EMERGENCIES

HEAD, NECK AND DENTAL EMERGENCIES

EDITED BY
Mike Perry

Chapters are symptom-based to assist rapid diagnosis

Quick-reference boxes list common presentations and their causes

Tips and tricks boxes aid assessment and prioritisation

SECOND EDITION 2 SECOND EDITION

EMERGENCIES

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SECOND EDITION

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Preface

This second edition has been extensively revised to make its contents more practically useful for the user. The aim is to help the reader develop a targeted approach in their assessment and management of those 'emergencies' that occur in the anatomical regions above the collar bones. Such patients may attend an emergency department or general practice clinic, or they may present on the ward. Although this book is part of the 'Emergencies in . . .' series of books published by OUP, the strict application of the definition of an emergency to the head and neck (i.e. an immediately life- or sight-threatening condition) would result in just a handful of cases being listed and discussed. Therefore, a more broadly defined remit has been used, that is, to cover urgent and potentially worrying problems which may present to the non-specialist or novice.

How this book works

Generally speaking, patients do not present with a ready-made diagnosis, but rather with either a symptom located to an anatomical region (e.g. toothache, a lump/swelling, or a headache), or an obvious problem (such as a nose bleed or injury). This is the starting point in each of the anatomically based chapters ('Common presentations' and 'Common problems and their causes'). For each symptom a variety of conditions may be the cause and these are listed. These conditions have also been categorized as common or uncommon, although it is accepted that individual clinicians, departments, and specialists will all have differing experiences of their frequency (depending on training and geographical location). We have tried to include the majority of conditions likely to be encountered in non-specialist practice, but clearly it is not possible (nor practical) to include the rare or obscure in view of the aims of this book.

Making a diagnosis

Diagnosis requires a history and examination. As undergraduate students, we are taught this must be all inclusive, with a full detailed history and full examination of the patient. However, the reality of any emergency department setting, busy practice, or assessment of an urgent problem is that a more limited, but targeted approach is required. By necessity the questions and examination are more focused. But at the same time these must not omit those key elements which are required to make an *accurate* diagnosis. In accordance with this, the next section in each chapter ('Useful questions and what to look for') lists relevant and important diagnostic cues, in relation to each presenting symptom. These questions should be regarded as an aide memoire and when appropriate can be tailored accordingly. Some overlap and repetition is inevitable. The aim of this section is therefore to equip the reader with the necessary knowledge to enable them to quickly and accurately triage and diagnose a problem.

The remainder of each chapter is self-evident with details on how to examine each anatomical site, useful investigations (in both the emergency department and outpatient setting), and some notes on the conditions themselves. Management is also covered, based on current evidence, but as guidelines continue to evolve this may change. Where available, local protocols should always be used (e.g. 'clearing' a cervical spine injury).

For the pedants among us, it is accepted that not every known condition is covered. It must also be remembered that some symptoms may be the result of systemic disease (e.g. bleeding gums, halitosis, and headaches), while other head and neck pathologies may present with symptoms outside this site (e.g. cervical rib, overactive thyroid, or secretory pituitary adenoma). Nevertheless, if this book is used as a practical guide, or a manual, we are confident the reader will find it a useful diagnostic aid. Undergraduates may also find it useful when preparing for clinical examinations.

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Symbols and abbreviations

➔	cross-reference
AACG	acute angle-closure glaucoma
ABG	arterial blood gas
AC	air conduction
ACE	angiotensin-converting enzyme
APD	afferent pupillary defect
ATLS®	Advanced Trauma Life Support®
AVM	arteriovenous malformation
BC	bone conduction
BNBM	nil by mouth
BP	blood pressure
BPPV	benign paroxysmal positional vertigo
BRONJ	bisphosphonate-related osteonecrosis of the jaw
CCS	central cord syndrome
CN	cranial nerve
CNS	central nervous system
COPD	Chronic obstructive pulmonary disease
CPP	cerebral perfusion pressure
CRP	C-reactive protein
CSF	cerebrospinal fluid
CT	computed tomography
CTA	computed tomography angiography
CXR	chest X-ray
DVT	deep vein thrombosis
EAM	external auditory meatus
ECG	electrocardiogram
EMG	electromyography
ENT	ear, nose, and throat
ESR	erythrocyte sedimentation rate
FBC	full blood count
FNA	fine-needle aspiration
GCS	Glasgow Coma Scale
GI	gastrointestinal
GORD	gastroesophageal reflux disease
HDU	high dependency unit
HSV	herpes simplex virus
ICH	intracranial haemorrhage
ICP	intracranial pressure
ICU	intensive care unit
IJV	internal jugular vein
IM	intramuscular
INR	international normalized ratio
IOFB	intraocular foreign body
IOP	intraocular pressure
ITU	intensive therapy unit
IV	intravenous
LFT	liver function test
LMA	laryngeal mask airway
LMN	lower motor neuron
LMW	low molecular weight
LP	lumbar puncture
MRA	magnetic resonance angiography
MRI	magnetic resonance imaging
MS	multiple sclerosis
MVC	motor vehicle collision
NOE	naso-orbitoethmoid
NSAID	non-steroidal anti-inflammatory drug
OCS	orbital compartment syndrome
OM	occipitomental
OPT	orthopantomography
ORN	osteoradionecrosis
OSA	obstructive sleep apnoea
PA	posteroanterior
PCR	polymerase chain reaction
PE	pulmonary embolism
PMH	past medical history
RAPD	relative afferent pupillary defect
RBH	retrobulbar haemorrhage
SCM	sternocleidomastoid

SGS	subglottic stenosis
SJS	Stevens–Johnson syndrome
SLE	systemic lupus erythematosus
SOF	superior orbital fissure
TB	tuberculosis
TIA	transient ischaemic attack
TMJ	temporomandibular joint
TMJDS	temporomandibular joint dysfunction syndrome
TON	traumatic optic neuropathy
U&E	urea and electrolyte
UMN	upper motor neuron
UTRI	upper respiratory tract infection
VZV	varicella zoster virus
WCC	white cell count

Chapter 1

Principles of assessment

Taking a history and examining the patient in the emergency department

History taking is the first stage in diagnosis. Even though this can be an arduous task, being repeated every day, one must not lose sight of the fact that for the patient this may be a sensitive or private issue. He or she may be asked questions for which the answers may not be normally shared even with their close contacts (e.g. circumstances resulting in an injury, alcohol/recreational drug usage, and sexual contacts/HIV risk). Therefore be sensitive to this. Introduce yourself and any member of your team who is present. Take time and be clear in the introductions. Try not to interrupt patients when they are talking. Not everyone is able to express themselves clearly in a few words. Know how to contact interpreters if the patient is having problems in communicating or expressing themselves in English. Remain in control.

Setting and privacy

Make sure that you have enough space to be able to create a comfortable environment. For patients accompanied by a carer or member of their family, ask them to join you, as they might be able to provide additional information. However, only include them if the patient consents to this (unless of course the patient is of non-consenting age or deemed mentally unable to give consent).

Sometimes your patient may wish to talk in private. In such a situation, make sure that you take the necessary precautions to safeguard yourself; include a member of staff as a chaperon. If this is not possible, then leave the door or curtains of the consultation area partially open. Document everyone present in the notes.

Documentation and handwriting

This should be clear enough for all future use. Many 'alleged assaults' will result in criminal proceedings and you or your seniors may be called upon to write a report many months later. Be careful what you write. Stick to the facts and what the patient tells you. Avoid speculation. Try to note as much detail as you can of what is told to you—this may avoid the patient having to repeat potentially embarrassing information to another colleague. It may help to highlight important information with a different coloured pen or a sticker, i.e. allergies, HIV, hepatitis C status, and sensitive topics (where the patient does not want others to know).

What is written in the notes is accepted as an accurate account of events, anything more is inadmissible unless a chaperon testifies to it. It is difficult to defend oneself in a court of law on the basis of memory and the law may favour the patient in this regard. Legible writing ensures that colleagues who continue the patient's care can read what you have written.

Photography

Photographs can be very helpful, but can be difficult to take in an emergency department. Make sure that the patient has consented in writing to

these if you can. Alternatively, get the consent in retrospect. Nowadays many hospitals are limiting the ability to take photographs so follow your local policies on this.

