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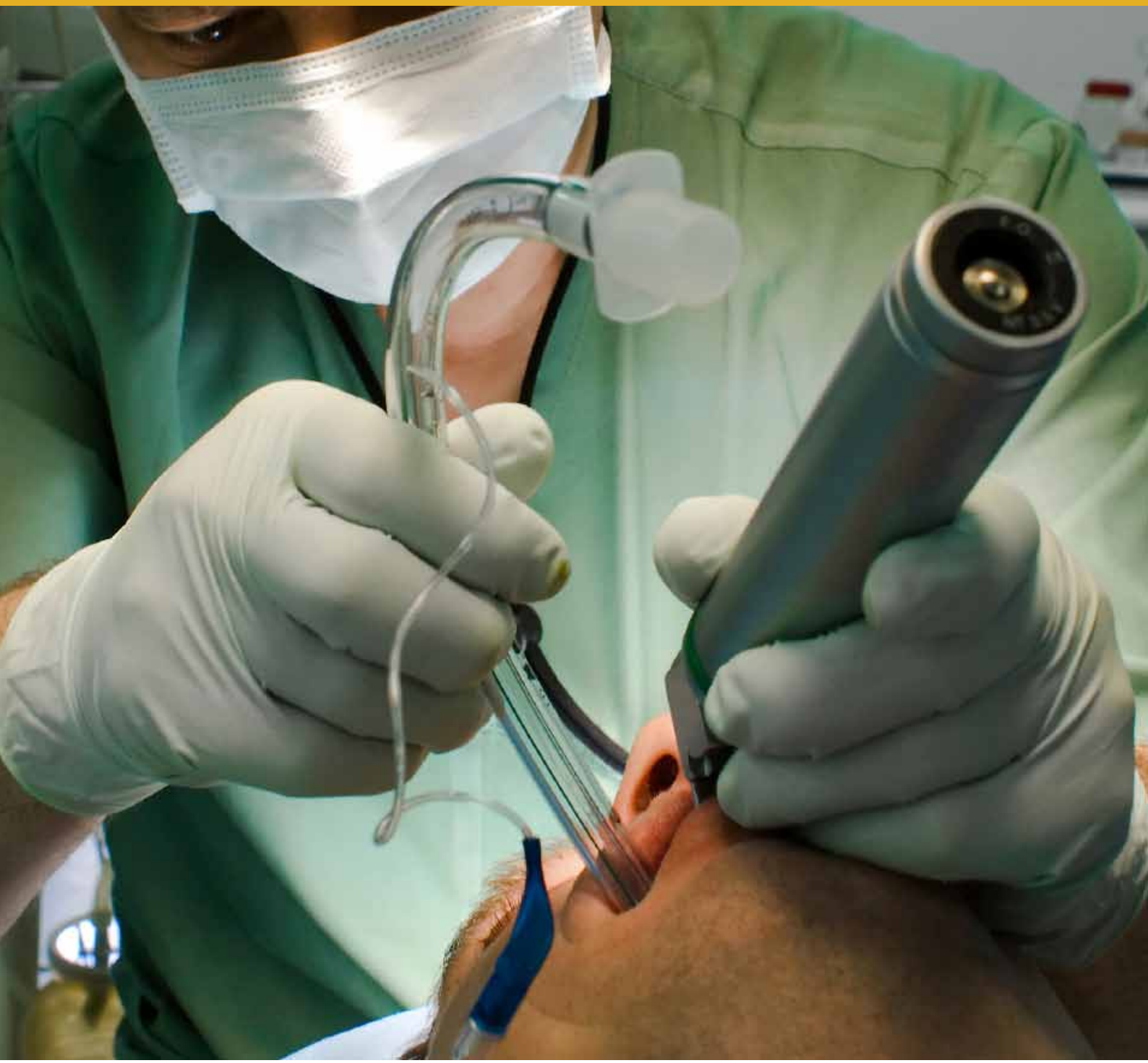

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Acute Medicine

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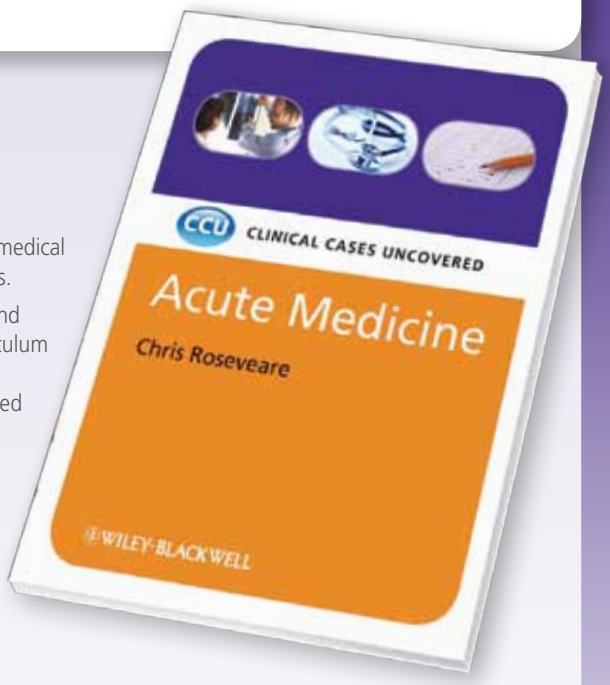
Chris Roseveare,
Southampton General Hospital



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REGIONAL ANAESTHESIA FOR SHOULDER SURGERY

D Hallsworth, A Kapila & K Place

Regional Anaesthesia for shoulder surgery. Practical Procedures.

Abstract

Shoulder surgery is a common orthopaedic procedure performed on both an inpatient and day-case basis. Excellent analgesia is essential for early mobilisation and improved postoperative function. Regional anaesthesia is used to provide good operating conditions and long lasting pain relief. Patients need to be clearly counselled how to look after the 'blocked' arm and to expect common side effects. Analgesia planning for when the block wears off is paramount. Dangerous complications are rare, but should be actively looked for in patients with atypical symptoms or slow recovery. In this article, we review the interscalene brachial plexus block and discuss the approach to some common postoperative problems.

History

A 60 year old gentleman has been admitted for a shoulder hemiarthroplasty. He has been assessed and has no medical problems apart from hypertension. He takes ramipril 5mg and aspirin 75mg daily. Physical examination is normal except for decreased shoulder range of motion due to pain.

Anaesthetic options

A shoulder hemiarthroplasty is usually performed under a general anaesthetic, as it can be a complicated and occasionally prolonged procedure. Post-operative physiotherapy is vitally important for restoring function to the shoulder, and can only be achieved if the patient's pain is well controlled. Options for post-operative analgesia are listed in Table 1.

	Advantages	Disadvantages
Systemic analgesia (e.g. PCA)	Simple, familiar to ward staff, patient can control dose	Respiratory depression, nausea, itching, constipation
Local anaesthetic infiltration	Simple, safe, no complex equipment required	Gives patchy analgesia, short acting, may still require morphine
Local anaesthetic continuous wound infusion	Long lasting analgesia without the risk of a nerve block	Requires infusion pump, staff training, occasionally patchy analgesia
Nerve blocks	Best anagesia	Risk of nerve damage, pneumothorax (see text)

Table 1: Options for post-operative analgesia.

Our patient was seen by an anaesthetist on the day of surgery and opted for general anaesthesia with a nerve block.

The interscalene brachial plexus block

First described by the American Anaesthesiologist Alon Winnie in 1970, the interscalene brachial plexus block (ISBPB) is useful for all surgery to the shoulder and upper arm. It is suitable for use on an inpatient or day-case basis and can be used as the sole anaesthetic technique (e.g. for awake arthroscopy) or in conjunction with general anaesthesia for post-operative pain relief.

The brachial plexus arises from the ventral rami of the C5-T1 nerve roots. These nerve roots run in a tight sheath between the anterior and middle scalene muscles before combining into trunks. These trunks split into divisions at the first rib and cords in the axilla, eventually forming the musculocutaneous, axillary, radial, ulnar and accessory nerves in the upper arm. The brachial plexus can be 'blocked' with local anaesthetic at any point during its course. An injection into the tight sheath at the level of the scalene muscles helps to ensure local anaesthetic spreads around the majority of the nerve roots. However injection at this level is not effective for surgery that involves the lower C8/T1 (unar) nerve root distribution as these roots are often missed.

Patient preparation

All patients should be given written and verbal information about regional anaesthesia in the pre-operative assessment clinic. Patients must be prepared to care for a 'numb arm' post-operatively, use a sling and take great care not to trap or burn the insensible limb. Consent should be taken balancing benefits and risks. Contraindications are listed in Table 2.

Absolute	• Patient refusal • Allergy to amide local anaesthetics
Relative	• Infection at site of injection • Coagulopathy or use of antiplatelets / anticoagulants • Pre-existing neurological dysfunction • Severe chronic obstructive pulmonary disease • Contralateral phrenic nerve or recurrent laryngeal nerve palsy

Table 2: Contraindications to regional anaesthesia.

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The use of regional anesthesia in patients receiving anticoagulants and antiplatelets can be complicated. The ISBPB can be performed safely in patients taking aspirin and all non-steroidal anti-inflammatory drugs. Prophylactic low molecular weight heparin should be given greater than 12 hours before the block, and >24hrs if higher treatment doses are used. If taking warfarin the INR should ideally be below 1.5. The risks and benefits of stopping clopidogrel should be considered, and if the patient has coronary artery stents their cardiologist should be consulted.

Even if the patient is not receiving a general anaesthetic, they should be starved preoperatively according to local guidelines.

The procedure

Equipment required	0.5% chlorhexidine : 70% alcohol cleaning solution
	Sterile gloves, preparation tray and drape
	Local anesthetic and 25G needle for skin
	Short bevel 22G 50mm regional anaesthesia needle
	Ultrasound machine and sterile cover
	Local anaesthetic solution (typically 20mL 0.25% bupivacaine, 0.25% levobupivacaine or 0.75% ropivacaine)

Table 3: Equipment required.

The ISBPB can be performed with the patient awake or under general anaesthesia, but many anaesthetists believe the risk of nerve damage is lower if the block is performed awake (the patient will complain of pain or paraesthesia if the nerve is threatened). The patient is positioned with the back elevated and head turned away from the side to be blocked. Light sedation (e.g. midazolam and / or remifentanil) is administered if required. The skin is sterilised and a small bleb of local anaesthetic is raised intradermally.

The nerves of the brachial plexus can be located by the use of a peripheral nerve stimulator (observing for twitches of the biceps or forearm when the needle is close to a nerve), or more recently by the use of ultrasound. It is our practice to use both techniques – ultrasound for accurate location of the nerves and surrounding structures, and a nerve stimulator to detect accidental intraneural needle placement.

When the nerves are identified they are surrounded with local anaesthetic solution (Figure 1). The block is tested by observing motor weakness in shoulder abduction and forward flexion, plus altered sensation to touch in upper arm. Sharps should be disposed of safely. The patient may then be anaesthetised and prepared for surgery (Figure 2).

