Chapter 6

The neck

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Penetrating injuries of the neck

Penetrating neck trauma can be a life-threatening injury. **Never explore a neck wound under local anaesthetic if it is deep to the platysma.** Many important underlying structures are at risk, especially when the injury is at the root of the neck. The neck is divided into zones:

- **zone I** is located below the cricoid cartilage;
- **zone II** is between the cricoid cartilage and the angle of mandible;
- **zone III** is located above the angle of the mandible.

Depending on the clinical picture and patient’s condition, management varies. Prior to exploration, zones I and III injuries may be evaluated with CT or angiography as surgery is difficult and risky. Zone II injuries may require CT angiography, MRI angiography, esophagoscopy, bronchoscopy, barium swallow, USS, or angiography depending on the injuries suspected.

**Consider:**

- **site and depth:**
  - anterior triangle;
  - posterior triangle;
  - zone (root of neck can also involve the chest and arm);

- **vascular structures:**
  - active bleeding;
  - hypovolemia;
  - haematoma (expanding, or pulsatile);

- **peripheral pulses (compare with other side):**
  - distal carotid;
  - superficial temporal;
  - brachial or radial;
  - bruit;
  - larynx/trachea, esophagus;
  - haemoptysis (ask patient to cough and spit on paper);
  - air bubbling through wound (ask patient to cough)/subcutaneous emphysema;
  - hoarseness;
  - pain on swallowing;
  - haematemesis;

- **nervous system:**
  - GCS;
  - localizing signs: (pupils, limbs);
  - spinal cord;

- **assess cranial nerves:**
  - facial;
  - glossopharyngeal (check mid-line position of soft palate);
  - recurrent laryngeal (hoarseness, effective cough);
  - accessory (shrug the shoulder);
  - hypoglossal;
  - spinal cord and brachial plexus;
  - Horner’s syndrome (myosis, ptosis, anhydrosis, enophthalmos).
Indications for exploration include:

- expanding haematoma;
- pulse deficit;
- active bleeding;
- haemoptysis;
- haematemesis;
- hoarseness;
- surgical emphysema
- cause of injury: (bullet, knife, other);
- suspected foreign body.
The larynx—injuries

The larynx is a semi-rigid structure consisting of a horse shoe-shaped hyoid bone and collection of small cartilages connected by fibrous tissue. It contains the vocal cords, ‘supraglottic’, and ‘subglottic’ spaces. The ‘paraglottic’ space lies between the lining mucosa and cartilages. **This space is potentially very distensible from bleeding and oedema.** The cricoid cartilage lies below the larynx and is the only complete ring in the respiratory tract.

Airflow through a tube varies according to Pouiselle’s law:

\[
\text{flow} = \frac{p r^4}{8 l n},
\]

where \( p \) is the pressure, \( r \) is the radius of the tube, \( l \) is its length, and \( n \) is the coefficient of viscosity. This formula strictly applies to fluids, but the principle also applies to air. **Small changes in the radius (e.g. from swelling/oedema) can therefore have profound effects on the flow of air through the larynx.** This is important at the vocal cords, the narrowest part of the upper airway, where the mucosa can swell considerably.

The **hyoid bone** is most commonly fractured following attempted strangulation. A fracture separating the cricoid from the trachea is referred to as laryngo-tracheal separation and is most commonly due to a clothesline type injury.

**Common causes of injury include:**
- road traffic accidents;
- sports (eg martial arts and racket sports);
- assaults;
- knife wounds;
- attempted suicide;
- inhalation of smoke, hot air or steam.

**Types of injury**
- **Oedema or haemorrhage.** This occurs particularly after thermal inhalation with rapid reductions in airflow. Early intubation is often necessary.
- **Fractured larynx.** In young patients, the larynx is elastic and flexes rather than fractures. Blunt injuries tend to bend and displace the larynx, which springs back to its normal position. However the epiglottis may become avulsed. In older patients the cartilages become calcified and fractures may occur.
- The **trachea can be avulsed** from the cricoid cartilage. Displacement is usually rapidly fatal, however if it springs back, the airway may be maintained but may displace later.
- **Surgical emphysema** of the neck and face may be seen after penetrating or blast injuries.

**Clinical features**
- Dyspnoea/stridor.
- Pain/tenderness.
- Hoarse voice.
- Dysphagia.
- Surgical emphysema.
- Palpable displacement of the larynx.
Fig. 6.1 Dog bite to the neck. Patient had a sore throat, tenderness, and palpable crepitus.

Fig. 6.2 Fracture of the hyoid—remember the potential for associated soft tissue swelling.
Management
First control the airway. Where there is airway distress a tracheotomy (not ostomy) may be necessary. Endotracheal intubation (ETT) is worth a try, but may cause further damage. ETT and cricothyroidotomy may not provide an airway in a patient with laryngo-tracheal separation.

In minor laryngeal injuries, humidified oxygen enriched air and steroids may be required. Severe injuries need the airway securing by either intubation or tracheostomy (after intubation).

Indications for surgery include:
- tracheal injuries;
- laryngeal displacement;
- swelling of the laryngeal soft tissues;
- most cases of surgical emphysema.

Beware the patient who presents with surgical emphysema. If this is not allowed to drain, air can accumulate in the chest and result in tension pneumothorax or cardiac tamponade. Tracheostomy is required.
The larynx—loss of voice

Laryngeal disorders can present with a ‘hoarse voice’ (dysphonia), which untreated can progress to stridor. **A change in voice lasting over 4 weeks should be investigated.** Causes of dysphonia include

- **Acute laryngitis**—usually associated with a respiratory tract infection or overuse. Usually painful, with a cough. Resolution is often spontaneous.
- **Carcinoma.**
- **Juvenile respiratory papillomata.**
- **Myasthenia gravis.**
- **Rheumatoid arthritis.**
- **Recurrent laryngeal nerve palsy (iatrogenic).**
- **Habitual dysphonia**—overuse of vocal cords can result in inflammation, oedema, nodule formation, or even contact ulceration. These are initially reversible but may become permanent if the overuse continues.
- **Psychogenic dysphonia.**
Deep neck infections—general points and clinical anatomy

Terminology can be confusing. Variation exists in the literature.

The neck may be regarded as containing superficial and deep fascial planes. These divide it into several specific compartments.

The superficial cervical fascia does not play a major role in deep neck infections. It encircles the neck blending with the fascia overlying the platysma muscle. Superiorly it blends with the muscles of the face comprising part of the ‘SMAS’ (superficial musculo aponeurotic system). This layer is important in certain types of ‘face lift’ procedures.

The deep cervical fascia is subdivided into three additional layers:

- The most superficial layer of the deep cervical fascia is also known as the investing cervical fascia. This encircles the neck, attaching and enclosing the sternocleidomastoid, trapezius, and omohyoid muscles, and parotid and submandibular glands. Posteriorly it attaches to the superior nuchal line. It can only distend a small amount.
- The middle layer of the deep cervical fascia is also known as the visceral layer. It encircles the strap muscles and the viscera of the neck, i.e. the larynx, pharynx, trachea, and thyroid gland. Part of this layer covers the pharyngeal constrictors and the buccinator muscle—the buccopharyngeal fascia.
- The deep layer of the deep cervical fascia is also called the pre-vertebral fascia. It lies just anterior to the pre-vertebral muscles of the spine allowing the pharynx to glide over them during neck movements and swallowing.

Both the middle and deep layers pass into the chest. Notably, the space between the buccopharyngeal and the pre-vertebral fascia (retropharyngeal) extends into the mediastinum.

The deep fascial planes divide the neck into several compartments. In the early stages, these limit the spread of infection to the defined compartment. However, untreated infection will eventually perforate the fascia and spread more rapidly.
Fig. 6.3  Deep fascia of the neck.
The acutely swollen neck

Ludwig’s angina
This is a rapidly spreading, tense cellulitis of the submandibular, sublingual, and submental spaces bilaterally. Usually there is no abscess formation, but instead firm induration of the floor of the mouth with surrounding perioral oedema. It is clinically important because the muscular sling (mylohyoid muscle) attached to the mandible prevents tissue oedema from spreading downward. Instead swelling pushes the base of the tongue backwards, resulting in airway obstruction.

When advanced, this is an obvious diagnosis with gross swelling, both in the neck and the mouth. Earlier infections need to be treated seriously and often need admission. **Ludwig’s angina is a potential airway emergency, which if not diagnosed and treated quickly has a mortality rate of around 75% within the first 12–24 h.** With aggressive surgical intervention, good airway control and antibiotics this has now dropped to 5%.

Usually the cause is a submandibular space infection **secondary to an infected wisdom tooth.** From the submandibular space, the infection spreads to the sublingual space on the same side around the deep lobe of the submandibular gland. It then passes to the contralateral sublingual space and thence to the adjacent submandibular space. The submental space is affected by lymphatic spread. Infection can also originate from the sublingual space. Other known causes are infected fractures and submandibular sialadenitis. Left untreated, the infection, oedema, and cellulitis spread backwards in the space between the hypoglossus and genioglossus to the epiglottis and larynx, resulting in respiratory obstruction.

**Clinical features**
- Systemic upset.
- Massive firm swelling bilaterally in the neck.
- Swelling in the floor of the mouth, forcing of the tongue up onto the palate.
- Difficulty in swallowing, talking and eventually breathing.
- Inability to protrude the tongue.

**Management**
The first consideration is the airway, which as in burns can rapidly obstruct. **Difficulty in swallowing and talking, and gross swelling are all indications to call an anaesthetist urgently.** Refer to maxillo-facial team urgently. Further management includes IV fluids (patients often present after a few days and have not been able to drink), IV antibiotics (eg penicillin and metronidazole), together with surgical decompression of the submandibular and sublingual spaces and removal of the underlying cause.

