal of Trauma and Orthopaedic Nursing* 19: 162–169.

Folstein, M., Folstein, S., and McHugh, P. (1975). 'Mini-mental state' a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 12: 189–198.

Frigerio, E., Pigatto, P., Guzzi, G., and Altonare, G. (2011). Metal sensitivity in patients with orthopaedic implants: a prospective study. *Contact Dermatitis* 64 (5): 273–279.

Fukui, N., Yamane, S., Ishida, S. et al. (2010). Relationship between radiographic changes and symptoms or physical examination findings in subjects with symptomatic medial knee osteoarthritis: a three-year prospective study. *BMC Musculoskeletal Disorders* 11: 269–279.

Hambly, K., Sibley, R., and Ockendon, M. (2012). Agreement between a novel smartphone application and a long arm goniometer for assessment of knee flexion. *International Journal of Physiotherapy and Rehabilitation* 54 (October): 4–6.

Jester, R., Wade, S., and Henderson, K. (2005). A pilot investigation of the efficacy of falls risk assessment tools

and prevention strategies in an elderly hip fracture population. *Journal of Orthopaedic Nursing* 9 (1): 27–34.

Jester, R., Santy, J., and Rogers, J. (2011). *Oxford Handbook of Orthopaedic and Trauma Nursing*. UK: Oxford University Press.

Jester, R., Santy-Tomlinson, J., and Drozd, M. (2018). The use of patient reported outcome measures (PROMs) in clinical assessment. *International Journal of Orthopaedic and Trauma Nursing* 29: https://doi.org/10.1016/j.ijotn.2018.02.003.

Maslow, A. (1954). *Motivation and Personality*. New York: Harper.

McRae, R. (2010). *Clinical Orthopaedic Examination*, 6e. Edinburgh: Churchill Livingstone Elsevier.

Medical Research Council (1975). *Aids to the Investigation of Peripheral Nerve Injuries*. London: HMSO.

Neogi, T., Felson, D., Niu, J. et al. (2009). Association between radiographic features of knee osteoarthritis and pain, results from two cohort studies. *British Medical Journal* 339: b2844.

Parker, M. and Magnusson, C. (2016). Assessment of trauma. *International Journal of Trauma and Orthopaedic Nursing* 21: 21–30.

Pinnell, N. and de Meneses, M. (1986). *The Nursing Process: Theory*. Appleton-Lange, Norwalk, CT: Application and Related Processes.

Qureshi, K. and Hodkinson, H. (1974). Evaluation of a 10 question mental test in the institutionalized elderly. *Age and Ageing* 3: 152–157.

Roy, C. (1984). *Introduction to Nursing: An Adaptation Model*, 2e. New Jersey: Prentice-Hall.

Royal College of Physicians (2017). *National Early Warning Score (NEWS) 2 Standardising the Assessment of Acute-Illness Severity in the NHS*. London: Royal College of Physicians.

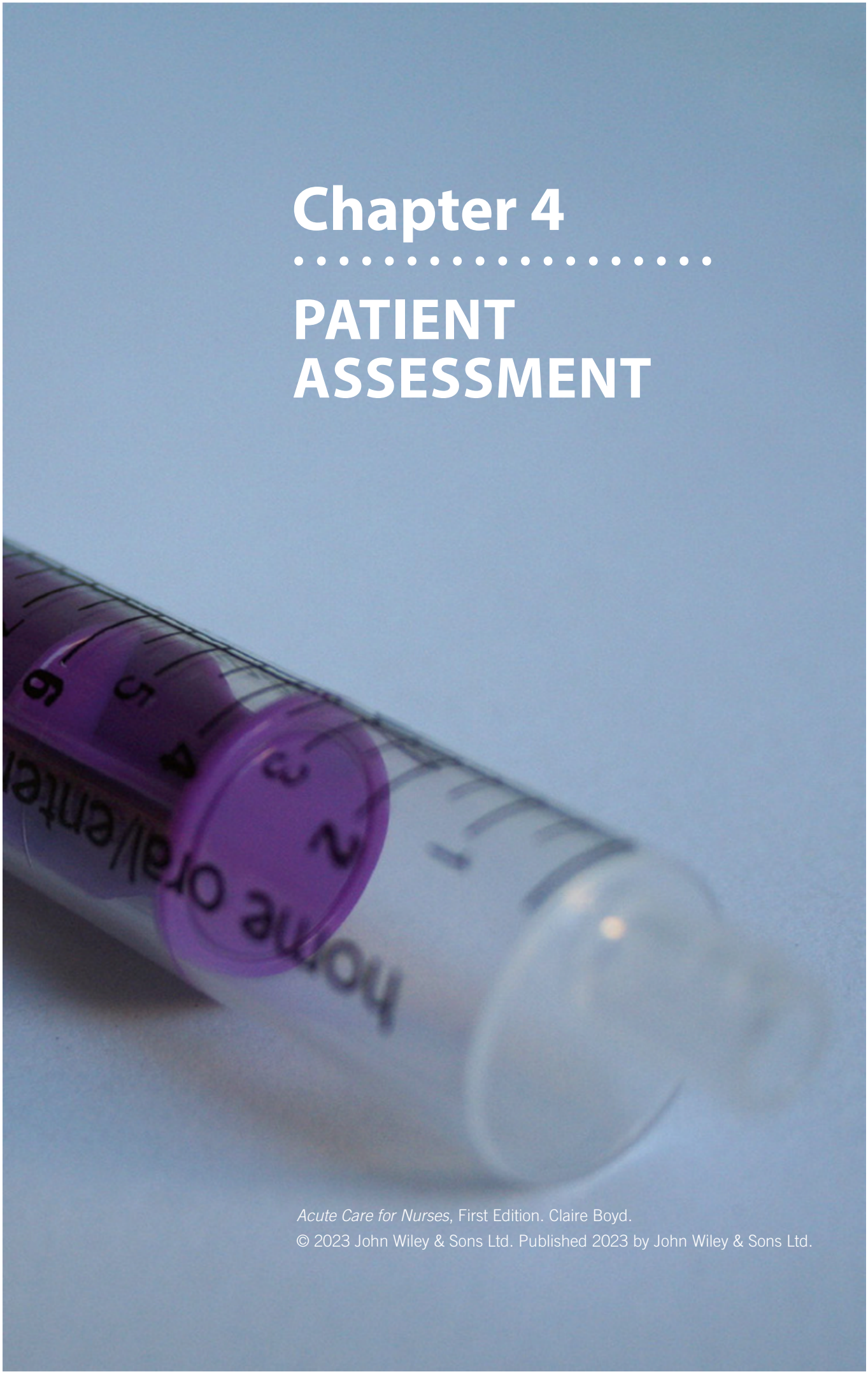
Swagerty, D. and Hellinger, D. (2001). Radiographic assessment of osteoarthritis. *American Family Physician* 64 (2): 279–287.

Tanaka, M., Oh, L., Martin, S., and Berkson, E. (2020). Telemedicine in the era of COVID-19: the virtual orthopaedic examination. *The American Journal of Bone and Joint Surgery* 102 (12): e57.

Watkins, M., Riddle, D., Lamb, R., and Personius, W. (1991). Reliability of goniometric measurements and visual estimates of knee range of motion obtained in a clinical setting. *Physical Therapy* 71: 90–96.

Chapter 4

PATIENT ASSESSMENT



Acute Care for Nurses, First Edition. Claire Boyd.

LEARNING OUTCOMES

By the end of this chapter you will have an understanding of patient assessment techniques used in routine admissions and in emergency situations.

We begin this chapter by looking at the four types of healthcare assessment:

- **Initial assessment of patient**, e.g. on admission to hospital, nursing care home, etc.
- **Patient-focused assessment**, e.g. used to determine status of a specific problem identified in an earlier assessment, etc.
- **Emergency assessment of patient**, e.g. rapid assessment performed during any physiological/psychological crisis of the patient to identify life-threatening problems, etc.
- **Time-lapsed assessment**, e.g. a reassessment of patient's functional health pattern performed some time after initial assessment to compare results

Patient assessment, whether obtained during routine hospital admissions or in emergency situations, in most situations, usually begins with vital sign data collection – step one of the nursing process. Table 4.1 shows the nursing process.

The data collection aspect of the nursing process, nursing assessment for the routine admission, should contain at least 14 elements, such as:

- **Documentation** – e.g. why the patient has been admitted/probable diagnosis, patient's next-of-kin or first contact
- **Past medical history** – e.g. previous hospitalisations
- **Pain assessment** – e.g. Is the patient in pain? Location/severity
- **Allergies** – e.g. to medicines/food, etc., and any food intolerances

Table 4.1 Nursing process.

Nursing process	Information
Assessment	**Critical thinking skills and data collection. Can be verbal statements from patient and/or primary care giver. May include vital signs, fluid intake and output, height and weight, electronic health records, etc.**
Diagnosis	**May be defined as a clinical judgement about responses to actual or potential health problems. Requires clinical judgement in the planning and implementation of patient care.**
Planning	**Consists of patient-specific goals to ensure positive patient outcomes. Care plans provide direction for personalised care. Goals should be specific, measurable (or meaningful), attainable (or action orientated), realistic (or results orientated), and timely (or time orientated).**
Implementation	**The action part of the nursing process, carrying out the nursing interventions outlined in the plan of care. Examples of nursing intervention may include undertaking cardiac monitoring on the patient, administering oxygen or drug administration, etc.**
Evaluation	**This is whereby the nursing interventions are assessed. This reassessment may be frequently required. The plan of care may need to be adapted based on the new assessment data.**

- **Medications** – e.g. did patient bring their usual prescribed medications with them. May need to order them from pharmacy.
- **Valuables** – e.g. record and send to safe storage
- **Rights** – e.g. patient orientated to ward area
- **Activities** – e.g. Is patient safe caring/able to mobilise? Vision/glasses?
- **Falls** – e.g. Assess falls risk
- **Skin** – e.g. Is patient at risk for pressure area problems? Does patient wear dentures?
- **Continence** – e.g. Does the patient have any incontinence?
- **Psychosocial** – e.g. Is patient depressed?
- **Nutritional** – e.g. Does patient have an appetite? What is their body mass index?

- **Vital signs** – e.g. temperature, heart rate, respiratory rate, blood pressure (BP), pain level on admission, 2 saturations
- Misc information: e.g. handover information from carers/care home?

NATIONAL EARLY WARNING SCORE-2 AND ABCDE ASSESSMENTS

As we can see, one of the first clinical skills a nursing student performs, under supervision and after training, is the task of vital signs monitoring: recording the observations and plotting the results on the National Early Warning Score 2 (NEWS2) observation chart.

At first, this ABCDE assessment is a matter of undertaking the physiology recordings of patients, i.e. respirations, BP, pulse, temperature, etc. Then as your experience increases, this assessment becomes more in-depth and the patients you are assessing may be more acutely unwell. Now the emphasis is about recognising early deterioration and acting on this to improve patient outcome.

DID YOU KNOW?

Source: HEINE Optotechnik GmbH & Co. KG.

If for any reason you are unable to take a brachial artery BP recording, you can put the BP cuff on the leg, as long as the patient does not have cellulitis or a deep vein thrombosis. Positioning of the cuff is usually at the posterior tibial artery (ankle), but the calf and thigh can be used. The patient should be in the supine position (lying flat) if they can tolerate this. Normally the systolic BP in the legs is 10–20% higher than the brachial artery pressure.

The ABCDE is a systemic framework, priority-driven assessment whereby priorities are addressed and the life-threatening problems recognised and addressed first. For example, if someone's airway is occluded, you would not go on and take a BP recording! As their airway is blocked, they will probably die within three minutes unless it can be unblocked! Therefore A (airway) is the first assessment in the ABCDE framework – we address this before moving on to B (breathing). We do not move on until every problem in each section has been addressed.

STUDENT TIP

Work on and fix what will kill the patient first!

Let me show you an example of a 29-year-old male patient who has just undertaken a minor surgical procedure, in the day case unit, and has a medical history of asthma. Using the ABCDE assessment tool, the postoperative assessment is as recorded by a nursing associate and shown in Table 4.2.

Table 4.2 Example of using the ABCDE assessment tool.

A	**Airway**	**Patient is talking**
		Wheezing sounds heard
B	**Breathing**	**Respirations 24 breaths/min**
		Oxygen saturations 92% on air (scale 1)
C	**Circulation**	**Pulse rate 45 beats/min, BP 190/80**
		Capillary refill time ≤2 seconds
		Peripheral cannulae patent
D	**Disability**	**Level of consciousness = alert**
		Urine output = has passed urine (500 ml)
		Blood glucose = 4 mmol/l
		Drugs = patient states he is not in pain
E	**Exposure**	**Skin assessment = no pressure area problems**
		No wound bleeding
		Apyrexial (37 °C)

Capillary refill assessment

This measures the rate at which blood refills empty capillaries. See Chapter 8 for information on how to conduct this test.

We have a problem with this scenario, as the nurse associate should have addressed the airway (A) problem at once, before moving on to the breathing component (B). The treatment could have been as simple as administering a prescribed nebuliser and oxygen therapy. Without this medication, the patient would have continued to deteriorate. This scenario also shows the importance of escalation – passing on the information to the nurse-in-charge and medics. It is no use recognising a problem without acting on it.

NOTE: Did you realise from seeing the patient's medical history and recognising his symptoms that the patient was actually having an asthma attack. Although you don't need to diagnose (let the medics do this), you can still offer your opinion/expertise. This can consist of preparing the medications, ready to be prescribed, i.e. oxygen (high flow), salbutamol, hydrocortisone, ipratropium, theophylline.
NOTE: Oxygen does not have to be prescribed in emergency situations.

Question 4.1 The BP observation on the NEWS2 chart scored 0 (BP 190/80), as did the temperature observation (37 °C) and conscious level (Alert). Looking at the earlier scenario, what is the score of the observations that did generate a score?

- Respiratory rate
- Oxygen saturations
- Conscious level
- Pulse

Chapters 6–10 will then look at each of the individual components to the ABCDE framework in more detail for a more in-depth assessment in the more acute situation.

Look, Listen, Feel, Smell

Another part of the patient assessment is the Look, Listen, Feel, and Smell assessment, as shown in Figure 4.1.

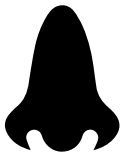
LOOK	
LISTEN	
FEEL	
SMELL	

Figure 4.1 Look, listen, feel and smell.

Just by looking at the patient in recovery, we could have just used our observation skills to see that the patient was having difficulty with his airway and breathing and in all probability was having an asthma attack.

By using the Look, Listen, Feel, and Smell technique, we can assess the patient and separate the normal from the abnormal. Table 4.3 shows how the Look, Listen, Feel, and Smell technique can be applied in practice. We will look at this in more detail in each of the ABCDE individual chapters (Chapters 6–10).

Table 4.3 How the Look, Listen, Feel, and Smell observations can be applied to practice.

	NORMAL	ABNORMAL
Look		
Facial expression	**Relaxed. Aware.**	**Grimacing. Slack facial expression.**
Skin colour	**Pink, brown, black. Mucosa pink.**	**Pale, grey/blue tinge. Mottled. Mucosa pale pink, blue. Skin sweaty at rest.**
Urine output	**Straw coloured. Fluid chart in balance (input and output).**	**Urine output very concentrated. Oliguria. Anuria**
Listen		
Breath sounds	**Not laboured. Quiet.**	**Rattling. Wheezing. Whistling. Stridor. Crackles.**
Verbal responses	**Talking normally. Orientated. Gives appropriate answer to questions.**	**Inappropriate answers. Appears confused. Agitated.**
Feel		
Pulse	**Regular rate, volume and rhythm.**	**Weak, thready, irregular. Difficult to palpate. Bounding.**
Capillary refill	**2–3 seconds.**	**3 seconds**
Smell		
Wound	**No smell eluded from wound.**	**Fleshy, meaty smell. Sweet or ammonia smell. Necrotic smell (dying flesh).**
Breath	**No smell.**	**Vomit, ketones, alcohol.**

The Look element is useful when observing for pain in the patient without the need for a physiological measurement, i.e. pulse, respiratory rate, BP, etc., because a patient informing us, whilst grimacing, sweating, and rolling around on the bed, that their pain level 'is fine' may not be telling the truth!

ACVPU

A = Alert
C = Confusion
V = Voice
P = Pain
U = Unresponsive

ABCDE Exercise

Time for another activity! We assess our patient using the ABCDE assessment tool. Following are words related to either the A, B, C, D, or E part of the assessment. Place the words into their correct boxes. Let me show you an example: I would have checked the 'nasopharyngeal airway' as part of the A for Airway check. Some of the words can fit into more than one part of the assessment, for example, 'Bleeding from surgical site' may have been picked up during the B (Breathing) part of the assessment (as a result of hypotension) or during the E (Exposure) part of the assessment – so both answers are correct. Good luck!

Activity 4.1 Place the words into the correct section of the ABCDE assessment.

Airway	Breathing	Circulation	Disability	Exposure
A	B	C	D	E

Skin cold and clammy	Non-productive cough	Oliguria	Glasgow Coma Scale
Pyrexial	Patient only comfortable sat upright	Anuria	ACVPU
Temperature	Arching back	Choking whilst eating and drinking	Motor Assessment
Hypothermic	Photophobia	Coughing	Pupil check
Oedema	Mouth breathing	Silent breathing	Capillary blood glucose

Skin cold and clammy	Non-productive cough	Oliguria	Glasgow Coma Scale
Wound drains	Bleeding from surgical site E	Confused	Review drugs chart
Chest drain	Bruising	Agitated	Diuresis
Patient sweating	Scars	Productive cough	Review/insert cannula
Seesaw chest movement	Capillary refill time	Oropharyngeal airway	Guedel airway
Accessory muscle use	Stridor	Jaw thrust	Urea and electrolytes blood test
Equal expansion of chest	Cyanosis	Skin turgor	Nasopharyngeal airway
Surgical emphysema	Clubbing of fingers	Blood pressure	Patient alert
Percussion	Swallowed tongue	Heart rate	Suction
Cardiac monitoring (3 lead)	Talking in full sentences	Chest auscultation	Respiratory rate
C-dimer test	Gurgling	Central trachea	Oxygen saturations (SpO_2)
12-Lead electrocardiogram	Head tilt/chin lift	Wheeze	Arterial blood gas
Patient talking	International Normalised Ratio	Full blood count	Snoring

CRITICAL CARE – cABCDE ASSESSMENT

So far we have looked at the NEWS2 observation assessment chart. However, in critical/emergency care the cABCDE assessment tool is used, which has superseded the original ABCDE in these clinical areas:

c = Catastrophic haemorrhage
A = Airway (with cervical spine control)
B = Breathing
C = Circulation (with haemorrhage control)
D = Disability
E = Exposure

This tool was adopted first by the military to deal with catastrophic haemorrhage caused by explosion or other serious trauma. If a catastrophic bleed is identified, this needs to be dealt with first, i.e. stemmed, before progressing with the ABCDE part of the assessment. This assessment is therefore used to identify any obvious major bleeding points in critical care, such as stab wounds, which is the immediate life-threatening issue. An example of a catastrophic bleed may involve the femoral artery in the leg, and the individual will experience hypovolemic shock very rapidly, followed by cardiac arrest if not addressed immediately – hence the cABCDE approach.

Treatment of a catastrophic bleed involves using the application of a clean bandage under pressure with elevation. If this is ineffective, a special haemorrhage dressing can be used. A tourniquet may also be used to apply indirect pressure on a proximal artery and is more effective against a single bone, such as the femur.

It should be noted that just because the bleeding may not be visible, it does not mean that it is not happening, and this is where we need to trust the vital signs, such as heart rate, respirations, capillary refill time, BP, mental status, and urine output. Other indicators of bleeding include oxygen delivery to bodily tissues (lactate, base excess). The earliest signs to change are usually the respiratory and heart rates. The last sign to change is usually the BP, particularly amongst younger, healthy individuals who may show a relatively normal BP, only dropping as the patient goes into peri-arrest.

This assessment also assesses the cervical spine and its relation to breathing, which we will look at in Chapter 6.

Maternity – Modified Early Obstetric Warning Score

The NEWS2 has also been adapted to be used in obstetrics and includes the following assessments:

- Temperature
- Systolic BP
- Diastolic BP
- Heart rate
- Respiratory rate
- Oxygen saturations
- Level of consciousness
- Per vaginam bleeding (vaginal bleeding)

Table 4.4 shows typical Modified Early Obstetric Warning Score (MEOWS) parameters but should always be checked within your own clinical areas.

Table 4.4 Modified Early Obstetric Warning Score (MEOWS) parameters.

Score categories	3	2	1	0	1	2	3
Respirations		≤8		9–16	17–20	21–29	≥30
O_2 saturations				≥94%	90–93%	85–89%	≤84%
Systolic blood pressure	≤70	71–80	81–100	101–199		≥200	
Pulse				51–100	101–110	111–129	≥130
ACVPU			New confusion/ agitated	Alert	None	Pain	Unres-ponsive
Temperature (°C)		≤35	35.1–36	36.1–37.5	37.6–38.1	≥38.2	
Urine (ml)				No concerns	21 – 35	1–20	None

A total of ≥5 or 3 in one parameter will trigger an increased frequency to a minimum of hourly observations and midwife to urgently escalate care to the obstetric team. Figure 4.2 shows the MEOWS escalation pathway.

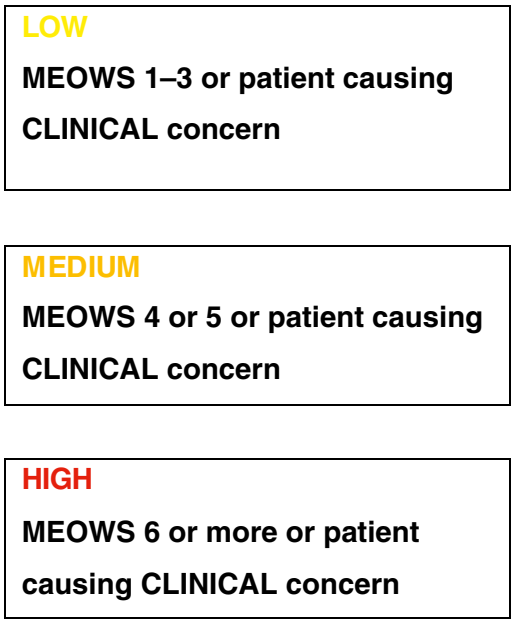


Figure 4.2 MEOWS escalation pathway.

Paediatric Early Warning Score

Another modification of the NEWS2 observation is the Paediatric Early Warning Score (PEWS). Table 4.5 shows a typical example of the PEWS.

Table 4.5 Paediatric early warning score observations.

Age	3	1	0	1	3
Respiratory rate					
<4 months	<20	20–29	30–39	40–54	>54
4 months–2 years	<15	15–24	25–34	35–55	>55
2–5 years	<10	10–19	20–29	30–45	>45
5–12 years	<10	10–19	20–29	30–45	>45
>12 years	<10	10–19	15–25	25–45	>45
Heart rate					

(*Continued*)

Table 4.5 (*Continued*)

<4 months	<80	80–109	110–159	160–190	>190
4 months–2 years	<80	80–99	100–149	150–180	>180
2–5 years	<60	60–79	80–119	120–150	>150
5–12 years	<60	60–69	70–119	120–150	>150
>12 years	<60	60–69	70–99	100–150	>150
Blood pressure					
<4 months			60–80		
4 months–2 years			70–89		
2–5 years			90–129		
5–12 years			90–129		
>12 years			90–129		
Capillary refill time					
All ages			<2 seconds	3–4 seconds	>4 seconds
Conscious level					
All ages			Alert	Responds to pain/voice	Unresponsive

Oxygen saturations guide: green indicates ≥95%; yellow indicates 92–94%; red indicates <92%.

Figure 4.3 shows the PEWS escalation pathway.

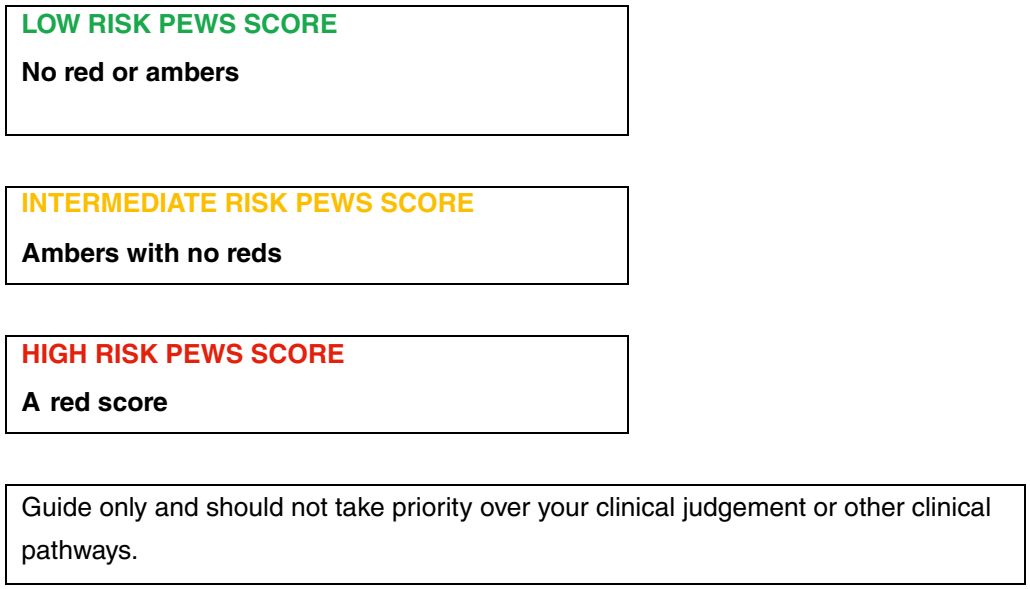


Figure 4.3 Paediatric early warning score escalation pathway.

PALPATION

Palpation is where areas of the body are assessed by feeling for any tenderness, inflammation, swelling, oedema, etc. This is also what we do when manually feeling the pulse, i.e. radial pulse, assessing the rate, regularity, and volume. Any abnormalities can give us information about the patient's state of health (see Table 4.6).

Table 4.6 Palpating the radial pulse.

Palpating the pulse	Abnormality and possible meaning
Pulse regularity	**Missed beats may be because of ventricular ectopics.**
Pulse irregularity	**May be caused by atrial fibrillation and other abnormal rhythms. A 12-lead electrocardiogram should be performed.**
High volume (bounding)	**May be associated with sepsis.**
Low volume, possibly thready; difficult to feel pulse	**May be a result of hypotension, possibly caused by hypovolaemia or cardiac dysfunction.**

Physical signs of abnormally during palpation include:

- Tenderness – Patient will report pain when area is touched and may move to protect the area.
- Inflammation – The skin will appear reddened and feel warm to the touch.
- Oedema – The skin will appear swollen and will remain indented when pressed.
- Surgical emphysema – Crackles/popping will be felt under the skin when pressed.