The presenting complaint

This is best recorded briefly and if possible in the patient's own words. The most common complaint is pain and it is important to be able to differentiate its different origins. This can be difficult in the head and neck. Patients may also present with a whole host of other problems that may or may not be associated with pain. There are of course many other clinical reasons why someone may seek urgent care and the following list gives an idea of the more common ones. These will be covered in more detail in the relevant sections. Some presenting complaints tend to be common in certain age groups, and this becomes more recognizable with experience. However, be warned not to prematurely make a diagnosis without completing the history and examination. It is tempting to do just that and you may miss a rare or unusual condition—these may still be seen in an emergency department.

Some reasons why patients go to an emergency department

Common

- Pain
- Injuries
- Bleeding
- Trismus
- Lumps or swellings
- Rashes and ulcers
- Social-related problems.

Uncommon

- Altered sensation or weakness
- Facial asymmetry
- Stiffness
- Abnormal function (e.g. vision, bite).

History of the presenting complaint

When asking about the presenting symptom, consider the following questions. These are of course just a starting point but will hopefully enable you to identify most problems. Questions can be tailored accordingly and this is discussed in the relevant chapters.

Useful key questions

Pain

- Site of pain—this must be documented with reference to trigger points and/or referred pain. Use a diagram.
- Description of pain—constant, intermittent, dull, aching, throbbing, sharp, burning, or shooting?
- Periodicity—speed of onset, duration, frequency.

- Influences—does anything affect the pain, e.g. movement, heat, or cold?
- Associated symptoms—swelling, dysfunction, numbness or dysaesthesia, pain anywhere else?
- Previous therapies—has anything to date improved the pain?

Assaults/injuries

- Time and place
- Mechanism of injury
- Any loss of consciousness?
- Where did the patient go afterwards (emergency department, home etc.), and how did they get to hospital (walk, ambulance, or other transport)?
- Any other injuries apart from on the head/face?
- Are the police involved? Get consent to speak to them if they arrive later.
- Any previous injuries (the broken nose may be old)?

Bleeding

- How long/often?
- Where from?
- Underlying cause?
- Predisposing history or medication?
- Symptoms of hypovolaemia/shock/anaemia?

Trismus (limitation of mouth opening due to muscle spasm)

- Duration?
- Progression?
- Symptoms of underlying infection or possible tumour?
- Difficulty swallowing?
- Difficulty breathing?

Lumps or swellings

- How long?
- Is it growing?
- Related to mealtimes (salivary obstruction)?
- Is it painful (infected or rapid growth)?
- Any obvious cause/lumps elsewhere?

Rashes and ulcers

- Dermatological history.
- Associated with vesicles/blisters?
- Any ocular/genital/gastrointestinal (GI)/joint symptoms?
- Drug history.

Altered sensation or weakness
- Where (anatomical or diffuse)?
- Any underlying cause?
- Any associated swellings/ulcers (possible tumours)?
- Any other neurological symptoms?

Facial asymmetry
- Localized or generalized?
- Painful/painless?
- Is it static/progressive/speed of swelling?

Stiffness
- Which joint?
- Any preceding cause?
- When is it most stiff (in the morning/evening)?
- Does movement improve the stiffness ('rusty gate')?
- Are other joints affected?
- Is there associated swelling or pain?
- Any neurological symptoms (especially with neck stiffness)?
- Any symptoms to suggest a connective tissue disease?
- Any family history?

Abnormal bite

(See ➔ Chapter 12.)
- When did it change?
- Is it painful?

Infections
- How long?
- Any obvious cause (toothache/viral/injury etc.)?
- Is it getting worse?
- Any signs of systemic upset?
- Has the patient been taking antibiotics?

Other useful information

Systems review

Document the patient's general health. This is important in order to assess the fitness of the patient should surgery be required and to decide on the type of anaesthesia required. It may also modify treatment. There is no real indication to listen to the chest of a medically fit and healthy 18-year-old who complains of pain from a wisdom tooth.

Past medical history, medication, and allergies

Any medication currently in use must be recorded, as well as allergies to medication and any other substances. This will help reduce the risks of a prescription error being made. Anticoagulants are of relevance following

trauma. Knowledge of chronic steroid use is important when dealing with infections. If there is an allergy, is it a true allergy? Or is it drug intolerance (e.g. diarrhoea with penicillin)?

Social history

Occupation, family situation, living conditions, smoking, alcohol consumption, employment, and hobbies. Do they require care? Ask 'On a good day, what is the most active thing you could do?'.

Religious beliefs

Ask about these in certain circumstances. Jehovah's witnesses, for instance, will not accept blood transfusions. This is a potential minefield medico-legally, especially in the unconscious patient (where relatives have been known to be wrong about the patient's beliefs). Seek help in these cases, and preferably find out local protocols before the situation arises.

Remember the possibility of anatomical variations and age-related changes (especially when examining radiographs).

The significance of the past medical, social, and drug history in assessing emergencies and admissions

In all patients requiring admission, or an anaesthetic, a full medical, social, and drug history will eventually be taken. However, when dealing with an emergency this may not be possible in the early stages. This is seen in the management of the seriously injured patient, discussed in Chapter 2. In all sick patients it is essential to rapidly identify those factors which may have an immediate impact on either establishing the diagnosis or managing the clinical problem. These include the following:

Age

Although not a medical condition, the elderly have a decreased physiological reserve and need close monitoring. This is particularly the case following blood loss where prompt fluid replacement is necessary. Care is required not to overload their cardiovascular system. Elderly patients are often taking a variety of medications, each with the potential for problems from withholding, or from drug interactions. Children are also at risk of fluid overload and hyponatraemia. Fluids must be administered with caution (see http://learning.bmj.com/learning/home.html).

Pregnancy

Ask about this in all women of childbearing age. In trauma, the best treatment for the fetus is to treat the mother first. Get the obstetricians involved early. In other emergencies, pregnancy may influence the choice of local anaesthesia and medications. Certain drugs are potentially teratogenic, and affect fetal maturation (closure of ductus arteriosus) or the onset of delivery. If in doubt, refer to medication information sheets or

a drug reference book such as the *British National Formulary*. In reality, radiographs (and computed tomography (CT)) of the face carry very little risk to the fetus, but by and large, most units will restrict or minimize these to those regarded as essential.

Ischaemic heart disease

This increases the risks of general anaesthesia and local anaesthesia containing adrenaline (epinephrine). Cardiac pain can occasionally present as discomfort in the neck or mandible or as 'toothache'. It should therefore be considered in the diagnosis. Pain on exertion, relieved by rest or glyceryl trinitrate, is highly suggestive. Nicorandil, a vasodilator prescribed for angina, can cause major solitary ulceration of the oral cavity (and the anus and penis). These ulcers can be confused with malignancy. They typically resolve completely on cessation of the medication within a few weeks.

Hypertension

This increases the risks of general anaesthesia and local anaesthesia. Hypertensive 'crises' (where the blood pressure (BP) is extremely high) can present with headaches and drowsiness.

Rheumatic fever, artificial valves, and endocarditis

Not all abscesses need antibiotics if they are adequately drained (e.g. dental abscess, boils). However, patients with a history of rheumatic fever, prosthetic heart valves, or previous endocarditis are at risk from bacteraemia. In these cases it is important to liaise with the cardiologist and microbiologist. These patients may require a specific antibiotic that covers organisms that cause infective endocarditis (see 'Prophylaxis against infective endocarditis', http://www.nice.org.uk/CG064).

Chronic obstructive pulmonary disease

Do not give oxygen over 28%. The exception to this rule is in the multiply injured patient with life-threatening injuries (see British Thoracic Society guidelines on emergency oxygen, https://www.brit-thoracic.org.uk/guidelines-and-quality-standards/emergency-oxygen-use-in-adult-patients-guideline).

Patients with Chronic obstructive pulmonary disease (COPD) should receive targeted oxygen therapy with the aim of maintaining targeted oxygen saturations. Hypoxia can kill rapidly and is more of a threat than the slower development of hypercapnia. The use of oxygen in respiratory failure is therefore not contraindicated. The vital aspect is that ***therapy is adjusted after arterial blood gas (ABG) results are available. Current guidelines suggest these patients are given high priority and that they are not just put on oxygen and then walked away from.***

Asthma

Avoid aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) if possible. However, not all patients are sensitive to NSAIDs and they are not absolutely contraindicated—they just need to be used with care and the patient reassessed or warned about possible worsening of their asthma. Asthmatics may be taking inhaled steroids which predispose

to thrush etc. Rarely, they are taking oral steroids. Get an idea of their asthma control (previous intensive care unit (ICU) admissions, recurrent exacerbations, frequent courses of oral steroids, etc.).