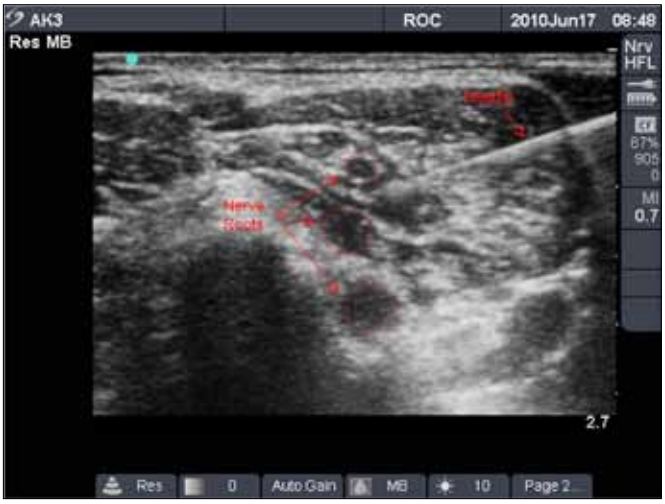

Figure 1: Ultrasound can be used to accurately identify nerves and surrounding structures.

Figure 2: The patient is prepared for surgery.

Expected course

Anaesthesia is usually achieved within 30 minutes but occasionally takes longer. 'Dense' anaesthesia and motor weakness generally lasts 4-12 hours, but the analgesic effect of the block is more prolonged, lasting up to 48 hours. The block may be prolonged by the use of additives such as clonidine.

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Time	Complication	Frequency
Immediate	Failure to achieve a complete block	Relatively common
	Local anaesthetic toxicity	Rare
Early	Diaphragmatic paralysis due to phrenic nerve block	100%
	Horner's syndrome (due to sympathetic chain block)	20%-100%†
	Hoarse voice due to recurrent laryngeal nerve palsy	5-25%†
	Pneumothorax	<1%
	Inadvertent epidural or intrathecal injection	Rare
Late	Persistent neurological dysfunction	2% up to 4 weeks
		Very rare after 4weeks

Table 4: Side effects and complications

†Incidence may depend on technique and local anaesthetic volume

Postoperative problems

Many patients receiving an ISBPB will be discharged the same day, although our hemiarthroplasty patient remained as an inpatient for two days. Ward doctors may be asked to review patients who have received nerve blocks and give advice on common problems.

'Doctor, the patient is in pain'

The analgesic efficacy of the ISBPB varies between patients and some blocks may not work at all! It is important to establish what pain the patient is experiencing. Some patients may simply find the sensation of a 'dead arm' deeply unpleasant and interpret this as pain. Enquire whether the block ever worked or is now simply wearing off.

A multimodal analgesia approach should be employed and simple analgesia should be prescribed regularly (including a non-steroidal anti-inflammatory if appropriate) and given before the block wears off. The patient may require opioids for breakthrough pain. If a block has completely 'failed', the patient may require morphine via a PCA. Analgesic adjuvants such as gabapentin and ketamine may be used on advice of the pain team.

'Doctor, the patient is short of breath'

Many people assume that shortness of breath in this situation is most likely a pneumothorax, but there are many other causes. Any patient short of breath following surgery should be assessed with a thorough history, examination and investigation if required. Causes can be subdivided into patient, surgical and anaesthetic factors (See table 5).

Patient factors	Pre-existing respiratory disease causing bronchospasm
	Cardiac failure or myocardial infarction
	Allergy / anaphylaxis
Surgical factors	Pain
	Soft tissue swelling of the neck following arthroscopic procedures
Anaesthetic factors (i.e. related to block)	Phrenic nerve palsy causing diaphragmatic embarrassment
	Recurrent laryngeal nerve palsy
	Neck haematoma
	Pneumothorax

Table 5: Causes of shortness of breath.

Phrenic nerve palsy is almost ubiquitous with the ISBPB. It is not clinically relevant unless the patient has respiratory comorbidity. It can be diagnosed by a raised hemidiaphragm on an inspiratory chest X-ray or by paradoxical diaphragmatic movement on ultrasound. The condition is self-resolving in a matter of hours, and supplemental oxygen should be given until the dyspnoea has improved.

Recurrent laryngeal nerve palsy is relatively common temporary problem and is difficult to diagnose without flexible nasendoscopy (which is rarely indicated). A hoarse voice should raise suspicion but respiratory failure is unusual without pre-existing laryngeal pathology.

Pneumothorax is a rare complication of ISBPB and can be diagnosed clinically and confirmed with a chest X-ray or ultrasound. All patients should be administered 'high-flow' oxygen and a tension pneumothorax should be immediately decompressed. Small pneumothoraces will resolve spontaneously with oxygen therapy, but larger or persistent pneumothoraces may need aspiration or drainage – seek anaesthetic or respiratory advice.

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'Doctor, the patient's arm is still numb'

The majority of patients have a normal arm within 36-48 hours. Numbness or weakness extending beyond 48 hours is suspicious and must be taken seriously. If there is concern about numbness or weakness, it is important to thoroughly document any neurological examination. The on-call anaesthetic or pain team should be informed immediately and urgent radiological investigation requested to rule out reversible causes such as haematoma (particularly in anticoagulated patients). Most neurological lesions will resolve with days or weeks, but persistent or permanent neurological damage is rare.

Block SAFE

In our institution, patients and staff are taught a simple mnemonic to help recall of important aftercare issues (Figure 3).

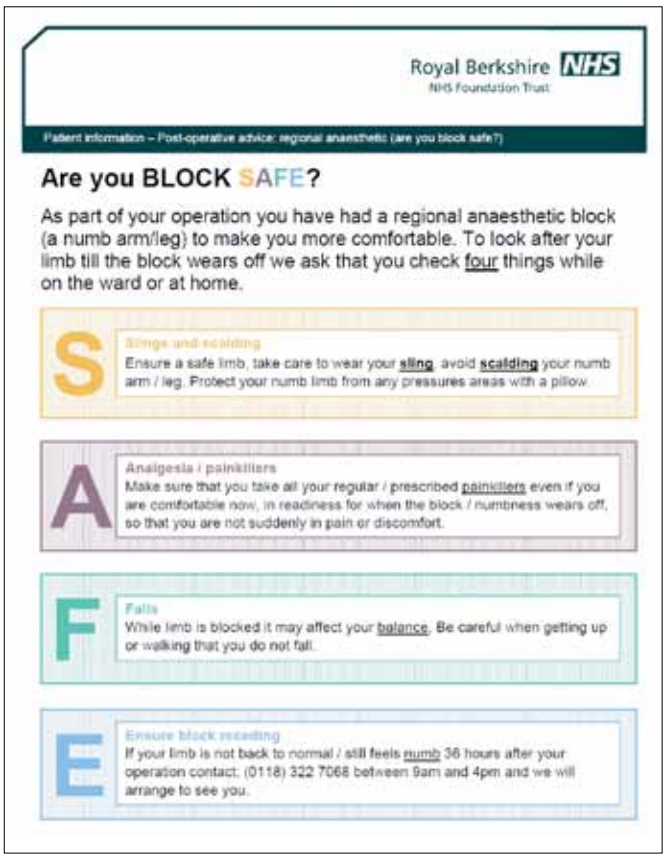

Figure 3: Block SAFE (Courtesy of Dr K Place).

Conclusion

The ISBPB is a commonly performed procedure and serious complications are rare. Attention should be paid to analgesia before the block wears off, and patients should be advised how to care for a numb arm. Pain, shortness of breath and persistent numbness raise red flags and the patient should be properly examined and assessed. Many hospitals have an acute pain service that will be able to advise how to deal with post-operative nerve block issues.

MCQs

Which of the following is NOT a worrying symptom following interscalene brachial plexus block?

a) Paraesthesia after 48 hours
b) Haematoma at the injection site
c) Inability to move arm after 6 hours
d) Shortness of breath
e) Severe pain

REGIONAL ANAESTHESIA FOR SHOULDER SURGERY

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Regional Anaesthesia for shoulder surgery. Practical Procedures.

Which of the following drugs should you consider stopping preoperatively if regional anaesthesia is considered:

a) Aspirin
b) Meloxicam
c) Oxycodone
d) Gabapentin
e) Clopidogrel

Answers

1. Answer is c) Inability to move arm after 6 hours

All of the answers are worrying apart from c) which is common. Paraesthesia lasting 48 hours or longer should be urgently investigated to rule out reversible causes of nerve injury, such as b) an expanding haematoma. Shortness of breath may have several benign causes but a pneumothorax should always considered. Severe pain is always worrying and should be diagnosed and treated straight away.

2. The answer is e) Clopidogrel

Patients presenting for shoulder surgery may have multiple comorbidities, including painful conditions such as arthritis. There is no contraindication to regional anaesthesia with aspirin or non-steroidal anti-inflammatory drugs (e.g. meloxicam). Oxycodone and gabapentin may be used in severe chronic pain and would be useful given on the morning of surgery. Clopidogrel increases the risk of bleeding and therefore nerve damage but often has a strong indication (e.g. drug eluting cardiac stents) and stopping it would be catastrophic. The reason for taking the medication must be elucidated and a thorough risk benefit analysis considered with the relevant multidisciplinary specialists.

References

1. Brull R. Neurological complications after regional anaesthesia: contemporary estimates of risk. Anaesh Analg 2007, 104(4): 965-974
2. European Society of Regional Anaesthesia Handbook of Regional Anaesthesia. 2007, **www.esraeurope.org**
3. Horlocker TT et al. Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy. Reg Anesth Pain Med 2010: 64-101
4. Winnie AP. Interscalene brachial plexus block. Anesth Analg 1970, 49(3): 455-66

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INDUCTION OF GENERAL ANAESTHESIA, A TRAINING & TEACHING ARTICLE

DC Bouch & EEF Helm

Induction of General Anaesthesia, a training & teaching article. Good Clinical Care.

Abstract

Induction of general anaesthesia is a common event and is the process by which a patient is rendered unconscious so that a treatment/intervention can take place. Anaesthesia can be induced by different methods (intravenous or gas inhalation) and is also determined by the urgency of the intervention that is planned. This article aims to explain the different methods of induction of general anaesthesia and the pharmacological agents used to provide a broad understanding of an interesting area of medicine, as well as outline some of the common complications associated with induction of general anaesthesia.

Introduction

The term Anaesthesia was first suggested by Oliver Wendell Holmes in 1846 to describe the state of sleep produced by ether. The word is derived from the Greek an + aisthesis; without feeling[1]. Since the first documented demonstration of a general anaesthetic by W T G Morton in Boston USA in 1846, anaesthesia has evolved in terms of the agents used and the method of their administration. Twenty first century anaesthesia is generally very safe, partly due to the agents involved, stringent patient monitoring and check lists used in theatre but also due to the extensive competency based training programme undertaken by anaesthetists.

Induction of general anaesthesia is the process by which a patient is rendered unconscious such that a medical or surgical intervention can take place. Although the patient is commonly described as being asleep, there is a marked difference in the EEG appearance between general anaesthesia and natural sleep. The purpose of induction is to smoothly reach a plane of surgical anaesthesia providing optimal operating conditions and ensuring the safety of the patient throughout the procedure until such a time that is appropriate for emergence to occur.

The initial step of a general anaesthetic induction carries a high risk of untoward events due to sudden physiological changes, particularly cardiovascular and respiratory, such as hypotension, arrhythmias, hypoventilation or apnoea, hiccupping, laryngospam, aspiration of gastric contents, vomiting, adverse drug reactions, involuntary movements, convulsions or masseter spasm. Induction and emergence from anaesthesia is often likened to the dangerous task of taking off and landing an aircraft.