PERCUSSION

This assessment technique is used to detect levels of fluids, air, or organ size in the body cavity. Both hands are used – one laid over the surface and the other hand's middle finger gives a sharp tap/strike to the area on the body being assessed. Table 4.7 lists the sounds associated with differing underlying densities.

Table 4.7 Percussion sounds.

Assessing for. . .	Sound
Tissue	Dull sound
Fluid	Dull sound
Air	Loud or resonant sound
Muscle	Flat sound
Bone	Flat sound

AUSCULTATION

Auscultation is where we use a stethoscope to listen to the lungs, heart, and abdomen, usually when caring for the acutely ill patient. Before using this assessment tool, especially in emergency situations, you should be well practiced in this skill, honing your skill firstly on well patients to hear the correct sounds, whereby you will be able to distinguish these from abnormal sounds.

The small bell part of the stethoscope is used to hear low-pitched sounds, and the larger diaphragm part of the stethoscope is used to hear high-pitched sounds, such as normal heart sounds and general respiratory sounds (Figure 4.4). Both the bell and the diaphragm should be placed directly on the skin as listening through clothing may be difficult to interpret.

Figure 4.4 The bell and diaphragm of a stethoscope.

ASSESSMENT INVESTIGATIONS

Blood results and other investigations can be used as part of the patient assessment for interpretation, diagnosis, and treatment plan. Table 4.8 shows a selection of some of these primary investigations.

Table 4.8 Assessment investigations.

Biochemistry • Urea • Creatinine • Electrolytes (potassium, sodium) • Blood glucose • Blood gases: pH, pO_2, pCO_2, • Standard bicarbonate
Haematology • Full blood count; haemoglobin, white cell count, platelets, neutrophils • Clotting screen
Microbiology • Blood cultures • Sputum • Urine • Cerebrospinal fluid • Radiology • Chest x-ray
Electrocardiogram • 12 lead
Urinalysis • pH, glucose, ketones, leucocytes, nitrite, protein, blood

DID YOU KNOW?

Never try lying to an x-ray technician. They can see right through you!

Blood Tests

Assessment tests, as described earlier, depend on the nature of the symptoms, for example, if a patient complains of leg pain or tenderness (usually in one leg only) and a visual examination observes swelling (oedema) and discolouration, a D-dimer blood test may be requested because this patient is showing all the signs and symptoms of a deep vein thrombosis.

Also, if a patient presents with chest pain, the blood test requested in this instance is a troponin blood test.

DID YOU KNOW?

Troponin is a protein that is released into the bloodstream during a heart attack. Detecting troponin in the blood can help medics diagnosis a myocardial infarction (heart attack).

Patients in intensive care units who are on ventilators would undergo frequent arterial blood gas tests. In short, your symptoms do dictate what blood tests the patient will undergo.

Table 4.9 lists some of the blood tests you may see in practice, depending on placement, and gives a little information on each. Did you ever wonder what these tests mean and what this will tell the healthcare professional?

Table 4.9 Selection of blood tests.

Blood test	Information
Chem 7 **1 Blood urea nitrogen** **2 Serum glucose** **3 Creatinine** **4 Carbon dioxide (CO_2)** **5 Serum chloride** **6 Serum potassium** **7 Serum sodium**	**This blood test looks at the levels of essential enzymes in the blood and also checks kidney function and glucose levels.**

Table 4.9 (*Continued*)

Blood test	Information
Full blood count (also can be called complete blood count)	This blood test is used to detect infections and inflammation, bleeding and clotting issues. It can also help in giving an indication of general health, as well as checking for signs of iron deficiently anaemia and vitamin B_{12} deficiency anaemia.
Coagulation (prothrombin time, partial thromboplastin time, and International Normalised Ratio)	This gives an indication of how long your blood takes to clot – may be a sign of bleeding disorders, such as haemophilia. Disorders in clotting ability can cause problems in surgery (even delaying surgery). This test can also be used to monitor blood-thinning medications, such as warfarin, to check that the dose is correct.
Liver enzymes	Known as liver function tests and performed to determine whether the liver is functioning normally. Elevated levels may indicate liver damage or poor liver function. Can help to diagnose certain liver conditions, including hepatitis, cirrhosis, and alcohol-related liver disease. A typical liver function study includes aspartate phosphatase, alanine aminotransferase, alkaline phosphatase, total bilirubin, direct bilirubin, indirect bilirubin, and albumin
Arterial blood gas (ABG)	Known as ABG and looks at how the respiratory system is functioning and how much oxygen is in the blood. The test takes blood from the artery, which is typically drawn from the radial artery in the wrist. If the patient is on a ventilator, and having this blood test frequently, an arterial line may be inserted. A typical ABG includes: • pH – the acid/base balance of arterial blood • pCO_2 – how much carbon dioxide is in the blood • pO_2 – how much oxygen is in the blood • HCO_3 – the bicarbonate levels that may indicate kidney function issues • O_2 – how much oxygen is available for the tissues of the body to use

(*Continued*)

Table 4.9 (*Continued*)

Blood test	Information
ABO typing	This blood test determines blood type. Most surgeries do not require a blood transfusion but some do, such as heart bypass surgery. Also used during pregnancy because there is a small risk that the unborn child and mother may have different blood groups, causing rhesus disease (whereby the mother's immune system attacks the baby's red blood cells).
Blood culture and sensitivity	Blood is drawn into a bottle of sterile culture medium (nutrients) that 'feeds' bacteria. The sample is then kept warm for a few days and then checked to see if bacteria is growing, indicating that the bacteria is present in the blood. The correct antibiotic is then prescribed.
Blood cholesterol	Cholesterol is a fatty substance mostly created by the liver from fatty foods in the diet. High cholesterol levels can contribute to an increased risk of serious health problems, such as heart attacks and strokes. Individuals undertaking this test may be asked not to eat anything for 12 hours.
Blood glucose	A number of tests can be used to diagnose and monitor diabetes by checking for glucose in the blood, including: Fasting glucose test – levels of glucose in blood checked after fasting for at least eight hours Glucose tolerance test – level of glucose checked after fasting, and again two hours later after been given a glucose drink HbA1C test – this test checks your average blood glucose level over the past three months
Chromosome testing (karyotyping)	This test 'counts' the chromosomes (each cell should have 23 pairs) and checks their shape, from which it may be possible to detect genetic abnormalities. Chromosome testing can be used: • To help diagnose disorders of sex development, such as androgen insensitivity syndrome • For individuals who have experienced repeated miscarriages to see if a chromosomal problem could be responsible

Table 4.9 (*Continued*)

Blood test	Information
C-reactive protein (CRP) test	This test helps to diagnose conditions that cause inflammation. CRP is produced by the liver, and higher concentrations in the blood is a sign of inflammation in the body.
Electrolyte test	Electrolytes are minerals in the body, such as sodium, potassium, and chloride, and perform jobs such as maintaining a healthy water balance in the body. Changes in the level of electrolytes can have various possible causes, such as dehydration, diabetes, or certain medications.
Erythrocyte sedimentation rate (ESR)	This test works by measuring how long it takes for red blood cells to fall to the bottom of a test tube. The quicker they fall, the more likely it is that there are high levels of inflammation. An ESR is often used to help diagnose inflammatory conditions, such as: • Arthritis • Endocarditis • Crohn's disease • Polymyalgia rheumatica, e.g. fibromyalgia, rheumatoid arthritis, etc.
Genetic testing and screening	This involves extracting a sample of DNA from the blood, then searching the sample for a specific change (mutation). Genetic conditions that can be diagnosed are: • Haemophilia • Cystic fibrosis • Spinal muscular atrophy • Sickle cell anaemia • Polycystic kidney disease Genetic screening can also be used genes that increase their risk to check if individuals carry a particular gene increasing their risk of developing a genetic condition.
Thyroid function test	This test is used to test the blood for levels of thyroid-stimulating hormone and can also test for thyroxine and triiodothyronine (thyroid hormones). If you have low or high levels of these hormones, it may mean individuals have underactive or overactive thyroid conditions.

(*Continued*)

Table 4.9 (*Continued*)

Blood test	Information
Cancer blood test	**A number of blood tests can be carried out to help diagnose certain cancers or check to see if individuals are at an increased risk of developing a particular type of cancer. These include:** • **Prostate-specific antigen (PSA) – PSA can help to diagnose for prostate cancer and detect other problems, such as an enlarged prostate or prostatitis.** • **CA125 protein – This protein can indicate ovarian cancer and detect pregnancy or pelvic inflammatory disease.** • ***BRCA1* and *BRCA2* genes – These genes can greatly increase a woman's chance of developing cancer; test is carried out if there is a familial link.**

Question 4.2 You read about the following conditions related to genetic testing and screening, but what do these conditions mean, in one sentence?

- Haemophilia
- Cystic fibrosis
- Spinal muscular atrophy
- Sickle cell anaemia
- Polycystic kidney disease

PATIENT DOCUMENTATION AND COMMUNICATION

When assessing the patient, it should be remembered that patients' medical and nursing admission notes and charts (such as fluid balance charts, observation charts, prescription charts, etc.) are a valuable source of information for the nurse assessor. Communication with the patient themselves, family members (where appropriate), and of course the patient's medical team and other healthcare professionals should never be underestimated as a means to gleam

information beneficial to the patient's nursing and medical care. Let me tell you about four real-life incidences I witnessed in clinical practice.

1. Whilst I was mentoring a nursing student, the student asked the female patient, being admitted to the ward, about her monthly periods, to which the patient replied (somewhat embarrassed and upset) that she had had a full hysterectomy two years ago. If the student had read the patient's medical notes before the nursing admission, as she had been asked to do, she would have known this and saved any embarrassment or upset for the patient.
2. The doctor had written a penicillin prescription on the patient's prescription chart. The patient had previously informed me on the patient nursing admission notes that they were allergic to penicillin, but this had not yet been written on the patient's prescription form. The doctor was immediately informed and changed the prescription. The prescription form was adjusted in the 'any sensitivities or allergies' box, and this fact was also added to patient's medical notes. During handover, nursing staff were also informed of this.
3. Patient had stated on admission that they took no prescribed medication. The newly qualified nurse had recorded this in the patient's admission documentation. The patient was due to go to surgery the next day for a microdiscectomy (removal of ruptured portion of lumber spine disc). After visiting and on her way out of the ward, her partner handed the nurses the patient's ginseng tablets and stated that she took them every morning and asked the nurse to hand them to her partner, the patient. The surgeon and her medical team were immediately informed. The patient thought that as it was a 'herbal' medication, she did not need to inform the healthcare professionals that she was taking it as she thought this was completely harmless, similar to 'a vitamin supplement.'

DID YOU KNOW?

Ginseng – The pharmacokinetics of ginseng suggests that patients should discontinue this drug at least 24 hours before surgery, but discontinuation at least 7 days before surgery is preferred because of the irreversible platelet inhibition.

4 A nurse completed nursing admission on a patient and had been informed that he had a lactose intolerance, which the medic had recorded in the patient's notes and on the prescription form. The patient had complained about his rhinitis and 'itchy eyes' caused by hay fever. The medic had prescribed an antihistamine, which the nurse administered. A short while later, the patient stated that he felt unwell and had 'the runs' (diarrhoea). The nurse immediately realised that the antihistamines contained lactose, which was causing the patient's reaction.

These incidences demonstrate the importance of both verbal and documentation communication and **acting** on the information.

TEST YOUR KNOWLEDGE

1 What is a healthy capillary time for an adult?
2 Can the ABCDE assessment be used in routine admissions?
3 Can the ABCDE assessment be used in emergency admissions?
4 You will need to look at the NEWS2 chart (see Appendix 1) for questions 4 and 5. What is the NEWS score?
Respirations – 17 breaths/min
SpO_2 (Scale 1) – 99%
Air or oxygen – Air
Blood pressure – 130/80
Pulse – 88 beats/min
Consciousness – Alert

Temperature – 37.5 °C
NEWS score:
Escalation of care:
Monitoring frequency:

5 Respirations – 24 breaths/min
SpO_2 (Scale 2) – 94%
Air or oxygen – Oxygen Simple Mask (SM)
Blood pressure – 180/60 mmHg
Pulse – 100 beats/min
Consciousness – New confusion
Temperature – 38.5 °C
NEWS score:
Escalation of care:
Monitoring frequency:

6 What is anuria?

7 What results can we obtain from a urinalysis 'dip stick' assessment on admission?

8 Is it important to know the ingredients of a medicine before administering it to the patient?

9 What is a healthy capillary refill time for a five-year-old child?

10 What is the reading on the MEOWS chart that will score a zero on the systolic BP vital sign recording?

KEY POINTS

Patient assessment techniques:

- NEWS2 observation chart
- ABCDE assessment – during routine admission and emergency situations
- Look, Listen, Feel, Smell assessment
- Capillary refill assessment
- Palpation assessment
- Percussion assessment
- Auscultation assessment
- Assessment investigations: biochemistry, haematology, microbiology, electrocardiogram, urinalysis
- Patient documentation and communication

WEB RESOURCES

Nursing Admission Assessment and Examination: https://www.ncbi.nlm.nih.gov/books/NBK 493211

Nursing Process: https://www.nursingprocess.org/nursingprocesssteps.hymi

Nursing Assessment: https://easierwithpractice.com/what-is-initial-assessment-in-nursing

Nursing Process: https://www.rnpedia.com/nursing-notes/fundamentals-in-nursing-notes/assessment-first-step-nursing-process

NEWS2 Observation Chart (reproduced with permission from the Royal College of Physicians (2017)): www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news-2

CHAPTER 1

History taking and the newborn examination: an evolving perspective

Claire Evans

Warrington and Halton Hospitals NHS Foundation Trust, Warrington, Cheshire, UK

KEY POINTS

- The principal aim of history taking is to screen for predictive risk indicators that may predispose the newborn to an adverse postnatal transition or presence of an abnormality that requires an appropriate and timely referral for further diagnostics.
- The newborn examination history-taking process should be mapped to the Public Health England (PHE) Antenatal and Newborn Screening Programme and be used as a benchmark for screening and assessment of risk factors in the neonatal period and beyond.
- Identification of risk factors within the newborn examination can isolate and target health promotion issues.

Introduction

A comprehensive history taking is implicit to all health care disciplines to aid the diagnostic consultation process and to inform the optimal course of management. The skill of history taking has changed over the decades and has adopted a wider context as a predictive diagnostic tool. To facilitate a more holistic approach to the examination of the newborn, a thorough evaluation of the maternal and newborn history is essential.

Examination of the Newborn: An Evidence-Based Guide, Third Edition. Edited by Anne Lomax.

Companion website: www.wiley.com/go/lomax/newborn

Short-term outcomes, long-term morbidities or even mortality can be influenced by the quality of the history taking in terms of the predictive risk for some adverse clinical conditions.

This chapter outlines the context of the history profile from the maternal, perinatal and familial perspective. It also addresses history taking as a skill as well as the potential barriers that may reduce the effectiveness of the process. The aim of this chapter is not only to address common risk factors but to embrace the wider context of history taking from a psychosocial and safeguarding perspective (see also the website that accompanies this book for more information on safeguarding and the newborn examination). The focus on history taking must be meaningful, achievable and valuable to the newborn examination practitioner. History taking remains the principal standard underpinning the clinical examination; to disregard the importance of history taking may lead to suboptimal practice and outcomes. Effectively gathering a history demands time and should not be rushed because it is a powerful instrument that can influence the quality of the examination.

Historically, the profile of the newborn examination systematic history assessment has been raised over the decades (NHS QIS 2008; NICE 2015; PHE 2020c; Skills for Health 2019). However, history taking is an essential component of the newborn and infant physical examination (NIPE) that has been validated through the development of the UK National Screening Committee (NSC) NIPE Programme (PHE 2018a) and implementation of the national NIPE Programme guidance documents mandating the programme (PHE 2018; 2020c).

For the purposes of this chapter, the National Health Service (NHS) Antenatal and Newborn Screening Programmes will be used as a framework to underpin the history-taking process. This approach should encompass all relevant information from the maternal and newborn medical records, dialogue with the mother and/or father and information from clinical staff.

The NIPE Programme Handbook, standards and service specifications can be found on the gov.uk website:

https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-programme-handbook/newborn-and-infant-physical-examination-screening-programme-handbook

https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-screening-standards

https://www.england.nhs.uk/wp-content/uploads/2017/04/Service-Specification-No.21-NIPE.pdf.

The NIPE Programme Newborn Screening Pathway can be found as an appendix to the Programme Handbook and on the following weblink:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/702100/NIPE_Screening_Programme_Newborn_Pathway.pdf.

Objectives and characteristics of good history taking

The principal aim of the history-taking exercise is to identify predictive risk indicators for those newborns that may be risk of an adverse postnatal transition extending into childhood. Families with newborns who are identified as being at risk will then benefit

from early detection, intervention and treatment options. To achieve this, the history profile must be factual, accurate, concise, informative and relevant. Discussions with the parents, to gather the history, can also offer a platform that targets health awareness and safety issues to promote optimal health in the neonatal period and beyond. A review of maternal and parental lifestyle habits in general, e.g. smoking, addictive behaviours and high-conflict relationships, can be identified, and appropriate timely referrals or support can be arranged. Other health promotion issues including BCG vaccination to high-risk populations can be actioned.

A quality history-taking process is largely dependent upon the skill of the practitioner. Health care professionals who conduct the newborn examination are fortunate in having pre-existing skills that are transferable. Doctors, midwives and neonatal nurses engage in history taking on a regular basis within their daily practice. However, the underlying principles of history taking follow that of all patient groups. Howard (2008) comments upon the role of history taking in establishing trust, which in turn paves the way for the physical examination. Thus, the interpersonal skills of the NIPE practitioner can influence the quality of the history obtained. Mannerisms, eye contact, body language, patience, listening skills and empathy are all key skills that any health care professional requires to obtain a good history. If there is any deficiency in these key skills, the level of narrative imparted by the mother or father to the NIPE practitioner may be negatively affected. Stoeckle and Billings (1987), in their signature work on history taking, refer to the process as a clinical interview, and the way it is conducted will influence the communicative processes necessary to generate the clinical picture.

Parallels can be drawn between history taking for the newborn examination and maternal history taking throughout pregnancy that may illuminate any element of risk to the mother/infant dyad. In addition, engagement of the parents with the history-taking exercise facilitates participation in the decision-making process and the request for consent to conduct the newborn examination (NHS QIS 2008).

It is important to note that in the event of any subsequent admission to hospital for the infant, the first point of reference is the history and newborn examination. In addition, if anything was missed during the examination, e.g. cleft palate, a dislocated hip, then this may result in a complaint and possible legal action (see also Chapter 10). A thorough history can identify potential as well as actual risk of an aspect being overlooked that may later impact upon neonatal and infant outcome.

Concise and thorough history taking will also assist the NIPE practitioner to ascertain if the examination meets the healthy newborn criteria. Some aspects of the history may require midwives or neonatal nurses to refer the newborn to a medical colleague if a more detailed examination is necessary. For this reason, it is vital that maternity units have local guidelines in place to support all health care disciplines who undertake the newborn examination.

Paediatric medicine has long since considered family history as key to the clinical examination process. The family profile is informative when screening for common complex and single-gene conditions but includes isolating genetic predispositions in some families (Green 2007). As a result, several family history-taking checklists in the form of mnemonics have emerged to guide paediatricians. Such systems may be helpful and indeed insightful, but they cannot be fully applied to newborn history taking. However, this does highlight the importance of gathering information in an ordered manner and, most importantly, that the family history must be placed at the centre of history taking for the newborn infant.

Building a history profile: where to start?

When building a history profile, a clear identifiable process can be followed. Assimilation of the perinatal history can be challenging, and therefore the first point of reference is the maternal medical records. However, knowing what to look for and having some order of assemblage in the gathering of information is crucial if the task is to be efficient and not time-consuming. The maternal booking history often yields the most significant information alongside the serology results. The maternal early booking history will, in the main, provide most of the baseline history. This should provide the medical and surgical history of the mother as well as the maternal well-being so far during the current pregnancy.

Reliance upon the maternal medical records alone will not provide all of the information needed. It is therefore necessary to question the mother and/or father on family history to extract those risk factors that parallel the national standards (PHE 2018a).

The NHS Antenatal and Newborn Screening Programme should be used as the benchmark for identifying risk factors for the newborn examination (see Table 1.1). The maternal antenatal screening tests undertaken will provide a framework of investigative results for the NIPE practitioner that will provide the foundation for the history profile.

Evaluation of maternal medical records: biophysical information

The maternal socio-demographic and biophysical details should be assessed. Age must be noted, particularly in the teenage primigravida, as additional health promotion and education by the examiner may be necessary upon completion of the examination. Early and recent evidence suggests that upper and lower margins of maternal age are adversely related to prenatal and perinatal outcome (PHE 2019a). Bornstein et al. (2006) explore this relationship, concluding that varied age groups have differing parenting abilities. Nevertheless, the teenage mothers may require more intensive health promotion advice for themselves, possibly their partners and their newborn infants.

A raised body mass index (BMI) can influence general health and may also indicate the family unit's dietary habits. A positive relationship exists between a raised BMI and complications of pregnancy including diabetes, hypertensive disease and thromboembolic disorders (Bhattacharya et al. 2007; NICE 2010; RCOG 2018). Pregnancy outcome can be affected, resulting in macrosomia, shoulder dystocia at delivery and hypoglycaemia of the newborn (Kalk et al. 2009; Khashan and Kenny 2009). Maternity units must have a policy in place for the prevention, detection and treatment of neonatal hypoglycaemia to identify those newborns most at risk (BAPM 2017).

Previous obstetric and medical history

The medical history can reveal conditions such as maternal hypothyroidism, cardiac disease, type 1 or gestational diabetes, renal disease, epilepsy, blood disorders e.g. idiopathic thrombocytopenia, haemophilia or von Willebrand disease, or maternal

TABLE 1.1 **Key elements of the National Antenatal and Newborn Screening Programme.**

Screening tests	Timing	Biophysical details
Serology investigations		
Blood profile to include group, rhesus and antibodies status and haemoglobin	At booking Antibodies and haemoglobin repeated at 28 weeks	Approximately 15% of the population are rhesus-negative (Salem and Singer 2009). Anti-D immunoglobulin is offered to all rhesus-negative women at 28 weeks' gestation to prevent haemolytic disease in the newborn. Maternal antibodies can also cause haemolytic disease.
Sickle cell	As early as possible, preferably by 10 weeks' gestation	Inherited genetic condition resulting in the red blood cell forming a sickle cell shape. There are variants of this disease that impact on the severity. In cases where women are healthy carriers, the baby's father should be offered screening. The risk of an affected infant is 1:2 where both parents are carriers (PHE 2018b).
Thalassaemia	As early as possible, preferably by 10 weeks' gestation	Inherited genetic condition that affects the production of red blood cells. The genes that make haemoglobin are altered, causing anaemia. This condition takes two forms: alpha and beta (Ryan et al. 2010; PHE 2018b).
Hepatitis B	At booking	Some populations of women are at high risk of hepatitis B infection (HBsAG positive). Transmission of the virus is through sexual contact, vertical transmission or contaminated blood, e.g. needle sharing. Transmission to the fetus can be transplacental. Vaccination of the newborn must be offered to HBsAG positive women and their partners (PHE 2016, 2019b).
HIV	At booking	HIV infection is a retrovirus that causes an alteration of the immune system. The virus infects the CD4 cells or the helper T cells that lower the body's cell-mediated immunity. Infection with HIV-1 can progress to AIDS (Carpenter et al. 2009; PHE 2016, 2019b).
Syphilis	At booking	Sexually transmitted disease with a risk of transplacental transmission (PHE 2016, 2019b)
First trimester combined test	11+2 – 14+1 weeks	Combined screening test with combination of age, blood profile, nuchal scan measurement and other factors (PHE 2018b).
Ultrasonography		
Nuchal translucency	11+2 – 14+1 weeks (part of combined test)	Nuchal translucency measurement greater than 3.5 mm in early pregnancy. This finding is significant as associated with cardiac and syndromic pathology. This finding is also part of the 'combined' screening test for trisomy 21 (PHE 2018b).

(*Continued*)

TABLE 1.1 (Continued)

Screening tests	Timing	Biophysical details
Quadruple test	14+2 – 20+0 weeks	Biochemistry tests, which include AFP, BHcG, oestriols and inhibin A (PHE 2018b).
Fetal anomaly	18+0 – 20+6 weeks	This scan can detect certain gross structural anomalies but does have its limitations. Approximately 45% of cardiac defects can be detected at this time (PHE 2018b).
NIPE National Standards	Within first 72 hours of birth Repeated at 6–8 weeks of age	Full physical and behavioural examination of the newborn incorporating the four-core condition-related screening standards: developmental dysplasia of the hip, examination of the eye, congenital heart defects and undescended testes (PHE 2018a).

Source: Adapted from the NHS Antenatal and Newborn Screening Programmes (PHE 2016, 2018a, 2020c).

depression. The surgical history may not have such a direct impact upon risk for the newborn but does add to the completeness of the history-taking process for the NIPE practitioner.

Previous obstetric histories can provide information regarding maternal well-being and pregnancy outcome that may be of relevance. The health of existing siblings should be noted. A previous intrauterine death, neonatal death or sudden infant death syndrome (SIDS) sibling should be noted. It is good practice to offer the option of an ECG being performed on the new sibling to rule out any risk of cardiac conduction disorders, e.g. prolonged QT syndrome or Wolff–Parkinson–White syndrome. The newborn would also be on the Care of Next Infant (CONI 2020) scheme with the provision of an apnoea monitor prior to discharge.

Intrapartum history

The intrapartum history is important in terms of identifying risk factors for the newborn. If resuscitation of the newborn was required, note the level of support given and time to response. It is also important to note if the newborn required admission to the neonatal unit for ongoing observation.

Taking note of the mode of delivery is important because this may impact upon the health of the newborn. If shoulder dystocia presented during the second stage, the newborn must be thoroughly examined by a senior paediatrician for evidence of a brachial plexus injury, a clavicle fracture or sternomastoid muscle injury. An examination in the immediate post-delivery period by a paediatrician should be part of the maternity service local shoulder dystocia management guideline.