Diabetes

Consider hypoglycaemia in all confused, drowsy, or aggressive head-injured (and non-head-injured) patients, even if they appear to be intoxicated. Patients with diabetes are also at risk of infections, which can spread rapidly (notably dental). Occasionally a severe infection may be the presenting feature of diabetes. All patients with facial abscesses should be screened for this.

Hepatitis

Risks of cross infection. Check liver function tests (LFTs) and clotting.

Epilepsy

Fitting can occur after head injuries, especially in children. It also makes assessment difficult. Status epilepticus aggravates secondary brain injuries (as a result of fluctuations in BP and hypoxia). Intubation, ventilation, and transfer to ICU/intensive therapy unit (ITU) may be required.

Blood dyscrasias

Clotting disorders (haemophilia, platelet disorders, etc.) predispose to the same problems as anticoagulants. Leukaemic patients are also at risk of severe infections. Sickle cell disease requires care with general anaesthesia. It can present acutely with severe pain in the mandible.

Previous injuries

Old facial fractures (e.g. nose, zygoma, or mandible) may make it difficult to decide whether a new injury is a new fracture or just bruising. Acute chest injuries preclude the use of Entonox®, which is particularly helpful in reducing dislocations of the mandibular condyle.

Tetanus status

This is relevant to all lacerations, bites, abrasions, and other penetrating wounds. Wounds can be classified as tetanus prone or non-tetanus prone and depending on the patient's immunization status, a booster, course, or immunoglobulin may be required (see http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Tetanus/Guidelines).

Drug interactions

Commonly prescribed drugs in the emergency department include opiates, antibiotics, NSAIDs, and sedatives. Each has the potential to interact with commonly prescribed medication that the patient may already be taking. Remember herbal medicines as well (e.g. St John's wort)—they can also interact.

Anticoagulants (e.g. warfarin and aspirin)

Reduced clotting may have an impact following trauma in several ways. Head injuries are at an increased risk of intracranial bleeding and may require admission for observation. Similarly, retrobulbar haemorrhage, and bleeding into easily distensible tissues (floor of mouth, upper airway,

and eye), are more likely to occur following trauma to these sites. Panfacial injuries may even require airway protection. Some authorities recommend avoidance of nerve blocks. Bleeding into large body cavities (chest, abdomen, pelvis) around fractures (limbs, retroperitoneum) and externally can rapidly result in haemorrhagic shock. Check clotting and if necessary reverse the anticoagulant. Discuss with haematology.

More recently, new oral anticoagulants (such as apixaban, dabigatran, and rivaroxaban) have become available. These also carry risks of haemorrhage but with these drugs there is no specific reversal agent available (see http://www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/CON322347).

Steroids/bisphosphonates

Patients on long-term steroids may require extra steroid cover during infection, trauma, or other periods of stress to prevent adrenal insufficiency. Usually a doubling of their normal dose or conversion to intravenous (IV) is sufficient to ensure reliable administration. Never abruptly stop long-term steroids. The *British National Formulary* has a handy section on this including dose reduction in chronic use. Chronic steroid use also predisposes the patient to the risks of infection, poor wound healing, osteoporosis, and a diabetic potential, each with their own attendant problems. Bisphosphonates may have been prescribed to reduce osteoporosis in the elderly and in patients with metastatic bone disease. These can affect bone healing in the mandible following fracture or dental extractions.

Alcohol intake

Acute alcohol intoxication can result in agitation and unconsciousness, with loss of protective airway reflexes and vomiting. In the head-injured patient, this always makes assessment difficult. Never assume that the drowsy state is simply due to too much 'booze'. Chronic alcoholics are often malnourished and self-neglected and at an increased risk of infection. If it is anticipated that the patient will not be able to drink alcohol for some time, get help in setting up an appropriate withdrawal protocol. They should be given high-potency vitamins B and C, such as Pabrinex®, and require close observation for withdrawal symptoms (see http://publications.nice.org.uk/alcohol-use-disorders-diagnosis-and-clinical-management-of-alcohol-related-physical-complications-cg100; http://www.nice.org.uk/nicemedia/live/12995/49004/49004.pdf).

Home circumstances

One of the criteria for discharge of head-injured patients is appropriate home support. This involves regular observations for at least 24 hours by a responsible adult who can either bring the patient back to casualty or phone for an ambulance if required. If the patient lives in a remote area, it might be better to consider overnight observation.

Allergies

Notably with antibiotics used to treat facial infections.

Family/occupational history

This may sometimes indicate potential risks from anaesthesia and patients should be asked about a history of malignant hyperpyrexia, porphyria, and, if of non-European decent, sickle cell disease.

People in certain occupations may be exposed to hazards that can produce respiratory disease. These include cancers (e.g. asbestos workers), infections (e.g. bird breeders), asthma (e.g. painters), pneumoconiosis (e.g. coal miners), and allergic alveolitis (e.g. farmers). Travel abroad can occasionally result in exotic infections and cervical lymphadenopathy.

Rapid assessment of patients requiring emergency/urgent surgery

Consider the impact of the following in planning management

- Age
- Smoking
- Alcohol abuse
- Ischaemic heart disease
- Respiratory disease (e.g. COPD and asthma)
- Diabetes
- Malnutrition
- Blood disorders (haemophilia, sickle cell anaemia)
- Head/facial injury
- Cervical spine injury.

Management considerations

The initial care of a patient can be considered under several headings. These are applicable to varying extents, but a useful checklist is:

- Treating coexisting medical conditions
- Fluid balance and nutritional support (patient may already be in deficit)
- Deep vein thrombosis (DVT) prophylaxis
- Antibiotic cover
- Steroid cover
- Effective pain relief
- Stress ulcer prophylaxis
- Early involvement of specialists, including physiotherapists and social services.

Whereas patients undergoing elective surgery can be pre-assessed in good time, those requiring emergency surgery cannot and may only be rendered as fit as possible within the time allowed, depending on the degree of urgency. Relatively few emergencies in the head and neck require immediate intervention (such as airway obstruction, extradural haematoma, and retrobulbar haemorrhage) and most can be delayed by at least a few hours, so that the patient's general health can be improved if possible. In selected cases, some patients may benefit from a brief period of intensive management on a high dependency unit (HDU) or ICU. In all cases, early input from an anaesthetist is essential, particularly in those patients with conditions affecting the airway.

Getting patients ready for urgent surgery: medical considerations

Cardiorespiratory assessment

Risk factors for cardiac disease include:

- Smoking
- Diabetes
- Hyperlipidaemia and obesity
- Hypertension
- Male sex
- Family history of cardiac disease.

Thorough assessment of the cardiovascular and respiratory systems is particularly important in patients undergoing surgery. Ischaemic heart disease (myocardial infarction, heart failure, angina), hypertension, asthma, COPD, chest injuries, and chest infections all significantly increase the risks of anaesthesia. Myocardial infarction within the preceding 6 months is a recognized major risk factor in anaesthesia and surgery. There is a 20–50% risk of a further infarction and perioperative death. Patients with a history of ischaemic heart disease should have an up-to-date electrocardiogram (ECG) preoperatively. Patients with a past history of rheumatic fever are predisposed to valvular heart disease, which can lead to heart failure or infective endocarditis. Intraoral procedures, especially those involving the teeth (e.g. removal), are well-recognized risk factors in the development of endocarditis and some patients may require antibiotic cover, depending on the surgical procedure (although not every patient does). Similarly, some types of congenital heart disease and patients with artificial heart valves may require appropriate antibiotic cover.

Chronic obstructive airways disease/tuberculosis

This predisposes to postoperative chest infections and hypoxia. Preoperative measures to reduce postoperative chest infection include:

- Being aware of high-risk patients
- Forbidding smoking for at least a few days before surgery
- Nebulized beta agonists and steroids preoperatively
- Physiotherapy
- Using high dependency or intensive care beds for patients who are particularly at high risk.

Tuberculosis is still seen even in developed countries especially among the homeless and in deprived inner city areas where poverty and overcrowding contribute to its incidence.

Asthma

Lung function in asthmatics can be improved with nebulized beta agonists and steroids preoperatively. Avoid aspirin and other NSAIDs.