Peritonsillar abscess (quinsy)
These are common infections arising when infection of the tonsil spreads to the surrounding tissue. Initially there is tonsillitis (sore throat, fever, and malaise), which progresses to a **unilateral, asymmetric bulge in the palate with displacement of the uvula to the opposite side.** Often
they can be drained in casualty but if they threaten the airway GA is required. Tonsillectomy is generally not indicated for a single peritonsillar abscess, but recommended if it recurs.

**Necrotizing fasciitis**

This is a rare but potentially life-threatening mixed infection, characterized by **necrosis of the fascia and subcutaneous tissues**. Untreated the condition can spread rapidly with a **mortality approaching 40%**. Although it is more commonly seen in the groin, it can occur in the neck where it is usually due to an **underlying dental infection**. Patients often have an underlying predisposition such as diabetes, alcoholism or chronic malnutrition.

Clinically the overlying skin is often pale and mottled or may appear dusky due to thrombosis of underlying vessels. Blisters and ulceration may develop. Complications include:

- systemic toxicity and multi-organ failure;
- lung abscess;
- carotid artery erosion;
- jugular vein thrombosis and mediastinitis.

**Treatment** involves intravenous antibiotics, wide surgical debridement and hyperbaric oxygen. Any underlying predisposition must also be managed.

**Fascial tissue spaces**

**Fascial spaces related to the mandible**

The mylohyoid muscle has been described as the ‘diaphragm’ of the mouth. It divides the floor into two large (and two of the most commonly involved) spaces. These are the sublingual space above the muscle—(see The acutely swollen mouth), and the submental and submandibular spaces below it.

**Submandibular space**

This is triangular in shape, bounded by the mylohyoid muscle medially, and laterally by the mandible above and the deep cervical fascia below. It contains lymph nodes, the superficial lobe of the submandibular glands and blood vessels. It communicates with the sublingual space above, the superficial facial space laterally and the deep pterygoid space posteriorly.

Surgical access can be made 2–3cm below the lower border of the mandible (to avoid injury to the mandibular branch of the facial nerve). Skin and subcutaneous tissues are incised and sinus forceps are used to penetrate the deep cervical fascia towards the lingual side of the mandible.

**Submental space**

This is contained by the two anterior bellies of the digastric muscles. Above is the mylohyoid muscle and below the deep cervical fascia covered by platysma and skin. It contains submental lymph nodes and communicates posteriorly with the submandibular space.

Surgical access is obtained behind the chin prominence in the neck.

**Deep neck infections**

These usually arise following penetrating injuries, untreated tonsillitis, or wisdom tooth infections. Once established the infection can rapidly
spread throughout the neck, into the chest, and become life-threatening. When this occurs mortality is high. In the early stages diagnosis can be difficult.

**Signs and symptoms**

*Fever, malaise, and lethargy* are common and patients rapidly become very ill. A *very high WCC (>20)* is an ominous sign and often indicates tissue necrosis and likely mortality. *Pain on swallowing* should be taken seriously, which can be so severe that the patient sits drooling and unable to swallow their own saliva. There may be *cellulitis*, but because of the overlying fascial planes, deep abscesses do not fluctuate. Instead *swelling* presents with a ‘dough-like’ consistency. Initially the fascia may direct swelling medially, compromising the airway. Other signs of symptoms of deep neck infections include *dysphagia* and *trismus*.

Untreated, if *airway obstruction, sepsis* or *mediastinitis* does not kill the patient erosion into the carotid vessels can result in *septic emboli* and CVA.

**Indicators of severe infection include:**
- difficulty breathing
- shock
- pyrexia
- malaise
- dysphagia/drooling
- trismus
- dysphonia
- inability to protrude the tongue
- high WCC.

**Management**

*Assess for airway obstruction* and where necessary consider intubation or a surgical airway. Once secure, assess the patient’s haemodynamic status and give fluids. Often they have sat at home for a few days unable to eat and drink, so will probably be *at least mildly dehydrated*. These patients need to be admitted. *Consider immunosupression* (diabetes, alcoholics, long-term steroids, HIV, etc.).

*CT* or *MRI* of the neck and chest is usually required to determine the extent of infection, notably into the mediastinum. *Aggressive surgical drainage* and removal of dead tissue is usually required, even if there is only cellulitis. By opening tissue planes, not only is pus released but tissue perfusion is improved by reducing pressure. The surgical approach depends on the location of the abscess. Some can be drained intra-orally, eliminating a scar. However, drainage via a neck incision is more common, allowing identification of the great vessels and placement of large drains.

There is some evidence that *hyperbaric oxygen* may be beneficial, but this is a controversial issue. Only in very mild cases can patients be managed conservatively, if so they must be watched very closely. In selected cases ultrasound guided aspiration may avoid aggressive surgery.

*Antibiotics*—since many infections originate as dental, pharyngeal, or tonsillar infections, coverage should include organisms known to affect these areas. Most infections will be mixed and will include gram positive cocci and anaerobes.
The cervical spine in the trauma patient

Initial considerations

Thorough assessment of the cervical spine is essential following trauma. In all patients with injuries above the collar bones there should be a high index of suspicion of an associated spinal injury. Always assume there is one, until proven otherwise.

Injuries to the spine occur when the force applied is greater than that which can be resisted by the vertebral bones or supporting structures. Serious injuries can therefore be either bony or ligamentous in origin. The latter is especially important since the patient may have a normal looking X-ray. Forces may be applied in any one or a combination of directions:

- compression flexion;
- vertical compression;
- distraction flexion;
- compression extension;
- distraction extension;
- lateral flexion.

When considering cervical spine trauma the mechanism of injury provides important clues. For instance following a road traffic accident (RTA) consider:

- the speed,
- the vehicle (motorcycle, pedal bike, lorry, 4 x 4, open top sports car, etc.);
- nature of the impact (head-on, side blow or glancing);
- ejection from the vehicle;
- seat belt use;
- bulls-eye breakage of the windscreen;
- air bag deployment;
- head restraint;
- how long trapped in the vehicle;
- if walked about after the accident;
- alteration in movement and sensation of the limbs since or worsening neck pain.

Remember the possibility of other injuries. So long as the spine is correctly immobilized, imaging can wait until more pressing injuries are dealt with (this may include laparotomy, craniotomy, or rarely thoracotomy).

Full c-spine immobilization includes not just the neck but immobilization of the entire spine. Movement lower down the spine will result in a degree of movement in the neck. Furthermore, injuries of the c-spine may be associated with spinal injuries elsewhere, which also need to be protected. Following significant injuries most patients arrive supine with

- spinal board—solid inflexible plastic board the length and width of the patient with straps that hold the patient rigid across the chest, pelvis and legs;
blocks—usually foam filled rubber coated blocks about the size of a shoe box, on both sides of their head, preventing the neck from rotating, radiolucent to allow radiographic examination of the spine;

- tape—often simple elastoplast tape but more commonly two purpose-made straps, one across the mandible, the other across the forehead, holding the head down on to the spinal board;

- hard collar—stiff plastic neck collar that holds the cervical spine more stable by reducing flexion, extension, and lateral flexion of the neck.

Go to your A&E department, and ask to see these items, be familiar with how they are applied and taken off. Better to learn now than have to learn during the real thing!

Cervical spine film interpretation

Unlike almost any other clinical examination for a fracture where we Look, Feel, Move, then X-ray, in the examination of the suspect trauma cervical spine X-ray first. The key view is the lateral, and this should be obtained first as part of the initial assessment according to the Advanced Trauma Life Support protocol. However, before a cervical spine can be cleared radiologically you need adequate anterioposterior and odontoid peg views. Do not interfere with the immobilization until you have seen a film, unless other life threatening conditions demand.

Adequacy

First determine whether the film is adequate. Do not feel embarrassed in rejecting a film and asking for improved views. All radiographers involved in trauma know how difficult it is to obtain good films. You are about to make a vital decision.

An adequate film demonstrates all seven of the cervical vertebrae, skull base, and the superior aspect of T1.

Fig. 6.4 Correct spinal immobilization.
There are various ways of getting better views of the C7-T1 level. The experienced radiographer will know them. Different protocols exist between units but they include:

- coned view with greater penetration of the film;
- swimmers view—one arm raised forward as if the patient is doing the crawl;
- pull-down view—gentle firm traction on both arms allowing the shoulders to be removed from the lateral view;
- trauma obliques—sometimes known as ‘scottie dog views’, these consist of two films taken at 90 degrees to each other but each one an oblique of the spine rather than a true lateral;
- computered axial scan (CT scan).

Consider things in a logical order. A useful approach is **Alignment, Bones, Cavities and Disc (ABCD)**. This is a difficult radiograph to interpret, and deserves time.

Alignment

There are four curves to follow. Let your eyes follow your index finger as you trace each one out. This allows you to concentrate on specific areas in turn, rather than be flooded with information all at once.

- Anterior line of the vertebral bodies (greater than 3 mm mal-alignment indicates a possible dislocation).
- Posterior line of the vertebral bodies.
- Posterior spinal canal (width of canal at least 13 mm, but age and sex dependent).
- Tips of the spinous processes.

Bones

Examine in turn:

- Vertebral body—any cortical discontinuity, normal height, wedged >3 mm between anterior and posterior height, retropulsion into spinal canal.
- Atlas and Axis (C1 and C2)—posterior aspect of C1 on lateral should not be greater than 3 mm from the anterior aspect of the odontoid peg on the lateral film.

**Fig. 6.5 (a)–(b)** Anterioposterior (A–P), lateral, odontoid peg and trauma oblique views of the cervical spine. Is the lateral film adequate? No, count the number of vertebral bodies visible.
Fig. 6.6 Diagram of the lateral view of the cervical spine showing the four curves needed to check alignment.