Breech presentation carries a strong correlative risk of developmental dysplasia of the hip (DDH) and is therefore a national NHS NIPE Screening Programme risk factor (PHE 2018a, 2020c). Breech presentation at birth irrespective of mode of delivery, or clinically diagnosed in pregnancy after 36 weeks gestation, or if external cephalic

TABLE 1.2 **Maternal medical records: summarised alert indicators.**

Maternal medical records: alert indicators
Ultrasound scans:
• Polyhydramnios
• Oligohydramnios
• Dilated renal pelves
• Intrauterine growth restriction
• Suspected chromosomal or syndromic aberrations
• Other significant ultrasound screening findings
• Congenital heart defect
Abnormal combined or quadruple test result
HIV positive serology status
Hepatitis B and C
Haemoglobinopathy
Maternal antibodies
Maternal pyrexia in labour
Prolonged fetal tachycardia
Pre-labour prolonged rupture of membranes
Meconium stained liquor
Maternal group B streptococcal infection
Breech presentation
Maternal disease state: type 1 and type 2 diabetes, autoimmune disorders, e.g. systemic lupus erythematosus
Maternal substance use
Maternal alcohol dependency
Thrombocytopenia

version performed for breech presentation irrespective of gestational age at delivery requires referral of the newborn for ultrasound examination of the hips in line with the national NIPE standards (PHE 2018a, 2020c).

A precipitate delivery may cause facial congestion that can be misdiagnosed as cyanosis. An instrumental delivery may result in the newborn suffering a degree of head trauma, such as bruising, which may require analgesia and can increase the risk of hyperbilirubinaemia (see Table 1.2 and Chapter 3).

Meconium stained liquor (MSL) can be problematic for a minority of newborns and therefore must be noted from the delivery summary. The presence of MSL is associated with an increased mortality and morbidity, accounting for 2% of perinatal deaths (NICE 2017). It is relatively common with an occurrence of 15–20% in term pregnancies (NICE 2017). Although meconium aspiration syndrome is relatively rare, some of these infants may seem well at delivery but rapidly develop signs of respiratory compromise as a result of aspiration. The National Institute for Health and Care Excellence (NICE) (2017) advocates close observation of the newborn with MSL present at delivery in the immediate postnatal period.

Early onset neonatal sepsis

Newborn examiners must be continuously on the alert for possible risk factors for early onset neonatal sepsis. Early onset sepsis in the newborn is a significant contributor to perinatal mortality. One of the most common bacterial isolates is group B haemolytic streptococcus (GBS), which carries a mortality of 6% in term infants and 18% in preterm infants (NICE 2017). Maternal infection during the antenatal period must be actively treated with antibiotic therapy. Treatment with antibiotics for the newborn may also be required but is risk dependent or if the newborn is symptomatic (NICE 2012; RCOG 2017). Ohlsson and Shah (2009) inferred that intrapartum antibiotic therapy does reduce the risk of early onset GBS in the newborn.

In the case of pre-labour prolonged rupture of membranes (PROM), the length of time must be noted (NICE 2012). The risk of early onset GBS infection in the newborn is greater in women with PROM (NICE 2012; RCOG 2017). In the absence of any other symptoms, true maternal pyrexia in labour must never be ignored. In addition, there was no strong evidence to recommend antibiotic prophylaxis for newborns of women with PROM in labour (NICE 2012).

Conversely, the symptomatic newborn must commence antibiotic therapy and admission to the neonatal unit for further diagnostics. Every newborn must be treated on an individual basis, depending on the risk factors presenting. Multiple risk factors will necessitate newborn screening for infection and the commencement of antibiotic prophylaxis until blood culture results become available. Local policy on the prevention and detection of early onset sepsis in the newborn must reflect the red flag and non-red flag risk indicators as detailed in the NICE guidance for neonatal infection early onset (NICE 2012) available at https://www.nice.org.uk/guidance/cg149. The NICE guidance advocates the avoidance of routine antibiotic therapy.

It is estimated that 90% of newborns with early onset sepsis will be symptomatic within 12 hours of birth (NICE 2017). Therefore, all newborns with risk factors for early onset infection must receive close observation as indicated on the local neonatal early warning score (NEWS) chart. A framework for the use of the neonatal early warning trigger and track (NEWTT) chart can be found on the British Association of Perinatal Medicine (BAPM) website: https://www.bapm.org/resources/38-newborn-early-warning-trigger-track-newtt-a-framework-for-practice-2015.

The NIPE examiner must ensure that the observations are documented on the NEWS chart and reviewed within the context of the examination and assessment of the overall health of the newborn.

Infant of the diabetic mother

The newborn of the diabetic mother, irrespective of diabetes type, will require blood glucose monitoring. The newborn examiner must review the blood glucose results prior to conducting the examination. Local policy will dictate the monitoring intervals for such newborns. Suboptimal results will require more active management of hypoglycaemia that may necessitate admission to the neonatal unit (BAPM 2017). The BAPM guidance for the identification and management of neonatal hypoglycaemia can be found at https://www.bapm.org/resources/40-identification-and-management-of-neonatal-hypoglycaemia-in-the-full-term-infant-2017.

The NHS Antenatal Screening Programme

Antenatal serology results

The NHS Antenatal Screening Programme components (Table 1.3) aim to help the NIPE examiner navigate investigations and results and signpost the relevant information within the maternal medical records. Familiarisation with the key components of the programme will enhance this process.

The maternal prenatal serology results must be reviewed, particularly the rhesus status. A maternal rhesus negative status or the presence of antibodies should alert the NIPE examiner to the possibility of rhesus incompatibility and the risk of early onset pathological hyperbilirubinaemia with the first 24 hours of life. A sibling of the newborn with neonatal jaundice requiring phototherapy carries a significant risk (NICE 2016). Further information on neonatal jaundice management guidelines can be found on the NICE website: https://www.nice.org.uk/guidance/cg98. Surveillance of the newborn should be increased, particularly in the case of an early discharge to the community.

The maternal human immunodeficiency virus (HIV), hepatitis B and hepatitis C status should be reviewed in all cases. Antiviral therapy will be required for the newborn of an HIV positive mother (PHE 2016; 2019b) in accordance with the national British HIV guidelines (British HIV Association 2019) available from https://www.bhiva.org/file/5bfd30be95deb/BHIVA-guidelines-for-the-management-of-HIV-in-pregnancy.pdf.

The newborn of a hepatitis B positive mother will require vaccination with or without immunoglobulin within 4 hours of birth and follow the hep vaccine schedule for the first year of life (PHE 2016; 2019b) in accordance with the PHE Green Book recommendations (PHE 2014) available from https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book#the-green-book. Treatment may be required for the newborn of a syphilis positive mother in accordance with care pathway guidance (PHE 2016; 2019b).

A family history of metabolic disease must also be noted following the incident alert with medium-chain acyl-coenzyme A dehydrogenous deficiency (MCADD) (NPSA 2011). If MCADD is known within the family, then the newborn will require early special rapid bloodspot testing at 24–48 hours of age prior to the standard bloodspot screen at 5 days. Further information on newborn bloodspot screening can be obtained from the PHE Newborn Bloodspot Screening Programme website: https://www.gov.uk/government/collections/newborn-blood-spot-screening-programme-supporting-publications and the British Inherited Metabolic Disease Group at http://www.bimdg.org.uk/site/index.asp.

The fetus in focus

Fetal anomaly screening

Ultrasonography in pregnancy is part of the NHS Fetal Anomaly Screening Programme (FASP) (PHE 2018b). Two key ultrasound scans are offered as a minimum standard. The first scan is the early dating scan. It is therefore important to note the gestational age of the newborn from the dating ultrasound scan result prior to conducting the examination.

The second is the 18+0 to 20+6 week fetal anomaly scan (PHE 2018b). Additional serial scans will be performed if an abnormality or abnormal fetal growth is detected,

TABLE 1.3 **Using the maternal obstetric records, newborn records and NHS Antenatal Screening Programme results to create a history profile.**

Creating a history profile					
Maternal medical history	**Antenatal screening results**	**Pregnancy and labour history**	**Family history**	**Psychosocial factors**	**Newborn**
General health status	Serology reports		History of diabetes	Smoking	Resuscitation at birth and time to response
Cardiac disease	Rhesus status	Incidence of infection and bacteria isolate	Intergenerational conditions	Substance use	Method and frequency of feeding
Renal disease	Prenatal screening positive test results	Pathologies, e.g. pre-eclampsia, placental insufficiency	Inborn errors of metabolism	Alcohol dependency	Passage of urine and meconium
Hypothyroidism	Prenatal diagnostic investigations	Mode of delivery and presentation	First-degree relative with CHD	Depression or mental illness	General health and behaviour since birth
Gestational or type 1 diabetes	Prenatal diagnosis of a cardiac abnormality	Pre-labour length of membranes rupture	First-degree relative with DDH	High-conflict relationship	Presence of meconium at birth or risk or early onset sepsis
Nutritional status and BMI	Prenatal diagnosis of a trisomy		First-degree relative with a childhood eye condition	Safeguarding issues with siblings	Parental concerns
Depression or history of mental illness	Ultrasound growth scan profile			Social services involvement with family	Symptomatic of illness

either with the fetus or with the intrauterine environment, e.g. liquor volume or placental positioning. Fetal growth estimation is the primary parameter assessed. The Royal College of Obstetricians and Gynaecologists (RCOG) provides a green-top guideline (RCOG 2013) and the Perinatal Institute offers guidance on fetal growth and the use of growth tools during pregnancy to monitor fetal growth that can be found at http://www.perinatal.org.uk/FetalGrowth/fetalgrowth.aspx.

Evidence of intrauterine growth restriction is not an uncommon finding There may be evidence in the maternal history that may indicate why the newborn is small for gestation age. There may be a pre-existing maternal medical condition that has adversely contributed to placental function resulting in a poor fetal growth profile. Fetal growth restriction may be a feature of an underlying chromosomal abnormality or other pathology, e.g. transplacental viral transmission or the effect of a toxic substance, such as alcohol excess in pregnancy. Further information on the NHS FASP can be obtained from the website: https://www.gov.uk/government/publications/fetal-anomaly-screening-programme-handbook.

The NHS FASP (PHE 2018b) outlines the conditions screened for at the anomaly scan. Whilst it is useful in many cases, it is prudent to accept that this scan does have its limitations; therefore, the focus lies with a standard for 11 structural conditions where the specificity for detection is greater than 50% (PHE 2018b). Conditions screened for are as follows:

- Anencephaly
- Open spina bifida
- Cleft lip
- Diaphragmatic hernia
- Gastroschisis
- Exomphalos
- Serious cardiac anomalies
- Bilateral renal agenesis
- Lethal skeletal dysplasia
- Edward's syndrome (trisomy 18)
- Patau's syndrome (trisomy 13). (Adapted from PHE 2018b.)

The presence of other findings is significant and, as such, is reportable by the ultrasonographer as listed:

- Nuchal fold (greater than 6 mm)
- Ventriculomegaly (atrium greater than 10 mm)
- Echogenic bowel (with density equivalent to bone)
- Renal pelvic dilatation (AP measurement greater than 7 mm) (PHE 2018b).

Fetal renal pelvic dilatation will require serial scan monitoring throughout the pregnancy. However, it is particularly important to note this during history taking and to arrange follow-up ultrasound scans and urology clinic referral for the newborn.

The presence of oligohydramnios must alert the NIPE practitioner to the possibility of the following:

- Prolonged rupture of membranes earlier in the pregnancy
- Urinary tract anomaly or uropathy
- Fetal growth restriction (Baxter et al. 2010)
- Intrauterine infection.

Conversely, polyhydramnios will alert the examiner to consider the following:

- Duodenal atresia or stenosis (Rajiah 2009)
- Oesophageal atresia.

Exposure to the effects of intrauterine teratogens has been investigated and publicised over recent decades, but arguably the most common causes of such exposure is smoking and excessive alcohol consumption during pregnancy.

Smoking in pregnancy

Smoking is the most common substance dependency, yet the most preventable. Reduction in maternal smoking during pregnancy remains high on the public health agenda through smoking cessation initiatives as part of maternity care (NHSE 2016; NHS 2017; NICE 2018c). Clinical guidance can be found on the NICE website at http://www.nice.org.uk/nicemedia/live/13023/49346/49346.pdf. There is compelling evidence highlighting the adverse effects of maternal smoking in both the antenatal and postnatal periods (La Souef 2000; Gilliland et al. 2001; Landau 2001; Stocks and Dezateux 2003; British Medical Association 2004; Bradley et al. 2005). The adverse health implications for the newborn and older children are numerous and can impact upon mortality and morbidity.

Perhaps the most significant, devastating and publicised adverse effect of parental smoking is the increased risk of SIDS (McMartin et al. 2002; Anderson et al. 2005; Matturi et al. 2006; Sellwood and Huertas-Ceballos 2008). The hypothesis surrounding this causal relationship is multifactorial, ranging from respiratory infection susceptibility to altered respiratory control mechanisms (Hofhuis et al. 2003). This positive association cannot be underestimated nor ignored; therefore, the prevention of SIDS is high on the maternity services' health education agenda for the newborn examination. There should be reinforcement of the potential harmful long-term effects of smoking in the postnatal period upon the newborn and into childhood as part of the newborn NIPE health education.

Maternal alcohol consumption

Fetal alcohol exposure from excessive maternal consumption is associated with dysmorphic features and varied neurodevelopmental and behavioural disorders ranging from fetal alcohol syndrome to fetal alcohol spectrum disorders (Disney et al. 2008). Maternal alcohol consumption is often associated with an existing suboptimal social environment (Dawson 2003). The likelihood of domestic abuse may also be greater. The newborn can also suffer withdrawal symptoms from prenatal alcohol exposure that may result in seizure activity (Lall 2008).

Admittance to alcohol consumption during pregnancy in excessive amounts is often retrospective (Jacobson et al. 2002); therefore, intervention and preventative strategies must be put in place for subsequent pregnancies. Disney et al. (2008) reports on the long-standing evidence (Olson et al. 1997; Roebuck et al. 1999) to support altered neurobehavioural abilities in infancy through to antisocial behaviour and attention deficit disorders in children from small amounts of alcohol during pregnancy (Jacobson et al. 2002; Sayal 2007; Sayal et al. 2009). Enquiries into maternal alcohol and units consumed are made by the midwife at the prenatal booking interview. The current social acceptability of alcohol consumption in the United Kingdom may be harbouring an upsurge in a future generation who are affected by prenatal alcohol exposure. Some women, particularly the teenage population, may be engaging in alcohol misuse around the time of conception and beyond until confirmation of the pregnancy. For some newborns, the cessation of alcohol use, even early in the first trimester, may be too late.

Maternal substance use

Maternal substance use signals a probable newborn withdrawal process and a challenge to the health care team in establishing the exact nature of the drugs taken. In the first instance, the NIPE practitioner must establish what illicit drugs have been taken in pregnancy and the immediate pre-labour period. However, obtaining an accurate substance use history is often fraught with imprecise maternal disclosures. Such behaviour can be linked to the social stigmatisation of drug use and the fear of the newborn being placed in care. Sensitive, but direct, further maternal questioning may be required, especially in cases of polysubstance use.

The withdrawal timelines for the common illicit substances have been well documented over recent years. Withdrawal from opiates and heroin can be evident in the newborn within hours of birth, whilst cocaine and amphetamine withdrawal begins within 48 hours of birth (Wang 2010) and withdrawal from methadone does not occur until 48–72 hours of age (Leggate 2008), but it can be as long as 7–14 days before withdrawal is evident (Lall 2008; Wang 2010). The longer half-life of methadone is known to prolong and increase the severity of the withdrawal symptoms. Neonatal abstinence syndrome (NAS) is often considered the foremost adverse condition for the newborn of the substance misuse mother; however, the effects upon fetal brain development have far more significant and long-lasting consequences. Substance use in the first 20 weeks of pregnancy can cause disruption in the cytogenesis and cell migration processes. In the subsequent weeks of pregnancy, cell differentiation and overall brain growth can be disturbed (Wang 2010), including midline defects and congenital heart defects (Mone et al. 2004).

Neonatal abstinence syndrome

NAS indicates multisystem involvement, resulting in a cascade of symptoms. Fetal growth is disrupted, resulting in growth restriction that can independently place the newborn at greater risk of co-morbidity (Smith et al. 2006). Normal neurobehavioural function is altered, resulting in a display of central nervous system instability, abnormal feeding behaviour, respiratory compromise and gastrointestinal symptoms (Volpi-wise 2005; Hamden 2009). Seizure activity can manifest as a late onset symptom of diazepine withdrawal.

NAS can occur with prescribed maternal medication. Morphine-based analgesia for long-term protracted pain management and psychotropic drugs for mental illness are the most common. The social context of the mother requiring morphine for

long-term pain in many cases differs from that of the illicit substance user. Nonetheless, a sensitive approach is required with these parents when reiterating information about the clinical presentation of NAS, as they will have already received information in the prenatal period.

Where maternal substance use is known, it may be prudent for midwives and neonatal nurses to refer the examination to a senior paediatrician because the newborn will require a more thorough examination to assess for withdrawal symptoms.

Risk factors and the newborn examination

Intergenerational traits may indicate an inheritance risk to the newborn. History taking may elicit such conditions (see Chapter 8). However, they may have already been identified in the prenatal period, particularly the haemoglobinopathies, e.g. thalassaemia or sickle cell disease. The NHS national Antenatal Screening Programme performs well in such cases. The NIPE programme provides seven national risk factors that must be applied to by the NIPE practitioner when performing the newborn examination (PHE 2018a, 2020c). Table 1.4 outlines the four screening components from the NIPE Programme Handbook (PHE 2020c) and conditions that carry a predictive risk, as well as other conditions that may have a positive family trait.

It can be argued that some elements of the newborn screening agenda perform poorly in terms of predictive risk based on clinical examination alone. The newborn examination does have its limitations. The most common example is current screening techniques for congenital heart defects (CHDs) (see also Chapter 2). It is estimated that over half of CHDs are not detected in the newborn period (Wren et al. 2007; Sharland 2010). Despite prenatal cardiac screening as part of the fetal anomaly scan and the clinical cardiovascular assessment at the newborn examination, current methods of detection do not compete on merit as an effective screening tool. This is particularly the case for critical duct-dependent anomalies (Abu-Harb et al. 1994; Green and Oddie 2008; Ewer et al. 2012). Sharland (2010) confers that most congenital cardiac anomalies lie within low risk factions. However, a positive family history does correlate with a higher incidence (Romano-Zelekha et al. 2001).

The use of pulse oximetry may complement the clinical examination and may improve the detection rate of critical CHDs for some newborns. There is increasing evidence to support the use of pulse oximetry as an adjunct to the newborn examination (Knowles et al. 2005; Thangaratinam et al. 2007; Valmari 2007; Ewer et al. 2012), thereby increasing the sensitivity of this screening tool overall. See Chapter 2 for further information on the use of pulse oximetry during the newborn examination.

Increased risk of cardiac anomalies related to newborn

- *Sibling*: Recurrence of 2–3% in a subsequent sibling increasing to a 50% recurrence rate in three affected siblings.
- *Parental cardiac anomaly*: 2–5% risk to infant.
- *Maternal diabetes*: 2% risk to infant particularly in uncontrolled diabetes.
- *Drug-related teratogens*: For example, phenytoin, 2% risk to infant (adapted from Sharland 2010).

TABLE 1.4 **Predictive risk factors with potential impact upon newborn outcome including the NIPE Programme national risk factors.**

The four NIPE screening elements and others	Risk factors	Specific condition	Intergenerational trait status
Hips	First-degree relative with DDH (national NIPE Programme risk factor)	Developmental dysplasia of the hips	Positive
	Risk factors: persistent breech presentation or breech delivery (national NIPE Programme risk factor)		Positive
Eyes	First-degree relative with congenital eye condition (national NIPE Programme risk factor)	Congenital cataracts if syndrome associated Glaucoma Retinoblastoma	
Heart	First-degree relative with CHD (national NIPE Programme risk factor)	Congenital heart defect	Positive (dependent on cause)
	Major CHD on fetal anomaly scan (national NIPE Programme risk factor)		
	Previous SIDS	Cardiac conduction mechanism disorders, e.g. prolonged QT syndrome, Wolf–Parkinson–White syndrome	
Testes	First-degree relative with cryptorchidism	Unilateral or bilateral undescended testes – bilateral very significant	Positive

(*Continued*)

TABLE 1.4 **(Continued)**

The four NIPE screening elements and others	Risk factors	Specific condition	Intergenerational trait status
Significant others	Siblings	Chromosomal aberrations	Positive
	First-degree relative	Genetic disorders	
	Intergenerational	Structural anomalies	
		Syndromes	
		Inborn errors of metabolism	
	First-degree relative	Severe congenital hearing deficit	Positive
		Jaundice treated with phototherapy	
	First-degree relative (sibling)		Positive
	First-degree relative	Atopy:	Positive
		Dermatitis	
		Eczema	
		Epidermolysis bullosa	
	First-degree relative	Asthma	Positive (multifactorial variables – genetic, environmental)
	Intergenerational	Haemoglobinopathies, e.g. thalassaemia, sickle cell disease	Positive
	First-degree relative	Tongue tie	Positive
	Intergenerational	Marfan syndrome	Positive
	Intergenerational/first-degree relative	Myasthenia gravis	Positive

Source: Adapted from the NIPE Screening Programme Handbook (2020c) and cited references.

- *Intrinsic fetal anomalies*: Incidence increased in the presence of other fetal structural or chromosomal anomalies, e.g. the triad of trisomies 21,18 and 13.
- *Transplacental viral transmission*: Increased risk of CHD.
- *Parental consanguinity*: Increased risk of CHD (Ramegowda and Ramachandra 2006; Khalid et al. 2006).
- *Psychotropic drugs*: Teratogenic and newborn effects, e.g. paroxetine may increase the risk of ventricular septal defect, lithium may increase the risk of Ebstein's anomaly.

Other conditions of parental concern

Other common traits within families are atopy and asthma (Moore et al. 2004; Wadonda-Kabondo et al. 2004). These conditions can be of concern to parents and are often raised at the time of the newborn examination. Devereux et al. (2002) reported that maternal environmental factors could influence the fetal immune system and thus neonatal immunity, resulting in an increased risk of atopy and asthma. Similarly, Moore et al. (2004) cited ethnicity, gender, gestational age at birth and family history, particularly maternal, as factors influencing the development of atopic dermatitis within the first 6 months of life. Such findings can confirm the genetic disposition of these disorders.

SMaRT 4 NIPE (S4N)

The NIPE Screening Management and Reporting Tool (SMaRT 4 NIPE) (S4N) IT system aims to identify babies with congenital conditions of the eyes, heart, hips or testes. Initial checks are undertaken within 72 hours of birth as part of the 'head-to-toe' – the 'newborn' part of the physical examination. The purpose of the examination is to identify babies likely to have conditions that may need further monitoring, investigation or treatment. However, as some conditions can develop later, the examination is repeated at 6–8 weeks of age - the 'infant' part of the physical examination.

S4N provides a field containing the six national risk factors mapped to the UK NSC Antenatal and Newborn Screening Programme. The NIPE standards stipulate that 'family history' should be confined to a first-degree relative (PHE 2018a). Additional local risk factors, e.g. BCG vaccination requirement, maternal GBS infection, sibling with jaundice at birth, can be added to the local risk factor menu for each individual maternity unit. Table 1.5 outlines the NIPE Programme national risk factors (PHE 2018a) and an example of additional local risk factors.

The system provides data collection for audit purposes and the provision of key performance indicator (KPI) data against the NIPE National Standards screening elements for quality assurance purposes and local performance monitoring. More importantly, S4N provides a failsafe system and a consistent means of capturing data and tracking newborn babies throughout the screening pathway to ensure that no babies miss out on this detailed physical examination. Provision of a failsafe process for examinations not offered or missed, as well to track children through the health care system, makes it possible to ensure that any required follow-up is timely and in line with national guidance. The safety net for additional screening remains with the examiner at the time of the newborn examination to determine any further element of risk with the clinical assessment.

Use of the NIPE Screening Management and Reporting Tool (S4N) IT system is mandatory (PHE 2018a), provided for use for the NHS by PHE (NIPE Screening

TABLE 1.5 **Summary of defined and national risk factors.**

NIPE Programme national risk factors	Additional defined risk factors
Antenatal diagnosis of a cardiac abnormality	Maternal GBS positive status in current pregnancy/risk of early onset neonatal infection
Antenatal diagnosis of a trisomy	Meconium stained liquor present in labour
First-degree relative with DDH or hip problem in infancy or childhood	Risk of haemolytic disease in the newborn
Breech presentation at birth or after 36 weeks' gestation	Sibling with neonatal jaundice requiring phototherapy
First-degree relative with a cardiac abnormality	Neonatal BCG vaccine required
First-degree relative with a childhood eye condition	

Programme). It is regularly updated to make sure it meets the needs of NIPE practitioners across England. S4N is an IT solution for the recording of all elements the newborn NIPE for all babies born in or residing in England. When the Birth Notification is submitted and an NHS number generated, S4N is automatically populated with newborn baby data records, and it operates via the secure N3 network.

There is a national requirement for the NIPE practitioner to enter screening and post-referral outcome information for the four screening elements of the examination – eyes, heart, hips and testes – to improve programme reporting and assure a safe and effective screening pathway. This also allows local NIPE services to review coverage data and to audit and provide oversight/management of referral outcomes.

All NIPE practitioners should be familiar with and use S4N to record all newborn NIPE screening activity (currently not available to record the 6–8 week examination). Always ensure that data is entered in a contemporaneous way and direct any queries to the Trust NIPE Lead.

More information is available at https://phescreening.blog.gov.uk/2019/07/17/smart-4-nipe-s4n-is-up-and-running/.

The psychosocial and safeguarding agenda

Parental psychosocial influences and adverse lifestyle choices have consistently impacted upon the outcome for newborn infants. Psychopathology morbidity can persist throughout childhood and into adulthood (Hien and Honeyman 2000; Maughan et al. 2001; Dawson 2003; Disney et al. 2008) and mortality in extreme cases (Victoria Climbié Inquiry [Lord Laming Chair] 2003). There are extensive and varied sociodemographic variables that indicate the complexity of the subject matter (see website that accompanies this book for more information on safeguarding). Co-morbidities exist between smoking, alcohol and substance misuse, domestic violence, maternal depression and adverse social environments that place the newborn at greater risk of maladaptive behaviours in childhood and adulthood that replicate that of the parents (Leonard et al. 2007). Therefore, the aim of social support and intervention strategies in the prenatal period and beyond is to break the cycle. See Table 1.6 for a summary of fetal and newborn outcome adverse effects related to lifestyle.

TABLE 1.6 **Maternal/paternal lifestyle and psychosocial influences.**

Lifestyle	Fetal effect	Potential neonatal and childhood outcome
Smoking	Spontaneous abortion Altered placental morphology Chronic hypoxia Intrauterine growth restriction (IUGR)	Abnormal newborn neurobehaviour Increased risk of infant irritability Hypertonia Childhood behavioural problems Lowered immunity SIDS, RSV infection Lower respiratory tract infections Altered pulmonary function Childhood asthma Increased risk of tobacco dependency in adulthood
Alcohol use	Fetal alcohol syndrome (FAS) IUGR	FAS Fetal alcohol disorder spectrum Behavioural problems
Substance misuse	Risk of transplacental transmission of hepatitis B and C Congenital anomalies Symmetrical IUGR Prematurity Meconium liquor	Neonatal Abstinence syndrome
High-conflict relationships: domestic abuse	Intrauterine death Increased risk of acute obstetric complications that impact on newborn outcome	Child abuse Cognitive psychological impairment Childhood depression
Parent in care system		Increased risk of infant in care system Increased risk of child neglect

Sources: Adapted from Hien and Honeyman 2000; Maughan et al. 2001; Dawson 2003; Disney et al. 2008.