Diabetes

Surgical risks in diabetic patients

- Acute hypoglycaemia
- Ketoacidosis
- Ischaemic heart disease
- Hypertension (renal disease)
- Increased risk of infections (chest, urinary, wound)
- Predisposed to pressure sores (spinal injured patients).

Postoperative complications and mortality are more common in diabetic patients. This is partly due to controllable factors such as blood glucose, but also due to established complications such as ischaemic heart disease and infection, both of which are more common in these patients.

The problems with diabetic patients undergoing major surgery are related to the period of starvation (nil by mouth (NBM)) and the metabolic effects secondary to the surgery itself. The main source of nutrition to the brain is glucose, yet persistently high blood sugar predisposes to infections, poor wound healing, and ketoacidosis. The aim of management is therefore to minimize gross variations in blood sugar by ensuring an adequate glucose, calorie, and insulin intake. Blood glucose needs to be within normal limits preoperatively and maintained until normal feeding is resumed following surgery. For many patients, normal feeding may be delayed by many days, especially following major procedures in the head and neck. Preoperative blood glucose control can be determined by urinalysis or preferably, a random blood sugar. Blood urea and electrolyte (U&E) concentrations, creatinine, and estimated glomerular filtration rate should also be checked to exclude renal disease.

Preoperatively determine:

- The type of diabetes
- The adequacy of blood glucose control
- The treatment regimen (diet, oral hypoglycaemic agent, or insulin)
- The presence of any organ impairment (e.g. cardiovascular, renal)
- The likely delay in resumption of oral feeding.

Many regimens exist for stabilizing diabetic patients in the preoperative period.

General principles in diabetic management

- Get expert help—liaise early with the anaesthetist or diabetic specialist.
- Establish good control of blood sugar before surgery if possible.
- Avoid long-acting insulin preparations or oral hypoglycaemic agents 12–24 hours preoperatively, to prevent hypoglycaemia.
- Regularly monitor blood sugar.
- Fast from midnight (if on morning theatre list).
- Place patient first on the list.
- Control blood sugar on the day of surgery using IV short-acting insulin and IV dextrose (many regimens exist).
- Check potassium and supplement if necessary.
- Postoperatively, continue sliding scale until an adequate oral diet is re-established and then restart normal regimen.

All type 1 and type 2 diabetics on insulin should never be left without insulin. They may develop ketoacidosis. Do not withhold insulin because the patient is fasting. Seek advice.

In acute cases, blood glucose may be grossly abnormal secondary to infection, trauma, or reduced oral intake. Patients are often hyperglycaemic, which can lead to diuresis, dehydration, and ketoacidosis. These patients require IV rehydration, correction of sodium depletion (beware of pseudohyponatraemia), potassium supplementation, and infusion of short-acting soluble insulin. Regular monitoring of blood glucose, sodium, potassium, and acid–base balance is essential. The CO_2 reported with U&E results give an indicator of the acid–base balance. Check ABGs. When rehydration is underway and some correction of acidosis and hyperglycaemia has been achieved, urgent surgery may then be performed while continuing management during and after surgery.

Sliding scales

These involve the continuous infusion (sometimes subcutaneously) of a short-acting insulin, using a syringe pump. The rate of infusion varies according to the patient's blood glucose which is checked regularly (e.g. hourly, depending on its stability). The higher the blood glucose, the more insulin is given. In this way hyperglycaemia can be controlled without risking profound hypoglycaemia. Sliding scales should be reviewed constantly and adjusted to achieve a relatively steady infusion rate. The aim is to establish a steady blood glucose rather than constantly oscillating below low and high infusion rates. Ketoacidosis guidelines include those from the Joint British Diabetes Societies Inpatient Care Group: http://www.diabetes.org.uk/Documents/About%20Us/What%20we%20say/Management-of-DKA-241013.pdf.

Bleeding disorders and anticoagulants

The undiagnosed presence of blood dyscrasias and other causes of delayed clotting should be considered whenever there is prolonged bleeding following apparent minor injury or minor surgery. The commoner problems include haemophilia A, haemophilia B, von Willebrand disease, liver disease, and patients on anticoagulants. Patients with known or suspected bleeding problems need to be fully assessed by an appropriate specialist. With appropriate prophylactic measures (e.g. local measures, tranexamic acid, DDAVP, factor replacement, or adjustment/reversal of warfarin), urgent surgery can usually be safely performed. Opinions vary considerably as to what is an 'acceptable' international normalized ratio (INR) for surgery, although this depends on the site (superficial vs deep, or within a cavity).

Stopping warfarin: a guide (refer to your local policy)

Patients undergoing low-bleeding-risk procedures (dental extractions, minor skin procedures) do not require alteration of their anticoagulation regimen. In these patients, the procedure can be performed at the therapeutic range. Patients undergoing high-bleeding-risk procedures (e.g. abdominal surgery, intracranial or spinal surgery) require discontinuation of warfarin preoperatively. If the patient has a metallic heart valve, this should be discussed with their cardiologist. A metallic mitral valve is at higher risk of thrombosis.

After stopping warfarin it takes approximately 2–3 days for the INR to fall below 2, and 4–6 days for the INR to normalize. When the INR is 1.5 or below, most surgery can be performed with relative safety. Patients with the following risk factors may require bridging anticoagulation with either unfractionated or low-molecular-weight (LMW) heparin:

- Prior stroke or systemic embolic event
- Mechanical mitral valve
- Mechanical aortic valve and additional stroke factors
- Atrial fibrillation and multiple stroke risk factors
- Previous thromboembolism during interruption of warfarin therapy.

Bridging anticoagulation with unfractionated heparin may be stopped 4–5 hours before surgery. If LMW heparin has been used, it should be stopped 24 hours before surgery. In some patients, heparin may not be restarted postoperatively until at least 24 hours after major surgery and delayed longer if there is evidence of bleeding. Seek advice on this. Patients at low risk for thrombosis can stop warfarin 5 days preoperatively without the need for bridging anticoagulation. Use other measures (such as antiembolism stockings). Once haemostasis has been achieved, warfarin can be resumed 12–24 hours after surgery.

Stopping dabigatran: a guide (refer to your local policy)

Dabigatran is a thrombin inhibitor approved for use in stroke prevention, atrial fibrillation, and DVT prevention after hip and knee replacement surgery.

Patients with a creatinine clearance >50 mL/minute should stop dabigatran 1–2 days prior to the surgical procedure. If creatinine clearance is <50 mL/minute then stop dabigatran 3–5 days before the procedure. A longer period of time may be required in patients undergoing major surgery. It has been recommended that a normal or near normal activated partial thromboplastin time be documented to ensure that dabigatran has been adequately cleared from the circulation prior to surgery.

In patients undergoing high-bleeding-risk surgery, it is recommended to restart dabigatran 2–3 days post procedure. The rapid offset and onset of dabigatran activity obviates the need for bridging anticoagulation with heparin.

Stopping rivaroxaban and apixaban: a guide (refer to your local policy)

Rivaroxaban and apixaban are direct factor Xa inhibitors. They have a similar onset of action and half-life as dabigatran but are less dependent on renal clearance. The same perioperative management for dabigatran should be used with these anticoagulants.

Deep vein thrombosis

DVT is generally uncommon following head and neck problems or their management. However, it is a potentially life-threatening condition (due to the risk of pulmonary embolism (PE)) and is preventable. Diagnosis is often difficult and it has been estimated that around half of patients with extensive thrombosis have no clinical findings. Such 'silent' thrombi are a particular risk where the condition may remain unrecognized until fatal

PE has occurred. It is therefore important that patients are assessed for risk factors and appropriate preventive measures taken.

Risk factors for DVT

- Previous history of DVT or PE
- Age
- Obesity
- Extensive trauma
- Congestive heart failure
- Malignancy
- Diabetes
- Length and type of operation
- Prolonged immobilization
- Oral contraceptives
- Smoking
- Sex
- Type of anaesthetic
- Pregnancy and the puerperium
- Varicose veins
- Drugs.

DVT prophylaxis

Currently, prevention is directed towards elimination of stasis in the veins, or reducing the tendency to clot in the patient. Measures include

- Full-length antiembolism stockings
- Intermittent pneumatic calf compression
- Low-voltage electrical calf stimulation
- Early mobilization
- Heparin/LMW dextrans, warfarin.