Not all aspects of anaesthesia are a component of the foundation programme curriculum[2]. This article provides a general overview of the induction of general anaesthesia as an educational requirement. All medical practitioners should have some knowledge of the process of induction of anaesthesia and an awareness of the risks involved. Understanding the process will aid in managing patients pre and post-operatively and may help in answering any questions patients or relatives may have about general anaesthesia prior to their assessment by an anaesthetist. Pre-Induction of General Anaesthesia

Prior to induction the patient must be seen by the anaesthetist and a full anaesthetic assessment made, including a history and examination, specifically including an assessment of the patient's airway. Only in very exceptional circumstances can induction take place with no assessment. Even in an emergency for a patient who has a ruptured abdominal aortic aneurysm, for example, there is time to elicit very basic information. The pre-assessment must also include discussions with the patient and, where necessary, next of kin regarding risks and benefits of any interventions to be undertaken during the anaesthetic e.g. central line insertion or epidural analgesia. Risks of morbidity and mortality should have been discussed and documented prior to the day of surgery.

After discussion with the patient it is important for the anaesthetist to plan the preferred method of induction, maintenance and post-anaesthetic care, including appropriate analgesia. A plan B and possibly C must also be considered in anticipation of potential complications. This means that appropriate management can be initiated without unnecessary delays, should a problem arise.

All drugs and equipment that may be required must be checked prior to the arrival of the patient[3]. This includes locating and checking any emergency resuscitation equipment or the difficult airway trolley. All drugs must be drawn up and stored in an aseptic manner[4]. At the beginning of each theatre list and before each individual patient's procedure it is now mandatory to perform the World Health Organisation surgical safety checklist[5]. This allows all members of the theatre team to discuss anaesthetic and surgical concerns and ensures everyone is aware of any issues, for example, patient allergies, potential blood loss, duration of surgery and any unusual or special equipment required.

INDUCTION OF GENERAL ANAESTHESIA, A TRAINING & TEACHING ARTICLE

DC Bouch & EEF Helm

Induction of General Anaesthesia, a training & teaching article. Good Clinical Care.

Induction of General Anaesthesia

It is standard practice for induction of general anaesthesia to occur in an anaesthetic room in the United Kingdom. However, in other parts of the world and increasingly in the UK induction is undertaken within the operating room. Induction in theatre allows continuous monitoring until the patient is woken up and is ready to be accompanied by the anaesthetist to the recovery room. Transferring the patient from the anaesthetic room into theatre can result in a period of time without monitoring, unless the institution has easily portable monitoring equipment, at a time where the patient may have potentially just been rendered apnoeic and is at a point where adverse events are at their most likely. The economic benefits of not duplicating expensive anaesthetic machines and monitoring equipment are apparent.

Prior to induction full monitoring must be instituted[6]. This must include pulse oximetery, ECG, blood pressure measurement, capnography and anaesthetic vapour monitoring. Although monitoring is vital, it cannot replace the presence of a trained skilled anaesthetist who has the ability to observe and palpate various subtle clinical signs. The pink, warm patient with no autonomic disturbance is as reassuring to an anaesthetist as the numbers and waveforms on the anaesthetic monitor.

Intravenous Induction of anaesthesia

The vast majority of both elective and emergency general anaesthetics in adults are induced with an intravenous (IV) agent. The benefit of an intravenous induction is a smooth, rapid onset of surgical anaesthesia which is generally more tolerable for the patient than a gaseous induction.

The definition of an IV induction agent is one that results in loss of consciousness in one arm-brain circulation time. Unfortunately there is currently no ideal IV induction agent but if there were it would have the following properties: no pain on injection; rapid induction of anaesthesia; safe in all groups of patients; rapid metabolism which is independent of organs that can be compromised by disease such as the kidney or liver; no cardiovascular or respiratory compromise; analgesic component; anti-emetic component.

There are a number of induction agents from different chemical groups (table 1). The induction agent of choice is administered as a slow IV bolus until loss of consciousness is achieved. Although the standard induction doses are shown in the table it must be remembered that these are only a guide. Dose modification frequently takes place e.g. in the elderly, neonates and patients with cardiac disease. Although routine pre-medication administered on the ward (traditionally an opioid plus an anticholinergic agent) is now relatively uncommon, the co-administration of drugs at the time of induction (analgesics or hypnotics such as opioids and benzodiazepines) can also reduce the induction dose required. No anaesthetic is ever the same, even in the same patient for an identical procedure on a different day. Some might say that anaesthesia is an art based on scientific principles and it is the individual patient tailored treatment that results in a safe, smooth, stable induction.

Drug	Adult induction dose	Points of interest
Propofol	1-4mg/Kg	Most popular of all induction agents. Smooth induction & rapid recovery. CVS & RS depression common.
Thiopentone	3-5mg/Kg	Barbiturate. Agent against which all others are compared. Must be injected IV or tissue necrosis occurs. Causes less CVS/RS depression than Propofol. Gold standard agent for rapid sequence induction.
Etomidate	0.1-0.3mg/Kg	Marketed as drug with a very stable CVS profile. Side effects now known to outweigh benefits. In sick patients or those with CVS disease will actually still reduce cardiac function. Commonly causes vomiting. Single dose will impair normal adrenocortical steroid synthesis for 48 hours.
Ketamine	0.3-2mg/Kg	Atypical agent, phencyclidine ('angel dust') derivative. Produces state of 'dissociative anaesthesia'. Onset of anaesthesia slow with no definitive end point. Sympathomimetic effects advantageous in trauma patients. Intense analgesic properties useful for painful procedures e.g. burns dressings, fractured hips. Use limited due to vivid, often frightening, dreams and hallucinations.

Table 1. Intravenous induction agents.

INDUCTION OF GENERAL ANAESTHESIA, A TRAINING & TEACHING ARTICLE

DC Bouch & EEF Helm

Inhalational Induction of Anaesthesia

Gaseous or inhalational induction with an anaesthetic vapour was the usual mode of induction before the advent of IV agents. Inhalational induction is now mainly only used when anaesthetising small children, in whom gaining IV access prior to being anaesthetised is deemed unsuitable, or in patients with an anticipated difficult airway. The principle behind using an inhalational agent in a patient with a difficult airway is that the patient remains spontaneously breathing throughout. If the anaesthetist finds that he/she is unable to intubate the trachea safely then the vapour can be withdrawn and the patient allowed to wake up without the airway being lost.

Classically the inhalational agent halothane was used beyond 1956 to perform gaseous induction of anaesthesia. However, myocardial arrhythmias were common and the potential for hepatotoxicity has limited its use in favour of sevoflurane which was introduced in 1996. This agent has a much quicker onset and offset due to its physicochemical properties, it is not usually arryhthmogenic and the risk of hepatotoxicity is greatly reduced. Other volatile agents are used for maintenance of anaesthesia, such as isoflurane and desflurane, but these are not suitable for inhalational induction because they are too pungent causing airway irritability and coughing.

The ability to induce anaesthesia by inhalational means was historically undertaken without IV access. This is still the case in paediatric anaesthesia where IV access is secured after the patient is fully anaesthetised. In adults a cannula should always be sited beforehand where possible, although inhalational induction can be a useful technique in patients with poor venous access e.g. IV drug abusers or the long term critically ill. Extra pairs of hands are often required to help secure IV access as quickly as possible whilst the airway, and hence depth of anaesthesia, is maintained during this potentially hazardous period of anaesthesia.

As with IV induction of anaesthesia, full monitoring is required[6]. Much discussion within anaesthetic circles takes place regarding the exact method of inhalational induction. It is the authors' practice to undertake induction whilst the patient is breathing 100% oxygen (O_2). Whilst this can result in a slightly slower induction process, there is a store of oxygen in the functional residual capacity (FRC), as nitrogen is washed out, allowing a prolongation of the time taken to reach hypoxaemia in the event of any adverse incident. It is accepted that inhalational induction of anaesthesia can also take place with a combination of nitrous oxide (N_2O) and O_2 carrying the inhalational agent. This has the advantage of increasing the speed of induction, N_2O having both anaesthetic and analgesic properties. The obvious disadvantage is the reduction in the store of O_2 which reduces apnoeic capacity. Clinical signs of anaesthesia[7].

From the time the first anaesthetic was administered the anaesthetist had to rely on physical signs to gauge the depth of anaesthesia. In 1937 Arthur Guedel in the USA described the classic stages and planes of anaesthesia in unpremedicated patients breathing ether in air. He noted the progressive increase in muscle paralysis and loss of reflex responses with increasing depth of anaesthesia. These signs have all but been superseded by the use of IV agents, muscle relaxants and mechanical ventilation.

However, the observations that excitement occurs in very light planes of anaesthesia with eye movements, lacrimation and autonomic responses still holds true. Indeed, anaesthetists still look at the position of the eyes and autonomic signs to help gauge depth of anaesthesia.

Emergency anaesthesia / Rapid sequence induction

A major concern with emergency anaesthesia is the patient with a full stomach. This increases the risk of aspiration of stomach contents on induction of anaesthesia. The risk of aspiration is also present in some elective patients e.g. patients with pre-existing gastro-oesophageal reflux, obese patients and pregnant women over 20 weeks gestation.

Agreed perioperative fasting times[8] are 2 hours for clear fluids and 6 hours for food or particulate beverages, including milk. In infants, breast milk may be given 4 hours before surgery but formula or cow's milk can only be given 6 hours before. When gastric contents are aspirated, it is the volume, pH and the type of substance that determines the severity of pulmonary injury. Mendelson demonstrated that aspiration of gastric acid of pH 2.5 or less with a volume of 25ml puts the patient at risk of a severe pneumonitis. Clinically there is little evidence to support this. What we do know is that aspiration of gastric acid and particulate matter can induce pneumonitis and larger particles will directly obstruct the airway.

Over the years a number of measures have been taken in an attempt to reduce the risk of this occurring. As well as adhering to fasting guidelines, those at risk of aspiration should be identified and appropriate agents administered which raise the intra-gastric pH above 2.5. Ranitidine can be given on the ward or 30ml of sodium citrate 0.3M solution can be given immediately prior to induction. Metoclopramide may also be prescribed as a premedication for its prokinetic properties whereby it increases gastric emptying and lower oseophageal sphincter tone. In appropriate circumstances it may be possible to place a nasogastric tube to drain the stomach and leave on free drainage during induction. However, there is a risk that this itself may cause vomiting and aspiration of stomach contents. Deliberately inducing vomiting prior to theatre to empty gastric contents e.g. with ipecacuanha is no longer practised both for humanitarian reasons and the risk of aspiration.

INDUCTION OF GENERAL ANAESTHESIA, A TRAINING & TEACHING ARTICLE

DC Bouch & EEF Helm

A rapid sequence induction is used in patients at increased risk of aspiration. The rapid sequence aims to produce unconsciousness and paralysis with a muscle relaxant as promptly as possible to allow the airway to be secured and protected with a cuffed endotracheal tube. There is no manual inflation of the lungs between rendering the patient apnoeic with the induction agent and the onset of the muscle relaxant, which paralyses the vocal cords, allowing an endotracheal tube to be passed. This avoids inadvertent gastric distension and subsequent refluxing of stomach contents. If there is any doubt about successfully being able to manage the airway once the patient is paralysed then a senior experienced anaesthetist must be present. An awake fibre-optic intubation may even be preferred to secure the airway prior to induction of general anaesthesia.