Maternal mental health

Maternal mental health and depression should be of significant interest to the NIPE practitioner. The use of psychotropic drugs can affect the newborn in relation to withdrawal symptoms (Wang 2010; NICE 2018a; NICE 2018b). In comparison to withdrawal behaviours in the newborn from illicit substances, the effects from antidepressant medication, particularly the selective serotonin reuptake inhibitors (SSRIs), are perhaps better defined (Sanz et al. 2005; Wang 2010, NICE 2018b). This is very helpful to the NIPE practitioner who is perhaps unsure of the significance of such drugs taken during pregnancy. The following list outlines some associations with the use of antidepressant drug groups:

SSRIs:

- Risk of fetal cardiac anomalies has not been confirmed – conflicting evidence.
- Increased risk of persistent pulmonary hypertension after 20 weeks of gestation.
- Risk of transient neonatal withdrawal syndrome can affect newborns exposed to SSRIs in the weeks preceding birth, causing central nervous system, motor, respiratory and gastrointestinal symptoms (NICE 2018c).

Tricyclic antidepressants (TCAs):

- Limited evidence to suggest that TCAs are associated with an overall increased risk of congenital malformation.
- Neonatal withdrawal symptoms may be associated with TCA use in pregnancy.

Adapted from NICE (2018b).

The NIPE practitioner must firstly establish when the mother commenced the medication and, secondly, check if the mother is still taking medication. There is an associated risk to the mother if she has abruptly stopped taking the medication at any point without seeking medical advice. This is particularly relevant in the immediate postnatal period and may predispose her to active postnatal depression. If the mother is still taking medication, then the newborn must have a thorough neurological examination. There is some debate as to whether withdrawal from antidepressant medication in the newborn is more of a toxicity reaction (Wang 2010) to the drug as opposed to active drug withdrawal, which would increase the severity and prolong the severity of the symptoms.

Maternity services may have local guidelines in place for postnatal observation on newborns of mothers who have been prescribed antidepressant medication in pregnancy, particularly during the latter stages.

The NIPE practitioner can observe the behavioural interactions between a mother and her newborn at the time of the newborn examination. Any concerns about abnormal attachment behaviour must be relayed to the midwife caring for the mother and newborn, in the first instance. The level of concern may necessitate the activation of the safeguarding pathway. Further information about mental health in pregnancy can be found at https://www.nice.org.uk/guidance/cg192/evidence/full-guideline-pdf-4840896925.

Addressing safeguarding issues when reviewing the antenatal history

Public policy, with reference to safeguarding, has rapidly changed the landscape of history taking. Having been brought into sharp focus on a national scale over the last 30 years

since the advent of the Cleveland Report (1988) and the Children's Act of 1989, this issue is high on the agenda within maternity and paediatric services (DfE 2018). Evaluation of the family psychosocial background is an important facet of the newborn examination as in childhood. It is the responsibility of the NIPE practitioner to raise any concerns that have not already been addressed with the safeguarding named midwife. Once this process is activated, the safety of that newborn will become paramount.

Paternal information is often viewed as a lesser priority. However, the father's date of birth is an important demographic in tracing any previous safeguarding issues or domestic violence should concerns be raised. With the date of birth, the police protection services can investigate any previous convictions or concerns. With the movement of some population groups around the country and the fluidity of family units within society, male partners may move from one family unit to another and not disclose any information about previous relationships, e.g. SIDS, congenital anomalies or previous child deaths. It is also important to know the names and dates of birth of other siblings even when not biologically belonging to the mother of the new infant.

It is vital that all aspects of safeguarding are considered and applied during the history-taking process for the newborn examination. Newborns can be subject to safeguarding, and the relevant assessments in the antenatal period can minimise potential harm with the right level of intervention and support (Brandon et al 2016). All significant information must be made available and shared through the use of multiagency protocols including neonatal and paediatric community teams and other multidisciplinary organisations involved in the protection of children in accordance with national and local policy.

Cultural practices can be disclosed during the history-taking process in relation to female genital mutilation (FGM). This practice is illegal in the United Kingdom and is a high priority for safeguarding. The practice of FGM is common in Africa, the Middle East and Asia. It is mandatory for the disclosure of FGM to be reported to the safeguarding named midwife and local safeguarding policy activated and followed. The Department of Health (DfE 2020) provides further information on FGM for health care professionals available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/573782/FGM_Mandatory_Reporting_-_procedural_information_nov16_FINAL.pdf.

The NIPE practitioner and maternity staff must be aware of their responsibilities in the safeguarding of children and adults. Lack of communication has been cited as a common and sadly repetitive failing of the 'Safeguarding Children' systems (*The Victoria Climbié Inquiry Report*) (House of Commons Health Committee 2003; CEMACH 2008; Haringey Local Safeguarding Children Board 2008; CQC 2009; NPSA 2009). Further information on safeguarding children can be found at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779401/Working_Together_to_Safeguard-Children.pdf.

Parental dialogue and involvement with the newborn assessment process

Women and their partners may already have concerns about their newborn at the start of the examination. These concerns may have a physical or behavioural focus. The history-taking process must include discussion with the parents, if present, prior

to commencing the examination, and they must be invited to share those concerns. Some of these concerns may be delayed until the examination is completed. The dialogue regarding family history or worries demonstrates a collaborative approach to the examination, and many parents welcome the opportunity to engage with this aspect of their newborn's care. The history-taking interview for some parents can be therapeutic because they have a staff member who is more than willing to listen. If the mother or father was adopted, then gaining a thorough family history will be problematic; therefore, a sensitive approach will be required.

The involvement of the parents in such conversations will not only engage them with the examination but also engender an early sense of responsibility for their newborn. Blake (2008) advocates the empowerment of women to examine their newborns, thereby making an active contribution to the assessment of the neonate. This level of participation can enhance the women-centered care experience for many mothers as well as helping to lessen the incidence of abnormalities that are missed at the newborn examination. Many women and their partners examine their newborn in detail and can often be the authority on many aspects of their newborn's external appearance and behaviour.

The culture within maternity care services requires implementation of the concept by Blake (2008) from a health promotion perspective. In the first instance, a timeline exists within those initial stages of newborn care and surveillance where the parents must assume responsibility for the welfare of their newborn. Therefore, they must be advised of the signs of illness and indicators for concern prior to discharge. This could have the following advantages:

- Possible earlier detection of CHD in the postnatal period.
- Probable earlier recognition of illness and a medical review by the general practitioner sought more promptly.
- Potential to prevent SIDS in infants with subtle symptoms of illness.

Currently, maternity services facilitate early and very early discharge options for mothers and newborns, therefore parental awareness of the signs of illness and points of contact must be reprioritised within the health promotion agenda for the newborn examination.

Parental concern arises during the examination in relation to the cosmetic aspects of any minor findings and is often of great significance to them. The practitioner must be able to recognise what is a minor variant in comparison to possible clinical dysmorphology. There are some physical findings that may be a familial trait, e.g. syndactyly or polydactyly. See Table 1.7 for a list of common parental concerns found at the newborn examination. The practitioner must keep an open mind to the possibility of 'subtle' dysmorphic findings indicating a possible syndrome in the presence of other abnormal clinical features. There may be a contextual basis for this result, e.g. familial; therefore, examiners must assess the complete prenatal and postnatal history before seeking a senior paediatric option or expert review.

Interpretation of the information

Aside from the psychosocial skills of history taking, the ability of the examiner to interpret the information being given in a relevant way is just as significant. The history profile is only as good as the facts that are given and acknowledged as pertinent. The

TABLE 1.7 Common parental concerns at the newborn examination.

Syndactyly
Polydactyly
Feeding issues, e.g. vomiting
Mild talipes previously undiagnosed on ultrasound scan
Tongue tie
Skin tags
Sinuses
Birthmarks
Pseudo-menstruation
Moulding
Caput
Cephalohaematoma
Birth trauma markings
Intergenerational eczema, dermatitis and asthma
Intergeneration conditions and syndromes
Congenital abnormalities in first-degree relatives

parents of the newborn may not recognise the significance of the questions being asked specific to family history. Some may be unaware of intergenerational traits within the family or of its significance to the newborn. Romitti (2007) commented on the accuracy of reporting family history by relatives. Interestingly, some mothers did not always disclose that they had a previous child with a birth defect; also the nature of the defect was not always accurately named. Socio-demographic variables did influence the accuracy of detail given. However, factual details from the family are often confounded by their own understanding of the condition and their description of the condition or defect when medical terminology is not used. Indeed, they may not be clear on the exact position of the affected member in the family tree. It is not uncommon for a mother or father to contact other family members at the time of the newborn examination to obtain more information about conditions within the family.

As with many families who do have a positive trait for congenital anomalies or conditions, constructing the aetiology of the family from the environmental or genetic predisposition is often difficult. If a detailed family history is needed in the case of a positive intergenerational trait, then it may be desirable for the examination to be conducted by a senior paediatrician.

Importance of location for the newborn examination

The location of the examination is crucial to the quality of the history-taking discussion with the mother or both parents. The postnatal ward is not a benign environment as the majority are bustling and noisy and not conducive to a history interview. Women may not disclose sensitive information in this environment for fear of being overheard by other patients and health care workers. Disclosure of domestic violence within the high-impact family relationship can be prohibited due to lack of privacy. Indeed, the presence of the father or other family members may also prevent disclosures of abuse. Patient confidentiality is paramount within the health service. Equally, noise is a distracting feature for both the examiner and the mother. The maternity services of the

future may need to revise the existing provision for the examination of the newborn to accommodate an environment that provides privacy and quietness.

Electronic as well as written documentation should acknowledge and reflect that a detailed history has been taken. The use of a history proforma to record the pertinent history themes and significant risk factors can be used. The history proforma can then be placed in the newborn's medical records as evidence of the history-taking process along with the documentation from the S4N IT system.

Limitations to history taking

This chapter has addressed the elements of the history-taking assessment to inform the newborn examination. However, there are obstacles that may present and complicate the process (Table 1.8). The two most common problems are time and the environment. These two elements alone can have a significant impact upon the quality and outcome of the history-taking exercise. The workload pressures endured by many newborn examiners impact upon the time available to perform the examination.

There are other barriers that can compromise the quality of history taking. The questioning technique, manner and general communication skills of the examiner can compromise the level of information imparted by the mother or both parents, who may interpret the line of questioning as invasive, particularly at a sensitive time after childbirth. Conversely, they may have something to hide and fear probing questions. The language barrier has become an increasing problem for many minority groups. All maternity units have access to interpretation services and the *Screening Tests for You and Your Baby* booklets are now available in a variety of languages. Mothers with hearing disabilities must also be accommodated with a sign language representative.

The evidence base to support the varied facets of the newborn examination may be developing, but NIPE practitioners must continue to acknowledge the importance of an evidence base to underpin and validate practice. Therefore, practitioners must engage with current empirical evidence and embrace the research process. As the body of midwives and neonatal nurses who are trained to conduct the newborn examination is relatively small in comparison to our medical colleagues, it is important that we contribute to the evidence to take practice initiatives forward.

TABLE 1.8 Limitations to effective history taking.

Time constraints in relation to excessive workload
Inappropriate questions
Questioning technique, e.g. manner
Misrepresentation of facts given about family history
Environment in which history is being obtained, e.g. noise
Confidentiality
Lack of privacy
Suppression of disclosure due to partner presence
Equality and diversity issues, e.g. language barriers, understanding, cultural diversity, disability, maternal deafness
Misinterpretation of information given

Conclusion

Good history taking has always underpinned effective medical practice. However, the nature of the history profile has changed through the incorporation of government directives and a public policy agenda. The NHS Antenatal and Newborn Screening Programmes can be mapped to the history-taking process to help guide the NIPE practitioner towards gathering the relevant information. Whilst the maternal obstetric, surgical and medical history remains firmly implicit with the history-taking process, the psychosocial agenda now reflects the challenges facing families coupled with today's parental lifestyle choices. It can be strongly argued that parental psychosocial influences can impact directly upon not only the newborn period but also childhood and adulthood. The newborn examination provides a platform to address some of these issues so that interventional measures can be implemented at an early stage. This may go some way to help direct parents and safeguard the vulnerable newborn, thereby protecting the health of a future generation. History taking remains an active element of the newborn examination. Without it, the clinical validity of the newborn examination itself could indeed be negligible.

This chapter provides an overview and context of the changing and dynamic nature of history taking as part of the newborn examination. The following websites will provide additional specific information and resources:

Clinical condition	Useful website
Congenital heart defect	https://www.nhs.uk/conditions/congenital-heart-disease/
	https://www.gov.uk/topic/population-screening-programmes
	https://www.gov.uk/topic/population-screening-programmes
	http://pathways.nice.org.uk/pathways/structural-heart-defects?fno=1
Developmental dysplasia of the hips	http://www.steps-charity.org.uk/
	https://www.gov.uk/topic/population-screening-programmes
Eye conditions	https://www.gov.uk/topic/population-screening-programmes
	http://www.rnib.org.uk/?gclid=CJOErMnopsACFSXKtAodUEcAWg
	http://www.nhs.uk/Conditions/Cataracts-childhood/Pages/Introduction.aspx
	http://www.nhs.uk/Conditions/retinoblastoma/Pages/Introduction.aspx
	http://www.childrenwithcancer.org.uk/News/retinoblastoma?gclid=CPKz6I3ppsACFabLtAodbBwANA
Undescended testes	http://www.nhs.uk/conditions/undescendedtesticles/Pages/Introduction.aspx
	http://www.nlm.nih.gov/medlineplus/ency/article/000411.htm
BCG vaccination	http://www.nidirect.gov.uk/bcg-vaccination
	https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book#the-green-book
	http://www.nhs.uk/Conditions/vaccinations/Pages/bcg-tuberculosis-TB-vaccine.aspx
Metabolic diseases	http://www.bimdg.org.uk/site/index.asp

(*Continued*)

Clinical condition	Useful website
NICE and national guidance documents	
Antenatal and postnatal mental health	https://www.nice.org.uk/guidance/cg192
Antibiotics for the prevention and treatment of early onset neonatal infection	http://www.nice.org.uk/guidance/CG149
Neonatal jaundice	http://pathways.nice.org.uk/pathways/neonatal-jaundice?fno=1
Congenital heart defect	http://pathways.nice.org.uk/pathways/structural-heart-defects?fno=1
Reducing differences in the uptake of immunisations	http://www.nice.org.uk/guidance/PH21
Drug misuse – opioid detoxification	http://www.nice.org.uk/guidance/CG52
MBRRACE UK: Saving Lives, Improving Mothers' Care	https://www.npeu.ox.ac.uk/mbrrace-uk/reports
NHS Antenatal and Newborn Screening Programmes	https://www.gov.uk/government/publications/infectious-diseases-in-pregnancy-screening-programme-handbook https://www.gov.uk/government/publications/infectious-diseases-in-pregnancy-screening-care-pathway https://www.gov.uk/government/publications/handbook-for-sickle-cell-and-thalassaemia-screening https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749742/NHS_fetal_anomaly_screening_programme_handbook_FINAL1.2_18.10.18.pdf https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-screening-standards https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-screening-standards https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/702100/NIPE_Screening_Programme_Newborn_Pathway.pdf https://www.gov.uk/topic/population-screening-programmes/newborn-blood-spot https://www.gov.uk/government/publications/standards-for-nhs-newborn-blood-spot-screening https://www.gov.uk/government/publications/newborn-hearing-screening-programme-nhsp-operational-guidance https://www.england.nhs.uk/wp-content/uploads/2017/04/Service-Specification-No.21-NIPE.pdf
Continuing professional development and education	https://www.e-lfh.org.uk/ https://www.skillsforhealth.org.uk/services/item/22-elearning-healthcare

References

Abu-Harb M, Hey E, Wren C (1994) Death in infancy from unrecognised heart disease. *Archives of Disease in Childhood* **71**, 3–7. Available from: www.fn.bmj.com (accessed December 2019).

Anderson ME, Johnson DC, Batal HA (2005) Sudden infant death syndrome and prenatal maternal smoking: rising attributed risk in the back to sleep era. *BMC Medicine* **3**, 4. Available from: http://www.biomedcentral.com/1741–7015/3/4 (accessed January 2020).

BAPM (2015) Newborn Early Warning Trigger and Track (NEWTT): a framework for practice. Available from: https://www.bapm.org/resources/38-newborn-early-warning-trigger-track-newtt-a-framework-for-practice-2015 (accessed January 2020).

BAPM (2017) Identification and management of neonatal hypoglycaemia in the full term infant – a framework for practice. Available from: https://www.bapm.org/resources/40-identification-and-management-of-neonatal-hypoglycaemia-in-the-full-term-infant-2017 (accessed January 2020).

Baxter JK, Sehdev HM, Breckenbridge MD (2010) Oligohydramnios. eMedicine Radiology. Available from: http://emedicine.medscape.com/article/405914-overview (accessed December 2019).

Bhattacharya S, Campbell DM, Liston WA, Bhattacharya S (2007) Effect of Body Mass Index on pregnancy outcomes in nulliparous women delivering singleton babies. *BMC Public Health* **7**, 168.

Blake D (2008) Assessment of the neonate: involving the mother. *British Journal of Midwifery* **16**(4), 224–226.

Bornstein MH, Putnick DL, Suwalsky JTD, Gini M (2006) Maternal chronological age, prenatal and perinatal history, social support and parenting of infants. *Child Development* **77**(4), 875–892.

Bradley JP, Bacharier LB, Bonfiglio J, Schechtman KB, Strunk R, Storch G, Castro M (2005) Severity of respiratory syncytial virus bronchiolitis is affected by cigarette smoke exposure and atopy. *Pediatrics* **115**, e7–e14.

Brandon M et al. (2016) Pathways to harm, pathways to protection: a triennial analysis of serious case reviews 2011 to 2014; Final report. Department of Education.

British HIV Association (2019) British HIV Association guidelines for the management of HIV in pregnancy and postpartum 2018 (2019 second interim update). Available from: https://www.bhiva.org/file/5bfd30be95deb/BHIVA-guidelines-for-the-management-of-HIV-in-pregnancy.pdf (accessed January 2020).

British Medical Association (2004) *Smoking and Reproductive Life; The Impact of Smoking on Sexual Reproductive and Child Health*. London: Board of Science and Education and Tobacco Control Resource Centre.

CareQuality Commission (CQC) (2009) Review of the involvement and action taken by health bodies in relation to the case of Baby P. https://www.whittington.nhs.uk/document.ashx?id=1660 (accessed February 2015).

Carpenter RJ, Hale BR, Chan Tack M (2009) Early symptomatic HIV infection. eMedicine. Available from: http://emedicine.medscape.com/article/211873-overview (accessed July 2014).

CEMACH (2008) Why children die: a pilot study. London: CEMACH. Available from: www.cemach.org.uk. (accessed January 2020 – now https://www.npeu.ox.ac.uk/mbrrace-uk/reports.

Cleveland Report (1988) *Report of the Inquiry into Child Abuse in Cleveland 1987*. Cmd 412. London: HMSO.

CONI (2020) Website: https://www.lullabytrust.org.uk/bereavement-support/how-we-can-support-you/our-care-of-next-infant-scheme/ (accessed January 2020).

Dawson DA (2003) Methodological issues in measuring alcohol use. *Alcohol Research and Health* **27**, 18–29. http://pubs.niaaa.nih.gov/publications/arh27-1/18-29.htm.

Department for Education (DfE) (2018) Working together to safeguard children. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779401/Working_Together_to_Safeguard-Children.pdf (accessed January 2020).

Department for Education (DfE) (2020) Mandatory reporting of female genital mutilation – procedural information. January. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/573782/FGM_Mandatory_Reporting_-_procedural_information_nov16_FINAL.pdf (accessed January 2020).

Disney EAR, Iacono W, McGue M, Tully E, Legrand L (2008) Strengthening the case: prenatal alcohol exposure is associated with increased risk for conduct disorder. *Pediatrics* **122**, e1225–e1230.

Ewer AK, Furmston AT, Middleton LJ, Deeks JJ, Daniels JP, Pattison HM, Powell R, Roberts TE, Barton P, Auguste P, Bhoyar A, Thangaratinam S, Tonks AM, Satodia P, Deshpande S, Kumararatne B, Sivakumar S, Mupanemunda R, Khan KS (2012) Pulse oximetry as a screening test for congenital heart defects in newborn infants: a test accuracy study with evaluation of acceptability and cost-effectiveness. *Health Technology Assessment* **16**(2), 1366–5278. Health Technology Assessment HTA Programme.

Gilliland, FD et al. (2001) Effects of maternal smoking during pregnancy and environmental tobacco smoke on asthma and wheezing in children. *American Journal of Respiratory Critical Care Medicine* **163**(2), 429–436.

Green K, Oddie S (2008) The value of the postnatal examination in improving child health. *Archives of Disease in Childhood - Fetal and Neonatal Edition* **93**, F389–F393.

Green RF (2007) Summary of working group meeting on use of family history information in pediatric primary care and public health. *Pediatrics* **120**, S87–S100. http://www.pediatrics.org/cgi/content/full/120/supplement_2/s87 (accessed 16 February 2010).

Hamden AH (2009) Neonatal abstinence syndrome. eMedicine. Available from: http://emedicine.medscape.com/article/978763-print (accessed December 2019).

Haringey Local Safeguarding Children Board (2008) *Serious Case Review. Child A. Executive Summary.* London: Haringey Local Safeguarding Children Board.

Hien D, Honeyman T (2000) A closer look at the drug abuse: maternal aggression link. *Journal of Interpersonal Violence* **15**, 503. Available from: http://jiv.sagepub.com/cgi/content/abstract15/5/503 (accessed December 2019).

Hofhuis W, de Jongste JC, Merkus PJFM (2003) Adverse health effects of prenatal and postnatal tobacco smoke exposure on children. *Archives of Disease in Childhood* **88**, 1086–1090. Available from: www.archdischild.com (accessed December 2019).

House of Commons Health Committee (2003) *The Victoria Climbié Inquiry Report*. London: HMSO. http://www.publications.parliament.uk/pa/cm200203/cmselect/cmhealth/570/570.pdf (accessed December 2019).

Howard FM (2008) History-taking and interview techniques and the physician–patient relationship. Global Library of Women's Medicine. Available from: https://glowm.com/resources/glowm/cd/pages/v6/v6c072.html (accessed October 2020).

Jacobson SW, Chiodo LM, Sokol RJ, Jacobson JL (2002) Validity of maternal report of prenatal alcohol, cocaine, and smoking in relation to neurobehavioral outcome. *Pediatrics* **109**, 815–825. Available from: www.pediatrics.org (accessed December 2019).

Kalk P, Guthman F, Krause K, Delle K, Godes M, Gosing G, Halle H, Wauer R, Hocher B (2009) Impact of maternal mass index on neonatal outcome. *European Journal of Medical Research* **14**(5), 216–222.

Khalid Y, Ghina M, Fadi B, et al. (2006) Consanguineous marriage and congenital heart defects: a case–control study in the neonatal period. *American Journal of Medical Genetics. Part A* **140**(14), 1524–1530.

Khashan AS, Kenny LC (2009) The effects of maternal body mass index on pregnancy outcome. *European Journal of Epidemiology* **24**(11), 697–705.

Knowles R, Griebsch I, Dezateux C, Brown J, Bull C,Wren C (2005) Newborn screening for congenital heart defects: a systematic review and cost-effectiveness analysis. *Health Technology Assessment HTA Programme* **9**(44).

La Souef PN (2000) Pediatric origins of adult lung diseases. 4. Tobacco related lung diseases begin in childhood. *Thorax* **55**, 1063–1067.

Lall A (2008) Neonatal abstinence syndrome. *British Journal of Midwifery* **16**(4), 220–223.

Landau LI (2001) Parental smoking: asthma and wheezing illnesses in infants and children. *Paediatric Respiratory Reviews* **2**, 202–206.

Leggate J (2008) Improving pregnancy outcomes: mothers and substance misuse. *British Journal of Midwifery* **16**(3), 160–165.

Leonard NR, Gwardz MV, Cleland CM, Vekaria PC, Ferns B (2007) Maternal substance use and HIV status: adolescent risk and resilience. *Journal of Adolescence* **3**, 389–405. Available from: www.sciencedirect.com (accessed January 2020).

Matturi L, Ottaviani G, Lavezzi AM (2006) Maternal smoking and sudden infant death syndrome: epidemiological study related to pathology. *Virchows Archiv* **449**(6), 697–706.

Maughan B, Taylor C, Taylor A (2001) Pregnancy smoking and childhood conduct problems: a causal association? *Journal of Child Psychology and Psychiatry* **42**(8), 1021–1028.

McMartin KI, Platt MS, Hackman R, et al. (2002) Lung tissue concentrations of nicotine in sudden infant death syndrome (SIDS). *Journal of Pediatrics* **140**, 205–209.

Mone SM, Gillman MW, Miller TL, Herman EH, Lipshultz SE (2004) Effects of environmental exposures on the cardiovascular system: prenatal period through adolescence. *Pediatrics* **113**(3), 1058–1069.

Moore M, Rifas-Shiman MPH, Rich-Edwards JW, Kleinman KP, Camargo CA, Gold D, Weiss ST, Gillman M (2004) Perinatal predictors of atopic dermatitis occurring in the first six months of life. *Pediatrics* **113**, 468–474. Available from: http://www.pediatrics.org/cgi/content/full/113/3/468 (accessed January 2020).

National Patient Safety Agency (NPSA) (2009) *Review of Patient Safety for Children and Young People*. London: NHS.

National Patient Safety Agency (NSPA) (2011) Rapid Response Report – Keeping newborn babies with a family history of MCADD safe in the first few hours and days of life. Safety Alert 2.

NHS (2017) Stop smoking in pregnancy. Available from: https://www.nhs.uk/conditions/pregnancy-and-baby/smoking-pregnant/ (accessed October 2020).

NHS England (NHSE) (2016) Saving babies' lives: a care bundle for reducing stillbirth. Available from: https://www.england.nhs.uk/wp-content/uploads/2016/03/saving-babies-lives-car-bundl.pdf (accessed December 2019).

NHS QIS (2008) Best practice statement: routine examination of the newborn. Available from: www.nhshealthquality.org (accessed December 2019).

NICE (2010) Weight management before and after pregnancy. National Institute of Health and Care Excellence. July. Available from: https://www.nice.org.uk/guidance/ph27 (accessed January 2020).