Heparin is currently available as 'fractionated heparin' and 'LMW' which are reported to be more effective but are more expensive. Low-dose subcutaneous heparin significantly reduces the incidence of DVT. LMW heparins may be given once daily, which is more convenient for staff and the patient.

More recently, new oral anticoagulants (such as apixaban, dabigatran, and rivaroxaban) have become available. These also carry risks of haemorrhage but with these drugs there is no specific reversal agent available (see http://www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/CON322347).

Steroids in surgery: 'steroid cover'

Patients on long-term or high-dose steroids for whatever reason (asthma, rheumatoid arthritis, inflammatory bowel disease), are at risk of adrenocortical suppression. Following surgery, trauma, and infections, they are unable to mount a normal 'stress response' which can lead to metabolic disturbances and occasionally, collapse. Steroid supplementation may be required in the perioperative period commencing on induction of anaesthesia and continued postoperatively with a reducing dose.

For an 'average' NBM patient, one regimen might be (protocols vary depending on patient and procedure):

- Major surgery: hydrocortisone 100mg intramuscularly (IM) or IV with the premedication and then four times daily for 3 days after which return to previous medication.
- Minor surgery: prepare as for major surgery, except that hydrocortisone is given for 24 hours only.

Stress ulceration

This occurs in patients after prolonged physiological stresses and is classically seen following extensive burns, major trauma, and multiorgan failure. Patients undergoing surgery for head and neck cancer may similarly be 'stressed' postoperatively, particularly if their recovery is complicated. GI ulceration can result in fatal haemorrhage and in such patients prophylaxis is necessary. Current measures include H2 receptor blockade, proton pump inhibitors, sucralfate, and other drugs.

The elderly patient: some specific problems

Urgent preparation of elderly patients can be particularly challenging. Although the principles of assessment in the elderly are no different than in the younger population, some specific points are worth highlighting:

- Chronological age per se is no indication of relative risk and careful assessment is still necessary. Contrary to general belief, most old people are fit. A better indication is the 'biological age', i.e. how old the patient looks.
- Hypertension, ischaemic heart disease, and congestive cardiac failure are all common in the elderly and often undiagnosed.
- Several diseases or problems may coexist.
- Elderly patients are often taking one or more different drugs. These should generally be continued throughout the perioperative period. The potential for drug interactions must always be considered.
- Patients may have impaired metabolism and excretion of drugs.
- One problem (e.g. poor mobility) may have several causes, each requiring attention.
- Complications are relatively common and may present non-specifically, with absence of typical symptoms (e.g. myocardial infarction without chest pain or a urinary tract infection (UTI) without dysuria). Rapid deterioration can occur if these are not recognized and treated.
- Incontinence, instability, immobility, hypothermia, and confusion are common problems in the elderly. However they may be early symptoms of underlying treatable disease (e.g. UTI).
- More time is required for recovery.
- Many elderly people live alone. Early involvement of social services may prevent delayed discharge in patients who go on to become 'social' admissions.

For major surgery, routine preoperative full blood count (FBC), biochemistry, blood gases, and chest X-ray (CXR), are useful as a baseline against which postoperative investigations can be compared. This is essential in patients with longstanding medical problems and associated biochemical abnormalities. A preoperative CXR and ECG are mandatory in all elderly patients, as asymptomatic respiratory or heart disease may be detected.

Physical examination of the head and neck needs to be tailored according to the individual requirement of the patient.

Examination of the head and neck: an overview

In order to recognize the abnormal, you must first be able to recognize what is 'normal'. Practise your examination techniques until you are comfortable with them, this way you will be slick and minimize your chances of missing something. Further details for each anatomical site are given in the appropriate chapters.

If at all possible, document clinical findings (notably injuries) photographically. Not only is this useful from a medico-legal perspective, but wounds etc. can then be dressed and repeated examinations avoided. If photography is unavailable, use diagrams.

Extraoral examination

- Inspection. Standing at a distance from the patient, take a general look at the head and neck. Note any asymmetry, lumps, trauma, discolouration, and muscular neuronal deficit. Remember that hair (and even a hat) can sometime hide problems.
- Function. Check eye movements (blowout fractures), vision (ocular trauma), cranial nerves, swallowing, hearing, and jaw movements where appropriate. Remember the Glasgow Coma Scale (GCS), pupils, and cranial nerves (especially II, V, and VII).
- Palpation of the head and face. Depending on the presenting complaint, a thorough palpation of any visual findings is performed. This includes all surfaces that form the head and neck:
  - Scalp
  - Forehead
  - Supraorbital ridges
  - Zygomaticofrontal sutures (lateral orbital margins)
  - Infraorbital ridges
  - Nasal bridge
  - Maxilla
  - Zygomatic body and arch
  - Temporomandibular joints
  - Mandibular ramus, body, and lower border
  - Mandibular range of movement, i.e. opening and lateral excursions
  - Surface of the neck down to the clavicle, cervical spine, and occiput.
  - Feel for tenderness, fluctuation, steps in bony continuity, and enlarged lymph nodes or swellings in the neck.

- Auscultation and auroscopy. Can be considered for vascularized lumps (e.g. haemangioma, arteriovenous malformation, enlarged thyroid) or following trauma to the neck (surgical emphysema/carotid bruit).

Intraoral examination

- Tongue. Look for any signs of neural weakness, i.e. slurred speech, tingling, or difficulty in swallowing. Trauma, i.e. lacerations or haemorrhage. Change in colour, texture, or size can be due to tumour, fungal infections, anaemia, folate, vitamin B12 deficiency, or acute cyanosis. The condition of the mucosa forming the floor of mouth under the tongue is noted. If this is enlarged it can raise the tongue. This may indicate spread of infection with a potential airway problem, or a sublingual haematoma following mandibular trauma.
- Occlusion (the bite). Note whether this is deranged before asking the patient to open the mouth. If not sure, then ask the patient to close the teeth together and retract the cheeks to see if there is even and balanced contact at the back and front on either side. Ask the patient if the 'bite' feels normal. Be mindful of artificial teeth that can alter the occlusion without underlying bony trauma. There are also natural variations in different bites related to the relative sizes of the jaws.
- Gingival (gums)/oral mucosa overlying the alveolar bone, hard palate, cheeks (buccal mucosa), and soft palate. No intraoral examination is complete without looking at the back of the throat or tonsillar area. The presence of a swelling or discolouration needs to be further examined for size, tenderness, sinus tract, and whether it is associated with a tooth.
- Teeth. Those present in both the upper and lower alveolar ridges are noted. These are 'charted' by assigning numbers to those present in each arch in relation to their position. Following loss of a tooth, its neighbours will drift a little over several years. The more teeth that are lost, the more this occurs. This can make identification difficult.
- Salivary flow. The three paired parotid, submandibular, and sublingual salivary glands secrete into the oral cavity. Parotid glands discharge adjacent to the upper molar teeth through a papilla on the buccal mucosa. Submandibular and sublingual glands discharge though a papilla on either side in the floor of mouth near the lingual frenum. Ductal patency and gland function can be assessed by 'milking' or massaging the glands.
- Palpation. This is just as important inside the mouth as it is on the face. Feel for induration, lumps, swelling, loose teeth, and fracture crepitus.

How the teeth are arranged

For permanent teeth, see Table 1.1 and Figure 1.1. For deciduous teeth, see Table 1.2. Mixed dentition can be any combination of Table 1.1 and Table 1.2.

Table 1.1 Permanent ('adult') teeth

Right	Left
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

1 + 2 = incisors
3 = canine
4 + 5 = premolars
6 + 7 + 8 = molars

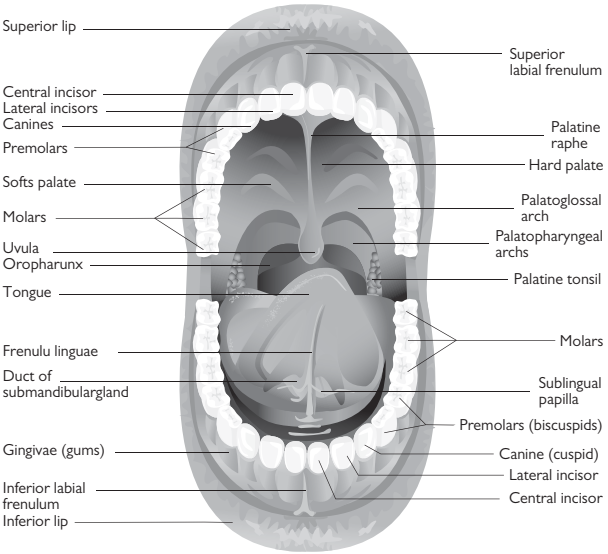

Figure 1.1 Adult dentition. © stockshopp/123RF.