Full monitoring is established as previously stated and reliable IV access is verified by a free flowing IV fluid infusion which also flushes in the drugs used during induction. Pre-oxygenation with 100% O_2 through a tight fitting face mask for at least 3 minutes washes out the N_2 in the lungs and replaces it with O_2. This allows for a period of apnoea before hypoxaemia occurs. A chosen induction agent of a fixed induction dose, as opposed to a dose titrated to the patient's loss of consciousness, is administered rapidly. Traditionally thiopentone is used as it produces a reliably rapid loss of consciousness, however it is possible to use any induction agent. Cricoid pressure (or Sellick's manoeuvre) is applied by the anaesthetic assistant as the patient starts to lose consciousness. The cricoid cartilage is pushed backwards to occlude the upper end of the oesophagus.

This prevents any refluxed gastric contents from entering the trachea. The cricoid pressure is only removed when the anaesthetist instructs the assistant to do so, once the endotracheal tube is confirmed to be in the correct place and the cuff is inflated. Given that the anaesthetist and assistant are 'attached' to the patient during this part of the procedure, it is understandable why a third is person must be to hand to act as a runner or call for extra help should a complication arise.

A fast acting muscle relaxant is administered. This is classically the depolarising muscle relaxant suxamethonium which provides optimal conditions in which to place an endotracheal tube about 1 minute after administration. Spontaneous ventilation returns again after a few minutes, which is useful if the anaesthetist finds they are unable to intubate the trachea.

If suxamethonium is contraindicated, for example in burns patients or patients with spinal cord injury, then high dose rocuronium, a non-depolarising muscle relaxant, can be used to achieve optimum intubating conditions just as rapidly as with suxamethonium. However, spontaneous ventilation will not return for 30 minutes or more should intubation fail. It is paramount under these circumstances that the anaesthetist is confident in their ability to be able to maintain the patient's airway with a bag and mask otherwise a 'can't intubate can't ventilate' catastrophe could ensue.

A smooth, safe induction, ideal for both patient and anaesthetist, is the result of good, timely preparation, expertise and understanding. This is further enhanced in the twenty first century by modern drugs and the latest technology. Crucially in relatively recent times, mandatory patient safety checklists have encouraged better communication within the theatre team as a whole which has been proven to be of the utmost importance in ensuring patient safety throughout their peri-operative journey.

Questions True or False?

1. An intravenous induction of anaesthesia:
a) shows all of Guedel's stages of anaesthesia
b) can be carried out without intravenous access
c) results in rapid loss of consciousness
d) always occurs in one arm-brain circulation time
e) is always the technique of choice

2. An inhalational induction of general anaesthesia:
a) can be performed with any of the anaesthetic vapours
b) results in rapid loss of consciousness
c) induction can be sped up by adding N2O to the inhaled mixture
d) is always used in children
e) must always occur with intravenous access

3. Fasting guidelines:
a) reduce the risk of aspiration of stomach contents
b) can be ignored as long as a rapid sequence induction is performed
c) only relate to solids
d) ingestion of fruit juice is permissible
e) drinking water is allowable up to 1 hour prior to surgery

4. Rapid sequence induction:
a) is the induction method of choice for emergency surgery
b) allows the anaesthetist to ventilate the lungs prior to intubation
c) any muscle relaxant can be used
d) it is advisable to wait a minimum of 2 hours from eating to induction
e) pressure is applied to the thyroid cartilage

INDUCTION OF GENERAL ANAESTHESIA, A TRAINING & TEACHING ARTICLE

DC Bouch & EEF Helm

Answers to questions

1. c is correct.

IV induction of general anaesthesia whilst preferable, because of its rapidity, is not the only technique. IV access must always be obtained. Guedel's stages are only seen with inhalational induction. Whilst one arm-brain circulation is classically described as the true induction time for anaesthesia this is not always the case.

2. c is correct.

Sevoflurane and halothane (rarely used due to side effects) are the only inhalational agents used for induction. Isoflurane and Desflurane are avoided due to their pungent smell and intolerance by awake patients. It is advisable to gain IV access in adults prior to induction but in children IV access is obtained after they are asleep. In children IV induction is an equally acceptable mode and will be dependent upon the child and the preference of the anaesthetist. The addition of N_2O will speed up induction with the risk of a shorter apnoeic time compared with O_2 alone.

3. a is correct

Fasting guidelines are nationally agreed and reduce the risk of aspiration. They apply to any form of drink or food, being 6 hours for food, including cow's milk (in hot drinks) and formula milk, 4 hours for breast milk and 2 hours for clear fluids, preferably water. A rapid sequence induction should never be used to circumvent a patient who has not followed the guidelines. In those with a risk of aspiration or where fasting will delay emergency surgery inappropriately, rapid sequence induction is the correct method of induction.

4. a is correct

A rapid sequence is the correct technique of induction for emergency surgery. Pre-oxygenation prior to induction and no ventilation of the lungs takes place until the endotracheal tube is placed and the cuff inflated. The gold standard muscle relaxant used is suxamethonium due to its quick onset time and provision of ideal intubating conditions. When a rapid sequence is performed in an elective case fasting guidelines must be adhered to. This is not the case, however, for emergency surgery where time can be critical. Pressure is applied to the cricoid cartilage by a skilled assistant to occlude the upper end of the oesophagus and thus prevent aspiration of stomach contents.

References

1. Yentis SM, Hirsch NP, Smith GB. Anaesthesia. In: Anaesthesia and Intensive Care A-Z. An encyclopaedia of principles and practice, 3rd edn. Butterworth Heinemann 2004, 26.
2. **http:// http://www.foundationprogramme.nhs.uk/pages/home/training-and-assessment.**
3. Checking Anaesthetic Equipment. 2004. Association of Anaesthetists of Great Britain & Ireland
4. Infection Control in Anaesthesia. 2002. Association of Anaesthetists of great Britain & Ireland
5. **http:// http://www.who.int/patientsafety/safesurgery/ss_checklist/en/.**
6. Recommendations for standards of monitoring during Anaesthesia & Recovery. 2007. Association of Anaesthetists of great Britain & Ireland
7. Atkinson RS, Rushman GB, Davies NJH. Inhalational Anaesthesia. In:Lee's Synopsis of Anaesthesia, 11th edn. Butterworth Heinemann 1993,127-149
8. **http://www.rcn.org.uk/__data/assets/pdf_file/0009/78678/002800.pdf**

Further reading

Aitkenhead AR, Rowbotham DJ, Smith G eds.
Textbook of Anaesthesia, 4th edn. Churchill Livingstone 2001

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CLINICAL AUDIT CYCLE

TN Sudarshana, D Chhabra & GSA Kumar

Clinical Audit Cycle.
Teaching & Training.

"To err is human, to cover up is unforgivable, and to fail to learn is inexcusable."
Sir Liam Donaldson

Abstract

Audit is one of the six pillars of clinical governance. It is a quality improvement process to improve patient care and outcomes by systematically reflecting and reviewing practice.

Introduction

The General Medical Council (GMC) states that as a part of good medical practice to maintain and improve performance, doctors are required to take part in regular and systematic audits. Doctors are also asked to carry out audits during their post graduate training years. Audits are an integral part of a doctors' appraisal and revalidation process. Audit is one of the key pillars of clinical governance.

Definition

The National Institute for Health and Clinical Excellence (NICE) published the paper 'Principles for Best Practice in Clinical Audit' which defines clinical audit as:

"A quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change."

Aspects of structure, processes, and outcomes of care are selected and systematically evaluated against explicit criteria. Where indicated changes are implanted at an individual, team, or service level and further monitoring is undertaken to confirm improvement.

History

Florence Nightingale undertook one of the first ever audits during the Crimean War. Due to poor sanitary conditions, there was a high mortality rate amongst the injured or unwell soldiers, so she and her team of nurses applied routines and standards of hygiene to the hospital and its equipment. They also kept records of mortality rates of the hospital patients. Following these changes, the mortality rate fell from 40% to 2%. This methodical approach, uniformity and comparability of the results of healthcare is recognised as one of the earliest audits of outcome-management.

In 1912, Ernest Codman undertook the first ever medical audit with a clinical approach on monitoring the surgical outcomes. He reviewed every patient's case history after the surgery to identify individual surgeon's errors on specific patients. These processes of quality monitoring and establishing accountability have helped in the improvement of patient outcomes.

Clinical Governance and Audits

Despite successful outcomes by Florence Nightingale and Ernest Codman, audits in healthcare were very slow to catch on.

Following some high profile cases like the Bristol heart scandal in 1995, clinical governance became a major part of NHS. Clinical governance is as systematic way of maintaining and improving the quality of care within a health organisation. In 1997, a white paper, 'The New NHS: Modern and dependable' was introduced which incorporated clinical audits as one of the six pillars of clinical governance.

Audits vs. Research

The following table highlights the differences between audits and research.

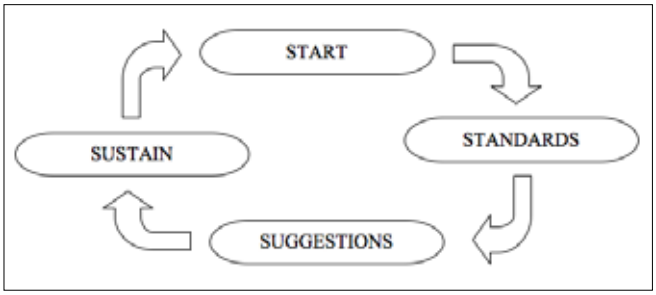
Audit	Research
• A continuous process on an ongoing cycle • A comparison of current practice with evidence of good practice • Does not require ethical approval	• Study into new knowledge, new treatments and new practices • Usually a one-off exercise • Usually requires ethical approval

Clinical Audit Cycle

The audit process is an ongoing cycle. In a certain area, practice is identified which needs to be audited and this is compared with the set gold standard. The results are analysed and suggestions for improvements are recommended and implemented. The practice is re-audited to gauge the improvement and to see if any further changes are required. This process is called 'the audit cycle'.

CLINICAL AUDIT CYCLE

TN Sudarshana, D Chhabra & GSA Kumar



Start the preparations

- Identify the topic – Having high priority for the patients, procedures or organization and is measurable and changeable.
- Identify the objectives and aims – Why are we doing this? What are we hoping to achieve?
- Identify resources – Is it an individual or multidisciplinary? Funds?

Standard methods

- Choose the standards and references taken from NICE guidelines, National guidelines of Royal Colleges and Societies, Local Trust guidelines, etc. for the audit.
- Create a good practice check list.
- Construct a timetable – start, end and presentation dates.
- Comply with ethics, confidentiality and data security regulations.
- Configure the methods – prospective (collect the data from new) or retrospective (trawl existing records).
- Collect and analyse the data with or without statistical help.

Suggestions and recommendations

- Identify the areas of problems, successes and expectations.
- Identify the areas for development and improvement.
- Implement changes and develop an action plan.

Sustain the improvements

- Identify the strengths and weaknesses of the audit.
- Identify the areas of for further work.
- Start preparation of re-auditing the practice with further changes / standards / improvements.

Audits and anaesthesia

Anaesthesia has been in the forefront of auditing national data to improve patient safety. In the early 80s, two leading anaesthetists, Professor William Mushin and Dr John Lunn conducted a confidential and anonymous pilot study of 'Mortality associated with Anaesthesia' in five regions in England, Scotland and Wales.

This ground breaking report led to the Association of Anaesthetists of Great Britain and Ireland (AAGBI) teaming up with Association of Surgeons of Great Britain and Ireland to undertake a study called the 'Confidential Enquiry into Perioperative Deaths'. The study reviewed 30 days perioperative mortality and the causes therein. This led to the establishment of the National Confidential Enquiry into Patient Outcome and Death (NCEPOD). NCEPOD has since helped provide an insight into ways of improving clinical practice thereby improving patient safety.