NICE (2012) Neonatal infection (early-onset): antibiotics for prevention and treatment. National Institute of Health and Care Excellence. Available from https://www.nice.org.uk/guidance/cg149 (accessed January 2020).

NICE (2015) Routine postnatal care of women and their babies. NICE clinical guideline 37. National Institute of Health and Care Excellence. Available from: www.nice.org.uk/CG037 (accessed December 2019).

NICE (2016) Jaundice and newborns under 28 days. National Institute of Health and Care Excellence. Available from: https://www.nice.org.uk/guidance/cg98 (accessed January 2020).

NICE (2017) Intrapartum care of healthy women and their babies. Clinical guideline (CG 190). London: RCOG Press. Available from: https://www.nice.org.uk/guidance/cg190 (accessed January 2020).

NICE (2018a) Antenatal and postnatal mental health. The NICE Guideline on Clinical Management and Service Guidance. Updated edition. Available from: https://www.nice.org.uk/guidance/cg192/evidence/full-guideline-pdf-4840896925 (accessed January 2020).
NICE (2018b) Depression – antenatal and postnatal. Available from: https://cks.nice.org.uk/depression-antenatal-and-postnatal (accessed January 2020).
NICE (2018c) Quitting smoking in pregnancy and following childbirth. Quick reference guide. National Institute of Health and Care Excellence. Available from: http://www.nice.org.uk/nicemedia/live/13023/49346/49346.pdf (accessed January 2020).
Ohlsson A, Shah VS (2009) Intrapartum antibiotics for known maternal group B streptococcal colonization. *Cochrane Database of Systematic Reviews* **3**, CD007467. DOI: 10.1002/14651858.CD007467.pub2. Available from: http://mrw.interscience.wiley.com/cochrane/clsysrev/articles/CD007467/pdf_standard_fs.html (accessed January 2020).
Olson H, Streissguth A, Sampson P, Barr H, Bookstein F, Theide K (1997) Association of prenatal alcohol exposure with behavioural and learning problems in early adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry* **36**(9), 1187–1194. Cited by Disney et al. (2008).
PHE (2014) Immunisation against infectious disease: The Green Book. Available from: https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book#the-green-book (accessed December 2019)
PHE (2016) Infectious Diseases in Pregnancy Screening: Programme Handbook. July. Available from: https://www.gov.uk/government/publications/infectious-diseases-in-pregnancy-screening-programme-handbook (accessed January 2020).
PHE (2018a) Newborn and Infant Physical Examination Screening: Standards. Available from: https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-screening-standards (accessed January 2020).
PHE (2018b) NHS Fetal Anomaly Screening Programme Handbook. August. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749742/NHS_fetal_anomaly_screening_programme_handbook_FINAL1.2_18.10.18.pdf (accessed January 2020).
PHE (2018c) Sickle Cell and Thalassaemia: Screening Handbook. July. Available from: https://www.gov.uk/government/publications/handbook-for-sickle-cell-and-thalassaemia-screening (accessed 14 January 2020).
PHE (2019a) A framework for supporting teenage mothers and young fathers. April. Available from: https://www.gov.uk/government/publications/teenage-mothers-and-young-fathers-support-framework (accessed January 2020).
PHE (2019b) Infectious Diseases in Pregnancy Screening: Care Pathway. July. Available from: https://www.gov.uk/government/publications/infectious-diseases-in-pregnancy-screening-care-pathway (accessed January 2020).
PHE (2020c) Newborn and Infant Physical Examination: Programme Handbook: Available from: https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-programme-handbook/newborn-and-infant-physical-examination-screening-programme-handbook (accessed 23 January 2020).
Rajiah P (2009) Polyhydramnios. eMedicine Radiology. Available from: http://emedicine.medscape.com/article/404856-overview (accessed January 2020).
Ramegowda S, Ramachandra NB (2006) Parental consanguinity increases congenital heart diseases in South India. *Annals of Human Biology* **33**(5–6), 519–528.
RCOG (2013) Small for gestational age fetus, Investigation and Management. Green-top Guideline No. 31. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg31/ (accessed December 2019).
RCOG (2017) Group B streptococcal disease early onset. Green-top Guideline No. 36. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg36/ (accessed December 2019).

RCOG (2018) Care of women with obesity in pregnancy. November. Green-top Guideline No. 72. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg72/ (accessed January 2020).

Roebuck TM, Mattson SN, Riley EP (1999) Behavioural and psychosocial profiles of alcohol-exposed children. *Alcoholism, Clinical and Experimental Research* **23**(6), 1070–1076. Cited by Disney et al. (2008).

Romano-Zelekha O, Hirsh R, Blieden L, Gree MS, Shohat T (2001) The risk of congenital heart defects in offspring of individuals with congenital heart defects. *Clinical Genetics* **59**, 325–329.

Romitti PA (2007) Utility of family history reports of major birth defects as a public health strategy. *Pediatrics* **120**, s71–s77. Available from: http://www.pediatrics.org/cgi/content/full/120/supplement_2/s71 (accessed December 2019).

Ryan K, Bain B, Worthington D, James J, Plews D, Mason A, Roper D, Rees DC, de la Salle B, Streetly A (2010) Significant haemoglobinopathies: guidelines for screening and diagnosis. *British Journal of Haematology* **149**, 35–49.

Salem L, Singer KR (2009) Rh incompatibility. eMedicine. Available from: http://emedicine.medscape.com/article/797150-overview (accessed December 2019).

Sanz EJ, Delas-Cuevas C, Kiuru A, Bate A, Edwards R (2005) Selective serotonin receptor uptake inhibitors in pregnant women and neonatal withdrawal syndrome: a data analysis. *Lancet* **365**(9458), 482–487.

Sayal K (2007) Alcohol consumption in pregnancy as a risk factor for later mental health problems. *Evidence-Based Mental Health* **10**, 98–100.

Sayal K, Heran J, Golding J, Alati R, Smith GD, Gray R, Emond A (2009) Binge pattern of alcohol consumption during pregnancy and childhood mental health outcomes: longitudinal population-based study. *Pediatrics* **123**(2), E289–E296. Available from: http://pediatrics.aapublications.org/cgi/contnent/abstract/123/2/e289 (accessed December 2019).

Sellwood M, Huertas-Ceballos A (2008) Review of NICE guidelines on routine postnatal infant care. *Archives of Disease in Childhood. – Fetal and Neonatal Edition* **93**, F10–F13. Available from: www.fn.bmj.com (accessed January 2020).

Sharland G (2010) Fetal cardiac screening: why bother? *Archives of Disease in Childhood – Fetal And Neonatal Edition* **95**, F64–F68. Available from: www.fn.bmj.com (accessed January 2020).

Skills for Health (2019) *National Workforce Framework for Maternity and Care of the Newborn*. London: Department of Health. Available from: https://www.skillsforhealth.org.uk/?gclid=EAIaIQobChMIlsfvzJvf4wIVBrDtCh2kNA_2EAAYASAAEgIV2fD_BwE (accessed January 2020).

Smith LM, LaGasse LL, Derauf C, Grant P, Shah R, Arria A, Huestis M, Haning W, Strauss A, Grotta SD, Liu J, Lester BM (2006) The infant development, environment and lifestyle study: effects of prenatal methamphetamine exposure, polydrug exposure, and poverty on intrauterine growth. *Pediatrics* **118**, 1149–1156. Available from: http://www.pediatrics.org/cgi/content/full/118/3/1149 (accessed January 2020).

Stocks J, Dezateux C (2003) The effects of parental smoking on lung function and development during infancy. *Respirology* **8**, 266–285.

Stoeckle JD, Billings JA (1987) A history of history-taking. *Journal of General Internal Medicine* **2**(2), 119–127.

Thangaratinam S, Daniels J, Ewer AK, Zamora J, Khan KS (2007) Accuracy of pulse oximetry in screening for congenital heart disease in symptomatic newborns: a systematic review. *Archives of Disease in Childhood – Fetal and Neonatal Edition* **92**, F176–F180. Available from: www.fn.bmj.com (accessed December 2019).

Valmari P (2007) Should pulse oximetry be used to screen for congenital heart disease? *Archives of Disease in Childhood – Fetal and Neonatal Edition* **92**(3), F219–F224. Available from: www.fn.bmj.com (accessed December 2019).

Victoria Climbié Inquiry (Lord Laming Chair) (2003) *Summary and Recommendations*. HMSO.

Volpi-wise M (2005) Neonatal abstinence syndrome. Available from: http://bach.fhs.usyd.edu.austu/hse/iec/volpiwisem/html (accessed July 2014).

Wadonda-Kabondo N, Sterne JAC, Golding J, Kennedy CTC, Archer CB, Dunnill MGS (2004) Association of parental eczema, hayfever, and asthma with atopic dermatitis in infancy: birth cohort study. *Archives of Disease in Childhood* **89**, 917–921. Available from: www.adc.bmj.com (accessed January 2020).

Wang M (2010) Perinatal drug abuse and neonatal drug withdrawal. eMedicine. Available from: http://emedicine.medscape.com/article/978492-print (December 2019).

Wren C, Reinhardt Z, Khawaja K (2007) Twenty-year trends in diagnosis of life-threatening neonatal cardiovascular malformations. *Archives of Disease in Childhood – Fetal and Neonatal Edition* **93**, 33–35. Available from: www.fn.bmj.com (accessed December 2019).

Chapter 16

Assessing the female reproductive system

Aim

This chapter introduces the reader to the assessment of the female reproductive system and the care required for those women who experience problems related to this system.

Learning outcomes

By the end of the chapter the reader will be able to:

1. Provide a brief overview of the female reproductive system and its functions
2. Discuss a number of conditions that might affect the female reproductive system
3. Outline the various ways in which the nurse may undertake an assessment of the female reproductive system
4. Describe care planning that is related to the female reproductive system

Introduction

The female reproductive system is considered in this chapter. Chapter 15 addresses the male reproductive system. It has been acknowledged that whilst these two systems are different, some issues concern both systems. The female reproductive system encompasses the urinary and reproductive organs.

Reproduction of the human species is a complex activity that requires a series of integrated anatomical and physiological events. The physiological and anatomical aspects of the reproductive tract are predominately associated with procreation. The psychological and social aspects of reproduction are also important, as too is the pleasure that is often provided by the reproductive organs. Ill health in relation to the reproductive tract can result in loss of life, acute and chronic illness, as well as physical and emotional distress.

How an individual decides to express themselves is a key component of reproductive health and this is often associated with attitudes (the person's attitudes as well as the nurse's attitudes). Social norms and cultural upbringing also impact on an individual's reproductive health; sexuality and sexual health are closely linked to reproductive health. This chapter provides an overview of the assessment of the female reproductive tract.

The nurse must use a framework, a systematic approach to guide assessment, diagnosis, planning, implementation, and the evaluation of care required. When a systematic approach is applied, the physical, psychological, and cultural needs of the woman and her family (if appropriate) are taken into consideration.

Fundamentals of Assessment and Care Planning for Nurses, First Edition. Ian Peate.

The female reproductive system

Collectively the external female genitalia are referred to as the vulva. They include the mons pubis, the labia, the clitoris, the vaginal and urethral openings, and glands (see Figure 16.1). There are three key functions associated with the external genitalia:

1. Allowing sperm to enter the body
2. Protecting the internal genital organs from infectious organisms
3. The provision of sexual pleasure

The mons veneris

The mon veneris (Is called the mons pubis) is the pad of elevated fatty tissue that covers the pubic bone and is situated inferior to the abdomen and superior to the labia. During puberty, the amount of fat increases and after the menopause this decreases. The mons protects the pubic bone from the impact of sexual intercourse. The mons is covered with coarse pubic hair during puberty and after puberty this then decreases.

Labia majora

The outer lips of the vulva are the labia majora and they are made of two symmetrical pads of fatty tissue that wrap around the vulva, extending from the mons veneris to the perineum. They offer protection to the urethral and vaginal openings. These labia are usually covered with pubic hair. They contain a number of sweat and oil glands. The scent (pheromones) from these glands may have a role to play in sexual arousal.

Labia minora

The inner lips of the vulva are called the labia minora. They are composed of thin stretches of tissue within the labia majora, folding and protecting the vagina, urethra, and the clitoris. The labia minora are thin, delicate folds of fat-free, hairless skin that are positioned between the labia majora. The labia minora contain a core of spongy tissue. Within this there are a number of small blood vessels but there is no fat. The appearance of the labia minora varies from woman to woman, from tiny lips that are hidden between the labia majora to larger lips that can protrude. Internally the surface is comprised of thin skin and has a pink colour associated with mucous membranes, with a number of sensory nerve endings. The inner and outer labia are very responsive to touch and pressure.

Clitoris

This is a small white aspect of oval tissue located at the top of the labia minora and the clitoral hood. The clitoris is a small body of spongy tissue that is sexually sensitive. Externally it is only the tip or glans of the clitoris that is visible, the organ is elongated and branches into two forks, the crura, this

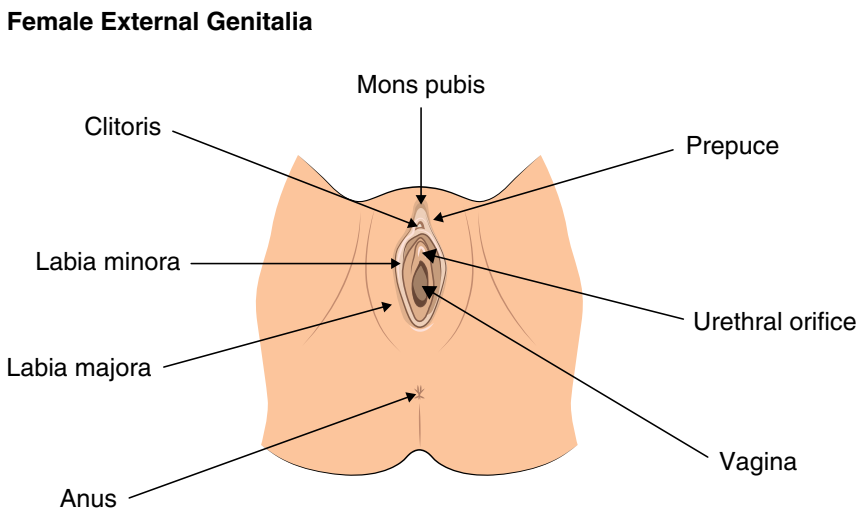


Figure 16.1 The external female genitalia.

then extends downwards along the edge of the vaginal opening towards the perineum. The clitoris is approximately 3 cm in length, size varies. The external tip of the clitoris or the clitoral glans is protected by the prepuce, (also called the clitoral hood), this is a covering of tissue that corresponds to the foreskin of the male penis. The clitoris may extend and the hood will retract, making the clitoral glans more accessible during sexual excitement. The clitoris is an erectile organ; usually hidden by the labia when in the flaccid state, it will, as does the penis, enlarge upon tactile stimulation; it does not, however, lengthen significantly. It is highly sensitive and very important in the sexual arousal of a woman. There are variations in size; in some women the clitoral glans may be very small, in others the woman may have a large clitoris and the hood may not completely cover it. The clitoris is suspended by a suspensory ligament.

The urethra

The external urethral orifice is situated 2 to 3 cm posterior to the clitoris and immediately anterior to the vaginal orifice. The openings of the ducts of the paraurethral glands (also called Skene's glands) are located either side of the vaginal orifice. The urethra is not related to sex or reproduction, it is where urine is excreted when it passes from the urinary bladder.

Hymen

The hymen is pinkish and often shaped like a crescent, though there may be many other variations. It is a thin membrane located at the lower end of the vagina. In nearly all young women, there is a large gap in the membrane, it does not block off the vagina completely. This is important, because the gap in the hymen permits menstrual blood flow when the girl menstruates. The hymen is the traditional representation of virginity. As it is a very thin membrane, it can be torn by vigorous exercise, the insertion of a tampon, masturbation, or the use of sex toys such as dildos.

Blood supply

Arterial supply of the female external genitalia

The rich arterial supply to the vulva comes from two external pudendal arteries as well as one internal pudendal artery located on either side. The internal pudendal artery supplies the skin, sex organs, and the perineal muscles. The labial arteries are branches of the internal pudendal artery, and this is the same for the dorsal and deep arteries of the clitoris.

Venous drainage of the female external genitalia

The labial veins are offshoots of the internal pudendal veins and venae comitantes of the internal pudendal artery.

Lymph drainage

Within the vulva there are a number of very rich networks of lymphatic channels. Most lymph vessels in the vulva pass to the superficial inguinal lymph nodes and deep inguinal nodes.

Nerve supply

The nerves that supply the vulva are branches of, the ilioinguinal nerve, the genital branch of the genitofemoral nerve, the perineal branch of the femoral cutaneous nerve, and the perineal nerve.

The internal female reproductive organs that are located in the bony pelvis comprise the ovaries, the Fallopian tubes, the uterus, and the vagina (see Figure 16.2).

Review

What does the surgical procedure tubal ligation involve?

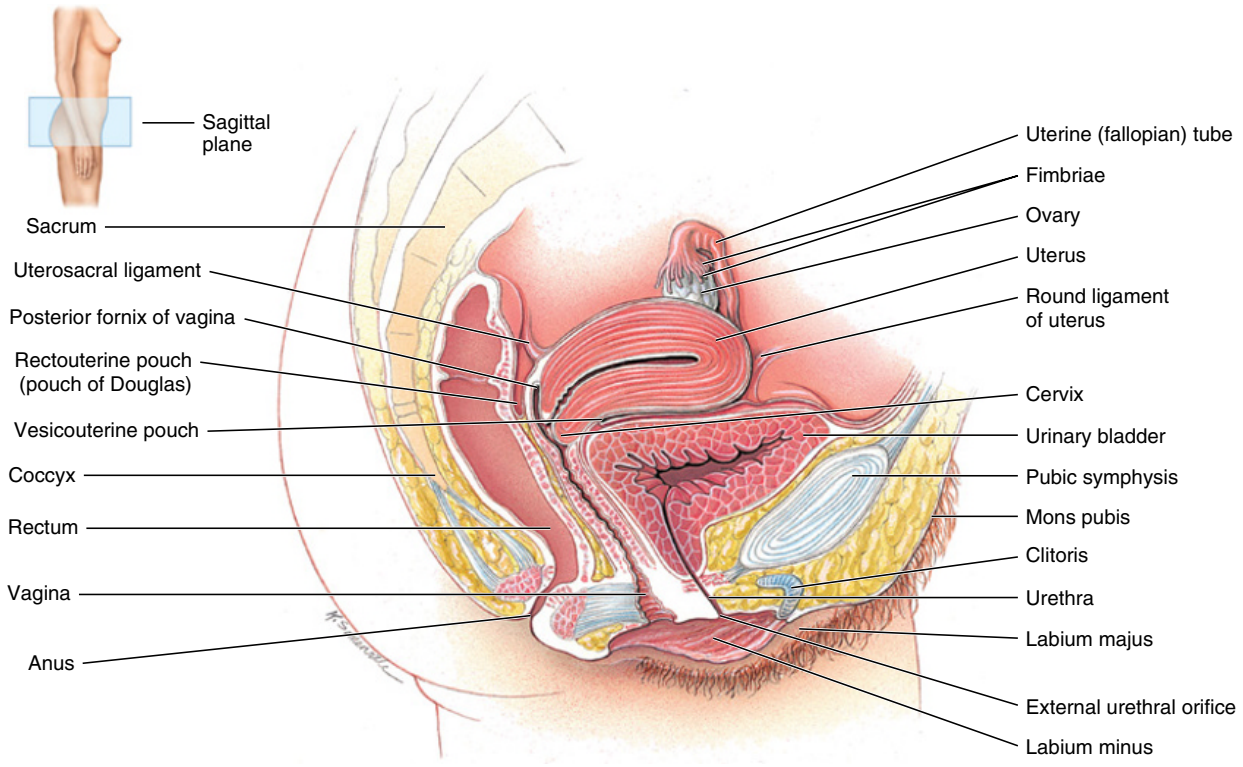


Figure 16.2 The female reproductive system.

The ovaries

The paired ovaries are the primary reproductive organs. These glands also produce female sex hormones. In the adult woman they are flat, almond-shaped structures positioned on each side of the uterus below the ends of the Fallopian tubes. They are held in position by ligaments that attach them to the uterus. They are also attached to the broad ligament that attaches them to the pelvic wall. The ovaries act as a storage space for the female germ cells and also the production of the female hormones oestrogen and progesterone. A woman's total number of ova (singular ovum) is present at her birth. When a girl reaches puberty she usually ovulates each month.

The ovary is made up of a number of small structures called ovarian follicles. The follicles contain an immature ovum (an oocyte). Follicles are stimulated each month by two hormones, follicle-stimulating hormone (FSH) and luteinising hormone (LH), which stimulate the follicles to mature. The developing follicles are enclosed in layers of follicle cells. Mature follicles are called Graafian follicles.

The ovarian cortex

Located deep and close to the tunica albuginea is the ovarian cortex, which contains the ovarian follicles, surrounded by dense, irregular connective tissue. These follicles contain oocytes in various stages of development and a number of cells that nourish the developing oocyte. As the follicle grows it will secrete oestrogen.

Graafian follicles

The Graafian follicles make oestrogen, promoting the growth of the endometrium. Each month in the woman who is menstruating, one or two of the mature follicles (the Graafian follicles) will release an oocyte. This is known as ovulation. The large ruptured follicle becomes a new structure; the corpus luteum, the fragments of a mature follicle.

Corpus luteum

The corpus luteum produces oestrogen and progesterone that supports the endometrium until conception or until the cycle starts again. The corpus luteum will gradually disintegrate, leaving a scar on the outer aspect of the ovary (the corpus albicans). The outer ovary is enclosed in a fibrous

capsule called the tunica albuginea, which is composed of cuboidal epithelium. The inner ovary is divided into parts.

The ovarian medulla

Within the ovarian medulla are the blood vessels, nerves, and lymphatic tissues that are surrounded by loose connective tissue.

Figure 16.3 shows the developmental sequences associated with the maturation of an ovum.

Oogenesis

This is related to the development of relatively undifferentiated germ cells called oogonia, which are fixed in numbers between two and four million diploid (2n) stem cells during foetal development. All of the ova are ultimately derived from these clones, developing into larger primary oocytes. The meiotic phase is not completed until puberty. FSH and LH are released by the anterior pituitary gland, which stimulates primordial follicles monthly after puberty and until menopause; usually only one will attain maturity as needed for ovulation (see Figure 16.4).

Female sex hormones

The ovaries repeatedly produce the hormones oestrogens, progesterone, and androgens. Oestrogens are necessary for the development and maintenance of secondary sex characteristics together with a number of other hormones, preparing the female reproductive organ to prepare for the growth of a foetus and also having a key role to play in the usual structure of the skin and blood vessels. They help to reduce the rate of bone resorption, enhance increased high-density lipoproteins, decrease cholesterol levels and increase blood clotting.

The menstrual cycle is controlled by hormones. In each cycle, rising levels of the hormone oestrogen causes the ovary to develop and for ovulation to occur. The endometrium of the uterus begins to thicken.

The length of the menstrual cycle varies from woman to woman. However, the average is to menstruate every 28 days (Waugh and Grant 2018). A regular cycle may be longer or shorter than this; from 21 to 40 days are normal. The menstrual cycle begins from the time of the first day of a woman's period to the day before her next period.

In the second half of the cycle progesterone helps prepare the uterus for implantation of a developing embryo. The ovum travels down the Fallopian tubes and if pregnancy does not occur, the egg is reabsorbed into the body. The levels of oestrogen and progesterone fall and the uterine lining comes away and leaves the body as a period (the menstrual flow). The time taken from the release of an egg to the start of a period is approximately 10–16 days.

The uterus

This is a hollow muscular organ situated in the pelvic cavity, located posteriorly and superiorly to the urinary bladder and anteriorly to the rectum, and is approximately 7.5 cm long. The fundus of the uterus is a thick muscular region above the Fallopian tubes; the body is joined to the cervix by the isthmus (see Figure 16.5). The cervix is the narrowest aspect of the uterus opening into the vagina. The uterus also has three layers; the uterine wall has three distinct layers (see Table 16.1).

The fallopian tubes

The two Fallopian tubes are delicate, thin cylindrical structures approximately 8–14 cm long, they are attached to the uterus at one end supported by the broad ligaments. The lateral ends of the Fallopian tubes are open and are made of projections known as fimbriae that are draped over the ovary (see Figure 16.5). The fimbriae pick up the ovum after discharge from the ovary, the fimbriae are composed of smooth muscle that are lined with ciliated mucous-producing epithelial cells, moving the ovum along the tubes towards the uterus. Fertilisation of the ovum usually occurs in the outer portion of the Fallopian tubes.

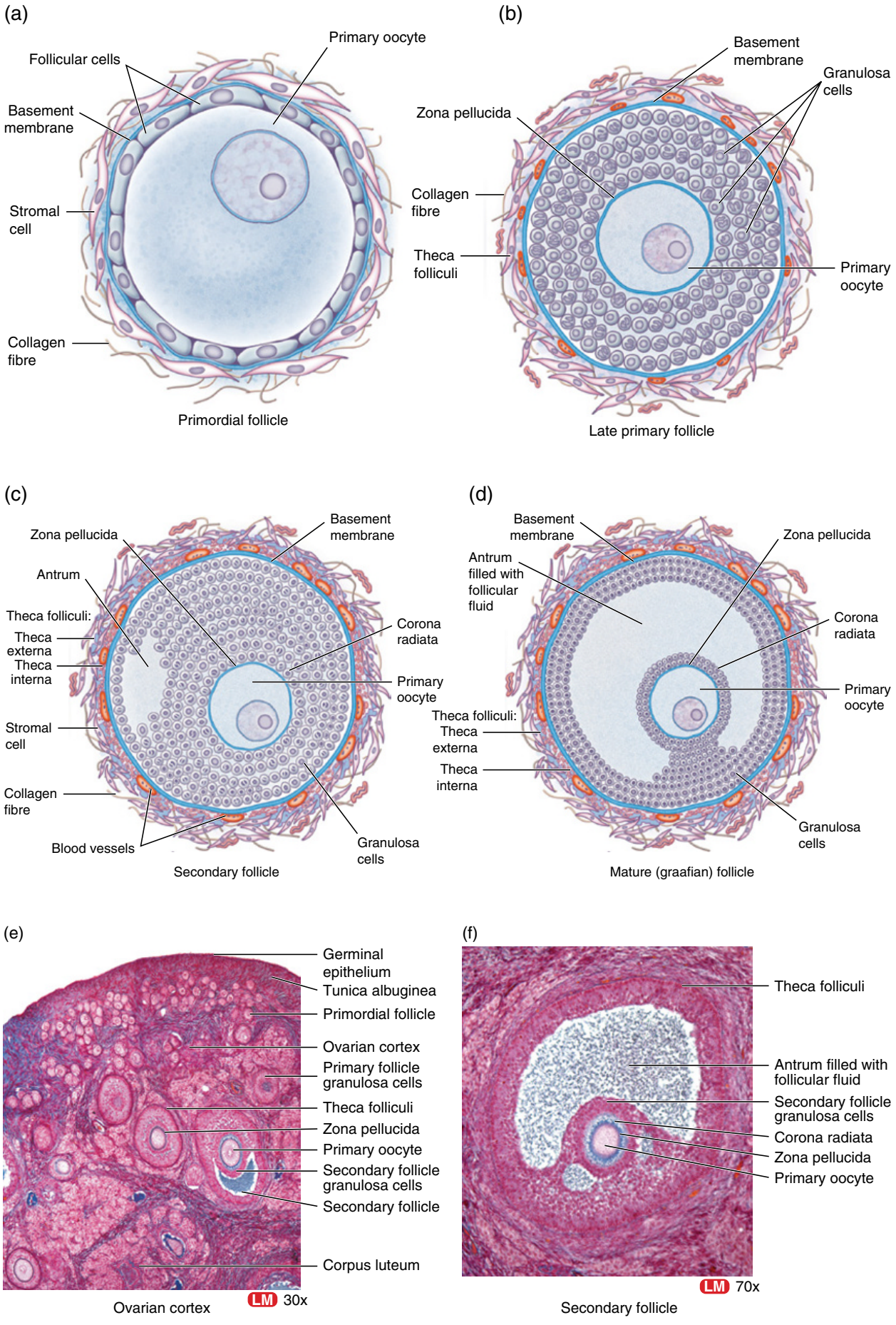


Figure 16.3 Developmental sequences related to the maturation of an ovum.