- Posterior elements—facet joint dislocation, laminal fracture, pedicles splayed or clay shoveler fracture of spinous process tip.

Cavities
These include:
- a pre-vertebral space of more than 3 mm in the proximal spine, 5 mm in the mid segment and 10 mm in the distal segment is highly suspicious of free blood implying an underlying fracture;
- normal fat stripe should be present. loss may indicate oedema or haemorrhage at that level;
- an increased angle between the spinous processes could imply a ruptured interspinous ligament—look for the potentially associated anterior disruption.

Disc
Intervertebral disc (height, even width, an angle between the end plates of more than 11 degrees is suspicious, calcification).

Examination
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However, before a cervical spine can be cleared radiologically you need adequate anterioposterior and odontoid peg views. Do not interfere with the immobilization until you have seen a film, unless other life threatening conditions demand.

Fig. 6.7 Anterior subluxation of C2 due to lamina fracture (Hangman’s fracture).

Fig. 6.8 ‘Clay shovellers’ fracture of the tip of C7. This is not a normal lateral film but a trauma oblique.

Trauma Life Support protocol. However, before a cervical spine can be cleared radiologically you need adequate anterioposterior and odontoid peg views. Do not interfere with the immobilization until you have seen a film, unless other life threatening conditions demand.
Fig. 6.9 Lateral view of cervical spine, the red line demonstrates the soft tissue swelling.

Fig. 6.10 (a) and (b) Note the angulation of C6 on C7 is greater than 11 degrees.
Following the primary survey if radiologically clear reassess the patient.

- **Talk** to them. This will tell you whether the airway is patent, part of the Glasgow Coma Scale, improves patient cooperation, and tells them what you are going to do.

- **Look**—remove tapes, head blocks and undo collar but keep the head and neck stationary by in line manual immobilization. Do **not** allow movement at this stage. Are there any wounds, swellings, bruising, or unusual posture?

- **Feel**—start by standing above the patient and feel the trachea and hyoid bone. Progress along the line of the mandible posteriorly, then inferiorly to the clavicles. Palpate along the posterior aspect of the neck from occiput to thoracic spine. At this stage you may detect:
  - deviated trachea;
  - fractured larynx/hyoid bone;
  - surgical emphysema;
  - strap muscle haemorrhage;
  - great vessel haematoma;
  - soft tissue or bone pain.

Finally place a gloved finger in the mouth of the patient (this depends on their level of co-operation and GCS) and feel for a ‘boggy swelling’ or pain at the back of the throat. This is highly suggestive of an underlying fracture and haematoma.

- **Move**—if all of the above fail to demonstrate any significant problems, it is reasonable to attempt to ‘clear’ the c spine (see ‘Clearing’ the c spine). Ascertain whether the patient has head control; are they able to comfortably move their neck or is there muscle spasm, fear or instability preventing this? Do not force the patient to move. Allow them time to truly assess what they can do. Assess flexion, extension, lateral flexion and rotation.

- **Listen**—over the carotids for bruits, especially if there has been a direct blow to the front of the neck. Blunt carotid injury is seldom thought of and therefore frequently missed.

### ‘Clearing’ the c spine

Always follow local protocol. Assess the neurological state of the limbs:

- **tone**—lower motor neurone lesion, i.e. cut peripheral nerve = flaccid, upper motor neurone lesion, i.e. cerebrovascular accident = increased;

- **strength**—medical research council grading;

- **sensation**—soft touch and pinprick (spinothalamic tract);

- **reflexes**—look for qualitative reduction or quantitative absence, compare and contrast sides;

- **propioception** (posterior columns) and **coordination** are included in the perfect neurological examination, but seldom practically needed here.

In addition:

- **Examine relevant X-rays.**

- **Are there any other injuries?** (Distraction from neck pain.).

- **Has analgesia** (especially opiates) **been given?** (May mask cervical pain.).

- **Is there any spinal tenderness?**
Fig. 6.11 Anterior abrasion on patient’s neck may be a sign of more serious cervical or vascular injury.

- **Is the patient mentally alert?** (HI/alcohol/drugs, etc.).
- **If all the above are normal/excluded, take the collar off.**
- **Assess active movement first** (i.e. get the patient to move their neck—not you). Lateral flexion first, then rotation, then lift head off bed. Take your time, the neck will be a bit stiff at first if they have been laying on a trolley with collars, blocks, etc., for some time.
- **Any neurological Sx or pain**—not cleared—replace immobilization and refer. Consider the mechanism of injury and possible need to X-ray the whole spine.

**Neurological injuries**

These can be considered as:
- complete
- incomplete.

Or anatomically as:
- anterior cord syndrome (motor function lost but sensation preserved);
- posterior cord syndrome (seldom seen);
- central cord syndrome (upper limbs affected more than lower);
- Brown–Sequard syndrome (ipsilateral loss of motor and proprioception, with contralateral loss of pain and temperature sensation).

**Frankel classification of spinal cord injury**

- Complete loss (no motor or sensory function).
- Incomplete loss (no motor but useful sensory function).
- Incomplete loss (some motor function but not useful below injury level).
- Incomplete loss (reduced but useful motor function below injury level).
- Normal.
Specific fractures

*Atlas (C1)*
- Posterior arch.
- Anterior arch.
- Jefferson fracture (blow-out fracture through anterior and posterior arches).
- Transverse process fracture.
- Lateral mass fracture.

*Odontoid peg (C2) Anderson and D’Alonzo classification*
- Tip of the odontoid process.
- Through the base of the odontoid.
- Through the odontoid and extends into the body of the vertebra.

*C2 Posterior elements hangman’s fracture produced by extension and distraction (Levine classification)*
- Minimally displaced.
- Displaced greater than 3 mm.
- Fracture associated with unilateral or bilateral facet dislocation of C2 on C3.

*Vertebral body*
- Wedge compression.
- Burst.
- Tear-drop.

*Facet joints*
- Occipital–cervical dislocation.
- Atlanto-axial subluxation (normal atlanto anterior arch, and odontoid distance is less than 3 mm).
- Unilateral facet dislocation (25% displacement of the superior vertebra on the inferior or malalignment of the spinous processes on the anterior-posterior film).
- Bilateral facet dislocation (50% displacement of the superior vertebra on the inferior).

Fig. 6.12 Blow out fracture of C1 Jefferson type.
Fig. 6.13  Type II odontoid fracture.

Fig. 6.14  Lateral diagram of Hangman’s fracture.

Fig. 6.15  Burst fracture of C7.
Examination of minor injuries

Initial considerations
Although the ATLS dictates complete immobilization of the spine, this is clearly not necessary (or practical) in every patient complaining of neck pain. 'Clinical common sense', together with a high index of suspicion based on the mechanism of injury will allow most cases to be managed appropriately. If in doubt, err on the side of caution and seek advice. Useful clues include:

- **age**—young patients are more commonly associated with trauma and congenital malformation, older ages with degenerative causes;
- **position**—are they standing, sitting or lying down;
- **posture**—do they turn their head to see you or does their whole body turn?
- **clothing**—velcro fastening on a blouse vs tiny intricate buttons (pre-existing neurological problems);
- does the patient use any **prostheses**?—walking aids, standing frame, soft collar, etc., these also give clues about pre-existing pathology and psychology of the patient;
- **the hands**—are these the hands of a rheumatoid patient?

**Look**

- Can they look you in the eye or is there a cervical spondilosis?
- Is this a case of congenital unifacet dislocation and sternocliedomastoid spasticity resulting in a torticollis?
- Can you see the incision from an anterior approach to cervical spine?
- How flexed is the cervical spine?
- Note any thoracic kyphosis, muscle bulk and skin changes.
Fig. 6.17  Occipital-cervical dislocation.

Fig. 6.18  Bilateral facet dislocation of C5 on C6. Note 50% overlap.
Feel
Most palpation in the cervical examination can be done from behind. It is often less tiring for the patient, and easier for you, if they are sitting down.

Start at the occiput working your way down over the erector spinae and spinus processes. The highest bone you will feel will be C2. Work down to T1, the most prominent bone in the neck. This is sometimes overshadowed by C7. To work out if you are on T1 or C7 ask the patient to extend the neck slightly—C7 glides back, T1 does not.

Palpate laterally, around and over trapizeius into the supraclavicular fossae. Continue advancing till your fingers meet in the mid-line anteriorly. Be gentle, do not throttle the patient!

Feel the top of the manubrium sterni and advance upwards towards the thyroid gland. Continue upwards, remember the hyoid bone is a landmark for C3–4 level. Assess the tension in sternoclideomastoid continue under the angle of the mandible proceed forwards feeling for nodes till you reach the point of the chin.

Move
Only possible if a spinal injury is not suspected. Always start with active (patient initiated) movement to avoid hurting the patient. If necessary, ask the patient to put a tongue depressor in their mouth to act as a guide to the range.

Ask the patient to hold their head in a comfortable position, does this differ from neutral? Ask the patient to put their ‘chin on chest’ for forward flexion—usually about 75 degrees (but varies with age). Then ‘look up at the ceiling’ for extension usually about 50 degrees.

Assess lateral flexion, ‘put your right ear on your right shoulder’ and the opposite for the left. Look at the rise of the shoulder and compare sides. The range of motion is usually about 90 degrees. Assess rotation—‘put your right chin on your right shoulder’. This is just short of 90 degrees.

Passive movement is very useful but this is not a chance to move the head a little further and demonstrate that full range of motion does exist. Consider it in two ways:

• physiological motion—assessing the static elements of the neck (i.e. are the ligaments, joint capsule, roots, etc.. the cause of pain and limitation?);

• mobility motion—assessment of not only the flexibility of the cervical spine but the rhythm and cadence of the motion.

Power
You have assessed the control of the neck, now assess the power in all the planes of movement, ‘push against my hand’.