In addition, the Royal College of Anaesthetists (RCoA) has been conducting National Audit Projects (NAP) since 2003 to look into different areas of anaesthetic practice to identify areas for improvement. The latest project, NAP4, was undertaken prospectively to study all the major patient airway complications that occurred throughout the United Kingdom.

In addition, within every hospital, anaesthetists and intensive care doctors are constantly auditing their practices and services to improve the quality of patient care. Knowing the importance of audits in anaesthesia practice, in 2006, the RCoA published an audit recipe book. This has a collection of audit topics along with the relevant best standards.

Conclusion

Clinical audit is an integral part of clinical governance and it has helped to improve standards of care, quality of services and patient safety. The NHS, nationally and regionally should strive to further audit and re-audit their services in order to give best quality of care to our patients.

CLINICAL AUDIT CYCLE

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MCQs

True or false?

1. Audits are studies to search for new knowledge and treatment (T/F)

2. Audits usually require ethical approval (T/F)

3. Audits include comparisons of current practice with gold standard (T/F)

4. Re-auditing of the data is essential to complete the audit cycle (T/F)

5. Audits are one of the pillars of clinical governance (T/F)

Answers

Question 1.
False, research is the study for new knowledge and treatment and not audits

Question 2.
False, audits do not usually require ethical approval

Question 3.
True

Question 4.
True, re-auditing the data is an essential part of completing the audit cycle.

Question 5.
True

Clinical Audit Cycle.
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References

1. National Institute of Clinical Excellence, Principles of Best Practice in Clinical Audit. London: NICE, 2002

2. Healthcare Quality Improvement Partnership. Criteria of best practice in clinical audit

3. Lunn JN, Mushin WW. Mortality associated with anaesthesia. Anaesthesia 1982;37:856.

4. Cook T, Woodall N, Frerk C. 4th National Audit Project of the Royal College of Anaesthetists and The Difficult Airway Society, Report and findings. March 2011. **http://www.rcoa.ac.uk/index.asp?PageID=1089**

5. Raising the Standard: A compendium of audit recipes (Second edition 2006) **http://www.rcoa.ac.uk/index.asp?PageID=125**

6. Kumar GS. Patient safety in anaesthesia, BIDA Journal June 2011:23

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JEHOVAH'S WITNESSES & ANAESTHESIA

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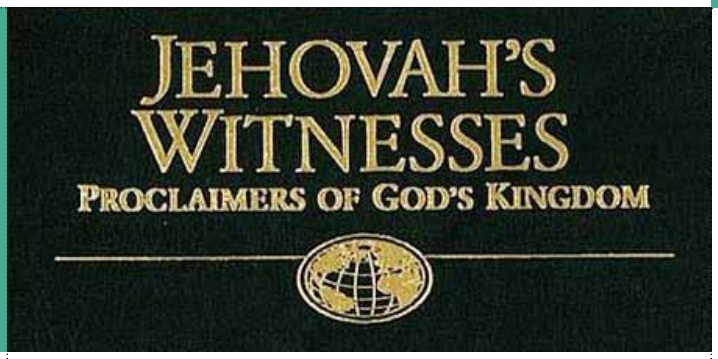

Abstract

Jehovah's Witnesses are members of a Christian-based religious movement for whom prohibition of blood transfusion is a deeply held value. Operating on a Jehovah's Witness patient can be very challenging both medically and ethically and it is important to involve senior medical colleagues at the earliest.

Jehovah's Witnesses

Jehovah's Witnesses are members of a Christian-based religious movement which was founded in the USA towards the end of the 19th century. There are around seven million members worldwide. There are approximately 131,000 Jehovah's Witnesses in the UK. [1]

Though entirely bible-based, there are some fundamental differences between Jehovah's Witness and other churches. Jehovah's Witnesses believe in the word for word teaching of the Bible. As a result of the beliefs within this religion, taking of blood into the body through mouth or veins violates God's law, especially according to Genesis.9:3,4; Leviticus.17:14; Acts.15:28,29. [2]

Since 1945, blood transfusion has been considered as 'consumption of blood' and is prohibited for members of Jehovah's Witness. The prohibition of blood transfusion is a deeply held core value and is a sign of respect for the sanctity of life. However since June 2000, the Watchtower Society (the official body of the Jehovah's Witness) issued a directive stating that the organisation would no longer disfellow members who did not comply with the policy of refusal of blood.

The knowledge of the risk of transmission of diseases and other complications of blood transfusion has further strengthened the view of Jehovah's Witnesses' refusal to accept blood transfusions.

Legal issues

Informed consent before any medical intervention is essential. Every mentally competent adult is entitled to refuse treatment for any reason even though such a view might be at odds with the doctor's medical and ethical beliefs.

At the same time, no opinion should be attributed to a patient simply because they are a member of a certain religious group and their views should be sought when making such decisions.

It must be remembered that no absolute rules exist regarding acceptance of blood products and each patient should be offered all the possible choices.

Because of the variations in individual beliefs, it is common for a Witness patient to consult with the elders of the community for help in reaching a decision regarding blood products. Jehovah's Witnesses have established a nationwide network of 'Hospital Liaison Committee for Jehovah Witnesses'. The Liaison Committee comprises of elders and members who facilitate communication between Jehovah's Witness patients and medical practitioners. They can be contacted by either Jehovah's Witness or the medical team. The medical team should get permission from the patient prior to contacting the Liaison Committee. They are contactable at all times including out of hours. The contact number for the Liaison Committee is available via the hospital switchboards. More information about the local Hospital Liaison committee can also be obtained via:

Hospital Information Services for Jehovah's Witness
ISBA House
The Ridgeway
London
NW7 1RN
Tel: 02089062211
Email: his@wtbts.org.uk

During elective procedures, the clinician is not obliged to carry out a procedure that they feel cannot be performed safely and in that circumstance the patient should be referred to a suitably qualified clinician who agrees to further management. However, in an emergency, the clinician is obliged to provide care and must respect the patient's competently expressed view.

Unconscious Patient

If an unconscious patient carries an advance directive, it should be considered as the patient's decision as long as it is properly signed and witnessed.

In the event where a Jehovah's Witness status is unknown and he is unconscious, the attending doctor is expected to perform to the best to their ability and this may include transfusion of blood in life threatening situations. If the patient's relatives object to this they may be asked to provide legal evidence of the patient's wishes and senior medical staff should be involved as soon as possible.

JEHOVAH'S WITNESSES & ANAESTHESIA

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Children

The wellbeing of the child is of paramount importance and thus if the child's parents refuse to give permission for blood transfusion, it may be necessary to apply for a 'Specific Order Issue' via the High Court for legal permission for blood transfusion. In this situation the hospital's legal advisors must be notified and where possible this action should be agreed by two consultants. The parents and the patient should be notified of such intended action.

In a child above 16 years of age, there is no legal requirement to obtain consent from their parents and the child has the right to consent. This also holds good if the child of this age group agrees to accept blood transfusion against the wishes of their parents as long as they are able to demonstrate a clear grasp of the treatment and risks as per the Gillick competence principle.

A child younger than 16 may accept a blood transfusion, against the wishes of their parents, if they show evidence of Gillick competence. Consultant input should be sought in such situations.

In the event parents and a Gillick competent child refuse transfusion, the High Court can be approached to give consent on their behalf for treatment to occur. A multi-disciplinary team approach is essential in these circumstances, ensuring that the parents, social work department, Jehovah's Witness liaison officers, medical and nursing teams caring for the child are involved.

In an emergency situation where the child needs immediate transfusion of blood without which he might die and waiting to consult the court might take time, blood may be transfused without consulting the court. The court is likely to uphold the decision of the doctor who gave the blood.[3]

These scenarios can be ethically and legally very challenging and it is important to consider a multi-disciplinary approach which involves the family, anaesthetist, surgeon, haematologist, paediatrician and the social work department to come to the best possible solution.

Advance Directive and Consent form

Many Jehovah's Witnesses might carry with them an Advance Directive document. If the advance directive is made by a competent adult, signed and witnessed, it must be respected unless the patient has changed his view since the formulation of the directive. Even when an advance directive is present it is important to ascertain which aspects of the treatment are acceptable to the patient. To administer blood to a patient who has refused transfusion is unethical and unlawful.

Most hospitals have a special Jehovah's Witness consent form, and it also available from Jehovah's Witness Hospital Liaison Committee.

Jehovah's Witnesses' position on medical treatment and related matters

Jehovah's Witnesses accept most medical treatments, surgical and anaesthetic procedures, and therapeutic agents that do not contain blood.

Jehovah's Witnesses generally accept:

- Non-blood volume expanders such as crystalloids and colloids
- recombinant clotting factors
- Desmopressin
- Vasoconstrictors
- Recombinant factors including activated recombinant factor VII

Some Jehovah's Witnesses may accept the use of:

- Human Albumin solutions
- Cryoprecipitate
- Human Immunoglobulin
- Anti-D Immunoglobulin
- Clotting factor concentrates
- Human plasma proteins
- Acute Normovolaemic Haemodilution
- Autologous blood salvaged in the perioperative period
- Intra-operative cell salvage
- Heart bypass (pumps must be primed with non-blood fluids)
- Haemodialysis
- Organ transplants and donations
- Stem cell procedures

JEHOVAH'S WITNESSES & ANAESTHESIA

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Jehovah's Witnesses generally will not accept:

- Whole blood
- Packed red cells
- White cells
- Platelets
- Fresh Frozen Plasma (FFP)

Preoperative stage

In an elective situation, surgeons should inform the anaesthetic department as soon as possible in order to ensure a consultant anaesthetist is available to manage the patient's care. Where necessary, besides surgeons and anaesthetists the intensive care and haematology consultants should also be involved in planning the care of the patient.

The preoperative visit should also be used to ascertain what the limitations to treatment are and what products or procedures are acceptable to the patient. Surgical technique options should also be discussed with the patient during the pre-operative assessment such as minimally invasive procedures and prolonged operations could be carried out in stages to minimise blood loss. The patient's views on techniques such as blood salvage, Acute Normovolaemic Haemodilution and the use of blood products such as albumin, globulins and clotting factors should be ascertained. All discussions must be documented clearly in the patient's notes. The preoperative assessment should ideally be planned early enough to give sufficient time to address any problems with anaemia or clotting disorders that might arise from the assessment.

Optimising the patient pre-operatively may include:

- A thorough preoperative assessment
- Optimisation of comorbidities
- Involving haematologist
- Close monitoring of haemoglobin and coagulation studies
- Diagnosing and treating anaemia with the use of iron, folic acid, B12 and recombinant erythropoietin
- Review of drugs that the patient might be taking especially anticoagulant and antiplatelet drugs (Aspirin, Clopidogrel, NSAIDs and Warfarin)
- Optimisation of patient's nutritional status
- Minimising the number of blood samples taken for blood tests

Anaemia

The World Health Organization criteria for anaemia are haemoglobin less than 12 g/dL for non pregnant women and less than 13 g/dL for men. Anaemia is detrimental as it causes decreased oxygen delivery to the tissues. Hence if the patient is anaemic preoperatively, steps should be taken to identify the cause of anaemia and adequately treat it with medications like iron, folic acid, B12 and erythropoietin.