Table 1.2 Deciduous ('baby') teeth

Right	Left
edcba	abcde
edcba	abcde

a + b = incisors
c = canine
d + e = molars

Chapter 2

The injured patient

Initial assessment of the multiply injured patient with facial injuries

Some general points

Injuries to the head, face, and neck in the multiply injured patient need to be prioritized. Injuries resulting in airway compromise, significant and ongoing bleeding, and possible loss of vision are a high priority. But they are uncommon. When multiple coexisting injuries are present, it is important not to be distracted by the obvious facial injuries. A systematic approach beginning with the rapid assessment and management of all life-threatening injuries is required. This is followed by a head-to-toe secondary evaluation and investigations. This will provide information on the full extent of all injuries and help establish priorities. Once airway compromise, significant bleeding, and possible loss of vision have been addressed, all other facial injuries can wait for at least a short while, during which time the entire patient can be assessed. The initial priority is to treat any immediate life-threatening conditions first. The most widely adopted approach is that developed by the American College of Surgeons and known as Advanced Trauma Life Support® or ATLS®. It consists of an initial ***rapid primary survey*** to identify and treat immediately life-threatening conditions (the ABCDE approach). Once the patient is stable, a more detailed head-to-toe examination (***secondary survey***) can be performed.

Head and neck injuries resulting in life-threatening conditions

- Facial injuries resulting in airway compromise (e.g. panfacial fractures with gross displacement, mobility or swelling, comminuted #s of the mandible, gunshot, foreign bodies, burns).
- Anterior neck injuries resulting in airway compromise (e.g. penetrating injuries, circumferential burns, laryngeal/tracheal injuries) or injuries to the carotid arteries.
- Injuries resulting in profuse blood loss (e.g. penetrating neck, panfacial fractures—rarely).
- Head injuries resulting in intracranial swelling or bleeding.
- Cervical spine injuries with spinal cord injury (hypoventilation, hypotension and other late complications).

Once immediately life-threatening conditions are excluded/managed, specific imaging is undertaken (often a CXR, lateral C-spine and pelvic X-ray CT is now increasingly used to evaluate many injuries). The patient is then reassessed. Only when they are stable can the secondary survey be carried out. This is when attention can be focused on the majority of facial injuries.

The (rapid) primary survey

The initial goal in trauma management is to get adequate oxygen into the blood and then circulate this, notably to the brain. To achieve this, patients need:

- Oxygen.
- A patent airway so that oxygen in the air can get to the lungs.
- Adequate lung ventilation so oxygen can pass into the blood.
- An adequate volume of oxygenated blood to circulate to the vital organs.
- The ability to use oxygen at a cellular level (cf. cyanide poisoning).
- The absence of any intracranial pathology that would irreversibly damage the brain.

These issues are addressed during the primary survey. This is undertaken quickly. The sequence in which the primary survey proceeds is related to those conditions that would lead to loss of life quickest:

- Airway patency (while protecting the cervical spine to prevent neurological damage).
- Breathing (all trauma patients should be given 100% oxygen). They may also need to be ventilated.
- Circulation with control of haemorrhage.
- Disability (brain function).

This sequence ends with 'E'—for Exposure. This must be completed so a full examination front and back can be undertaken. After this, the patient needs to be covered to prevent hypothermia.

The primary survey is preferably performed by a team approach where different team members do the above-listed sequence simultaneously. In such cases, a 'team leader' ensures that each step has been performed. If team numbers are not sufficient for this, an ABCDE sequence is followed. It is also vital to enlist the early help of any speciality not on the receiving team if a problem or is identified (e.g. neurosurgery/maxillofacial surgery).

If a patient is clearly losing a lot of blood from a wound, apply immediate pressure then proceed with the primary survey. This is acceptable practice with massive external haemorrhage, rather than waiting until 'C' in primary survey. The acronym MARCH is sometimes used to describe this: Massive Haemorrhage, Airway, Respiration, Circulation, Hypothermia.

Taking a history in the multiply injured patient

The traditional approach of taking a full history from the patient prior to examination has no place in the preliminary assessment of the multiply injured patient. Instead an 'AMPLE' history is taken at this early stage. If a history of the event cannot be obtained from the patient, prehospital personnel or family members should be consulted regarding the events leading up to the injury. A medical history obtained either from the patient, general practitioner, or hospital notes may help.

History taking in major trauma: the 'AMPLE' history

Certain information may be helpful to understand what injuries may be present, or the effects of any potential treatment. This can be remembered by taking an 'AMPLE' history:

- A: enquire about any allergies related to medications.
- M: any medication that the patient is taking may alert us to potential problems following trauma (e.g. anticoagulants). They may also give us a clue about pre-existing medical problems (e.g. cardiovascular medication). Some medications may alter the response to trauma and need to be taken (e.g. patients taking beta-blockers who are shocked may not exhibit the expected degree of tachycardia). Steroids also affect management. Remember herbal remedies—these can also interact with prescribed drugs.
- P: a brief past medical history (PMH) and pregnancy. MedicAlert® bracelets might provide clues. Some conditions may influence management or alert us to other possible problems (e.g. the patient with known cardiovascular disease may have had a myocardial infarct before the car crashed). Age and reduced physiological reserve may necessitate careful fluid resuscitation.
- L: when the patient last ate (anaesthetic risk of aspiration).
- E: events leading to the trauma and the mechanism of injury.

The mechanism of injury

The mechanism of injury may give clues as to what injuries a patient may have. This may be available from the patient, witnesses, or paramedical personnel attending the patient. Ensure a team member records the information before the people who know it leave the department. As much detail as is known should be recorded.

- If the mechanism involves a single blow, the risk of injuries is localized to some anatomical regions more than others. For example, in the case of a neck stabbing, we need to know how long the blade was, which direction the assault was from (above/below, in front/behind), and whether the blade broke. In this situation, a pelvic, abdominal, and lower limb injury is unlikely, but chest, head, and upper limb trauma are all quite possible. There is also the potential for airway, cervical spine, breathing, and circulatory problems from such a wound.
- Some mechanisms may be more complicated (e.g. a motor vehicle collision (MVC), a fall from a height, or an explosion). In all these cases the details help assess risk. Speed of impact, whether a seat belt was worn, vehicle deformity, and injuries sustained by others (especially any fatalities), are all useful clues following MVCs. If the patient fell, the height and what he/she hit when they landed are clearly important. ***Deceleration injuries are particularly worrying***, due to the risk of tearing at vascular pedicles. With explosions, what

exploded, were chemicals involved, and was fire or smoke present? All these and other information help to raise the possibility of injuries over and above the obvious. These need to be actively looked for and treated.

- In circumstances where the details are vague or incomplete, consider what might have happened in addition to what is known. A patient who has been assaulted but is not sure what happened may have obvious facial injuries, but may also have received 'a good kicking' to the chest or abdomen, resulting in potentially life-threatening injuries. These can easily go unnoticed if not specifically looked for.
- The time from injury to help arriving and transfer to hospital is important and should be ascertained, especially following severe burns. Environmental conditions should also be noted—has the patient being exposed to contamination or extreme temperatures, and if so, for how long?

Thorough documentation of both the event and the patient's medical/social history will act as a guide to arriving at the correct diagnosis, and formulating an appropriate management plan (see Figure 2.1).

Some important mechanisms of injury in the head and neck

- A fall from a height of 10 feet or more carries an increased risk of sustaining spinal, pelvic, and long-bone injuries.
- Blunt trauma to the forehead can result in blindness, even in the absence of fractures.
- A blow directly on the chin can result in the well-known 'guardsman's fracture' pattern, or injury to the brainstem.
- Anterior–posterior directed impacts to the face can result in hyperextension injuries to the cervical spine and spinal cord injury (notably in the elderly).
- Successful airbag deployment can result in ocular injury.
- A high-velocity projectile can penetrate both the eye and the brain.
- Strangulation/hanging type injuries can fracture the hyoid/larynx and avulse the trachea.
- Compressed air/blast injuries can result in massive emphysema in the face, neck, and chest. Pneumothorax can occur.
- Rapid deceleration (such as seen in bungee jumping) has resulted in retinal haemorrhages, whiplash, carotid dissection, and stroke.
- Rapid deceleration (as seen in MVCs) can result in subdural haematoma, diffuse axonal injury, whiplash, detached retina, or traumatic optic neuropathy.