Neurology
Comprehensive neurological examination of upper and lower limbs is required. Remember tone, power, sensation, coordination proprioception and reflexes. Are the limbs held flaccid or is there a spastic posture? Coordination and proprioception expose central pathology, chronic alcohol abuse, infarct, metastasis, cord compression, and so on.
Special cases

Cervical rib
This may present with unilateral vascular changes in the hand. Such changes include cold, white, mottled, or blue skin discoloration, trophic ulcers, or tapering of the pulp, and so on (cf. Raynaud’s which is more often bilateral). Feel the radial pulse, and apply gentle traction to the arm to see if it is altered. Compare sides. Hold the arm across the body, feel the radial pulse and ask the patient to look towards you and take a deep breath, again assess both sides and compare any alteration. Finally listen for a bruit with a stethoscope in the supraclavicular fossa.

Cord compression
Look for the following:

- **Hoffmann’s test**—flick the terminal phalanx of the middle finger into extension suddenly and watch and see if index and thumb flex;
- **dynamic Hoffmann’s test**—the same flick as above but get the patient to flex/extend the neck at the same time; these tests demonstrate cortico-thalamic tract dysfunction;
- **Lhermitte’s** test is positive if flexion–extension of the neck produces neurological feelings in the legs of burning, electric shock, etc.;
- **clonus** occurs when the foot is rapidly brought up into dorsiflexion from a planter position—it is counted as normal if there two or three beats; more than this indicates an abnormality.

Whiplash
This is a very difficult diagnosis to prove or disprove, and is a potential minefield when it comes to litigation. Consider it as a sprain of the surrounding neck muscles, notably trapezius and the deep extensors. Anyone who has had whiplash will appreciate how painful it is. During the injury, muscle fibres are torn resulting in intense painful spasm. The neck is held still by this spasm and the muscles feel hard. Sometimes the head is rotated to one side due to the pull of the sternomastoid.

Radiographs can be difficult to interpret if the neck is twisted, which of course should be immobilized. One clue is the loss of the cervical lordosis, with straightening of the vertebra on the film. This does not confirm a whiplash injury and should be regarded as a marker that the neck has potentially sustained a serious injury. There should be no bony tenderness or neurological features.

Management of whiplash involves NSAIDs and a soft collar. It should settle after a few days.

Vertebrobasilar insufficiency
Osteophyte formation with increasing age can gradually compress the vertebral vessels. This can result in positional dependent vertigo or blackouts in which movement of the neck results in the symptoms. This is a useful clinical sign but be careful when eliciting it!
Lumps in the neck

Applied anatomy
The neck is divided into anterior and posterior triangles by the obliquely running sterno-cleido-mastoid (SCM) muscle. This muscle has two heads of origin inferiorly, one from the manubrium sterni and the other from the medial clavicle. These pass supero-posteriorly, fuse to form a fleshy belly, which inserts into the mastoid process and the superior nuchal line of the occipital bone. The sterno-cleido-mastoid is supplied by the spinal part of the accessory nerve (mostly C2 and C3), and receives its blood supply from the superior thyroid and occipital arteries.

Tips
- The triangular gap between the two heads of origin of SCM overlays the internal jugular vein—this site may be used for central venous access.
- The strip of anatomy deep to SCM should not be forgotten. Essentially the lower half covers the carotid sheath containing the common carotid artery, the internal jugular vein, and the Vagus, and the upper half lies over the emerging cervical plexus.

The deep cervical lymph nodes
These are classified into five groups or ‘levels’ denoted by Roman numerals:
- level I—nodes in the anterior submandibular or submental triangle;
- level II—jugulodigastric node(s);
- level III—nodes immediately above the intermediate tendon of omohyoid;
- level IV—nodes below the intermediate tendon of omohyoid;
- level V—nodes in the posterior triangle.
Levels II to IV simplistically divide the SCM into upper, middle and lower thirds.

Overview of the anterior triangle
Boundaries:
- upper—lower border of the mandible;
- back—anterior border of the SCM muscle;
- front—the mid-line.
This may be further sub-divided into submental, digastric, carotid, and muscular triangles by the digastric muscle and the hyoid bone. However, from a practical point of view this is not necessary. More useful is the simple sub-division into the submandibular triangle lying between the lower border of the mandible and the digastric muscles. Below the digastrics lies a more elongated inferior triangle with its apex inferiorly.

Contents of importance—these are all deep to platysma
- Suprahyoid muscles—digastric, stylohyoid, geniohyoid, mylohyoid (forming the diaphragm of the floor of the mouth).
- Infrahyoid muscles (the ‘strap muscles’)—sternohyoid, omohyoid, thyrohyoid, sternohyoid.
- Carotid sheath—runs from the level of the sterno-clavicular joint to the bifurcation of the common carotid artery (at the level of the upper border of the thyroid cartilage—C3 vertebra).
• **Common carotid artery** divides to give the
  - **internal carotid** (no extra-cranial branches);
  - **external carotid artery**: gives the following branches thyroid, lingual, facial, occipital, posterior auricular, ascending pharyngeal artery.

• **Internal jugular vein**—surface markings run from the ear lobe to the sternal end of the clavicle. Deep cervical lymph nodes are adjacent to the vein throughout its course. On the left-hand side the Thoracic duct crosses behind the vein at the level of C7 vertebra.

• **Anterior jugular veins**—commencing beneath the chin, running inferiorly to the suprasternal region.

• **Vagus nerve**, runs in the groove between the common carotid artery and the internal jugular vein.

• **Phrenic nerve** ‘C3, 4 and 5 keeps the diaphragm alive’.

• **Hypoglossal nerve**—emerges between the ICA and the IJV in the upper part of the neck. It lays on the carotid sheath deep to the posterior digastric and passes forwards beneath the tendon of digastric to provide motor innervation to the tongue.

• **Cervical lymph nodes**: levels I to IV (see above).

• **Submandibular salivary gland**—this comprises a large superficial part and smaller deep part that wraps around the posterior border of mylohyoid. Its duct runs forwards in the floor of the mouth, crossing the lingual nerve, to open in the anterior floor of mouth.

• **Parotid**—the lower pole, or tail, can pass into the neck, just below the earlobe. The lower branches of the facial nerve pass through and both can be injured by penetrating injuries in this region.

• **Thyroid**—a bi-lobed endocrine gland united in the mid-line by its isthmus, overlying the 2nd to 4th tracheal rings. Pathological enlargement of the gland may displace other structures in the neck.

• **Parathyroids**—small glandular tissue lying on the posterior aspects of the lateral thyroid lobes—normally four (90% of population).

**Mid-line structures**

• **Trachea**—continues from larynx at the level of C6. A vital site for urgent and elective surgical airways.

• **Oesophagus**—behind the trachea, a continuity of the pharynx at the level of C6. The recurrent laryngeal nerves run on each side in the groove between the oesophagus and trachea.

**Overview of the posterior triangle**

**Boundaries:**

• front—posterior border of SCM;
• back—anteriour border of trapezius muscle;
• below—the lateral part of the clavicle.

The posterior triangle is a spiral that passes from its apex at the back of the skull to its base in the front at the root of the neck. Its roof is formed by the investing layer of deep cervical fascia, and its floor by the pre-vertebral fascia.

**Contents of importance**

• **Third part of the subclavian artery**—runs very low in the posterior triangle at the level of the clavicle; just above the clavicle the suprascapular and transverse cervical vessels pass.
• **External jugular vein**—runs through the anterior/inferior part of the triangle to drain into the subclavian vein which lies more inferiorly and is not included in the posterior triangle.

• Occipital, transverse cervical, suprascapular and subclavian arteries.

• **Accessory nerve** emerges from the posterior border of SCM at the junction of its upper and middle thirds. It runs vertically down (over levator scapulae) to enter the anterior border of trapezius usually 5–6 cm above the clavicle.

• **Cervical plexus branches:**
  - muscular branches;
  - a loop from C1 to hypoglossal;
  - C2/3 branches to S–C–M and C3/4 to trapezius;
  - inferior root of ansa cervicalis.

• **Phrenic nerve** (C3, 4, and 5)—runs from lateral to medial over scalenus anterior:
  - cutaneous branches;
  - lesser occipital nerve (C2)—posterior part of the neck to the superior nuchal line, and behind the auricle;
  - great auricular nerve (C2 and 3)—skin over the angle of the mandible and parotid gland, and the auricle;
  - transverse cervical (C2 and 3)—skin in the mid-line of the neck;
  - supraclavicular nerve (C3 and 4)—root of neck/upper chest.

• **Brachial plexus** trunks—the three trunks of the brachial plexus along with the cervical plexus are held down to the pre-vertebral muscles by the covering of pre-vertebral fascia that forms the floor of the posterior triangle. Strictly speaking they are not contents of this triangle, but are mentioned, however, because of their anatomical importance in penetrating injuries.

• **Omothyoid muscle**—posterior belly. From its origin at the hyoid bone it passes deep to SCM, coming to lie over the carotid sheath. As it overlies the IJV the fibres form a flat tendon (the ‘intermediate tendon’) that are a useful marker during neck dissections to the vein’s position. The muscle is held down to the clavicle at the intermediate tendon by a fascial sling.

• **Cervical lymph nodes:** level V

**Lymphatic drainage**

When lymph nodes are enlarged secondarily to disease elsewhere, which node is involved depends on the site of the primary pathology. For this reason, it is important to know the lymphatic drainage patterns of the various anatomical sites in the head and neck:

• **pre-auricular**—eyelids, orbit, temple and vertex of scalp;
• **occipital**—posterior pinna, back of scalp;
• **bucco-facial**—cheek, lower eyelids;
• **submental**—anterior lower lip, tip of tongue, floor of mouth, lower anterior teeth (bilateral drainage);
• **submandibular**—anterior 2/3 tongue, lips, anterior neck, centre of forehead, nose, teeth, paranasal sinuses;
• **supraclavicular**—occipital nodes, axillary nodes, breast, upper anterior body wall;
• **infraclavicular**—lower neck, breast, body wall.
Deep nodes
- Jugulo-digastric—subcutaneous nodes, tonsillar area/pharyngeal wall.
- Jugulo-omohyoid—submental and submandibular groups, all of tongue.
- Lymphadenopathy in the neck (especially supraclavicular) can arise from disease both above and below the collar bones.