Intraoperative stage

The most prominent step intraoperatively in the management of a Jehovah's Witness patient is to minimise blood loss. Senior surgeons and anaesthetists should manage the care of the patient. Blood loss should be monitored meticulously. Coagulopathy should be assessed through visual assessment, laboratory tests, and perioperative monitoring of vital physiological signs like heart rate, blood pressure, oxygen saturation, and urine output. There should also be quantitative assessment of blood loss by checking blood in surgical field, drains, suction bottles and sponges.

If significant blood loss is anticipated, then invasive monitoring like arterial line and central venous access should be considered. This will help in haemodynamic monitoring, fluid management and use of vasoactive drugs like noradrenaline. Use of cardiac output monitoring devices like oesophageal doppler will also help in intraoperative care of the patient.

Surgical Measures

- Planning major procedures in stages
- Careful positioning of patient
- Use of tourniquets where possible
- Meticulous attention to haemostasis
- Appropriate use of diathermy, and surgical glues and sealants where appropriate

JEHOVAH'S WITNESSES & ANAESTHESIA

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Anaesthetic measures

- Use of regional and central neuraxial block where possible
- Hypotensive anaesthesia
- Use of cell saved blood (if acceptable by patient)
- Drugs like tranexamic acid, activated factor VII and vasoconstrictors

Specific measures

Acute Normovolaemic Haemodilution

Acute Normovolaemic Haemodilution is a blood conservation technique where, at induction of anaesthesia, patient's blood is collected and simultaneously crystalloid solution is infused to maintain normovolaemia. The collected blood can be used intraoperatively or postoperatively if needed.

Cell salvaged blood

Cell salvage is a procedure where blood that is lost during the surgery is collected, filtered, centrifuged to obtain Red Blood Cells (RBCs), and the RBCS are then washed by the cell saver machine to produce autologous red blood cells which can be transfused to the patient either during the intra-operative or post-operative phase. One of the drawbacks of this technique is removal of platelets, plasma, cytokines and as a result potential of coagulopathy when a large volume of blood is involved. (Fig 1)

Figure 1: Cell Saver.

Postoperative stage

Postoperatively, patients might have to be monitored in a critical care environment especially if they had massive blood loss or had a major operation. Patients should be monitored closely for any postoperative blood loss. Attention should be paid to patient's haemodynamic parameters, fluid balance and maintenance of normothermia. Blood investigations including clotting studies should be done in the postoperative stage

MCQs

True or false?

a) Major operations could be done in stages in Jehovah's Witness patients.

b) All Jehovah's Witness patients refuse all blood products.

c) The knowledge of risk of transmission of diseases and other transfusion related complications has further strengthened the views of Jehovah's Witnesses to refuse blood transfusion.

d) Some Jehovah's Witness patients might consult with the elders of the community to help reach a decision regarding blood products.

e) Regional anaesthesia is contraindicated in Jehovah's Witness patients.

Answers

a) True, especially in ones where there is a risk of bleeding intraoperatively

b) False, not all Jehovah's Witness patients refuse all blood products, hence it is important to ascertain which products are acceptable to the patient.

c) True

d) True, many communities have a committee of Elders, known as the 'Hospital Liaison Committee for Jehovah Witness, which can be contacted.

e) False

JEHOVAH'S WITNESSES & ANAESTHESIA

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References

1) Jehovah's Witness fact sheet h**ttp://www.leicestershiretogether.org/jehovah'switnesses.pdf.**
2) Jehovah's Witness official website **http://www.watchtower.org/e/jt/article_03.htm.**
3) Management of Jehovah's Witness, Association of Anaesthetists of Great Britain and Ireland, 2nd Edition, November 2005. **http://www.aagbi.org/sites/default/files/jehovah.pdf.**
4) Milligan LJ and Ballamy MC, Anaesthesia and critical care of Jehovah's Witnesses. Continuing Education in Anaesthesia, Critical Care & Pain 2004; 4: 35-39.
5) Ashley E. Anaesthesia for Jehovah's Witnesses. British Journal of Hospital Medicine 1997; Vol 58:375-380.
6) Code of practice for the surgical management of Jehovah's Witnesses, The Royal College of Surgeons of England, 2002. **http://www.rcseng.ac.uk/publications/docs/jehovahs_witness.html.**

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PREOPERATIVE ASSESSMENT OF THE SURGICAL PATIENT

K Valchanov & A Klein

Preoperative Assessment of the Surgical Patient. Good Clinical Care.

Abstract

The term pre-operative assessment implies that surgery has been planned, and that the patient should be prepared for the operation. However, the definition of pre-operative assessment has evolved, especially as new technology has become available to aid medical assessment. As well as this, patients are now usually admitted to hospital on the day of surgery, and pre-operative assessment has therefore been significantly expanded in its scope. It now encompasses all interventions aiming at evaluating the health state of an individual patient, assessing risks, and recommending best peri-operative management, as well as communicating this plan with the patient and the multi-disciplinary team. In this article we will discuss the value of pre-operative assessment and some of the key points of this work. We will also illustrate this with some examples from real patients.

Introduction

Pre-operative assessment involves a series of interventions aimed at improving safety and outcome of surgery, as well as preparing the patient for it. Patients who are identified as having a pathological or physiological condition necessitating surgical treatment must be assessed. The aims of pre-operative assessment are:

- **to assess patient fitness;**
- **inform the patient about risks associated with the procedure;**
- **and plan for safest management in the peri-operative period.**

In this sense, pre-operative assessment and safe surgery have become more or less the same entity. With regards to surgery itself, safety and results have improved but not as much as may be expected. In the 1920s, the overall mortality associated with surgery in Norfolk and Norwich hospital was 1 in 946[1]. Just under a century later, peri-operative mortality has not changed much. For example the overall mortality for elective groin hernia repair in male adults during 1992-2005 in Sweden was 1 in 907[2]. More than 20,000 peri-operative (within 30 days of surgery) deaths have been recorded in the UK per annum recently, accounting for an incidence of around 1%[3]. These facts imply that there are serious risks involved in the surgical treatment of disease.

Fitness for surgery

Fitness for surgery is often difficult to appreciate. It is largely governed by the type of pathology for which surgical treatment is required, as well as the stage of this pathology, and the benefit expected from the operation. Secondly, the co-morbidities of a patient may make the benefits of surgery unjustifiable. Great care needs to be taken when weighing the benefits against the risks associated with the operation. Although there are many risk stratification systems and a lot of medical evidence available to back up a decision, the individual patient and their attitude towards surgery must always be considered.

Sometimes the pathology to be treated and the overall condition of the patient may be obvious. Even an untrained person can recognise that the patient in Fig. 1 is likely to have suffered internal injuries. However, pre-operative assessment in this case is still necessary to permit any resuscitation that is required, as well as take a history and perform an examination so that best anaesthetic and surgical care may be performed. Of particular importance in such an acute patient are haemodynamic indices, fasting status, allergies, any anticipated airway difficulties and of course any history of medical conditions or previous relevant surgery. However, there may not always be time to perform all relevant investigations – in fact only a chest X-ray was taken before successful cardiothoracic surgery.

Figure 1: Patient shot with crossbow bolt.

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Systemic assessment of fitness is required for all patients to ensure their overall physiological condition is adequate for the proposed procedure. This should focus on the medical history, in conjunction with a review of the notes and any relevant recent investigations, as well as a physical examination. There are a number of fitness systems in use, but the most popular is the American Society of Anesthesiologists (ASA) scoring system. It was created to categorise the pre-operative physical status of a patient, and works best as a population rather than individual predictor.

ASA 1	No organic, physiological, biochemical or psychiatric disturbance. The surgical pathology is localised and does not entail systemic disturbance
ASA2	Mild or moderate systemic disturbance caused either by the surgical pathology or by any other process.
ASA3	Severe systemic disturbance or disease from whatever cause, even though it may not be possible to define the degree of disability with finality.
ASA4	A patient with severe systemic disease that is a constant threat to life
ASA5	A moribund patient who is not expected to survive without the operation.
ASA6	A declared brain-dead patient whose organs are being removed for donor purposes.

Table 1: American Society of Anesthesiology Risk Scoring System.

The best method of cardiovascular system assessment is history taking. The following case is an example of a situation where the pre-operative assessment played a major diagnostic role. A 43 year-old patient presented with gradually worsening dyspnoea and tachycardia. As the CT scan did not reveal an obvious pathology in the lungs, the patient was scheduled for open lung biopsy to exclude a vasculitic process. During the pre-operative assessment, while discussing the history of the presenting complaint, the dyspnoea was reported as positional. The medical team then requested echocardiogram and indeed it revealed an intracardiac tumour attached to the interatrial septum and protruding into the mitral valve inflow[4] (Fig. 2). The patient therefore underwent open cardiac surgery instead of the planned thoracic procedure, and made an uneventful recovery.

Figure 2: Transoesophageal Echocardiogram. Mid-oesophageal Four Chamber View demonstrating left atrial myxoma attached to the interatrial septum and obstructing diastolic mitral flow. The patient was complaining from positional shortness of breath.

Many of the concerns regarding fitness for surgery are related to the state of the cardiorespiratory system, as major complications that occur in the peri-operative period relate to it. An important tool that can address cardiovascular fitness and allow an assessment of its ability to cope with the stress of surgery is exercise tolerance. It is a useful indicator of global physiological reserve. In this context, the use of metabolic equivalence (MET) has become popular as the information is readily available from the clinical history.

For example, a patient capable of strenuous exercise without symptoms of dyspnoea can tolerate 14 MET. More examples include: 6 –7 MET – short run; 4 MET – climb a flight of stairs; 3 MET – light housework or walk 100 m at 2 – 3 mph; 1 MET – eating and dressing. In general, patients able to achieve 4 MET or greater have a relatively low risk of cardiovascular peri-operative morbidity. The usefulness of this system is lost however where physical activity is restricted by musculoskeletal disease, such a hip or knee disease, making assessment of patients with limited mobility more difficult to assess.

More accurate assessment of cardiopulmonary function can be obtained by cardiopulmonary exercise testing (CPET)[5]. This test subjects the patient to a set programme of physical exercise, using either a treadmill or an exercise (static) bicycle, and measures his/her anaerobic threshold. When such an exercise-based assessment can truly not be performed, an alternative is dobutamine stress testing and echocardiography.

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Systematic approach to pre-operative assessment

As pre-operative assessment is commonly conducted by anaesthetists, potential airway problems are usually checked first. Typical examples include temporomandibular arthritis leading to difficulty open the mouth and cervical spinal fusion, impeding neck movement. The airway of this patient is likely to be challenging. Fig. 3 demonstrates a lateral cervical spine X-ray of a patient with severe rheumatoid arthritis where airway management is likely to be difficult.

Figure 3. Lateral cervical spine X-ray of a patient with advanced rheumatoid arthritis. The cervical vertebrae are almost completely fused. In addition a wire stabilising the spinous processi of C2 and C3 is also seen. This patient is likely to have minimal neck movement.

Further, detailed history of the cardiovascular, respiratory, digestive, and nervous system is important to exclude as many difficulties as possible that may present in the perioperative period.

Drug history

Patients receiving regular medication deserve special attention as some of the drugs may need to be stopped pre-operatively, and others should be continued if at all possible. Antacids, anticonvulsants, antihypertensives, antiparkinsonian drugs, antipsychotics, drugs for asthma, corticosteroids, immunosuppressants and drugs of dependence should always be continued in the preoperative period[6].

Of special interest are diabetic patients receiving antiglycaemic medication. These should be managed according to the local diabetes management protocol, specific to the institution where surgery is to take place. Another important group of drugs are the anticoagulants. These should be stopped in most circumstances, but there are special cases where anticoagulants may have to be continued, such as when the patient has a mechanical cardiac valve or drug-eluting coronary artery stent.