Figure 2.1 MRI showing a cervical cord injury in an elderly patient following hyperextension injury to the neck. The patient tripped and fell forward, striking her face on the ground.

Reproduced from *Atlas of Operative Maxillofacial Trauma Surgery: Primary Repair of Facial Injuries*, 'Initial Considerations: High- vs. Low-Energy Injuries and the Implications of Coexisting Multiple Injuries', 2014, Figure 1.5, eds M. Perry and S. Holmes, Copyright © 2014, Springer-Verlag London. With permission of Springer.

Primary survey: airway

The most important initial step in recognizing a problem with the airway is to talk to the patient. An appropriate verbal response from the patient indicates that the airway is patent and the brain is adequately perfused, although it is no guarantee that it will remain so. ***The most common cause of airway compromise is a reduced level of consciousness.*** Failure of the patient to appropriately respond to simple questioning signifies an altered level of consciousness indicating a risk of airway compromise. Other common causes of airway compromise include a foreign body, swelling, and bleeding.

In any patient with significant facial injuries, the airway needs to be assessed very carefully. ***Even if the patient can talk, this cannot be taken as a guarantee that the airway is free from risk.*** Loose teeth, bleeding, or fractures can all be present and yet the patient may still be able to talk to you. In order to assess the airway properly, the patient must therefore

be able to open their mouth wide enough for you to look inside. This means that any hard collar will need to be unfastened. You will need an assistant to support the head during this time. This is often a source of anxiety when managing injured patients (due to concerns about cervical spine injury), so be sure you know how to do this safely.

Assessing the airway

The usual steps suggested are to

- Look—for use of accessory muscles of ventilation:
  - Agitation of patient suggesting hypoxia
  - In the mouth—active bleeding, loose teeth, dentures, etc.
- Listen—for abnormal sounds:
  - Noisy breathing indicates partial obstruction.
  - Stridor indicates partial obstruction above the laryngeal inlet.
  - Expiratory wheeze indicates lower airway obstruction.
- Feel—airflow at the mouth:
  - Also check the position of trachea (displacement is a sign of tension pneumothorax).

However, when obvious facial injuries are present, assessment needs to be more thorough. Specifically this requires the following:

- Speak to the patient—if they reply in a clear manner then they have an airway that is patent and have the capacity to use it. A hoarse voice may suggest airway injury. Ask them if they feel any blood trickling down the back of their throat.
- Are there gurgling/stridorous noises indicating partial obstruction? This must be cleared immediately. Common causes are blood/saliva or the base of the tongue falling back into the pharynx. Other causes of obstruction may relate to swelling in the neck from bleeding or direct trauma to the airway (larynx/hyoid).
- High-flow suction should be used and if necessary the mandible manipulated forward to lift the tongue base (chin lift/jaw thrust). To do this requires care and assistance to support the head. Otherwise the neck may be extended. The collar may need to be unfastened so you can suction properly—don't just force the suction tube between the lips and hope for the best. Be very careful, this can precipitate vomiting. If the airway re-obstructs then an oropharyngeal, nasopharyngeal, or a definitive airway will be required. If patients require an oro- or nasopharyngeal airway for more than a short while they probably require a definitive airway—get senior help early.
- If the airway is silent it is either completely occluded or the patient is not breathing. In the former, movement of the chest will be apparent and the patient will be in distress. Immediate relief of obstruction is essential. In severe facial/neck trauma this may require a surgical airway, although this is rarely needed.
- The anterior neck. This is often a forgotten site and requires careful examination. It should be regarded as a watershed between 'Airway' and 'Breathing' during the primary survey. Life-threatening problems arising in both can manifest clinical signs here. Fractures of the larynx and hyoid may lead to substantial glottic swelling. A hoarse voice,

haemoptysis, and crepitus in the neck are highly suggestive of these injuries. Carefully palpate the hyoid and larynx. Again, to assess the front of the neck properly the hard collar will need to be unfastened and the head supported.

Loss of the airway is often due to a combination of factors (more commonly alcohol, head injury, bleeding, and being restrained supine). If the patient is not breathing they require mechanical ventilation. This is usually achieved by orotracheal intubation or with a surgical cricothyroidotomy. Nasotracheal intubation is usually contraindicated in midface trauma or head injuries.

Airway risk factors in facial trauma

- Inability to handle normal secretions
- Foreign bodies
- Altered level of consciousness (this may be secondary to alcohol, drugs, or some medical conditions)
- Uncontrolled haemorrhage
- Surgical emphysema
- Adjacent soft tissue injuries/gross swelling
- Burns
- Hyoid/laryngeal/tracheal injury
- Disrupted mid/lower face anatomy
- A tightly fitting collar when the patient has mandibular fractures.
- Laying supine.

Remember that the unresponsive/comatose patient may also require a definitive airway for protection in the event of vomiting. Remember also the risk to the cervical spine. This must be presumed injured and stabilized using a correctly fitting collar, blocks, and tape. If these are not available, get an assistant to stabilize the head manually.

Some difficult airway-related problems in facial trauma

Sudden vomiting in supine patients

Unexpected vomiting is a difficult problem in all immobilized patients and poses an immediate threat to the airway. In all supine patients vomiting can occur at any time, often after the primary survey has been completed. ***Therefore, an experienced nurse escort and suction should be with the patient at all times until they are allowed to sit up***. Early warning signs may include repeated attempts by the patient to try and get up. Restrained supine patients should never be left unattended.

If vomiting occurs in the restrained supine patient, tilting the patient head-down approximately 6–12 inches and clearing the airway using high-flow suction is the safest approach. In the head-down position, vomitus preferentially flows into the oropharynx from the oesophagus reducing the risk of causing obstruction around the laryngeal inlet.

Have an agreed plan of action in the event of unexpected vomiting. When it occurs, there is no time to debate the relative merits of log rolling/sitting up/tilting the table head-down.

Is it safe for the patient to sit up?

See Figure 2.2. A common scenario seen in the emergency department is the intoxicated, aggressive male with apparently isolated facial injuries following an assault or fall. The patient will often sit up with little response to reason. In this situation an unstable cervical spine injury is rare. Allowing the patient to sit up may be the best initial option as it reduces the risk of airway compromise from vomiting or unstable facial fractures. If they will allow you to put a hard collar on them, do so. But never forcibly restrain.

However, in the potentially multiply injured patients with facial injuries a decision needs to be made quickly regarding the relative risks of keeping the patient supine (with potential airway obstruction) against the risks of axially loading a potential spine, torso or pelvic injury, by allowing

Figure 2.2 A patient with significant, but isolated, facial injuries. In this case, allowing the patient to sit up enabled self-protection of the airway. Had the patient been placed supine, his airway would probably have obstructed from the obvious bleeding, mobile midface, and facial swelling.

Reproduced from *Atlas of Operative Maxillofacial Trauma Surgery: Primary Repair of Facial Injuries*, 'Initial Considerations: High- vs. Low-Energy Injuries and the Implications of Coexisting Multiple Injuries', 2014, Figure 1.7, eds M. Perry and S. Holmes, Copyright © 2014, Springer-Verlag London. With permission of Springer Nature.

them to sit up. If the patient is combative despite adequate oxygenation, correction of hypovolaemia, and adequate pain relief, then early intubation and ventilation may be necessary to secure the airway and prevent loading. This reinforces the concept of the mechanism of injury in planning appropriate management for patients.

Beware the patient who keeps trying to sit up—they may be trying to clear their airway.

Clearing the cervical spine

This should take place as soon as possible due to the problems associated with prolonged spinal immobilization. Until then, the cervical spine needs to be protected (manual stabilization or collar, blocks, and tape). See Chapter 4.