General considerations
One of the most important considerations in an adult presenting with a lump in the neck is, it may represent a metastatic lymph node. In such cases the primary cancer is often in the upper respiratory or alimentary tract. The risk is increased in smokers and heavy drinkers. The primary tumour must then be found quickly but open biopsy of the node should not be done. Fine needle aspiration cytology may be useful.

- In patients over 40, 75% of lateral neck masses are caused by malignant tumours.
- In the absence of obvious infection, a lateral neck mass is malignant until proven otherwise (metastatic squamous cell carcinoma or lymphoma).
- The primary tumour can usually be found in half of patients by clinical examination alone. Endoscopy of the upper aerodigestive tract will find it in another 10–15%.
- Fine needle aspiration biopsy is a useful investigation.
- Biopsy of cervical metastases results in a 2–3 times increased incidence of recurrence. Most studies suggest that open biopsy of a metastatic node have an adverse effect on survival. It also makes subsequent examination of the neck more difficult and encourages fungation.
- Biopsy of parotid tumours risks damage to the facial nerve and recurrence may develop up to 20 years later.

**Fig. 6.19** Lymphatic drainage is generally predictable. This helps determine the possible source of lymph node swelling (especially infection of malignancy).
Causes of lumps in the neck

- **Developmental**—branchial cyst, haemangioma, laryngocoele.
- **Skin and subcutaneous tissues**: sebaceous cyst, lipoma.
- **Infected lymph nodes**—viral: Epstein–Barr virus, HIV, bacterial (Staphylococcus, tuberculosis, cat scratch, brucella), protozoa (toxoplasma, leishmaniasis), fungal (histoplasmosis, blastomycosis, coccidiomycosis).
- **Neoplastic lymph nodes**—lymphoma, metastasis.
- **Granulomatous lymph nodes** sarcoïd, foreign body reaction.
- **Carotid sheath**: aneurysm, carotid body tumour, vagal or sympathetic neuroma.
- **Salivary gland (parotid or submandibular)**—infective (sialadenitis, sialolithiasis), autoimmune (Sjögren’s syndrome), neoplastic, miscellaneous (AIDS related disease).

History

Even with obvious lumps, take a full medical history. This will ensure that other pathologies are not missed and may pick up important details relevant to the patient’s further management. Tuberculosis, for example, has relevance in terms of previous lung disease and the safe administration of general anaesthesia, and may also be relevant as an infective cause of cervical lymphadenopathy. Smoking and alcohol are important in head and neck malignancy. Some animals (cats) can pass on infections (toxoplasmosis).

Useful information in diagnosing neck lumps

- **Age.** This may be a useful guide:
  - <16 years: cervical lymphadenopathy secondary to infection is the commonest cause of neck swellings at this age group followed by congenital and developmental lesions (more so in the younger age groups). Neoplastic disease can still occur (especially leukaemia/lymphoma) but is less common.
  - 16 to 40 years: inflammatory lesions are still the most common followed by developmental lesions. Neoplasia is next most common with benign disease seen slightly more than malignant disease.
  - >40 years: neoplasia is the most common cause of neck swellings with malignant disease predominating.
- **How long has the lump been present?** Was it acute in onset or a gradual increase over many months or years. Developmental lesions tend to gradually increase in size becoming increasingly troublesome. Inflammatory causes tend to develop rapidly and are often associated with pain.
- **Is it painful?** Cervical lymphadenopathy secondary to infection and inflammatory salivary gland disease often present with painful swellings. Metastatic lesions in the neck are rarely painful unless associated with secondary infection or malignant invasion of local nerves.
- **Does it vary in size?** Has the lump gradually increased in size or does it increase and then decrease in size at different times of the day? Ask particularly about mealtimes as obstructive sialadenitis secondary to sialolithiasis (salivary stones) is quite common and often presents as submandibular swelling around mealtimes.
- **Does the patient have foul breath (halitosis) or a foul taste** in their mouth? Submandibular gland infection may discharge pus in the mouth,
resulting in a foul tasting discharge. Similarly, a pharyngeal pouch can become secondarily infected as a result of food stagnation; the patient (usually elderly) will present with halitosis, dysphagia and a painful neck swelling just anterior to SCM.

- **Ask about** sore throat, unilateral hearing loss, earache, and hoarseness. These may indicate underlying malignancy.
- **Other symptoms of systemic upset.** Are there other infective symptoms present: malaise, fever, and lethargy? Cervical lymphadenopathy may represent a generalised viral infection, e.g. glandular fever (late teens).
- **Has the patient travelled overseas recently?**
- **Are there other features of malignant disease?** Weight loss/cachexia, lethargy, malaise. Generalized lymphadenopathy, sweating, skin itching associated with lymphoma.
- **Are there features of thyroid disease?** Thyrotoxic (tremor, tachycardia/AF, perspiration, lid lag, thyroid eye disease, bruit.), hypothyroid (dry hair/skin, xanthelasma, puffy face, croaky voice).

**Examination**

Examine the entire head and neck including the mouth (infections and malignancy). You may also need to examine other body sites and systems (lymphadenopathy, abdominal masses, liver, spleen, etc.).

The patient must be:
- comfortable—as relaxed as possible and in a warm room;
- sitting upright;
- uncovered—so that you can see the clavicles;
- well illuminated.

**Look**

- Start by standing back and simply observing the patient from the front and then the lateral views.
- Is there an obvious lesion/lump? Note its site, size, and shape—think of underlying anatomical structures.
- Does the ear lobe stick out? (Parotid swelling).
- Get the patient to drink some water (if not an emergency!)—does the lump move up on swallowing? If so it must be attached to the tongue or upper airway.
- Get the patient to stick out their tongue. If the lump moves up it will be attached to it somewhere (classically seen in thyroglossal cysts).
- Is the overlying skin normal or changed? Is the skin tethered or is there a discharging sinus?
- Look at the scalp, the skin of the face and in the mouth—are there any lesions that could cause inflammatory or metastatic neck swellings (lymphadenopathy)?
- Is there evidence of systemic disease? Is the patient anaemic, cachexic, or are there signs of thyroid disease?
- Look at the nursing charts—what is the temperature?

**Feel**

Examine as many necks as possible until you are familiar with the ‘normal’. All necks have irregularities, palpable lumps, depressions, etc., which are
normal findings. For instance, you can often feel ptotic submandibular glands in the elderly. Only when you are familiar with the normal are you likely to pick up abnormal findings.

**There are different ways to examine the neck. Some clinicians feel both sides simultaneously for asymmetry, others feel each in turn—that way you can laterally flex the neck and feel deep into the submandibular triangle. Try both and decide for yourself but don’t throttle the patient!**

Standing behind the patient, gently but firmly rest your fingertips under the lower border of the mandible under the chin. Palpate the submental area moving posteriorly to the submandibular areas feeling for abnormal or painful masses. Feel along the side mandible as well as below, lymph nodes are commonly found in the lower face, but should be considered as part of the neck. Palpate the depression behind the ramus, below the ear lobe—an important site for parotid swellings. Follow on by feeling down the anterior border of sterno-mastoid to the sternal notch, and then staying in the mid-line move back superiorly to the submental area where you started. Palpate the posterior triangle behind the SCM, the supraventricular areas, and the occipital scalp for lymphadenopathy/masses. By laterally flexing the neck gently grab the SCM and try to feel deep to it—this is an important and often missed area of examination. It is where many lymph nodes lay.

If there is an unusual mass, note:

- site, size, shape, including nature of surface;
- fixed or mobile;
- consistency, e.g. cystic or solid, soft or hard, fluctuance;
- tender;
- pulsatile;
- transillumination.

**Other useful examination techniques**

- Fibre optic nasendoscopy—to assess the nasopharynx for occult primary tumours to complete the head and neck examination.
- Auscultation—listen over the mass with a stethoscope. Is there a thyroid bruit present?
- Illumination—cystic hygromas (congenital cavernous lymphangioma) transilluminate brilliantly.

**Investigations**

**Fine needle aspiration (FNA)**

A fine-bore needle (‘green’ gauge) attached to a 20ml syringe is passed into the mass while it is immobilized between the fingers of the other hand. Negative pressure is applied by withdrawing the plunger of the syringe, thus collecting cells from the lesion into the needle/syringe. A sample is the placed on a microscope slide and a thin film made by passing a second slide over it—this may then be air dried or fixed, depending on local protocols. The slide is then viewed by an experienced histopathologist to give a report on the nature of the cells of the lesion. Comment can be made as to whether the cells show malignant features or not, although a definitive diagnosis cannot be made as the architecture of the lesion cannot be seen. This is quite an ‘operator sensitive’ technique and on occasion a non-diagnostic sample is made.
Caution should be applied to the use of FNA in assessing salivary gland tumours, especially when there is some doubt as to whether the presenting lesion is benign or malignant.

**Ultrasound**

Ultrasound is useful for distinguishing between solid and cystic lesions and may be used to guide biopsy needles to sample masses or aspirate collections. It proves particularly useful for the investigation of salivary gland lesions as it has particular value in assessing suspected inflammation and tumours. Ultrasound may also be able to distinguish whether a suspected tumour is benign or malignant: benign masses, such as adenomas, are generally echo-poor with well-defined margins, whereas malignant conditions are generally ill defined, and are often lobulated with a heterogeneous echo texture.