Examination

The patient should be thoroughly examined physically, including at a minimum the chest (heart and lungs), abdomen, basic neurology and the mouth and teeth (airway – see above). A number of medical conditions may not cause symptoms, but may be discovered by the careful practitioner. Aortic stenosis is a commonly quoted example – most patients are asymptomatic unless the stenosis is absolutely critical, but a murmur can usually be heard and if this is the case an echocardiogram ordered to assess the severity of the lesion. Moderate or severe aortic valve stenosis is associated with significantly worse outcome unless appropriate measures are taken in the peri-operative period, and surgery may even be required to replace the valve before the original planned operation can take place (Fig. 4).

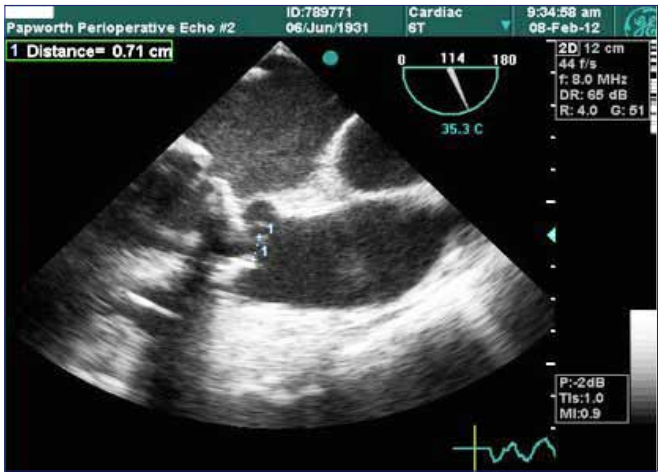

Figure 4a: Ttransoesophageal echocardiography: Midoesophageal Long Axis View of the aortic valve showing calcified aortic valve leaflets with maximal opening of 0.71 cm.

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Figure 4b: Ttransoesophageal echocardiography: Midoesophageal Short Axis View of the aortic valve showing calcified aortic valve leaflets with maximal valve area od 1.01 cm^2.

Pre-operative testing

When screening, or investigating a diagnosed pathological condition, a number of diagnostic tests can be useful. However, although the National Institute for Clinical Excellence (NICE) has reviewed the ordering of investigations in the preoperative setting for patients undergoing elective surgical procedures and has issued guidelines[7], the value of screening tests has been questioned recently[8]. As the NICE guidance is very comprehensive it is important that the assessor applies appropriate clinical acumen in choosing pre-operative tests that are likely to help the perioperative management of the patient.

Typical examples are: patients having joint replacements surgery will need full blood count and coagulation tested, patients scheduled for thoracic or cardiac surgery will need pre-operative chest X-ray. Elderly patients will need pre-operative ECG, as the incidence of ischaemic heart disease and conduction abnormalities are high. It is also important to note that routine pre-operative testing may not only mislead physicians but is also a costly exercise[9]. Table 2 represents examples of costing for typical investigations.

Addition of an E as postscript indicates that this is emergency surgery.

Investigation	Cost (£)
Chest radiograph	20.50
Haemostasis (coagulation)	3.65
Renal function	3.40
Arterial blood gases	3.10
Full blood count	2.35
Sickle cell (Sickledex)	2.30
Blood glucose	2.30
Pregnancy test	2.25
Lung function (spirometry)	2.10
Urinalysis dipstick	0.21

Table 2: Approximate costs of pre-operative investigations

Assessing risk associated with surgery

Assessing risk associated with surgery is a challenging task. There are number of risk scoring systems in use for predicting the outcome of surgery, but it is important to note that the risks attached to each patient are highly individual. One example is the Euroscore, used for predicting risk in cardiac surgery, which has recently been updated and can be calculated using a helpful online tool **(available at www.euroscore.org).**

Communicating risk

An important duty of medical professionals is to communicate risks associated with a particular procedure to the patient and their family[10]. The common risks associated with surgery are usually discussed with the patient by the surgeon at the time of their treatment proposal. However, it is important that the details of the common risks attached to the procedure are explained carefully. Risks of complications 1 in 10 to 1 in 100 are usually graded as high, risks of 1 in 100 to 1 in 1000 as moderate, risks of 1 in 1000 to 1 in 10 000 as low, risks 1 in 10 000 to 1 in 1 000 000 as minimal, and less than 1 in 1 000 000 as negligible[11].

Communicating risks efficiently is of paramount importance from the medico-legal point of view. When the pre-operative assessment takes place in an outpatient department, it is often appropriate to provide patients with further reading or audiovisual information to help clear understanding.

Peri-operative planning

Any problems identified during the pre-operative assessment should be discussed with the surgical and anaesthetic team so that appropriate planning is made. The patient needs to be advised on:

- **pre-operative starvation;**
- **glycaemic control;**
- **and cessation of current medication (anticoagulants and anti-platelet medication).**

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Plan for the timing of hospital admission, surgery, and expected discharge along with all necessary physiotherapy should be clarified. For major surgery where regional anaesthesia, invasive monitoring, urinary and gastric catheterisation are required, these should be planned pre-operatively. In cases where postoperative high dependency or critical care is expected, these should be organised in advance.

Documentation

It is important that all patient events are documented for several reasons:

- **to document the event;**
- **communicate facts and plans with other medical teams;**
- **and for medico-legal purposes.**

Documentation of all available and requested investigations are of paramount importance. Many hospitals have developed specialised streamlined documentation forms facilitating speedy and reliable records. Electronic documentation is currently replacing paper-based records.

Summary

Pre-operative assessment is a complex task. It involves a multidisciplinary team approach and aims at assessing patient fitness for surgery, identifying, communicating, and managing risk, as well as peri-operative planning. Efficient pre-operative assessment ensures a seamless patient journey through their surgical treatment, and avoids unexpected complications.

MCQs

1. Regarding pre-operative testing:
a) All patients require blood tests and ECG
b) All patients require blood tests
c) No patients require blood tests
d) Certain patients require blood tests and/or ECG
e) ECG is not required

2. During pre-assessment, all patients should:
a) Be asked about their clinical history but do not need to be examined
b) Be told to stop prescription drugs the day before admission
c) Be asked about their clinical history and be examined
d) Be told to stop aspirin 5 days before admission
e) Be told to stop warfarin 5 days before surgery

Answers

1. Answer: d)
Pre-operative testing is selective – certain patients based on their age, medical history, clinical examination or previous findings may require blood tests and/or ECG. Investigations however are costly and may be unnecessary, so local guidelines should always be followed, and guidelines should be regularly reviewed.

2. Answer: c)
All patients should be asked about their clinical history and be examined in the pre-assessment clinic. Some patients may need to continue aspirin or warfarin up to the day of surgery, depending on their history (coronary stent or mechanical heart valve). Some other prescription medications should also not be stopped, such as anti-epileptic drugs.

References

1. Woollam CH. The Sister Anaesthetists of Norwich. Anaes 2002, 57:984-94.
2. Nilsson H, Stylianidis G, Haapamaki M, Nilsson E, Nordin P. Mortality after groin hernia surgery. Ann Surg 2007, 245:656-60.
3. McFarlane HJ, van der Horst N, Kerr L, McPhillips G, Burton H. The Scottish Audit of Surgical Mortality: a review of areas of concern related to anaesthesia over 10 years. Anaes 2009, 64:1324-31.
4. Hallward G, Valchanov K. An unexpected pre-operative diagnosis. Eur J Echocardiogr 2010, 11:89-90.
5. Smith TB, Stonell C, Purkayastha S, Paraskevas P. Cardiopulmonary exercise testing as a risk assessment method in non cardio-pulmonary surgery: a systematic review. Anaes 2009, 64:883-93.
6. Dawson J, Karalliedde L. Drug interactions and the clinical anaesthetist. Eur J Anaes 1998, 15:172-89.
7. Mayor S. NICE guidance clarifies when to do preoperative tests in elective surgery. BMJ 2003, 326:1418.
8. Klein AA, Arrowsmith JE. Should routine pre-operative testing be abandoned? Anaes 2011, 65:974-6.
9. Valchanov K, Steel, A. Preoperative investigation of the surgical patient. Surgery 2008, 26:363-8.
10. White SM, Baldwin TJ. Consent for anaesthesia. Anaes 2003, 58:760-74.
11. Calman KC. Communication of risk: choice, consent, and trust. Lancet 2002, 360:166-8.

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DAY SURGERY ANAESTHESIA

MS May

Day Surgery Anaesthesia.
Good Clinical Care.

Abstract

Day surgery, the returning home of patients after surgery on the same day, has expanded due to social, anaesthetic, surgical and hospital organisational changes over the last two decades. For some procedures guidelines have been produced to benchmark the proportion of patients performed as day cases. Patient selection is as a consequence of three factors; surgical, anaesthetic and social. Anaesthetic technique is guided towards the use of briefly acting drugs to facilitate earlier recovery and discharge. Combinations of analgesics are typically used to limit the side effects of larger doses of individual drugs.

Introduction

Day surgery can be defined as - 'the admission of selected patients to hospital for a planned surgical procedure, returning home on the same day'. True day surgery patients are those who require full operating theatre facilities and/or a general anaesthetic and excludes outpatient procedures or endoscopy' (1)

Initially day surgery was limited to simple procedures by the drugs, equipment and facilities available. With the introduction of shorter acting 'cleaner' anaesthetic drugs, equipment such as the Laryngeal Mask, laparoscopic surgery and the widespread availability of dedicated day surgery facilities, day surgery has expanded.

In 1987 a Cholecystectomy would have been performed 'open' with a subcostal (painful) incision using longer acting anaesthetic gases and intravenous agents. Post operative analgesia would probably have been with opiates alone and the patient would have remained in hospital for 3 to 5 days. 25 years later in 2012, the surgery is 'key-hole', reducing the surgical stimulus. Modern, shorter acting anaesthetic agents are used and opiates are not regularly required post operatively. This, and patient expectation enable this procedure to be done as a day case in carefully selected patients.

Recommendations from NHS innovation bodies have helped efforts to increase day surgery use. The British Association of Day Surgery (BADS) along with the NHS Institute for Innovation and Improvement identified 10 procedures which could easily be done as day surgery procedures: (2)

Table 1: Ten procedures that can easily be done as day cases

Procedure	Current national day case rate (%)*	Potential national day case rate (%)**
1 Inguinal hernia	47.5	85
2 Varicose veins	54.4	90
3 Termination of pregnancy	89.0	95
4 Cataract	90.6	99
5 SMR	22.9	95
6 Extraction of wisdom teeth	87.9	95
7 Cystoscopy / TUR bladder tumour	19.1	40
8 Arthroscopy menisectomy	73.1	90
9 Excision of Dupuytren's Contracture	41.7	95
10 Myringotomy / grommets	85.0	98

Source: Hospital Episode Statistics (HES) for 2002/3. Based on admissions (FFCEs)

* National day case rate is calculated by dividing the total number of elective day case admissions across all providers (Trusts and PCTs) by the total number of elective admissions for each individual procedure.

** Potential day case rates are drawn from an exercise undertaken with a group of clinical leaders to estimate what the best possible national rate could be based on an international comparison.

Advantages of Day Surgery

The lack of overnight stay has significant financial and organisational savings. Both waiting times and the chance of the cancellation of the procedure due to lack of beds are reduced. Overall, patients express a preference for day surgery over inpatient surgery.