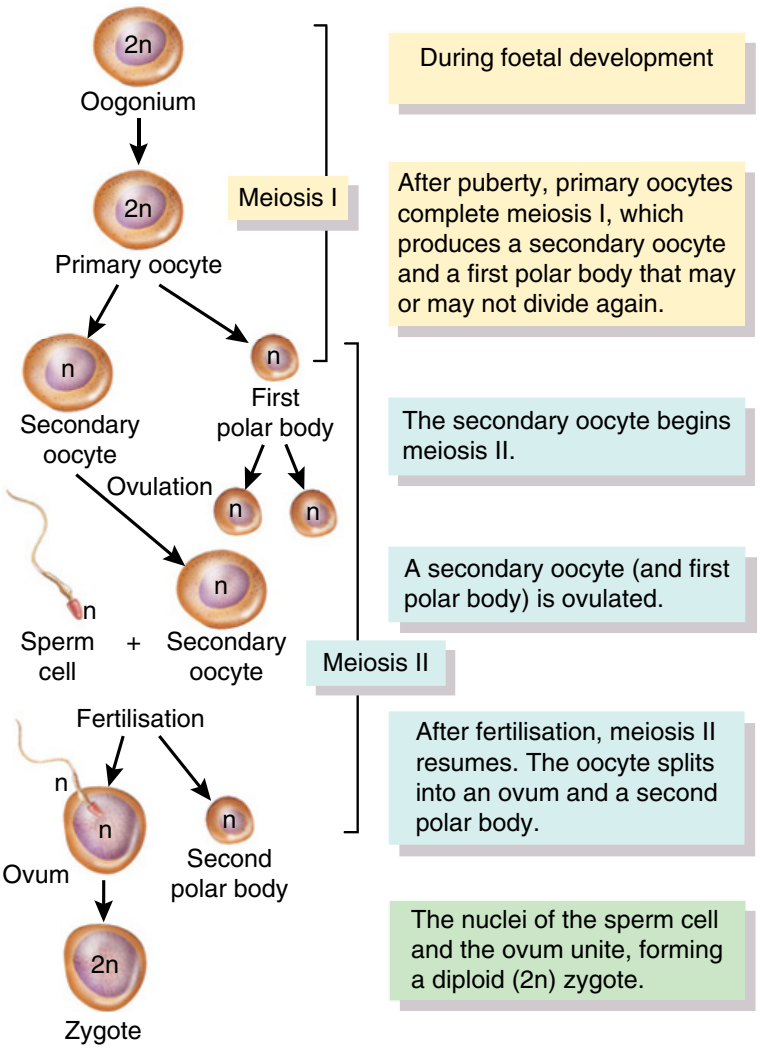


Figure 16.4 Oogenesis.

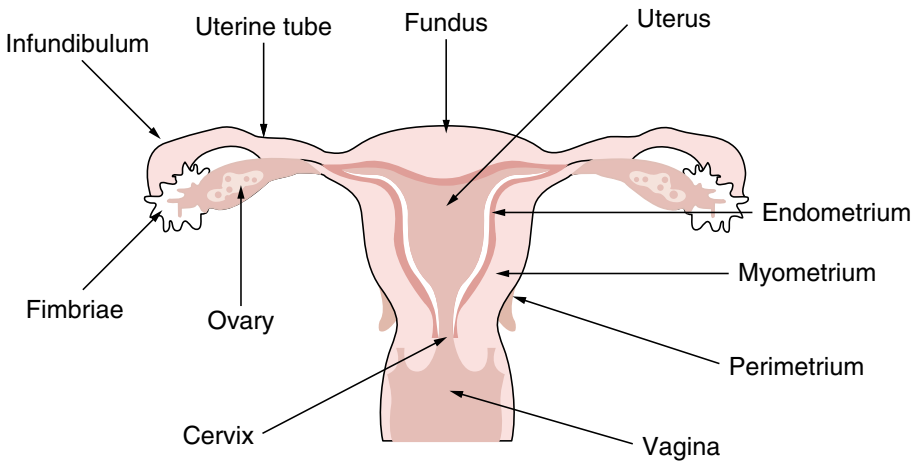


Figure 16.5 The uterus and associated structures.

The vagina

This is a tubular, fibromuscular structure that is approximately 8–10 cm in length and receives the penis during sexual intercourse, an organ of sexual response. The vaginal canal permits the menstrual flow to leave the body and is the passage for the birth of the child. It is located posterior to the urinary bladder and urethra and anterior to the rectum. The upper aspect contains the uterine cervix.

Table 16.1 The three distinct layers of the uterus.

Layer	Description
Perimetrium	A serous membrane enveloping the uterus. This is the outer layer, it provides support to the uterus and is located within the pelvis. The perimetrium is also known as the parietal peritoneum.
Metrometrium	The middle layer of the uterus is made up of smooth muscle. During pregnancy and childbirth the uterus is required to stretch, and this muscular layer allows this to happen. The muscle contacts during labour. Postnatally this muscular layer will forcefully contract to force out the placenta.
Endometrium	This is the inner layer of the uterus with a mucus lining. The outer aspect is continuous with the vagina and the Fallopian tubes. During menstruation the endometrium is shed, sloughing away from the inner layer; this is the menstrual period occurring as a result of hormonal changes. During the menstrual period the endometrium thickens and becomes rich with blood vessels and glandular tissue until the next period occurs and the cycle begins again.

The vaginal walls are made of membranous folds of rugae that are composed of mucous-secreting stratified squamous epithelial cells.

The vaginal walls are usually moist with a pH that ranges from 4.9 to 3.5 (Waugh and Grant 2018). Oestrogen is responsible for the growth of vaginal mucosal cells, causing them to thicken and develop, increasing glycogen content, which results in a slight acidifying of vaginal fluid.

The cervix

The cervix forms a pathway between the uterus and the vagina. The uterine opening of the cervix is known as the internal os and the vaginal opening is known as the external os. The area between these openings is the endocervical canal and this acts as a channel for the discharge of menstrual fluid, the opening for sperm and the delivery of the infant during birth.

The breasts

The breasts are a part of the female external reproductive system. Both men and women have breasts. Women, however, have more breast tissue than men.

Function

The key function of the breast is to produce, store, and release milk to feed a baby. Milk is produced in lobules located throughout the breast after they have been stimulated by hormones produced in the woman's body after she has given birth. The milk is transported to the nipple by the ducts and from the nipple to the baby during breast-feeding.

Review

A woman wishes to breast feed her baby. She has a nipple piercing. What advice might you offer her?

Structure

The structure of the female breast is complex. Within it there are fat and connective tissue and also lobes, lobules, ducts, and lymph nodes (see Figure 16.6). The breast lies over a muscle of the chest known as the pectoral muscle.

The female breast covers a large area, extending from just below the clavicle to the axilla and across to the sternum (see Figure 16.7). The breast is a mass of glandular, fatty, and connective tissue.

Lobules and ducts

Each breast houses a number of lobules (sections) that branch out from the nipple, the lobules are the glands responsible for the production of milk. A lobule holds very small, hollow alveoli that are linked by a network of thin ducts. During breast-feeding, the ducts carry milk from the alveoli towards

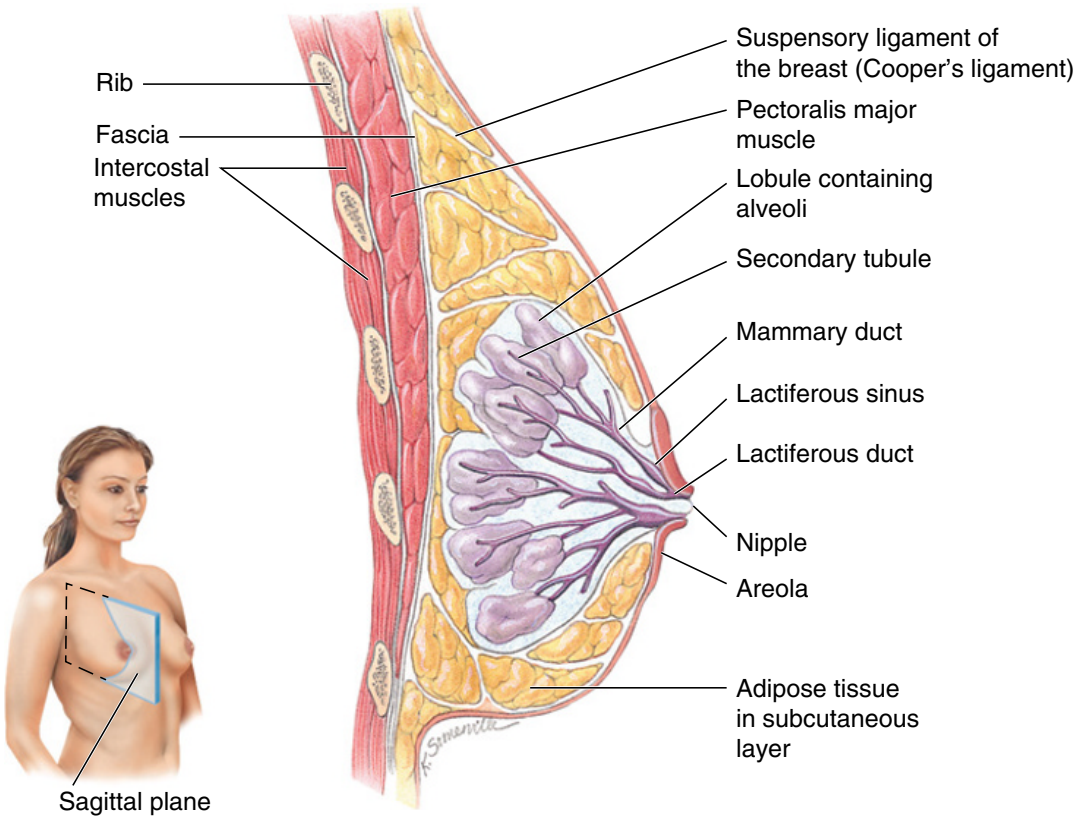


Figure 16.6 The breast.

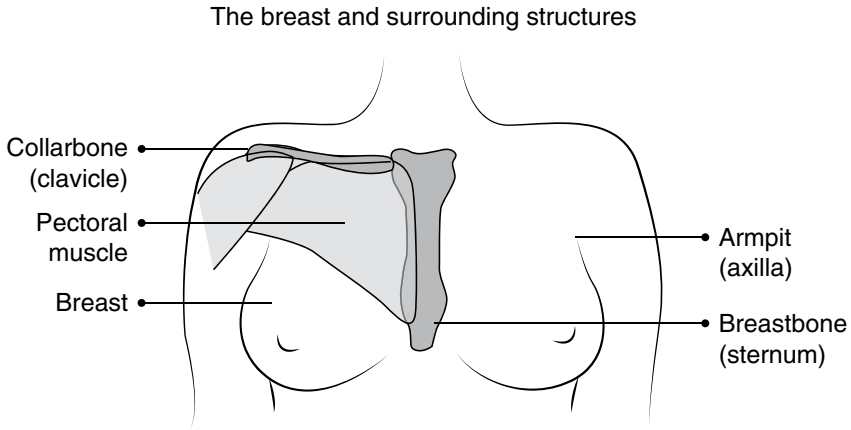


Figure 16.7 The breast and surrounding structures.

the breast areola. From the areola, the ducts join together into larger ducts which then terminate at the nipple. The areola is the circular area around the nipple, containing small sweat glands which secrete moisture that acts as a lubricant during breast-feeding. The nipple is the area found at the centre of the areola where the milk emerges.

Fat, ligaments, and connective tissue

The spaces around the lobules and ducts are filled with fat, ligaments, and connective tissue. The amount of fat in the breast will determine their size; the fat gives the breast its shape. In all women, the actual milk-producing structures are nearly the same. Cyclic changes in hormone levels will have an impact on breast tissue. Younger women usually have denser, less fatty breast tissue than older

women who have gone through the menopause. Ligaments provide support to the breast, running from the skin through the breast and attaching themselves to muscles on the chest (Tortora and Derrickson 2012; McLafferty et al. 2014).

Nerve supply

There are several major nerves in the breast area. These include nerves in the chest and arm. There are also sensory nerves in the skin of the chest and axilla. Branches from the 4th, 5th, and 6th thoracic nerves supply the breasts.

Arteries and capillaries

Arterial blood supply comes from the thoracic branches of the axillary arteries and the internal mammary and intercostal arteries. Venous drainage of the breast is primarily undertaken by the axillary vein. The subclavian, intercostal, and internal thoracic veins will also aid in returning blood to the heart.

Lymph nodes and lymph ducts

The lymphatic system is a network of lymph nodes and lymph ducts that assist in fighting infection. Axillary lymph nodes are located above the clavicle, behind the sternum as well as in other parts of the body. Lymph circulates throughout body tissues, picking up fats, bacteria, and other unwanted materials and filtering them out through the lymphatic system. Breast lymph nodes include supraclavicular nodes above the clavicle, infraclavicular (or subclavicular) nodes below the clavicle, axillary nodes in the axilla, and internal mammary nodes situated inside the chest around the sternum.

There are around 30–50 lymph nodes in the axilla. This number will vary from woman to woman. The axillary lymph nodes are divided into three levels depending on how close they are to the pectoral muscle on the chest:

- Level I (low axilla) – in the lower or bottom part of the axilla, along the outside border of the pectoral muscle
- Level II (mid axilla) – in the middle aspect of the axilla, under the pectoral muscle
- Level III (high axilla) – below and near the centre of the clavicle, above the breast area and along the inside border of the pectoral muscle

Breast development

Breast tissue changes at different times during a woman's life. Changes occur during puberty, during the menstrual cycle, during pregnancy, and after menopause. Female breasts do not begin growing until puberty and at this time are responding to hormonal changes, mainly due to increases in oestrogen and progesterone as they begin to develop. During puberty, breast ducts and milk glands grow. The breast skin stretches as the breasts grow and this creates a rounded appearance. Young women tend to have more glandular tissue than older women; most of the glandular and ductal tissue in older women will be replaced with fatty tissue and the breasts will become less dense. Ligaments lose their elasticity as the women ages and this can cause the breasts to sag. A woman's two breasts are rarely the same size, with one breast being slightly larger or smaller, higher or lower, or shaped differently than the other.

Hormones and the breast

The principal female hormone is oestrogen. This hormone affects female sexual characteristics such as breast development and is necessary for reproduction. The ovaries make up most of the oestrogen in a woman's body. However, a small amount is made by the adrenal glands. Progesterone (the other female sex hormone) is made in the ovaries, it is progesterone that prepares the uterus for pregnancy and the breasts for producing milk for breast-feeding (lactation). Each month breast tissue is exposed to cycles of oestrogen and progesterone throughout a woman's childbearing years, during the first part of the menstrual cycle oestrogen stimulates the growth of the milk ducts. Progesterone takes over in the second part stimulating the lobules. Post menopause, the monthly

cycle ends. The adrenal glands, however, will continue to produce oestrogen and a woman retains her sexual characteristics.

So far

The female reproductive system is complex. It is essential for sexual reproduction as well as other important issues, and the nurse must take this into consideration when caring for women – for example, the psychological and social features of reproduction, as well as the pleasure often provided by the reproductive organs. The female reproductive organs have been outlined along with their key functions.

The patient history

A comprehensive health assessment of the female reproductive system will include gathering subjective and objective data. Before you begin talking with the patient, the nurse should clarify goals for the interview. A gynaecological history requires the nurse to ask questions relevant to the female reproductive system. Some of these questions are highly personal and therefore effective communication skills and a respectful approach are absolutely essential.

Take note

The nurse practises in a holistic manner, by respecting individual choice, offering support, and promoting the health, wellbeing, and dignity of women.

Taking a gynaecological history requires asking a lot of questions that are not part of what might be considered the 'standard' history-taking format and as such it is important to understand what information you are expected to gain.

Take note

Addressing sensitive topics

- It is most important never to be judgemental. The privileged role of the nurse is to learn about the patient and to assist the patient in achieving better health. If the nurse shows condemnation of behaviours or elements in the health history, this will only interfere with this goal.
- Take time to explain why certain information is needed. Doing this can help the patient feel less anxious. For example, think about saying, 'Because there are some sexual practices that can put people at risk for certain conditions, I ask all patients the following questions.'
- For sensitive topics, use open questions and allow the patient to elaborate.
- Be consciously aware of the discomfort that you are feeling. Failing to acknowledge your discomfort could lead you to avoid the issue altogether.

6Cs

The nurse should introduce themselves to the patient. State your name and what your role is, and confirm patient identification. You should also explain to the patient why there is a need to take the history, and gain the patient's consent. The patient should be made comfortable and reassurance given that the consultation is private and the data that is collected will only be shared with the patient's permission.

Box 16.1 Some components of the health history: the female reproductive system

- Menstrual cycle history, onset, length, amount of flow, cramps, bloating, pre-menstrual syndrome, age of first period, age of menopause. If the presentation condition is cyclical, this may be related to the menstrual cycle (intermenstrual, post-menopausal bleeding).
- Abnormal vaginal bleeding: does bleeding occur after sexual intercourse?
- Any pregnancies – and if so, how many live births, miscarriages or abortions any complications, mode of delivery, birth weights. Antenatal, perinatal, postnatal complications.
- Current list of medications (including use of hormone replacement therapy) and reason for taking them. Also ask the patient about over-the-counter medications, vitamins, and herbal supplements.
- Symptoms of vaginitis, discharge, itching, irritation, dysuria, light bleeding or spotting
- Problems with urinary function, frequency, urgency, nocturia, haematuria, difficult controlling flow of urine
- Bowel problems, constipation/straining, urgency of stool, faecal incontinence, flatus, a feeling of incomplete evacuation, the need to apply digital pressure to the perineum or posterior vaginal wall to enable defaecation, the need for digital evacuation to pass a stool.
- Sexual history: is the patient sexually active, any difficulties with the physical act of intercourse
- Sexual health history (contact with a partner who may have had sexually acquired infection)
- Current or previous sexual abuse or physical abuse
- Contraceptive history (clarify type, questions, or concerns)
- Past surgical history (including female genital mutilation, Caesarean section)
- Long-term conditions (include physical and mental health conditions)
- Genetic disorders (for example, possible familial inheritance BRCA gene)
- Any breast tenderness, lumps, discharge, or concerns? Does the patient perform monthly self-breast examinations?
- Does the patient have regular smear tests?
- Social history, smoking, alcohol and recreational drug use, weight, home situation, occupation

Source: Adapted Jarvis (2015).

Take note

In order to promote the rights, options, and wishes of all women, the nurse is required to be confident and competent as well as understanding the importance of working in partnership with women to address women's needs in all care settings.

It is important to ask questions about the woman's past health history, this will provide information about the patient's childhood illnesses and immunisations, accidents or traumatic injuries, hospitalisation, surgery, psychiatric or mental illnesses, allergies, chronic illnesses, history of menstrual cycle, how many pregnancies, and how many births. As well as gathering data about the patient's general health, the nurse asks about past history and experiences specific to the woman's health (see Box 16.1).

Take note

The information that is obtained during the physical examination will help the nurse to narrow the list of possible diagnoses to explain the patient's symptoms and to refine plans for additional testing and treatment.

Cultural considerations

As far back as (1996) Harlow and Campbell noted that a person's ethnicity has strong influences on the duration and heaviness of bleeding during menses. In this early study, Black girls tended to have longer menses than white girls of the same age, with heavier menstrual blood flow.

So far

A focused approach to gathering subjective data during the history taking phase is required. The data gathered at this stage can provide direction for collecting primary data during the physical examination. A sensitive and respectful approach is required throughout. It is important to listen to the patient and each response that she makes so that you can ask additional questions as indicated.

Physical examination

The skills required to competently and confidently undertake an assessment of the female reproductive system are refined over the years. The nurse must employ a non-judgemental approach. Questions should be asked using open-ended questions, allowing the woman to elaborate. There is also a place for closed-ended questions, i.e. 'Did the episode come suddenly or not?' (acute or chronic). Physical assessment is undertaken in an environment that promotes patient comfort, cooperation, and participation.

Take note

Assumptions should never be made about aspects of the patient's background such as marital status or sexual orientation.

Griffiths (2015) suggest that an abdominal examination should take place before any examination of the female reproductive system occurs. Gynaecological examination is not something most women will enjoy. However, it is a necessity, and assessing the women's reproductive system can be difficult as it is complex and its functions can have an impact psychosocially. A pelvic examination should not be carried out unless this is symptomatically indicated (Griffiths 2015). There are some women who feel so intimidated by the examination that they delay it until something is obviously wrong, or they may avoid the examination altogether, fearing physical discomfort, embarrassment, a negative diagnosis, or questions and queries about past sexual trauma. The woman should be assured that information provided and results of the examination will remain confidential and that information will only be disclosed with her permission.

Assessment of the breasts

Breasts are a secondary reproductive characteristic; this means that reproduction can occur without them. In contemporary culture the breasts have an important role to play in sexual health as they are visible. Size and shape may be seen by some as a measure of sexuality, attractiveness, and femininity.

Breast assessment is carried out in an environment that enhances patient comfort, cooperation, and participation. A chaperone must be present. The gynaecological assessment (if appropriate) will begin with an examination of the breasts. The goal is to assess breast health, including the breasts' lymphatic system and changes related with puberty, pregnancy, and the menopause. The nurse can offer to teach the woman how to perform breast self-examine if she does not already do this.

All findings are documented and reported in line with local policy and procedure noting all masses, location, size, shape, texture, mobility, and any overlying skin changes. If the woman has

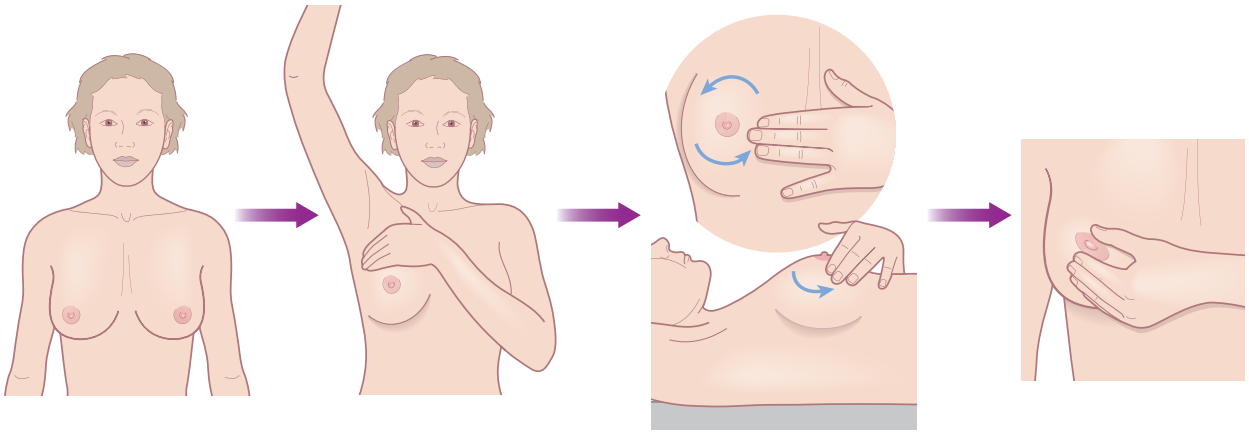


Figure 16.8 Breast examination.

had a mastectomy, a routine assessment of the unaffected side is performed. Inspect and palpate the surrounding tissue, lymph nodes and axilla for lumps, redness, swelling, tenderness, and any lesions. For women who have had breast surgery, examine in the same sequence, paying specific attention to scars.

With the woman seated, wash your hands and explain the procedure. Inspect each breast visually, taking note of any nipple retraction or deviation, skin dimpling, erythema, oedema, peau d'orange (this is oedema with skin pitting), induration, or asymmetry. Ask the woman to raise her arms above her head, lowering them and shrugging her shoulders forward, this may bring an otherwise unnoticed abnormality into sight. With the woman supine and with one hand under her head (lifting the breast slightly), palpate the ipsilateral axilla and breast. Palpate in a smooth, gentle back-and-forth or circular motion with the palmar surfaces of the three middle fingers, using light and deep but gentle palpation. In a systematic manner, palpate first the axilla and then the entire breast lightly, using deeper palpation to assess full tissue thickness. Explain to the woman what you are doing. Gently compress each nipple, discovering any masses or discharges that are not attributable to pregnancy or postpartum changes. See Figure 16.8.

Assessment of the organs of the female reproductive system

The organs of the female reproductive system cannot usually be felt on palpation. Physical assessment of the reproductive system begins with inspection and palpation of the external genitalia. A speculum is used to visualise the inner vagina and cervix and when the collection of specimens is required.

Prior to undertaking the examination, ask the patient to empty her bladder (a urine specimen may be required). An empty bladder promotes comfort and can make the examination easier; a full bladder can make palpation uncomfortable for the woman. Provide the woman with a gown. She should be asked to remove her clothing from the waist down and to remove any sanitary protection (Young et al. 2018); she can leave her socks and shoes on for comfort. A chaperone will be required and privacy must be afforded. The usual position to undertake the examination is with the woman in the lithotomy position with her knees flexed and apart. The nurse may need to help the woman to assume this position. In some instances of assessment of the female genitalia, the woman may be asked to stand, or to lie in the left lateral position, for example when assessing for pelvic organ prolapse.