**Sialogram**

Sialography involves the injection of a radiopaque medium into salivary ducts and the use of plain radiographs. It is a useful process in the investigation of neck swellings when salivary gland aetiology is suspected. It may be used to demonstrate salivary calculi or duct strictures when there is an obstructive history. It may also show pathological processes within the gland, or sometimes outside, compressing it. A plain film should be taken prior to the procedure (a ‘control’ film). This may show obvious calculi and so negate the need to proceed to formal sialography.

**Acute infection and iodine sensitivity are contra-indications to sialography.**

**Computerized tomographic scanning (CTS)**

CT scanning is exceptionally useful in assessing the extent of neck swellings particularly invasion into deeper tissues. However, artefact produced by metal in dental restorations often cause problems when investigating lesions in the floor of the mouth and upper neck.

**Magnetic resonance imaging (MRI)**

MRI is useful in the head and neck as it produces images with excellent soft tissue definition and so is particularly useful for the assessment of salivary glands and other neck masses. It has the advantage of not using radiation. Its use is contra-indicated in patients with metal implants such as aneurysm clips or cardiac pacemakers.

**Radio-isotope imaging**

In the assessment of neck swellings this technique is useful in the assessment of salivary and thyroid function. The images however do give relatively poor spatial resolution and the radiation dose can be relatively high so its use is limited.

**Lymphadenopathy**

Enlarged cervical lymph nodes—cervical lymphadenopathy, represent the most common cause of swellings in the neck. Lymphadenopathy in the neck (especially supraclavicular) can arise from disease both above and below the collar bones (eg Bronchial/gastric malignancy).
Possible causes of enlarged, palpable lymph nodes include:

- **Local causes:**
  - infection—dental infections, tonsillitis, skin sepsis, TB neck nodes;
  - neoplastic—lymphoma or metastatic (anywhere in the head and neck);
  - parotid nodes;
  - developmental;

- **Generalized causes:**
  - infection—URT, infectious mononucleosis, toxoplasma, cat-scratch fever, HIV;
  - sarcoidosis;
  - **Hodgkin’s disease, non-Hodgkin’s lymphoma, lymphatic leukaemia.**

**Infection**

Acute infections are the commonest cause of lymph node enlargement in patients under 40. They are generally viral (colds, glandular fever, etc.) or bacteriological (dental infections, tonsillitis, scalp infections such as impetigo). Tuberculosis is a chronic inflammatory cause that has seen an increase in incidence in recent years. TB lymph nodes tend to be firm and indurated and often give rise to sinuses.

**Neoplastic**

*Primary: Hodgkin’s disease and non-Hodgkin’s lymphomas*

Lymphomas are malignant neoplasms of lymphoid tissue. They are broadly divided into Hodgkin’s and non-Hodgkin’s type with further subdivisions made on histological and immunological criteria. Hodgkin’s disease is a neoplastic process affecting the lymphatics—in 80% of cases the cervical lymph nodes are involved. Some patients present with systemic symptoms such as weight loss, fever, and night sweats (type B symptoms). Diagnosis is confirmed by biopsy.

*Secondary: metastatic disease*

Enlarged cervical lymph nodes, secondary to head and neck malignancy are a common cause of neck swellings. It has been shown that in approximately 90% of cases spread to the cervical lymph nodes occurs in an ordered fashion (superior nodes being involved before inferior nodes). The pattern of cervical lymph node involvement not only dictates the nature of treatment, but is also the single most important prognostic factor in determining patients’ survival. Of particular importance is the level and frequency of node involvement and the presence (or absence) of extra-capsular spread.

**Congenital**

Cystic hygroma—also termed a cavernous lymphangioma is said to be a congenital lesion arising from an embryonic remnant of the jugular lymph sac. Approximately 65% are present at birth and the remainder become apparent before the child’s second birthday. On clinical examination these lesions are classically described as being able to transilluminante. Haemangioma can also present in the neck. If deep, discolouration may not be that obvious.
Thyroid/thyroglossal cyst

The thyroid gland lies in the mid-line of the lower third of the neck behind the pre-tracheal fascia; it is a bi-lobed gland with a central isthmus. Assessment of a thyroid lesion essentially involves two questions:

- **Is it a generalized enlargement of the gland or a solitary nodule?**
  - Enlargement of the whole gland is called a ‘goitre’.
  - A solitary nodule may be benign or malignant (primary or secondary).
- **What is the patient’s thyroid status?**
  - Euthyroid, i.e. normal.
  - Thyrotoxic, i.e. over-active—tiredness, weight loss, anxiety, palpitations and tremor.
  - Myxoedematous, i.e. under active: such patients tend to be overweight, have thick skin and thinning hair, and be slow in thought and speech.

Goitres

- **Physiological**—seen during pregnancy, at puberty and in conditions of iodine deficiency (less commonly seen in present day).
- **Inflammatory**—De Quervain’s Thyroiditis, Hashimoto’s Thyroiditis, Riedel’s Thyroiditis.
- **Nodular**—this is a simple benign enlargement of the thyroid gland and only necessitates treatment if the patient becomes thyrotoxic, concerned with its appearance, or presents with symptoms of compression of adjacent structures, e.g. dysphagia or dyspnoea.
Lumps in the Neck

Malignant change is possible and may present with a local increase in size or hoarseness of the voice due to recurrent laryngeal nerve involvement.

- **Toxic**—Graves’ disease.

**Solitary thyroid nodule**

- **Cyst**—usually a degenerative part of a nodular goitre although true cysts are seen. Haemorrhage into the cyst is a common complication and will present with pain and rapid enlargement that may compress adjacent structures.
- **Adenoma**—may produce thyrotoxicosis if functioning. Subdivided into histological type: papillary, follicular, embryonal, and hurte cell.
- **Papillary adenocarcinoma**—seen in younger age groups; low grade and rarely fatal.
- **Follicular adenocarcinoma**—a malignancy of middle age; bony metastases are common.
- **Anaplastic carcinoma**—an aggressive malignancy of the elderly; metastatic disease at presentation is common.
- **Medullary carcinoma**—seen in all age groups with equal sex incidence; moderate malignant potential spreading to lymph nodes.
- **Malignant lymphoma**—may occur in lymphatic tissue within the thyroid gland or as secondaries.
- **Secondary**—direct spread from adjacent malignancies or metastatic spread, most commonly from breast, renal, colon, lung.

**Thyroglossal cyst**

During embryological development the thyroid gland reaches its final anatomical position in front of the 2nd and 3rd tracheal rings having descended through the neck from its origin at the foramen caecum. Epithelial remnants along this embryological pathway may persist and form thyroglossal cysts. Clinically the vast majority of patients present with a mobile, painless neck swelling that transilluminates and fluctuates. Because of its links with the thyroid gland the lesion will move in the vertical plane with swallowing. If it remains attached to the tongue it will also move up on tongue protrusion. Other features include:

- commonest age of presentation is 5–10 years;
- 90% are mid-line lesions, although 10% lie laterally (frequently left);
- 75% are pre-hyoid;
- 25% are at the level of the thyroid or cricoid cartilage;

Management involves the surgical removal of the cyst and its tract that may incorporate the central portion of the hyoid bone (sistrunk procedure).

**Carotid body tumour**

Tumours of the carotid body (chemodectomas) are rare, slow-growing ovoid lesions arising in the carotid bifurcation, distorting and encasing the carotid vessels. They occur over a wide age range although are most commonly seen in patients in their fifties. Chronic hypoxia has been reported as a causal factor and the tumours are said to have a high incidence in high altitude areas, such as Mexico City and Peru. A familial tendency has also been reported, around 30% of familial tumours are said to be bilateral. Of the non-familial tumours 10% are bilateral.
Carotid body tumours are slow growing, although they may eventually become locally invasive or even metastasise via the lymphatics or the blood. The incidence of metastases has been reported between 2.5 and 50% and indeed some surgeons consider all these tumours as malignant. Left untreated about 5–10% will develop metastases within 10 years.

Clinical features
Patients are usually aged over 50 years and present with solitary or bilateral lumps in the neck at the level of the carotid bifurcation. The tumours are just in front of and deep to the anterior border of the sternocleidomastoid muscle, usually at the level of the hyoid bone. The lesion will transmit the carotid pulse rather than being pulsatile itself. It can be moved laterally (displacing the carotid pulse) but not vertically. Occasionally pressure on the carotid sinus by the tumour may cause fainting attacks.

Investigations
Carotid arteriography is the investigation of choice and will show a splayed carotid bifurcation containing a highly vascular tumour; it is useful in defining the extent of the tumour and also in establishing the adequacy of collateral blood flow through the other carotid artery.

Management
Surgical excision is the management of choice in the young patient as left untreated carotid vessel obstruction may ensue; there is also a greater
risk of malignancy as their size increases, and the larger the tumour the more difficult the surgery. It is often possible to dissect the tumour away from the carotid vessels; if it is necessary to sacrifice the vessels graft replacement of the artery is performed.

In the elderly, frail patient, these slow growing tumours are often simply watched as the surgery to remove them is certainly not without risk.

**Branchial cyst**

After the thyroglossal cyst, the branchial (lateral cervical) cyst is the second most common congenital swelling in the neck. It is thought that branchial cysts develop from remnants of the second branchial cleft in the neck, and in some cases tracts are found running from the deep surface of these cysts to the pharyngeal wall. However, it has also been postulated that branchial cysts are simply cystic degeneration in cervical lymphatic tissue, as almost all branchial cysts are found to have lymphoid tissue in their walls; hence the alternative name of lateral cervical cyst.