Assessment of the front of the neck following trauma

This is often a forgotten site and requires careful examination. It should be regarded as a watershed between 'Airway' and 'Breathing' during the primary survey, as life-threatening problems in both can manifest clinical signs here. Assessment of the airway involves more than just looking into the mouth and nose. Poiseuille's law dictates that even a small change in the diameter of a tube can result in a significant change in flow through it. Although strictly applicable to fluid dynamics, this equation highlights the potential for problems to arise when there is swelling within the larynx and trachea. Although unusual, fractures of the larynx and hyoid do occur and may lead to substantial glottic swelling. Motorcycle helmet wearers, strangulation, and contact sports injuries are important clues from the history. A hoarse voice, haemoptysis, and crepitus in the neck are highly suggestive of these injuries and should be actively sought after. Carefully palpate the hyoid and larynx for signs of injury and look for external swelling which may reflect swelling internally. Useful clinical signs to look for include:

- Tracheal deviation or separation
- Laryngeal tenderness or crepitus
- Hyoid tenderness
- Surgical emphysema
- Distended neck veins
- Open wounds
- Significant swelling.

These may indicate the presence of significant and potentially life-threatening injuries.

Airway problems seen in facial trauma

Obstruction

This may be caused by dentures/loose teeth or severe fractures of the mandible or midface. The commonest causes are bleeding and/or saliva, notably when the patient is intoxicated or supine. Swelling is often an aggravating factor. Saliva and blood should initially be cleared by suction. If the bleeding is coming from an identifiable controllable source it should be stopped. However, it is usually generalized and from multiple sites. Nasal packs may be necessary (remember the possibility of skull base fractures). If bleeding continues, the airway should be protected with a definitive airway.

Displaced tissues

Midface fractures may collapse in on themselves, impinging on the posterior pharyngeal wall and resulting in obstruction. Much of the obstruction is due to the associated swelling in addition to loss of soft palate support, which progresses over several hours. Bilateral anterior ('bucket handle') or comminuted mandibular fractures can similarly displace resulting in loss of tongue support. The base of the tongue can then fall backwards into the pharynx. Swelling is again often associated. ***All these effects are much more likely when patients are supine and there is alteration in their conscious level.*** A definitive airway will therefore probably be required. Seek senior help quickly.

Soft tissue swelling

This inevitably occurs, especially with major injuries, often necessitating prolonged intubation or an elective tracheostomy. However, major swelling can also occur in the absence of any fracture, as occasionally seen in patients taking anticoagulants, or those with clotting abnormalities. Patients with cervical spine fractures may develop posterior pharyngeal swelling contributing to an obstructed airway. Penetrating and blunt (e.g. strangulation/hanging) neck trauma may also be associated with pharyngeal oedema and bleeding. ***It is important to appreciate that swelling from whatever cause can take several hours to develop. Be wary and regularly re-examine the patient.*** Of particular concern are those patients who have suffered facial burns. These are frequently associated with inhalation injuries, which can lead to rapid swelling that is not apparent on initial examination. Stridor is a particularly worrying sign and often necessitates early intubation.

Direct trauma to the airway will probably require placement of a definitive airway.

Initial management of the airway

Control of the airway can be lost easily and may be very difficult to secure following facial trauma and burns. Often early assistance from an experienced anaesthetist is required and should be anticipated well in advance of signs of impending obstruction. Occasionally an immediate surgical airway is required, notably when there is gross swelling in extensive facial injuries. Members of the trauma team should be competent in performing this.

All seriously injured patients should receive oxygen. The patient should be given high-flow oxygen (15 L/min) through a non-rebreathing mask, and the oral cavity/oropharynx carefully cleared with suction while further assessment takes place. The following steps may help. They will probably require the hard collar to be loosened—ask someone to support the head.

Simple techniques to maintain an airway

Chin lift and jaw thrust

These are commonly used techniques to maintain the airway but may be difficult to carry out in the presence of comminuted mandibular fractures. Both of these techniques have been shown to produce movement of the cervical spine and should therefore be performed with counter support from an assistant to the head to prevent this.

Reduction of displaced facial fractures

This may involve gentle manipulation of the midface and its temporary stabilization using bite blocks between the posterior teeth. Bridle wires may be passed to temporarily stabilize mandibular fractures.

High-volume suction

A wide-bore soft plastic sucker should be readily available to clear the mouth, nose, and pharynx of blood and secretions, taking care not to induce vomiting. Loss of the protective gag reflex should prompt consideration of an oropharyngeal airway or intubation.

Adjuncts to simple airway techniques

Oropharyngeal airway

This is often poorly tolerated and can precipitate vomiting and laryngospasm. If not placed correctly it can push the tongue posteriorly, causing airway obstruction.

Nasopharyngeal airway

This is better tolerated than an oropharyngeal airway but is associated with epistaxis. Concerns exist about the potential for intracranial positioning in patients with midface/anterior skull base fractures. In reality the risks are very low, and in experienced hands nasopharyngeal tubes can be safely passed in these patients.

Advanced airway techniques

A definitive airway may be defined as a cuffed tube in the trachea. It may be required if there is any doubt about the patient's ability to protect their own airway immediately or in the near future. In the emergency situation, it is important that the technique used is one with which the clinician is most confident; the trauma setting is not the time to attempt unfamiliar procedures.

Laryngeal mask airway

A laryngeal mask airway (LMA) can facilitate rescue ventilation when mask ventilation and tracheal intubation are unexpectedly difficult. However the airway is not formally protected and aspiration from vomiting can still occur. It is therefore not the first choice of advanced airway.

A guide to initial airway management for the non-airway specialist (i.e. most of us)

- Give high-flow oxygen (15 L/min) via a non-rebreathing mask.
- Get senior help.
- Consider jaw thrust with counter support of the head.
- Consider an oropharyngeal airway if the patient is unconscious and obstructing (GCS score <8). Do not use a nasopharyngeal tube.
- If the airway is patent but there is no spontaneous ventilation then manually ventilate with a self-inflating bag and mask. Call for urgent anaesthetic assistance.
- If the patient is unconscious, you are on your own, and you cannot ventilate with a face mask then insert a LMA. If the mask leaks, add more air into the cuff, up to a maximum of 30 mL.
- If experienced, consider orotracheal intubation. Be careful, however, not to extend the head.
- If you are unable to intubate and cannot ventilate the patient, then suction the mouth with a large-bore Yankauer sucker and perform a surgical cricothyroidotomy.

Tracheal intubation

Orotracheal intubation with in-line cervical immobilization is usually the technique of choice in the majority of cases. A cuffed tube in the trachea provides a definitive, protected airway. However, placement can be challenging in patients with facial trauma. Difficulties can result in aspiration, hypoxaemia, hypercarbia, and hypertension, all of which may significantly worsen any coexisting cerebral injury. In the absence of midface or craniofacial fractures, alternative techniques include fibreoptic-assisted oro- and nasotracheal intubation. These specialized techniques have been shown to be associated with less manipulation of the injured cervical spine. However, they require extensive training. The use of fibreoptic assistance is usually limited as the view is often obscured by blood.

Surgical airway

This is required when it is not possible to secure the airway by any other means within a safe period of time.

Needle cricothyroidotomy

This is rarely required as it is better to place a surgical cricothyroidotomy directly. However, in some circumstances it allows you to 'buy time' (approximately 30 minutes) while preparing for a surgical cricothyroidotomy. ATLS® recommendations are that oxygen is delivered at a rate of 15 L/min via a Y-connector. Carbon dioxide removal is inadequate with this technique

Surgical cricothyroidotomy

This is widely recognized as the preferred choice of emergency airway control when endotracheal intubation is not possible. The main advantage of this technique over a needle cricothyroidotomy is that a larger, cuffed airway can be placed, facilitating positive pressure ventilation and reliable expiration with removal of carbon dioxide. The key factor in performing a needle or surgical cricothyroidotomy is identification of the cricothyroid membrane. This should be possible, provided the anterior neck is not too oedematous.

Tracheostomy

This is considered inappropriate in the emergency setting as it is time-consuming, technically more difficult to perform, and requires a previously secured airway during the procedure. Only those surgeons with extensive experience of performing tracheostomy (under local anaesthesia) should undertake this. For the rest of us, perform a surgical cricothyroidotomy.

Percutaneous tracheostomy

This should only be performed by experienced practitioners familiar with the technique. It cannot be undertaken if the neck has not been cleared (the neck needs to be extended).

Primary survey: breathing

All patients must be given 100% oxygen.

Look for signs that the patient is having problems in breathing (i.e. using accessory muscles of respiration, tachypnoea, stridor, or wheeze). This rapid assessment of breathing in the trauma patient should include the following:

- Stand at the top or foot of the bed and look at the chest. You are more likely to see asymmetrical movement of the chest than standing beside the patient.
- Talk to the patient.
- Assess respiratory rate (should be less than 20 breaths/min).