Equipment

The equipment needed will depend on the purpose of the examination. The equipment should be readily available in the room, ensuring that the examination proceeds without unnecessary pauses or interruptions. The equipment cited in Box 16.2 should be available to examine the genitalia.

Box 16.2 Equipment needed for genital examination

- A flexible light source
- Vaginal speculae
- Alcoholic hand rub
- Disposable examination gloves
- Water-soluble lubricant
- Several types of sampling devices (for example, wooden or plastic spatula, cytobrush, cervix brush)
- Glass slides, slide container
- Pencil for marking slides
- Fixative solution
- Specimen forms and bag
- Tissue paper
- Clinical waste container

Explain to the woman what the examination entails; verbal consent must be obtained. Wash hands and don gloves. With the woman in the lithotomy position, examine her external genitalia:

- Skin colour
- Hair distribution
- Labia and clitoris (oedema, lesions)
- Urethral opening (stricture, inflammation)
- Vaginal opening (malodourous discharge, inflammation, lesions)
- Palpate the vagina (tenderness, oedema, discharge, Bartholin's glands)

Document and report the findings after you have inspected the external genitalia.

Box 16.3 provides information for passing a vaginal speculum

The Papanicolaou smear test is used in most cases to undertake cervical screening. A sample of cells are taken from the cervix at the junction between the endocervix and the ectocervix in an area known as the transformational zone (see Figure 16.9).

Review

What does cervical cancer CIN IV mean?

Digital bimanual palpation

The bimanual examination enables the examiner to palpate the uterus and ovaries externally and internally concurrently. Griffiths (2015) notes that if ectopic pregnancy is suspected, a vaginal examination should not be undertaken as there is a possibility that rupture of the tubal pregnancy can occur. As with any examination, the examiner must be competent and confident in performing the examination.

Wash hands. Standing, explain to the woman the steps in the examination. Explain the examination can be stopped or paused at any time. The nurse uses gloved fingers and a water-soluble lubricant to gently insert the first two fingers of the dominant hand into the vagina, asking the woman to take deep breaths as this is done. Inside the opening (the introitus), the fingers are slowly and gently advanced along the vaginal canal vertically and the vaginal wall is palpated. Place the other hand above the symphysis pubis, gently pushing down towards the pelvis. Examine the cervix, uterus, and adnexa. As you are doing this, note any irregularities, such as masses or abnormal tenderness. Slowly

Box 16.3 Passing a vaginal speculum

Passing a vaginal speculum

An experienced practitioner is required to pass a vaginal speculum. This procedure should only be undertaken by a practitioner who has been deemed competent to carry it out. Observing a skilled practitioner insert a vaginal speculum can help to enhance learning and skill acquisition.

The speculum can be metal or single-use plastic. If using a metal speculum, running it under warm water prior to insertion will warm it up, and also provide lubrication. If using a plastic speculum, a water-soluble jelly can be used as lubricant; apply the gel only to the side of the blades and not the tip, as this can interfere with sample or swab results. Local policy and procedure must be adhered to at all times.

Standing at the foot of the bed, explain to the woman what you intend to do and that she will feel internal pressure and possibly some slight, transient discomfort. Ensure you have adjusted the light source so you can see clearly. To insert the speculum, spread the inner lips of the vulva with two fingers of the dominant hand, hold the blades (sometime called bills) of the speculum tightly together with the thumb and index finger of the other, and gently guide it into the vaginal canal, ask the woman to take some deep breaths.

Insert the speculum initially at a 90° angle, sideways initially, then asking the woman to take some deep breaths gently rotate it to 45° angle in the direction of the rectum. You can insert it with the handles up, or with the handles down.

Always apply pressure downward during insertion. Never apply pressure upward during insertion; pressing the urethra against the symphysis pubis causes pain or discomfort to the patient.

When the handles of the speculum are pinched together, they will open the blades, stretching the vaginal walls to reveal the cervix. Avoid catching the pubic hair, and with the handles held tightly together, the short handle slides down and the long handle slides up. Once the cervix is fully visualised, lock the speculum into place by the fixing mechanism, this can either be a screw or a ratchet.

Throughout the procedure, observe the woman for signs of pain or discomfort and reassure her that at any time you can stop or pause the procedure.

With the speculum locked, both hands are free to angle the lamp to illuminate the vaginal walls and the cervix and allow for procedures to be performed. Be aware of infection prevention and control practices when adjusting the lamp; use a paper towel when touching the lamp or request a colleague to assist you.

Once you have finished the procedure explain this to the woman. To remove the speculum, place the thumb of the dominant hand on the thumb rest, hold the handles and release the secured position by loosening the fixing mechanism. Gently apply pressure to the handles to ensure the cervix is not caught within the blades.

Ask the woman to take a deep breath and gently rotate clockwise. Take care to remove the blades at an oblique angle and avoid pulling pubic hair or pinching the labia. Offer the woman a paper tissue to clean herself, or you may be required to assist her. Ensure privacy for the patient to get dressed. Dispose of the equipment using local policy and procedure and document and report findings.

and gently remove the finger from the vagina. Provide the woman with tissues to clean herself; you may need to assist her with this. Dispose of the used materials and wash hands.

Document and report all examinations and outcomes according to local policy and procedure. Provide the woman with clear explanations of any findings as well as proposed next stages of care and treatment.

Basing care and treatment decisions on one diagnostic approach (i.e. digital bimanual examination) would be erroneous. Abnormal findings should always be followed up using further assessment that will involve other modes of assessment or diagnostic techniques.

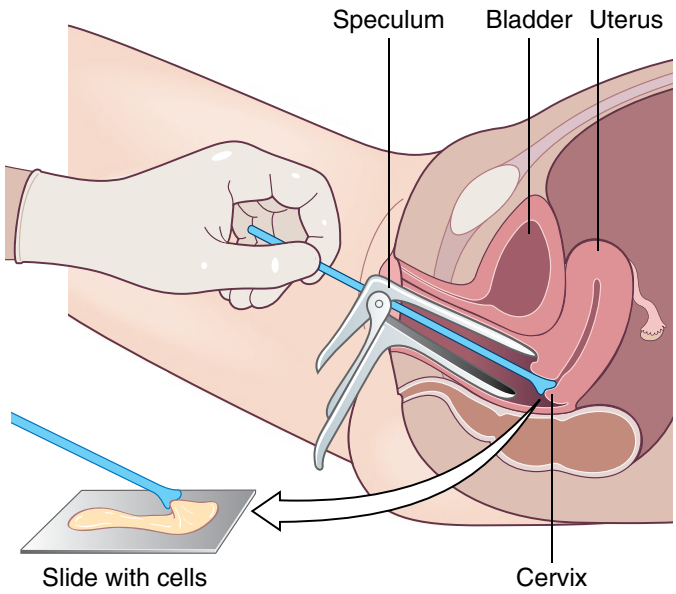


Figure 16.9 Cervical cell sampling.

Review

Define the following terms

Menses	
Menarche	
Amenorrhoea	
Oligomenorrhoea	
Menorrhagia	
Metrorrhagia	
Hypermenorrhoea	
Dysmenorrhoea	
Vulvodynia	
Libido	
Vaginitis	
Perimenopause	
Anovulation	
Climacteric	
Dyspareunia	
Hirsutism	
Hysteroscopy	

So far

There are several ways of undertaking an assessment of the female reproductive system; relying on one approach would be imprudent. Screening and diagnostic tests are available to help offer women care that is responsive and appropriate. The role of the nurse is varied and will include acquiring competence and confidence when carrying out several intimate examinations. The role also includes acting as the woman's advocate.

Kamina (Kam) Samuda

At the general practice. Kamina presents with a 2-year history of dysmenorrhoea. Her symptoms commenced when she was 14 years of age. This was 2 years after menarche. Kam's chief complaint was abdominal pain. The primary presenting symptoms included a four-month history of severe painful menstrual cramps accompanied by painful intercourse. Severe menstrual cramping and pain began four months ago when the oral contraceptives Kam was receiving were changed; the pain was so severe that she had several instances of absence from school. Kam takes naproxen 500 mg daily when cramps and pain begin with no relief. Painful cramping starts five to seven days before menses begin, with the worst pain experienced on the first day of flow; the pain disappears completely by the third day of flow.

Kam has had no children, no miscarriages and no termination of pregnancy. Her last normal menstrual period began six days ago. The physical examination undertaken by the practice nurse was unremarkable, with the exception of a dry vaginal vault. She had been treated conservatively by her general practice with over-the-counter non-steroidal anti-inflammatory drugs for her dysmenorrhoea with no relief. Her surgical history included abdominal surgery as a child to remove a gangrenous appendix with no subsequent problems. Kam also reported dyspareunia and vaginal dryness with penile thrusting for the past four months approximately one week before onset of her period. No history of sexually acquired infections, she has only ever been sexually active with her current boyfriend. Kamina reported no change in vaginal discharge with no itching, burning, or malodour.

Initial observations:

Looks well

Temperature: 36.8 °C

Pulse: 76 beats per minute

Respirations: 18 breaths per minute

Blood pressure: 120/60 mm/Hg

Using the SOCRATES mnemonic, gather a history from Kam. What questions will you ask her and how will you ask them in order to gather data?

S	Site. Where is the pain	
O	Onset. When did the issue start? Did this come on suddenly or was it gradual?	
C	Character. Is the pain dull or sharp? Is it intermittent or continuous? Describe the pain.	
R	Radiation. Does the pain radiate to other places? Where is it felt?	
A	Associations. Are there any other symptoms associated with the presenting condition?	
T	Time. How long have you had the condition? Does the condition worsen, is it improving, does it fluctuate?	
E	Exacerbating or reliving factors. Does anything make the condition worse or better? Does sexual intercourse exacerbate the condition (dyspareunia)? Is there any pain associated with the menstrual period (dysmenorrhoea)?	
S	Severity. Use a pain scale to assess severity of pain.	

The diagnosis of dysmenorrhoea has been made. What else can be done to help Kam manage her condition?

Is there any other information required and are there any other tests that might need to be carried out?

Conclusion

The reproductive system is key to the survival of the species. Nurses are required to have a working knowledge of the female reproductive system if their aim is to provide care that is delivered in a sensitive, patient-centred manner as well as being safe and effective. Undertaking a patient health history has to be focused and the nurse needs to always remember the intimate nature associated with the assessment of this system. A physical examination can cause embarrassment and thus the nurse should care for the woman in an environment where she feels safe and comfortable.

The female reproductive system is complex; so too is the care offered. A nurse who is skilled in the understanding of assessment is required to adopt a sensitive approach to care. It is also a key requirement that the nurse understands and respects the individual and the holistic needs of the woman and if appropriate her family.

There are several conditions that affect the female reproductive system and thus the person's overall health and wellbeing. Being familiar with these conditions can assist the nurse to help the woman in a timely manner, ensuring a timely diagnosis, treatment, and, if appropriate, referral.

References

Griffiths, B. (2015). The genitourinary system. In: *Physical Examination Procedures and Non-Medical Prescribers: Evidence and Rationale*, 2e (ed. Z. Rawles, B. Griffith and T. Alexander), 55–69. London: CRC Press.

Harlow, S.D. and Campbell, B. (1996). Ethnic differences in the duration and amount of menstrual bleeding during the postmenarcheal period. *American Journal of Epidemiology* 144 (10): 980–988.

Jarvis, C. (2015). *Physical Examination and Health Assessment*, 7e. St Louis: Elsevier.

McLafferty, E., Johnstone, C., Hendry, C., and Farley, A. (2014). Male and female reproductive systems and associated conditions. *Nursing Standard* 28 (36): 37–44.

Tortora, G.J. and Derrickson, B.H. (2012). *Essentials of Anatomy and Physiology: International Student Version*, 9e. New Jersey: Wiley.

Waugh, A. and Grant, A. (2018). *Ross and Wilson's Anatomy and Physiology in Health and Illness*, 13e. Edinburgh: Elsevier.

Young, O., Duncan, C., Dundas, K., and Laird, A. (2018). The reproductive system. In: *Macleod's Clinical Examination*, 14e (ed. J.A. Innes, A.R. Dover and K. Fairhurst), 211–236. Edinburgh: Elsevier.

6

Cardiovascular Assessment

Jan Keenan and Angela M. Kucia

Overview

Assessment data are obtained from a patient's history, physical examination and the appropriate use of diagnostic tests. The information is used to establish a clinical diagnosis, establish goals for care and management and to evaluate outcomes. Assessment is undertaken by various members of the health care team, and synthesis of the information allows development of a comprehensive plan of care for the patient that takes immediate and long-term health care needs into consideration. Immediate assessment of a patient with an acute or suspected acute cardiac condition will be different from that for patients presenting with chronic or stable disease because rapid assessment diagnosis and treatment will have a significant impact on outcomes for those with an acute condition.

This chapter outlines the components of assessment for a patient with a cardiac disorder. Chest pain assessment is discussed in detail in Chapter 14.

Learning Objectives

After reading this chapter, you will be able to:

- Describe the components of the cardiovascular history.
- Describe the steps of the cardiovascular physical examination.
- Explain the principles of accurate blood pressure measurement.
- Explain the steps in cardiac auscultation and the significance of abnormal heart sounds.
- Describe the aspects of cardiovascular examination that assess cardiac output and circulation.

Key Concepts

Health history; symptom history; precordial inspection; palpation; cardiac auscultation

Cardiac Care: A Practical Guide for Nurses, Second Edition. Edited by Angela M. Kucia and Ian D. Jones.

Health History

A health history provides physiological and psychosocial information that guides physical assessment, selection of diagnostic tests and the choice of investigation and potential treatment options. A health history is obtained from a patient, but supplementary information may be provided by secondary sources such as the patient's family or local doctor.

The history should focus on:

- A comprehensive history of the presenting problem
- Previous health history, including previous investigations
- Risk factors for cardiovascular disease (CVD)
- Medication history, including allergies and intolerance to medications
- Social and personal influences on cardiovascular health

Information about the patient's coping mechanisms, their perception of illness causation and impact on their life and activities is also relevant.

Presenting Problem

The patient is asked about the problem that has prompted them to seek care and about symptoms or problems associated with the chief complaint.

The nature of the problem will guide the development of further questions to explore the health issue.

> **Key Point**
>
> When taking a history of a problem that has subjective symptoms such as shortness of breath, a differentiation needs to be made between true dyspnoea that is an unpleasant subjective true difficulty in breathing and breathlessness, or a response to exertion or exercise.

Past Health History

Past history includes information about childhood and adult illnesses, accidents, injuries, operations, and interventions that may or may not be relevant to the current illness. It may be necessary to prompt the patient by asking questions such as 'have you ever been hospitalised for any reason?', or 'have you had any accidents illnesses or injuries?' as patients often relate only what they think may be relevant to the current health issue. The patient is also asked about current medication use and known allergies or intolerance to any previous medication.

Previous Illnesses and Operations

Previous illnesses and operations provide important clues to the current condition or offer potential alternative diagnoses where the problem is not clearly cardiac in nature. These include:

- History of cardiovascular disease, transient ischaemic attacks, stroke and peripheral arterial disease
- History of heart failure, cardiomyopathy or valvular disease
- History of peptic ulcer disease, gastro-oesophageal reflux or frequent ingestion of nonsteroidal anti-inflammatory drugs or steroids
- Recent operations (such as cardiothoracic surgery)
- History of pulmonary embolus or a long period of inactivity or immobility (such as a long journey, recent operation, or illness)
- History of arrhythmia or syncope (fainting)
- Recent viral illness
- Childhood illness or illnesses in later life such as rheumatic fever or a history of rheumatoid arthritis

Risk Factors for Cardiovascular Disease

It is important to assess for the presence of cardiac risk factors or diseases that are associated with an increased risk of CVD. These are discussed in detail in Chapter 5.

Medications

A comprehensive medication history should be obtained addressing the following elements:

- Identify prescribed medications currently taken including dosage, frequency, length of time taken, side effects and adherence to the medication including how it is taken and whether it is being taken at recommended timings dose and frequency
- Identify over-the-counter medications or alternative remedies/herbal preparations taken regularly or recently and the reason for use.
- Identify any known allergies or intolerances to medications.
- Identify any contraindications or cautions to medications that might be indicated, such as aspirin or beta blockers in asthmatics
- Identify any cautions to medication that may be prescribed, such as anti-platelet therapy where there may a bleeding risk
- identify any recreational drugs being used or addictions

Social and Personal History

Social and personal factors that affect cardiovascular health should be included in the patient's history. These include factors such as:

- Family composition/significant other support
- Living conditions
- Daily routine and activities
- Occupation and employment
- Cultural/religious beliefs
- Coping patterns

It is important to know the person, as well as the illness. These details will give some indication as to how the person will cope with illness, what support is available to them, what services need to be offered or put into place to assist the patient through the illness and achieve optimal health and involve the patient in formulating a plan of care that considers their individual needs and preferences.

Learning Activity 6.1

Culture refers to learned and transmitted knowledge of values, beliefs, rules of behaviour and lifestyle practices that guide a group of people in their thinking and actions. In our multicultural societies, health providers must provide person-centred care to people from a diverse range of cultural backgrounds with different languages, levels of acculturation and unique ways of understanding illness. When misunderstood, cultural influences and differences can adversely affect the patient (and family)–provider relationship, leading to mistrust and poor co-operation.

1) What is meant by the terms 'cultural awareness' and 'cultural competence'?
2) How might you implement culturally competent care in the cardiovascular setting?

Suggested Resource

How to improve cultural competence in health care
Tulane University (2021)
https://publichealth.tulane.edu/blog/cultural-competence-in-health-care/

Physical Examination

A baseline physical examination is obtained, and this will determine the requirement and timing of further assessment. Subsequent assessment can be compared with baseline to look for improvement or deterioration.

Suggested Resource

The video below will demonstrate physical aspects cardiovascular examination.
Cardiovascular Examination – OSCE guide (New Version)
Geeky Medics (2015)
https://youtu.be/eBnzjerIHj0

General Appearance

Information gathering about the patient starts from the first interaction and begins with first impressions from the patient's appearance. These include things such as whether the patient appears well groomed or unkempt and may have implications for the patient's ability or motivation to perform self-care activities. If obesity or cachexia is present, an observation is made about the patient's nutritional state. Facial expressions and body language are some of the first things that are noticed and may give an indication as to whether the patient is anxious, distressed or in pain. Their affect and how they interact will become evident as you introduce yourself and explain your intent in taking a history and examination. Observe if they make eye contact and respond appropriately to conversation. Other observations that can be made whilst taking a patient history are presence of pallor or cyanosis, diaphoresis, laboured breathing, coughing, vomiting, and a rapid circulatory assessment based on whether they are cool or warm to touch.

Precordial Inspection and Palpation

With the patient supine and the head of the bed raised at a 45° angle, inspect the precordium for any visible pulsations, masses, scars, lesions, signs of trauma or previous surgery (such as median sternotomy or pacemaker scar). Locate the angle of Louis (sternal angle) also known as the notch of Louis (sternal notch), the raised notch where the manubrium and the body of the sternum are joined. This notch is at the level of the second rib and can, therefore, be used as a reference point for locating intercostal spaces.

Palpate the areas of the valves for any thrills (a palpable vibration felt as a result of turbulent blood flow) that can best be felt with the flat of the hand, palpate for parasternal heaves (large movements are best felt with the heel of the hand at the sternal border).

Palpate the epigastrium for pulsations that might represent aortic pulsation. An abnormally large pulsation may suggest pathology such as an abdominal aortic aneurysm and will require further investigation.

Palpate the apex beat, also known as the 'point of maximal impulse', which is usually found in the fifth intercostal space and 1 cm medial to the midclavicular line. The apex beat should be no larger than the width of two fingertips and tapping in character.

The apex beat does not exactly correspond to the anatomical apex of the heart, so if the apex beat can be felt across a large area, feel for the most lateral and inferior position of pulsation. If the apex beat is located in the axilla, it would suggest cardiomegaly or mediastinal shift. Characteristics of the apex beat can be described using the mnemonic in Box 6.1.

Box 6.1 Characteristics of the apex beat

S	*Size*	Is it larger than one intercostal space?
A	*Amplitude*	Is it strong or weak?
L	*Location*	Is it in the fifth intercostal space at the mid-clavicular line?
I	*Impulse*	Is it monophasic or biphasic?
D	*Duration*	Is it abnormally sustained?

Key Points

If you are having difficulty palpating the apex beat, keep the pads of your fingers in the position described earlier and ask the patient to roll on to their left side.

It may not be possible to palpate the apex beat in late pregnancy, in obese patients or those with emphysema.

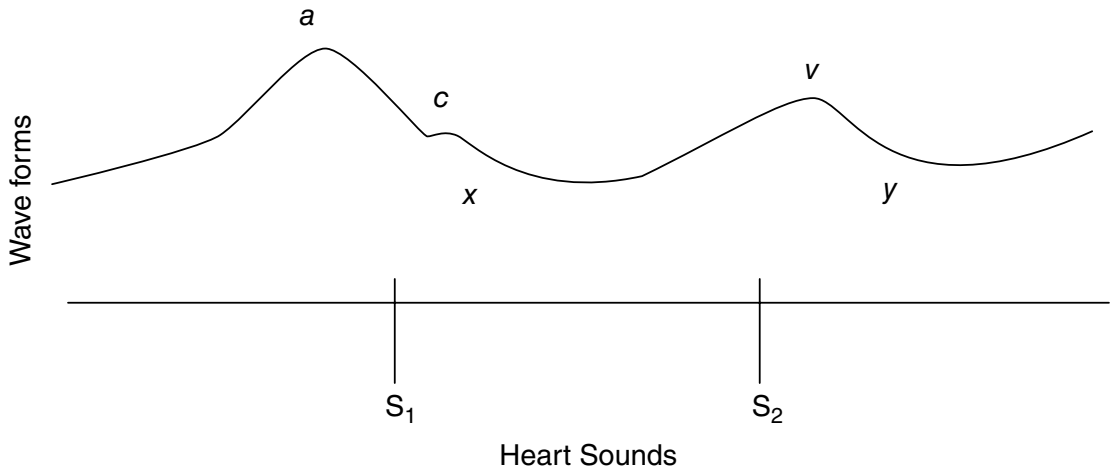
Jugular Venous Pressure

The jugular venous pressure (JVP) is an indirect measure of central venous pressure (CVP). The height of the level of blood in the right internal jugular vein (IJV) is an indication of right atrial pressure because there are no valves or obstructions between the vein and the right atrium. The patient should be positioned in a semi-recumbent position at a 45° angle with the head turned slightly to the left. If possible, have a tangential light source that shines obliquely from the left. Look for the surface markings of the right IJV that runs from the medial end of the clavicle to the ear lobe. The JVP has a double waveform pulsation. Measure the level of the JVP by measuring the vertical distance between the sternal angle and the top of the JVP. This is usually less than 3–4 cm.

Distinguishing the JVP from Carotid Pulse

Unlike the carotid pulse, the JVP pulse is not palpable, is obliterated by pressure and decreases with inspiration. The JVP has a double-waveform pulsation (Figure 6.1). Time the jugular venous pulse waves by simultaneous palpation of the carotid arterial pulse. The *a* wave precedes the carotid arterial pulse, whereas the *v* wave closely follows the pulse.

To confirm that the pulsation observed is caused by the JVP, apply firm pressure on the liver using the palm of the hand on the right upper quadrant and a transient increase in the JVP will be seen in a normal patient. This is known as the 'hepatojugular reflex'. Sustained elevation of the JVP during compression with an abrupt decrease of at least 4 cm following release of pressure signifies a positive test and has been demonstrated to correlate with elevated right atrial pressure and pulmonary capillary wedge pressure (Clerkin et al. 2019).



a Wave is produced by right atrial contraction.
c Wave represents tricuspid valve closure.
x Wave or *x* descent represents drop in pressure in the right atrium.
v Wave represents passive right atrial filling late in systole or by ballooning of the tricuspid valve during right venticular contraction.
y Wave or descent represents drop in pressure in the right ventricle.

Figure 6.1 Jugular venous pulse wave form.

Key Point

Kussmaul sign is a paradoxical increase in JVP occurring during inspiration and indicates an inability of the right side of the heart to handle an increased venous return. The Kussmaul sign is commonly found in severe heart failure, cor pulmonale (acute or chronic), restrictive cardiomyopathies, tricuspid stenosis and right ventricular infarction.

Pulses

The arterial pulses should be palpated using the pads of the fingers. In a full cardiovascular examination, the carotid, brachial, radial, femoral, popliteal, posterior tibial and dorsalis pedis pulses should be palpated. In a targeted examination (such as in an acute admission), the radial pulse is the usual site for assessing the arterial pulse. The pulse is assessed for rate and rhythm. Peripheral pulses are compared bilaterally for symmetry. The normal pulse is regular and between 60 and 100 bpm. The strength of the pulse is assessed, and this may be graded on a scale of 0–3 as described in Table 6.1.

The character of the pulse is described. A pulse that alternates in strength with alternate beats is known as pulsus alternans and invariably is associated with severe left ventricular systolic dysfunction and carries a poor prognosis (see Figure 6.2).

A pulse that reduces significantly in amplitude during inspiration but reappears during expiration is known as pulsus paradoxus. Mild pulsus paradoxus can be a normal finding. Changes in intrathoracic pressure during breathing are transmitted to the heart and great vessels, causing arterial blood pressure to fall with inspiration and rise with expiration. To determine if pulsus paradoxus is a pathological finding, use a sphygmomanometer and allow the cuff to deflate until the pulse is heard only during expiration and note the corresponding pressure. Continue to deflate the cuff. The point at which the pressure is heard throughout the inspiratory and expiratory cycle is noted. The second systolic pressure reading is subtracted from the first; if the difference is >10 mmHg during normal respirations, it is considered pathological (Morton and Tucker 2013).

Table 6.1 Rating scale for strength of arterial pulses.

0	Absent
1	Weak, thready, easily obliterated
2	Normal
3	Strong, bounding, cannot be obliterated

Key Point

There are several pathologic causes of pulsus paradoxus. Cardiac causes include cardiac tamponade, percicardial effusion, constrictive pericarditis, restrictive cardiomyopathy, cardiogenic shock, right ventricular infarction, tricuspid atresia and superior vena caval syndrome. Pulmonary causes include severe obstructive pulmonary lung disease, tension pneumothorax, obstructive sleep apnoea, pulmonary embolism, bilateral pleural effusion and tracheal compression. Hypovolaemia and shock can also give rise to pulsus paradoxus (Raj 2014).