**Clinical features**

Most lesions present in the third decade of life and show equal sex distribution. Patients complain of an enlarging mass arising from behind the anterior border of the junction of the upper and middle thirds of the sternomastoid muscle. Frequently the cyst may appear as a swelling during an upper respiratory tract infection, which may be painful and persist after the infection has been treated. Recurrent infections can result in a firm, fixed mass which are adherent to surrounding structures such as the jugular vein, proving difficult to excise surgically.

**Investigations**

Diagnosis is usually made on the basis of the history and the site of the swelling. However, fine needle aspiration biopsy can prove useful by producing an opalescent fluid containing cholesterol crystals or frank pus.

**Management**

Surgical excision of the lesion is the treatment of choice following management of infections with appropriate antibiotics. All of the cyst lining should be removed as any remaining remnants may result in recurrence or a chronic discharging sinus from the wound.

**Branchial sinus/branchial fistula**

A branchial sinus is a small opening found over the anterior border of sternomastoid, which may discharge a mucous secretion. They are generally present at birth but may present in later life as a consequence of a ruptured, chronically infected branchial cyst (a secondary branchial cyst). The sinus can extend supero-medially between the internal and external carotid arteries to open onto the lateral wall of the pharynx forming a branchial fistula.

**Pharyngeal pouch**

This is a mucosal protrusion (diverticulum) of the pharyngeal wall through part of the inferior pharyngeal constrictor muscle (thyropharyngeus and cricopharyngeus). Patients often give a history of a hiatus hernia (with heartburn and acid reflux). It is thought that the pouch arises as a result of a relative obstruction or spasm at the level of cricopharyngeus caused by
hypertrophy of the muscle attempting to prevent overflow of reflux contents into the larynx.

A weak area between thyropharyngeus and cricopharyngeus known as Killian’s dehiscence, is situated posteriorly. It is here the pouch originates, above the spasm of cricopharyngeus.

Clinical features
More commonly seen in males and the elderly where they often have a long, symptom-free development. Patients complain of dysphagia (difficulty swallowing), associated with regurgitation of undigested food and consequent weight loss. Often the first mouthful is easily swallowed, but as the pouch becomes full it obstructs the oesophagus and hence dysphagia develops with regurgitation. A palpable neck swelling low down in the anterior triangle may be felt which produces a characteriztic squelch on pressure and gurgling on auscultation due to free fluid in the pouch. Recurrent respiratory infections are a common feature along with coughing fits, especially at night, due to inhalation of regurgitated contents of the pouch. Neoplasia has been reported in less than 1% of pouches.

Investigation
Diagnosis of a pharyngeal pouch is easily confirmed by a barium swallow of the upper neck.

Management
Surgical management is by excision of the pouch along with release of the cricopharyngeal spasm by myotomy. Nasogastric feeding should be continued for five days to reduce the chance of fistula formation.

In high-risk patients, excision of the pouch (diverticulectomy) may be replaced by simple inversion and oversewing. However, this procedure does not allow for the histological assessment of the pouch and a carcinoma may be missed.
LUMPS IN THE NECK

Cervical rib
In approximately 0.5–1% of the population, the costal element of the lowest (7th) cervical vertebra overdevelops to form a cervical rib. This may range from a fibrous strand to a fully formed bone attaching to the first rib. In 50% of cases the cervical rib is seen to be unilateral, usually on the right, and anteriorly can be palpated as a fixed, hard swelling in the supraclavicular fossa where it can mimic neoplastic disease.

The cervical rib itself rarely cause symptoms, but its presence may cause disturbance of the function of the adjacent subclavian vessels and the brachial plexus resulting in symptoms of thoracic outlet syndrome.

Clinical features
The condition occurs equally in both sexes and is usually first noticed in the late teens when the neck extends and the shoulders droop. The patient may be aware of tenderness or swelling in the neck along with pain on the affected side due to vascular insufficiency. Exercise will exacerbate these symptoms, especially if the arm is pulled down, and the hand may be cold and pale as a result of distal ischaemia. Rarely the patient may present with a neurological deficit, including paraesthesia in the forearm and weakness of the hand. Close examination may reveal signs of ischaemia or emboli in the hand and the radial pulse may disappear if the arm is elevated. Auscultation may elicit a bruit over the subclavian artery.

Investigation
A cervical spine radiograph (X-ray) will show a bony cervical rib. In the absence of a bony rib close examination of the film may show a prominence of the anterior tubercle of the 7th cervical vertebra which could be associated with a fibrous band.

Post stenotic dilatation of the subclavian artery caused by the cervical rib may be demonstrated by angiography, particularly if the arm is elevated.

Management
Physiotherapy may improve muscles that elevate the arm and support the upper limb girdle in case where cervical rib causes mild neurological symptoms. Surgical excision should be considered if a cervical rib is causing vascular or marked neurological symptoms.

Subclavian aneurysm
Aneurysms of the subclavian artery were originally described in dock labourers and coal heavers where the strain of lifting heavy loads produced raised thoracic pressure causing the subclavian artery to be constantly occluded against the clavicle. Mechanization has now almost abolished this particular occupational hazard. Aneurysms at this site are now generally found in association with a cervical rib as a post stenotic dilatation: a ‘false’ aneurysm.

Clinical features
The patient may present with the features of a cervical rib and thoracic outlet syndrome. They may have noticed a mass or pulsation in the neck and clinically a bruit may be heard over the artery in the supraclavicular fossa. The bruit may vary in differing degrees of abduction of the arm.
Emboli from a subclavian aneurysm have the potential to cause patchy necrosis and gangrene of the hand and digits.

**Investigation**
Arteriography to show the extent of the aneurysm.

**Management**
Treatment of the cause, i.e. excision of the cervical rib if present. Following this the limits of the aneurysm are defined and the vessel is isolated before it is cross-clamped and the aneurysm resected. Often it is necessary to replace the aneurysm by a segment of long saphenous vein or a prosthetic graft.

**Salivary glands**
Any swelling of the glands may present as a swelling in the neck. It is unusual for the sublingual gland to produce a true neck swelling except in the case of a plunging ranula which is essentially a huge mucous extravasation pseudo-cyst of the sublingual gland.

The causes of salivary gland swelling are in essence threefold: obstructive, infective, and neoplastic. These may occur in isolation although more frequently may co-exist: for example, a neoplasia may produce obstructive symptoms.

**Obstructive**
Obstruction of any part of the salivary gland duct system may result in a build up of salivary secretions and hence a swelling. The degree of the swelling depends on the site of obstruction and to what degree the obstruction blocks drainage. With recurrent bouts of obstruction infection may supersede due to stagnation of secretions.

The classic history is of swelling associated with meal times as gustatory secretion is stimulated—the patient may report that the swelling settles a few hours after the end of eating.

**Salivary calculi**
Form as a result of calcium deposition around a nidus of organic material. Of salivary stones, 80% form in the submandibular gland and 10% in the parotid; they are usually unilateral and males are affected twice as often as females. Of submandibular gland stones, 20% are radiolucent, in which case sialography is indicated to locate them. Those in the floor of the mouth may be removed through a local incision under local anaesthetic. However, recurrent damage to the gland may necessitate its removal.

**Duct strictures**
Usually formed as a result of chronic trauma or iatrogenic injury (poor surgical technique), but may also be caused by ulceration around a salivary calculus. As a result fibrosis ensues and leads to duct stenosis which produces obstructive symptoms.

**Neoplasia**
May present with obstructive symptoms.

**Infective**
Infective causes of salivary gland swelling usually present with painful, red, warm, tender swellings at the site of the main gland. The regional lymph
nodes may be enlarged and tender and a pustulous discharge may exude from the duct orifice. Patients generally present with progressive malaise and systemic upset.

**Mumps**
Bilateral painful parotid swelling due to a paramyxovirus; highly infectious generally affecting children, with an incubation period of 21 days. Immunity is long lasting after an attack.

**Suppurative parotitis**
Seen in debilitated patients, particularly post-operatively, as a result of xerostomia secondary to dehydration. Management includes rehydration and appropriate antibiotic therapy.

**Chronic sialadenitis**
Usually a complication of duct obstruction.

**Neoplastic**
Salivary gland tumours are the second most common neoplasms of the head and neck after oro-pharyngeal squamous cell carcinomas. The current incidence in Europe of salivary gland cancer is reported at 1.2 per 100,000 population. Of all salivary gland tumours 70–80% arise in the parotid—of these 75% are pleomorphic adenomas and 10–15% are malignant.
Difficulty in swallowing (dysphagia) and aspiration

Normal swallowing

In order to better understand dysphagia, it is helpful to first understand the mechanism and stages of a normal swallow. On average, people swallow once or twice every minute, to clear saliva and mucus from the oro- and naso-pharynx. It takes approximately one second. Dysphagia, even when only mild or intermittent, affects the ability to enjoy almost all other aspects of life. Aspiration is the intrusion of food or liquid into the unprotected airway below the level of the vocal folds. This can lead to infections of the respiratory system, pneumonia and pneumonitis.

1 The pre-oral stage

Normal requirements

Sight, smell, taste, co-ordination.

Problems

• Loss of smell and taste following surgery and/or radiotherapy.
• Xerostomia following irradiation of salivary glands.
• Poor posture.
• Inco-ordination of head, arm, trunk, neck, tongue, lips, and jaw.

2 The oral stage

Normal requirements

Food or liquid enters the oral cavity. Tight lip closure prevents loss of material. The tongue and mandible function to move the food bolus laterally onto the teeth for mastication. Saliva containing digestive enzymes assists in softening and moistening the bolus, begins the digestive process and helps to provide taste. Typically, breathing is nasal and the velum (soft palate) is lowered. The food or liquid bolus is then squeezed by the tongue against the hard palate and moved posteriorly towards the hypopharynx. The velum then begins to elevate to close off the nasopharynx.

Problems

• Ineffective lip seal results in drooling, an inability to suck, take food from a spoon/cup, or initiate a swallow.
• Poor tongue movement (e.g. following glossectomy) results in inability to position food between teeth for chewing, form a bolus or control liquid and propel food into the pharynx. This leads to pooling/stasis of food in the oral cavity, particularly on the side affected by surgery.
• Cleft palate or reduced velopharyngeal seal results in nasal regurgitation.
• Loss of bolus into pharynx or larynx results in aspiration.
• Poor chewing as a result of poor alignment of teeth, dental extraction, soreness, swelling and inability to wear dentures.
• Xerostomia or excessive drooling (ptyalism)

3 The pharyngeal stage

Normal requirements

This stage triggers the swallow reflex as the bolus or liquid comes into contact with the pillars of the fauces. The velum elevates, contacts the
posterior pharyngeal wall and closes off the nasal cavity. The larynx is pulled upwards and the epiglottis tips down over it to protect the airway. Closure of the laryngeal valve system occurs with the false and true vocal folds closing simultaneously. The bolus or liquid moves over the closed airway and passes through the cricopharyngeal sphincter at the top of the digestive tract.

**Problems**
- Delayed or absent swallow reflex due to post-operative swelling or reduction in sensation from cranial nerve injury. Mis-timing of the swallow results and the bolus or liquid falls into the pharynx and then into the unprotected airway resulting in aspiration.
- Restricted laryngeal elevation results in unsatisfactory closure of the larynx and aspiration.
- Vocal fold paralysis following cranial nerve injury results in aspiration.
- Reduced pharyngeal motility results in food and liquid pooling in pockets either side of the larynx. Food residue can build up on the pharyngeal walls so food and liquid spill over into airway causing aspiration.
- The presence of a tracheostomy tube can restrict laryngeal elevation. Food particles can pool on top of the inflated cuff so bacterial colonisation can occur. Since inflated tracheostomy tube cuffs do not always prevent aspiration there is a risk of aspiration pneumonia.

4 The oesophageal stage

**Normal requirements**
The bolus and liquid enter the oesophagus and are propelled towards the stomach by peristalsis.

**Problems**
- Ineffective peristalsis hinders the passage of food to the stomach.
- Incomplete or constricted cricopharyngeal and cardiac sphincters hinder passage of food to stomach.

**NB Gag reflex does not provide significant information about the swallow reflex.**

**Cough reflex.** This is a protective reflex triggered when food/fluid enters the larynx and touches the vocal folds. It may be absent in neurologically impaired patients and silent aspiration may occur.

**Signs of aspiration**

**Acute:**
- distress;
- coughing, choking, and gasping;
- respiratory difficulty—wheeze or gurgling;
- loss of voice or gurgling ‘wet’ sounding voice;
- change of colour (greyness);
- tachycardia and sweating.

**Chronic:**
- respiratory problems/chest infections;
- coughing and choking;
- excess oral secretions;
- loss of weight;
- hunger;
- refusal to eat.
Silent aspiration—patients with loss of sensation in the larynx may aspirate without coughing and without awareness of the problem. Nasogastric tubes may also be easily passed into the trachea without obvious signs.

Speech disorders
Normal speech is dependent upon normal:
- nervous system;
- hearing;
- respiratory system including both lower (trachea, bronchi, and lungs) and upper nasal cavity;
- oropharynx including lips, cheeks, tongue, dentition, and larynx.

Assessment of dysphagia
Objective assessment
These are required if aspiration or a pharyngeal stage deficit is suspected.

Fiberoptic nasendoscopy
By inserting the fiberoptic scope into the nares and over the velum, it is possible to view the pharynx and larynx before, during and after the swallow. A blue dyed bolus or milk are often swallowed. Patient tolerance will naturally vary. The advantages are a comprehensive and objective picture of the pharyngeal stage of swallow, which does not expose the patient to radiation.

Videofluoroscopy (modified barium swallow)
Videofluoroscopic assessment of swallowing is a radiographic evaluation documenting the passage of a bolus through the oral, pharyngeal and oesophageal stages of the swallow and identifying the therapeutic manoeuvres for safe and adequate oral intake. A teaspoon of barium liquid and a small quantity of paste of biscuit consistency is taken. Following each swallow the oral cavity and pharynx are kept in view rather than following the bolus into the oesophagus. The procedure is viewed on a monitor and videotaped.

Management of dysphagia
Alternative feeding methods
- The naso-gastic tube—this is usually only used in the short term. It can cause the patient discomfort and has care is required in placement and confirming its position. It is usually not retained for more than one month.
- The percutaneous endoscopic gastrostomy (PEG)—patients’ often find this method more comfortable and recent research shows that patients’ weight and nutritional parameters are maintained or improved on PEG feeds

Swallowing rehabilitation
A variety of exercises may be given to a patient. Full range of motion exercises will not be attempted until the surgeon agrees that is safe to do without interfering with the healing process.

1 Posture
It is always helpful for patients to sit in an upright and straight position. Keeping the head up and discouraging the head dropping forward greatly reduces drooling and aids swallowing.
Postural variations:
- **Tilting** head to the *unaffected* side—useful in patients with unilateral tongue dysfunction. The bolus should be placed on the side which has most movement and sensation. The head should be *tilted* before the bolus is presented otherwise it will fall onto the damaged side and cannot be retrieved.
- **Turning** head to the *affected* side—useful in patients who have undergone more extensive resections, possibly involving the pharynx and or larynx. The patient *turns* his head to the affected side before placing the bolus in the mouth. This closes the pyriform sinus on that side and helps reduce the amount of pharyngeal pooling, which may be occurring.
- **The flexed head position**—useful when the patient is unable to hold the bolus effectively and/or there is a delay in triggering the swallow. The chin is placed down whilst food is presented thus preventing leakage into the hypopharynx.
- **Tipping the head backwards**—caution must be taken using this position. Useful in patients with total glossectomy as it allows gravity to help speed up oral transit. Aspiration is increased especially if there is a problem in the pharyngeal stage. To increase safety this technique can be combined with the supra-glottic swallow.
- **The supra-glottic swallow**—useful with most neurological dysphagias and with patients who have both oral stage difficulties and reflexive airway protection. It can be practiced without a bolus. Make sure the patient is sitting upright.
  - Take a breath and hold it tightly (this encourages vocal fold closure).
  - Take a sip/mouthful of food and keep holding breath.
  - Swallow hard, still holding breath.
  - Cough out hard or clear throat.
  - Pause before next swallow.
  - Remain seated in upright posture for 20 min after eating.

2 **Prosthetics**
Prosthetic devices can greatly aid the rehabilitation of swallowing after oral surgery. They help by narrowing the space between the hard palate and remaining tongue. They are known as ‘palatal augmentation prosthesis’, ‘palatal lowering devices’ and ‘obturators’. They are of particular use when masticating food. The oral cavity is made smaller so residual tongue movement is more efficient, and they can aid in the raising of the velum to prevent nasal regurgitation of liquids and food.

3 **Food presentation**
Close liaison with the dietitian, catering department, and nursing staff is essential when recommending suitable textures and consistencies of desirable foods. Usually recommended are pureed, thickened liquids, and a soft diet, but the levels of consistency must be correct to help the patient swallow successfully. The presentation of puréed food in particular is often the deciding factor in whether a patient perseveres with their swallowing or not. Puréeing the individual vegetables and meat separately and using commercially available food moulds to shape the purée into pleasant appetizing food shapes, greatly enhances presentation making the food far more palatable and attractive to the patient. Both the
dietitian and speech and language therapist will have lists and recipe books of suitable foods.

4 Feeding aids
There are a variety of commercially available feeding spoons, dysphagia cups, and mugs. They help the manoeuvring and propulsion of food and liquid. The spoons have small bowls and long handles for ease of placement. Because they are made of strong, smooth plastic they are less irritating and abrasive in sore mouths and without the metallic taste often experienced after irradiation. The therapist will advise on the appropriate aid.

5 Oral hygiene
Close liaison is required to help promote the best oral hygiene regime possible for post-surgical patients. These patients often need careful guidance and much encouragement to remember to keep their mouths clean. Swelling, soreness and xerostomia can make this difficult for them.
Tracheostomies

Indications include:

- upper airway obstruction;
- prevention of aspiration of fluids (cuffed tube);
- retention of secretions (access for suctioning);
- respiratory insufficiency (respiratory, cardiac or neurological disease).

This should be an elective procedure (see Emergencies). Tracheostomy tubes are placed through a small incision midway between the cricoid cartilage and suprasternal notch. Tissues are separated keeping to the midline of the neck. Meticulous haemostasis is essential at all times. Often the thyroid isthmus obstructs access to the trachea and needs to be securely ligated and divided. The thyroid is a highly vascular organ and carelessness in doing so can result in profound bleeding post-operatively. Once the anterior part of the trachea is defined it is opened, the endotracheal tube withdrawn and the tracheostomy tube inserted into the lumen. Several different access openings in the trachea have been described—a vertical slit, cutting a small hole or the ‘Bjork’ flap, which is U-shaped and remains attached inferiorly. Each has its own merits and which is chosen is down to the operating surgeon. Once in place the flanges of the tube need to be securely fastened to the patient and the wound closed.

Complications include:

- displacement of the tube;
- tube obstruction from secretions or crusting;
- bleeding;
- tracheal stenosis;
- local tissue injury;
- vocal cord paralysis (the recurrent laryngeal nerve runs alongside the trachea);
- emphysema and pneumothorax;
- chest infection;
- difficulty in re-intubation.

Although providing direct access to the lower respiratory tract for suction by by-passing the larynx, many patients find it difficult to produce an ‘explosive’ cough, useful in clearing secretions from the lungs. However they can be taught to expectorate, physiotherapists encouraging ‘huffing’ using the diaphragm. With a cooperative and well humidified patient, very little suction is required; most patients can effectively clear their lungs on their own.