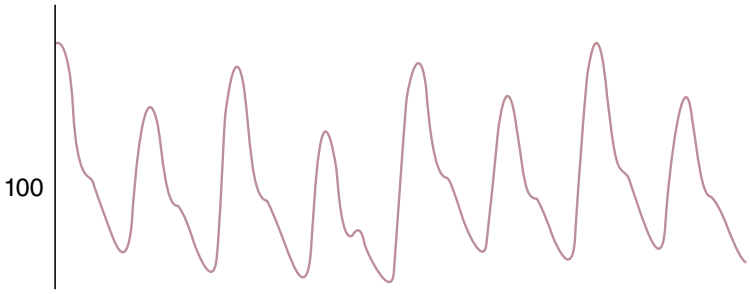


Figure 6.2 Pulsus alternans. *Source:* Wikipedia contributors (2021). Used under Creative Commons Attribution Share Alike 3.0 Unported License.

Peripheral Vascular System

Skin Temperature and Colour

The skin temperature and colour (including the peripheries) should be noted. Colour should be uniform. Note any areas of cyanosis. Central cyanosis reflects deoxyhaemoglobin from hypoxia and is generally distributed but best observed in the mucous membranes which appear dusky and bluish in colour. Central cyanosis is a sign of reduced oxygen concentration and is a late sign of hypoxia usually associated with heart or lung disease (Bickley 2013). Peripheral cyanosis, on the other hand, is localised in the extremities and protrusions (hands, feet, nose, ears and lips) and reflects impaired circulation.

Peripheral Oedema

Observe the legs and feet for oedema. Ask about the onset of oedema development and duration, and whether it is relieved by elevation of the limbs. In heart failure, oedema will usually be bilateral and pitting, resulting from water retention. It can also be caused by systemic diseases, pregnancy in some women, as well as directly or as a result of heart failure, or local conditions such as varicose veins or thrombophlebitis.

Peripheral Circulation

Look for any signs of thrombophlebitis, varicose veins, lesions and ulcers, and assess capillary filling time which will give an indication of the health of the peripheral arterial circulation. Do this bilaterally with both hands and feet and squeeze gently at the tip of the fingers or toes to blanch the skin. The time it takes for the skin to return to its normal colour reflects the capillary circulation, and in health this should be less than 2 seconds.

Blood Pressure

Comprehensive assessment of blood pressure (BP) should include multiple measurements taken on separate occasions, at least twice, one or more weeks apart. In a full cardiovascular examination, an initial BP assessment should be undertaken in lying and standing positions and in both arms. If postural hypotension is suspected, the patient should lie for 5–10 minutes before obtaining the BP and heart rate (HR); then BP and HR should be assessed again 2 minutes after standing (National Heart Foundation Australia [NHFA] 2016).

Key Points

A variation in BP by 5–15 mmHg in the setting of dizziness or syncope may indicate postural (orthostatic) hypotension.

A difference of systolic BP >15 mmHg between the left and right arms may indicate an increased risk of vascular disease and death and may identify persons who need further vascular assessment (Clark et al. 2016).

Learning Activity 6.2

Few clinicians observe the principles of accurate BP measurement. Consider whether you may need to update your practice. The following resources may be useful:

Suggested Resources

Hypertension and clinical management guidelines.
https://www.heartfoundation.org.au/Conditions/Hypertension

National Institute for Health and Clinical Excellence (2019; updated 2022). *Hypertension in Adults: Diagnosis and Management*. NICE guideline (NG136). https://www.nice.org.uk/guidance/ng136

There are several methods of measuring BP.

- The auscultatory method requires a sphygmomanometer and stethoscope. The sphygmomanometer is composed of an inflatable cuff that is inflated just enough to occlude the brachial artery. The cuff pressure is slowly released until the pressure in the cuff is equal to that of the patient's systolic BP, at which point first Korotkoff sound will be heard with the stethoscope over the brachial artery. The examiner notes the pressure at this point on the manometer, giving the systolic BP measurement. Deflation of the cuff continues until there is no longer any restriction to blood flow and no turbulence, so no audible sound is produced. The pressure reading on the manometer is noted at this point, and this is the diastolic BP measurement.
- Automated BP measurement devices are being increasingly used in hospitals and primary care and are reasonably accurate, but they rely on a constant pulse volume and may be inaccurate in some patients.
- The palpatory method requires the cuff to be inflated whilst palpating the radial pulse. When deflating the cuff, a pulsatile thrill can be palpated. The pressure at which the thrill appears is the systolic pressure and the disappearance of the thrill is the diastolic pressure. This method is not as accurate as using a sphygmomanometer or automated BP device, but may be useful when a quick estimate of systolic BP is required.

Key Point

Automated devices may have difficulty in 'reading' the BP and will continue to inflate and deflate, which will cause discomfort to the patient and can cause bruising to patients on antiplatelet or anticoagulation therapy.

Learning Activity 6.3

We use several devices in cardiovascular assessment. Understanding how these devices work helps us to ensure that we use them properly in order to get an appropriate result or reading. Obtaining a BP is something that we take for granted, but manual and automated methods of obtaining BP can be subject to operator error or equipment malfunction.

1) Consider factors that may contribute to an incorrect BP measurement when using automated devices.
2) What can you do to minimise errors in BP measurement?

Suggested Resource

The suggested resource from Learning Activity 6.1 can be used for this activity. See pages 15–25 of the resource

Cardiac Auscultation

With the availability of technological investigations, such as echocardiography, clinicians are becoming more dependent on technology and less skilled at auscultating heart sounds. This is an essential skill for nurses working in the cardiac environment. A good quality stethoscope is needed for cardiac auscultation. When using the diaphragm, it should be placed firmly on the chest wall to create a tight seal, and it is used to hear high-frequency sounds such as the first and second heart sounds (S1, S2), friction rubs, systolic murmurs and diastolic insufficiency murmurs. When using the bell, it should be placed lightly on the chest wall and is used to detect low-frequency sounds such as the third and fourth heart sounds (S3, S4) and the diastolic murmurs of mitral and tricuspid stenosis. The physiology behind heart sounds is demonstrated in Table 6.2.

The patient should be positioned in a semi-recumbent position with the head of the bed elevated 30–45°. Systematic auscultation of the

Table 6.2 Heart sounds.

Sound	Cause
First heart sound (S_1)	A normal heart sound timed with closure of mitral and tricuspid valves at the beginning of ventricular systole. Mitral closure is responsible for most of the sound produced, and so S_1 is best heard in the mitral area (apex). If the valves do not close at the same time, a 'split' S_1 sound may be heard. This may be physiological in a healthy individual (in conditions such as normal variant right bundle branch block) or might be pathological; right ventricular strain can give rise to right bundle branch block and can lead to splitting of S1, for example, in pulmonary embolism and the presenting history will guide the suspicion of a normal or pathological split. A split S_1 is best heard in the tricuspid area.
Second heart sound (S_2)	A normal heart sound produced by closure of the aortic and pulmonic valves at the beginning of diastole and best heard at Erb's Point. With inspiration, the pulmonic valve closes a bit later than the aortic valve, producing a split S_2 sound known as 'physiological splitting' which is best heard on inspiration with the stethoscope placed in the pulmonic area. The intensity of S_2 may be increased in the presence of aortic or pulmonic valvular stenosis or in pulmonary or systemic hypertension.
Third heart sound (S_3)	Low-frequency sound that occurs during the early, rapid-filling phase of ventricular diastole. May be a normal finding in children or young adults. In older adults, S_3 is associated with ventricular failure and is a sound caused by a non-compliant or failing ventricle that cannot distend to accept the rapid inflow of blood. The resulting turbulent flow causes vibration of the atrioventricular valvular structures or the ventricles themselves, producing a low-frequency sound. A left ventricular S_3 is best heard at the apex with the stethoscope bell. A right ventricular S_3 is heard best at the xiphoid or lower left sternal border and varies in intensity with respiration, becoming louder on inspiration (Morton and Tucker 2013).
Fourth heart sound (S_4)	An S_4, sometimes known as an atrial gallop, is a low-frequency sound heard late in diastole, just before S_1. The sound is produced by atrial contraction forcing blood into a non-compliant ventricle that is resistant to filling. Causes include systemic hypertension, acute myocardial ischaemia or infarction, cardiomyopathy and aortic stenosis (AS). S_4 is best heard with the bell of the stethoscope at the apex. Conditions affecting right ventricular compliance, such as pulmonary hypertension or pulmonic stenosis, may produce a right ventricular S_4 heard best at the lower left sternal border, where the sound is likened to the rhythm of the word 'Ten-ness-see' where the S4 represents the 'Ten. . .' and becomes louder on inspiration (Morton and Tucker 2013).
Summation gallop	As ventricular diastole is shortened in rapid heart rates, if S_3 and S_4 are both present, they may fuse together and become audible as a single diastolic sound called a summation gallop, because of the sound's likeness to a 'gallop'. This sound is loudest at the apex and is heard best with the stethoscope bell while the patient lies turned slightly to the left side (Morton and Tucker 2013).
Heart murmurs	Sounds produced either by the forward flow of blood through a narrowed or constricted valve into a dilated vessel or chamber, or by the backward flow of blood through an incompetent valve or septal defect. The sound produced is described as blowing, harsh, rumbling or musical and the intensity or loudness of a murmur is described using the following grading system: • Grade I: faint and barely audible • Grade II: soft • Grade III: audible but not palpable • Grade IV and V: associated with a palpable thrill • Grade VI: is audible without a stethoscope

Table 6.2 (Continued)

Sound	Cause
	Systolic murmurs are heard between S_1 and S_2 and the timing can be established during auscultation best when palpating a central pulse. • Stenosis of the aortic or pulmonic valve results in an ejection systolic murmur. The quality of these murmurs is harsh and of medium pitch. AS is heard best in the aortic area and may radiate into the neck following the path of the carotid arteries; pulmonic stenosis is heard best over the pulmonic area. • Mitral or tricuspid valvular insufficiency (regurgitation) or a ventricular septal defect (VSD) produces systolic murmurs caused by the backward flow of blood from an area of higher pressure to an area of lower pressure, which are harsh and blowing in quality. The sound is described as holosystolic (the murmur begins immediately after S_1 and continues throughout systole up to S_2). Mitral regurgitation (MR) is best heard at the apex and radiating to the left axilla. Tricuspid regurgitation (TR) is best heard at the left sternal border and increases in intensity during inspiration. This murmur may radiate to the cardiac apex. • A VSD produces a harsh, blowing holosystolic sound caused by blood flowing from the left to the right ventricle through a defect in the septal wall during systole. This murmur is heard best from the fourth to sixth intercostal spaces on both sides of the sternum and is accompanied by a palpable thrill (Morton and Tucker 2013). Diastolic murmurs occur after S_2 and before the onset of the following S_1. • Aortic or pulmonary valvular insufficiency (regurgitation) produces a blowing diastolic murmur that begins immediately after S_2 and decreases in intensity as regurgitant flow decreases through diastole. These murmurs are described as early diastolic decrescendo murmurs. Aortic regurgitation (AR) is best heard in the aortic area and may radiate along the right sternal border to the apex. Pulmonic valve regurgitation is best heard in the pulmonic area. • Mitral or tricuspid stenosis produces a diastolic murmur. This murmur decreases in intensity from its onset and then increases again as ventricular filling increases because of atrial contraction; this is termed decrescendo–crescendo. Mitral stenosis (MS) is best heard at the apex with the patient turned slightly to the left side. Tricuspid stenosis increases in intensity with inspiration and is loudest in the fifth intercostal space along the left sternal border (Morton and Tucker 2013).
Friction rubs	A pericardial friction rub may be heard anywhere over the pericardium with the diaphragm of the stethoscope. The rub may be accentuated by having the patient lean forward and exhale and, unlike a pleural friction rub, does not vary in intensity with respiration (Morton and Tucker 2013).

Suggested Resources

Heart Murmurs-Heart Sounds Practical Clinical Skills (2017) https://www.practicalclinicalskills.com/heart-murmurs

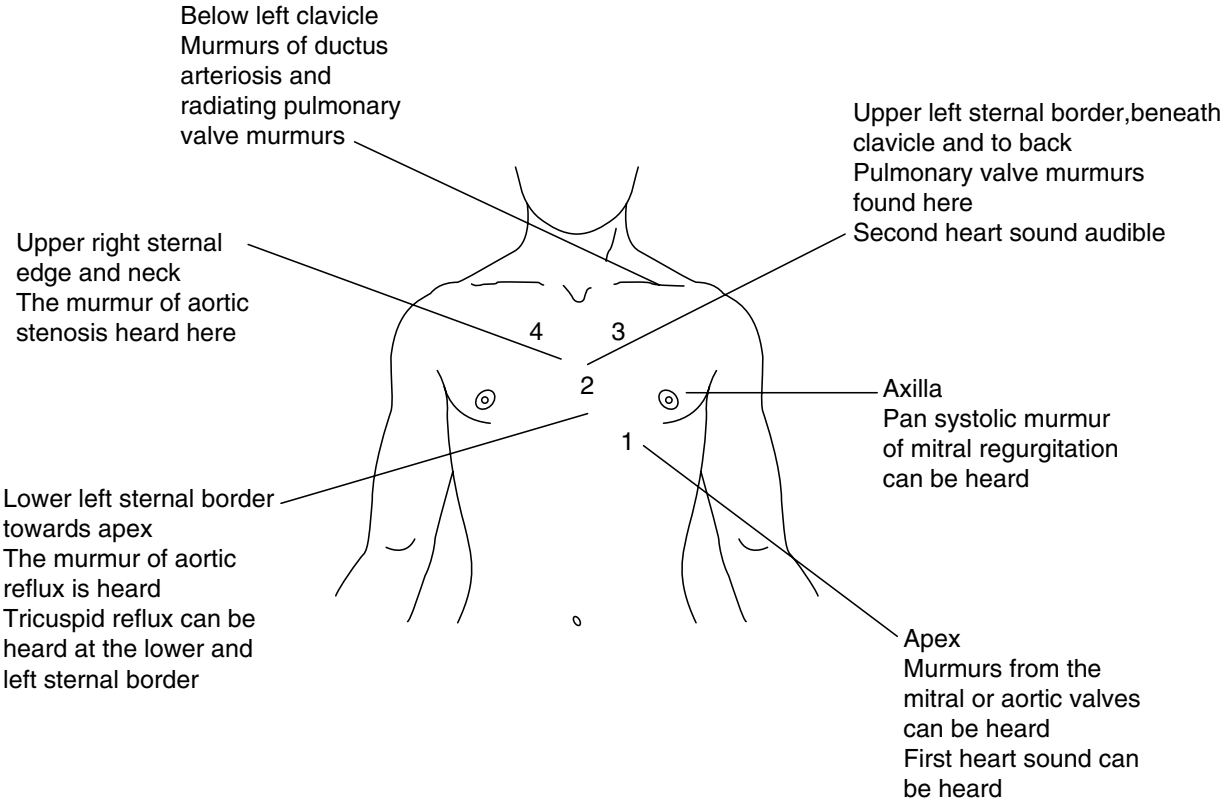
Systolic murmurs, diastolic murmurs, and extra heart sounds - Part 1 Khanacademymedicine (2014) https://youtu.be/6YY3OOPmUDA

Systolic murmurs, diastolic murmurs, and extra heart sounds - Part 2 Khanacademymedicine (2014) https://youtu.be/ZUHpAaVpiY8

precordium with the stethoscope diaphragm follows the following pattern:

- Right sternal border in the second intercostal space referred to as the aortic area.
- Left sternal border in the second intercostal space referred to as the pulmonic area.
- Left sternal border in the third intercostal space referred to as Erb's point where S_2 is best heard.
- Left sternal border in the fifth intercostal space referred to as the tricuspid area.
- Mid-clavicular line in the fifth intercostal space at the apex of the heart, which may be referred to as the mitral area where S_1 is the loudest.
- This pattern is then repeated with the stethoscope bell. Figure 6.3 shows the positions in which to place the stethoscope.

In each of the positions auscultated, the normal heart sounds S_1 and S_2 should be identified. The intensity of the sound, respiratory variation and splitting should be noted. After S_1 and S_2 are identified, listen for the presence of any extra sounds, first in systole, then in diastole. Each area is auscultated for the presence of murmurs and friction rubs (Morton and Tucker 2013). To help hear abnormal sounds, the patient may be asked to roll partly onto the left side to help bring the left ventricle closer to the chest wall. Quiet sounds over the aortic area can be amplified by sitting the patient forward and listening to the heart sounds through the respiratory cycle. If the patient holds their breath following expiration, this can amplify the murmurs associated with aortic stenosis or regurgitation. The apex should be auscultated during inspiration and



1 – Mitral regurgitation: apex, axilla
2 – Aortic regurgitation: lower left sternal border
3 – Pulmonary stenoses: upper left sternal border/clavicle
4 – Aortic stenoses: apex, upper right sternal border, neck

Figure 6.3 Sites for cardiac auscultation. *Source:* Chizner (2008). Used with permission.

expiration to differentiate between murmurs arising from the left or right side of the heart. Deep inspiration increases venous return to the right side of the heart and thus augments the intensity of right-sided murmurs while having little or no effect on murmurs arising from the left side of the heart.

Respiratory Assessment

A respiratory assessment should be undertaken to detect evidence of heart failure or other respiratory pathology.

Ask the patient about any symptoms of dyspnoea to establish whether:

- it occurs on exertion or at rest;
- the patient experiences orthopnoea – asking the patient how many pillows they use to sleep is often useful to establish whether orthopnoea is present;
- there is any evidence of paroxysmal nocturnal dyspnoea (PND);

Ask the patient about any symptoms of cough or sputum production. Observe the patient's pattern and cycle of breathing, including:

- The respiratory rate – in a healthy adult, inaudible respirations should occur between 12 and 20 times/min.
- The duration of the inspiratory/expiratory cycle, noting whether there is any difficulty in expelling air. Expiration [E] should take around twice as long as inspiration [I], giving an I:E ratio of 1:2.
- Use of accessory muscles of respiration, including the sternocleidomastoid, spinal, neck and abdominal muscles.
- Intercostal retractions, visible indentations between the ribs as the intercostal muscles aid in breathing.
- Nasal flaring, observed as intermittent outward movements of the nostrils.
- Pursed lip breathing (partial closure of the lips to allow air to be expired slowly).

Note the patient's posture, including whether the patient needs to sit upright and is unable to tolerate lying down. Auscultate the patient's posterior chest, beginning with the areas above the scapulae. Move downward in a stair-step fashion, comparing your findings from one side with those from the other side. Listen to the character of the breath sounds. Normal vesicular breath sounds are heard over most lung fields. See Table 6.3 for types and causes of abnormal (known as adventitious) breath sounds.

Key Point

As part of a respiratory assessment, look for signs of cyanosis, conscious level and mentation. An altered state of consciousness, anxiety, restlessness, confusion or other changes in mental status are important signs of potential respiratory problems.

Table 6.3 Abnormal breath sounds.

Type of breath sound	Nature of the sound	Potential causes
Crackles (rales)	Discontinuous breath sounds that sound like crinkling plastic wrap or can be simulated by rubbing strands of hair together between two fingers near one's ear. May be further described as: • Fine crackles are short high-pitched sounds • Coarse crackles are longer-lasting low-pitched sounds	Signify distension of fibrotic lung tissue or opening of collapsed alveoli most commonly with atelectasis and alveolar filling processes such as: • Pulmonary oedema • Interstitial lung disease

(*Continued*)

Table 6.3 (Continued)

Type of breath sound	Nature of the sound	Potential causes
Rhonchi	Low-pitched respiratory sounds that can be heard during inspiration or expiration	Probably relate to variations in obstruction as airways distend with inhalation and occur in a variety of conditions including: • Chronic bronchitis Pneumonia and infections of the lungs
Wheezes	Whistling, musical breath sounds that are worse during expiration than inspiration and are commonly associated with dyspnoea. May be audible without a stethoscope	• Asthma or chronic obstructive pulmonary (airways) disease (COPD) • Acute allergic reaction
Stridor	High-pitched, predominantly inspiratory sound that can normally be heard without a stethoscope formed by extrathoracic upper airway obstruction	It is a serious finding and often signifies a life-threatening upper airway obstruction
Decreased breath sounds	Poor air movement in airways	Usually caused by disease processes or mechanisms limiting airflow. May signify: • Bronchospasm • Pleural effusion • Pneumothorax • Asthma or COPD
Bronchial breath sounds	Louder, harsher and higher pitched than normal breath sounds	• Normal finding over trachea • May be caused by lung consolidation in conditions such as pneumonia
Bronchophony	Clear transmission of the patient's spoken voice through the chest wall	Results from alveolar consolidation such as in pneumonia
Egophony	Occurs when a patient says the letter 'e' and the examiner hears the letter 'a' on auscultation	Any condition that results in pulmonary consolidation such as pneumonia
Whispered pectoriloquy	Transmission of the patient's whispered voice through the chest wall at an increased volume	Pneumonia
Friction rubs	Grating or creaking sounds that fluctuate with the respiratory cycle	Sign of pleural inflammation associated with: • Pleurisy • Post thoracotomy • Empyema

Key Point

Auscultation and recognition of abnormal breath sounds takes practice. There is no substitute for practice, so make a habit of auscultating lung fields in the patients for whom you are caring.

A pulse oximeter is a computerised device that measures peripheral capillary oxygen saturation (S_pO_2). Pulse oximeters can distinguish oxygenated haemaglobin (Hb) from deoxygenated Hb (Chan et al. 2013) via a probe that is attached to the patient's finger or ear lobe. The device has a visual display and an audible

Learning Activity 6.4

Assessing breath sounds takes practice and there are many resources online to provide guidance. The resource below provides a great explanation of breath sounds with examples.

Suggested Resource

Simple Nursing: Breath sounds made easy
David Woodruffe (2020)
https://youtu.be/JUoZCrq25gc

situations in which oxygen is used (Beasley et al. 2015). A target S_pO_2 of 94–98% is suitable for most adult patients, although patients with long-standing respiratory or congenital heart disease may have lower readings reflecting the underlying severity of the disease. In patients with chronic obstructive pulmonary disease and other conditions associated with chronic respiratory failure, oxygen should only be administered if the S_pO_2 is less than 88% and titrated to a target S_pO_2 range of 88–92% (Beasley et al. 2015).

It should be remembered that pulse oximetry gives no information about the level of CO_2 and therefore has limitations in the assessment of patients developing respiratory failure due to CO_2 retention.

Learning Activity 6.5

Consideration of the appropriate oxygen delivery system and flow rate is essential in accurate monitoring of S_pO_2 (Beasley et al. 2015). The following website gives information about the percentage of oxygen delivered via various O_2 delivery devices:

Suggested Resource

Oxygen delivery devices
Oxford Medical Education
https://oxfordmedicaleducation.com/prescribing/oxygen-delivery/

Table 6.4 Causes and mechanisms of unreliable SpO_2 readings.

1) Causes of intermittent dropouts or inability to read SpO_2
   - Poor perfusion due to a number of causes, e.g. hypovolaemia, vasoconstriction, etc.
2) Causes of falsely normal or elevated SpO_2
   - Carbon monoxide poisoning
   - Sickle cell anaemia vaso-occlusive crises (overestimation of FO_2Hb and underestimation of SaO_2)
3) Causes of falsely low SpO_2
   - Venous pulsations
   - Excessive movement
   - Intravenous pigmented dyes
   - Inherited forms of abnormal haemoglobin
   - Fingernail polish
   - Severe anaemia (with concomitant hypoxemia)
4) Causes of falsely low or high SpO_2
   - Methemoglobinaemia
   - Sulfhemoglobinaemia
   - Poor probe positioning
   - Sepsis and septic shock
5) Causes of falsely low FO_2Hb as measured by a co-oximeter
   - Severe hyperbilirubinaemia
   - Fetal Hb (HbF)

Source: Chan et al. (2013).

When using devices in cardiovascular assessment, nurses should be aware of situations that may affect the accuracy or reliability of the device. A pulse oximeter may not give accurate readings some situations (see Table 6.4). Therefore, the presence of a normal S_pO_2 does not always negate the need for blood gas measurements because S_pO_2 on pulse oximetry may appear to be normal in a patient with normal oxygen tension but abnormal blood pH or pCO_2 or with low blood oxygen content due to anaemia.

Conclusion

Cardiovascular assessment is a systematic process that involves a thorough history and examination of the patient. In emergency situations, a targeted history and examination may

be needed, and further information is obtained when the patient is stabilised. Many of the skills required to perform cardiovascular assessment need to be practiced, and so every opportunity should be taken to perfect the techniques required.

References

Beasley, R., Chien, J., Douglas, J. et al. (2015). Thoracic Society of Australia and New Zealand oxygen guidelines for acute oxygen use in adults: 'swimming between the flags'. *Respirology* **20** (8): 1182–1191. https://doi.org/10.1111/resp.12620.

Bickley, L. (2013). *Bates' Pocket Guide to Physical Examination and History Taking*, 7ee. Philadelphia: Lippincott Williams and Wilkins.

Chan, E.D., Chan, M.M., and Chan, M.M. (2013). Pulse oximetry: understanding its basic principles facilitates appreciation of its limitations. *Respiratory Medicine* **107** (6): 789–799.

Chizner, M.A. (2008). Cardiac auscultation: rediscovering the lost art. *Current Problems in Cardiology* **33** (7): 326–408.

Clark, C.E., Taylor, R.S., Butcher, I., Stewart, M.C., Price, J., Fowkes, F.G.R., Shore, A.C. and Campbell, J.L., 2016. Inter-arm blood pressure difference and mortality: a cohort study in an asymptomatic primary care population at elevated cardiovascular risk. *British Journal of General Practice*, **66** (646), pp. e297-e308. doi: https://doi.org/10.3399/bjgp16X684949.

Clerkin, K.J., Mancini, D.M., and Lund, L.H. (2019). *Chapter 6: diagnosis of heart failure*. In: *Heart Failure* (ed. D.S. Feldman and P. Mohacsi). Springer International Publishing Imprint: Springer. https://doi.org/10.1007/978-3-319-98184-0.

Morton, P.G. and Tucker, T. (2013). *Critical Care Nursing: A Holistic Approach*, 10ee. Philadelphia: Lippincott Williams & Wilkins.

National Heart Foundation of Australia (2016). *Guideline for the Diagnosis and Management of Hypertension in Adults – 2016*, 15–25. Melbourne: National Heart Foundation of Australia https://www.heartfoundation.org.au/images/uploads/publications/PRO-167_Hypertension-guideline-2016_WEB.pdf (accessed 15 November 2016).

Raj, B. 2014. *Pulsus paradoxus*, emedicinelive. http://emedicinelive.com/?q=pulsus-paradoxus (accessed 14 November 2016).

Wikipedia contributors (2021). Pulsus alternans. In: *Wikipedia, The Free Encyclopedia*. Wikipedia https://en.wikipedia.org/w/index.php?title=Pulsus_alternans&oldid=1033588148 (accessed 23 September 2021).