Overall day surgery is associated with extremely low (if any) mortality, reduces hospital acquired infection rates and has a low thrombo-embolic complication rate (3).

Finally there are advantages for staff, with respect to satisfaction, training opportunities and development.

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Patient Selection

This will be as a consequence of considering the following three factors together:

1) Operative / surgical
2) Anaesthetic
3) Social

Surgical

Although initially surgery was limited to procedures taking less than one hour, factors now taken into account are:

- the level of post operative pain and incapacity
- the risk of early post-operative complications
- continuing fluid loss
- the need for early specialist care

Duration of surgery is not as important as the overall surgical impact on post operative pain and care requirements.

Anaesthetic

Initially strict criteria were applied for patients to be deemed suitable and obesity, diabetes mellitus, chronic illness and even age limited day surgery. Today however in many cases day surgery is considered the 'default option'. Absolute contraindications are few, and include unstable chronic cardiac disease, such as unstable angina or limiting cardiac failure, where anaesthesia or surgery might decompensate the condition. Even a patient on long term oxygen could have a procedure done using a regional technique as a day case. For many stable chronic conditions, complications related to them occur peri-operatively or in the hours immediately following surgery, so little is gained by admission overnight routinely.

The general fitness and exercise tolerance of a patient is an excellent predictor of suitability for day surgery. There should be no arbitrary age or body mass index limit. As day surgery is associated with a minimal effect on nutrition and fluid intake, insulin dependant diabetes is not a contraindication, but patients should be first on a list to minimise the starvation period, do not need a sliding scale, and restart their normal regime as soon as possible post operatively.

Social

After general anaesthesia patients should be escorted home by a responsible adult able to provide support for the first 24 hours. (4) Patients should not transport themselves to and from the hospital due to surgical pain and anaesthetic effects. They need to be able to access a post discharge advice service if post operative advice or treatment is needed - but this does not necessarily have to be the site which the surgery took place.

Preoperative assessment

In most centres this will follow a standardised protocol and be performed by nursing staff, supported by a consultant anaesthetist. This is often stratified after a patient answered questionnaire. Pre-operative assessment provides an opportunity for the patient to visit the surgical centre and be given information on the process and post-operative recovery as well as ask questions. This often assists with pain management and outcome. Guidelines for routine preoperative investigations have been produced (5), but there is evidence that arbitrary routine testing alters little. (6)

Anaesthetic technique

1) Pre-operative fasting and fluid

Patients should be encouraged to consume clear fluids until 2 hours before anaesthesia, unless contraindicated. Unless specifically needed, premedication is not indicated.

2) Airway

Anaesthetic airway management will be determined by the surgery to be performed; the need for intubation is of no consequence in deciding whether a patient is suitable for day surgery (independent of a complex airway problem per se associated with possible post operative morbidity).

3) Anaesthetic agents

Shorter acting induction agents such as Propofol, should be used. The pharmacological properties of Propofol enable it be used also for maintenance of anaesthesia intravenously. Additionally it has antiemetic effects.

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If inhalational agents are to be used there are theoretical advantages of using Sevoflurane or Desflurane as in simple terms they are cleared faster from the body than Isofluarane at the end of anaesthesia. Neuromuscular blocking agents should be shorter acting, typically Atracurium, with a choice of Mivacurium if brief paralysis for intubation is needed; the alternative Suxamethomium is associated with muscle pain due to its depolarising mechanism of action.

4) Peri and Post operative pain

Longer acting opiates are associated with post operative nausea and sedation, and may delay discharge. For peri operative opiate analgesia Remifentanil by infusion has theoretical advantages, as its duration of effective action after termination of infusion is a matter of minutes. However it provides no post operative analgesia. Fentanyl is a more typical choice as it will provide peri and post operative analgesia.

Intravenous Paracetamol, (as oral and rectal administration have variable absorption) (7,8) and an intravenous non steroid anti-inflammatory such as Diclofenac can be used to provide initial post operative analgesia.

Local anaesthesia provides and adjunctive role, with for example in an inguinal hernia repair, the use of ilio inguinal and ilio hypogastric nerve blocks (9) and wound infiltration (10). For peripheral limbs individual nerve blocks depending on the operative site could be used although significant motor block may impede discharge with some blocks and limit there use. Even modified central neuraxial blocks (spinal block) can be performed with lower doses of local anaesthesia, but the similar motor effects hold true.

All these agents act of different parts of the 'pain pathway' avoiding the side effects of using larger doses of opiates (eg. nausea, drowsiness).

It is important to give patients realistic expectations with good pre op information, the concept that the pain is self limiting and does not necessitate admission.

An excellent source of guidelines are those of the Australian and New Zealand College of Anaesthetists Faculty of Pain Medicine. (11)

5) Post operative Nausea and Vomiting

For more prolonged procedures intravenous fluids may be given perioperatively greater than replacement needs as there is evidence this reduces the incidence of post operative nausea (12,13)

Certain types of surgery, eg. gynaecological laparoscopic procedures, particularly in an obese patient with a history of nausea and vomiting are more strongly associated with post operative nausea and vomiting. Similar to pain, combination therapies, targeting different parts of the nausea pathway may be given. For example a combination of Dexamethasone (a steroid), Ondansetron (5HT3 antagonist) and Cyclizine (H1 antagonist).

Post Operative Care

Any intravenous post operative analgesia given should be short acting, or preferably oral. A typical combination would be a compound paracetamol / codeine preparation plus a non steroidal anti inflammatory, such as Diclofenac. Once a patient has eaten, drunk and is capable of mobilising safely they can return to their home. It is vital they have the capacity to contact a 24 hour service (not necessarily the site of their surgery) in the event of complications such as wound infection / bleeding or uncontrolled pain. Typically this will be nurse led. The commonest complications are related to blood loss (14,15).

Multiple Choice Questions

Question 1

For day surgery anaesthesia:

a. Specific anaesthetic agents are used compared to non-day stay anaesthesia
b. Because of the likelihood of side effects or motor block, regional anaesthesia should not be used
c. Aspirin and Clopidogrel should be continued until the date of surgery
d. Any pain necessitates admission
e. Patients should be encouraged to drink clear fluids until 4 hours preoperatively

Question 2

When considering day stay anaesthesia for a patient:

a. A Body Mass Index (BMI) of 36 contraindicates day case anaesthesia.
b. Patients can be discharged with a wound drain for early outpatient review
c. Stable Angina is not a contraindication to day surgery
d. For all patients of 80 years or over an ECG should be performed as part of preoperative assessment
e. Only procedures shorter than 1 hour should be performed as day surgery

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Answers

Question 1

a. False. Drugs used in Day Surgery are not unique and are often used in non Day Surgery anaesthesia. However long acting opiate analgesics are less likely to be used, as are induction agents such as Thiopentone, which are more likely to have a 'hangover' effect after surgery

b. False. Even spinal anaesthesia in a modified form can be used for day case anaesthesia. In fact regional peripheral blocks and wound infiltration is considered part of a balanced analgesia regime.

c. False. This would result in unacceptable risk of post operative bleeding and need for admission, secondary to the antiplatelet functions of both drugs. On cardiological advice Aspirin might be continued in selected high selected risk patients. Aspirin does not contraindicate spinal anaesthesia or the use of regional anaesthesia.

d. False. Some pain is to be expected and does not warrant admission. On the simple 0-3 pain score-
0= no pain at rest, no pain on movement
1= no pain at rest, mild pain on movement
2= mild pain at rest, moderate pain on movement
3= continuous pain at rest
a score of 1 would be acceptable to allow discharge.

e. False. They should be encouraged to drink until 2 hours preoperatively.This reduces post operative nausea and perioperative fluid requirements.

Question 2

a. False. This is not even Morbid Obesity (defined as BMI >40). Even morbid obesity is not a contraindication to day surgery anaesthesia.

b. False. Unless a specific local service geared towards this is present, with 24 hour cover this would be inappropriate. Selection for day surgery includes surgical factors such as the requirement for post operative drains or catheters and the risk of continuing blood loss.

c. True. Unstable angina is. Anaesthesia in a patient with unstable angina is associated with an increased risk of cardiac complications.

d. True. NICE guidelines recommend this. Asymptomatic ECG findings relevant to anaesthesia such as conduction abnormalities are more common in this age group. Additionally because of the greater risk of complications the presence of a premorbid ECG may help diagnosis of any post operative changes.

e. False. The length of surgery is not a factor; it is the likelihood of pain and immobility secondary to surgical trauma which is of more significance.

References

1. Day surgery: Operational guide. Department of Health 2002
2. Day Surgery – Treat Day Surgery as the Norm: NHS Institute for Innovation and Improvement 2008
3. Majholm B et al. Is day surgery safe? A Danish multicentre study of morbidity after 57,709 day surgery procedures. Acta Anaesthesiol Scand 2012, 56:323-31.
4. Day case and short case surgery. AAGBI and BADS. Anaesthesiology 2001, 66:417-34
5. Preoperative tests: The use of routine preoperative tests for elective surgery. http://publications.nice.org.uk/preoperative-tests-cg3
6. Chung F, Yuan H , Yin L , et al. Elimination of preoperative testing in ambulatory surgery. Anesth .Analg 2009, 108:467 – 75

7. Stocker M, Montgomery J. Serum paracetamol concentrations in adult volunteers following rectal administration. Br J Anaesth; 2001, 87: 638-40
8. Moller P, Sindet-Pedersen S et al. Onset of acetaminophen analgesia: Comparison of oral and intravenous routes after third molar surgery. Br J Anaesth, 2004, 94:642-Toivonen J, Permi J, Rosenberg P.
9. Analgesia and discharge following preincisional ilioinguinal and iliohypogastric nerve block combined with general or spinal anaesthesia for inguinal herniorrhaphy. Acta Anaesthesiol Scand 2004, 48:480-5
10. Ausems M et al. Postoperative analgesia requirements at home after inguinal hernia repair: effects of wound infiltration on postoperative pain. Anaesthesia, 62:325–31.
11. Acute pain management: scientific evidence third edition 2010: Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine 2010
12. Magner J, McCaul C,Carton E,Gardiner J and Buggy D Effect of intraoperative intravenous crystalloid infusion on postoperative nausea and vomiting after gynaecological laparoscopy: comparison of 30 and 10 ml kg-1 Br J Anaesthesia 2004, 93:381–5
13. Maharaj C, Kallam S, Malik A, Hassett P, Grady D, Laffey J Preoperative intravenous fluid therapy decreases postoperative nausea and pain in high risk patients. Anesth Analg. 2005, 100:675-82
14. Engbaek J , Bartholdy J , Hjorts N. Return hospital visits and morbidity within 60 days after day surgery: a retrospective study of 18,736 day surgical procedures . Acta Anaesthesiol Scand 2006, 50: 911–9
15. Twersky R , Fishman D , Homel P . What happens after discharge? Return hospital visits after ambulatory surgery Anesth Analg 1997, 84 : 319–24.

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INTRAOPERATIVE CARE

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Abstract

Intraoperative care lasts from the time the patient enters the induction room to when the operation is complete and the patient comes to the recovery ward. This article tries to familiarise the Foundation doctor with the operating theatre environment with an emphasis on measures which are in place to ensure the safety of patients. It observes the patient care in the intraoperative period from the anaesthetist's point of view.

The importance of intra-operative anaesthetic care

General anaesthesia is a state of induced, reversible loss of consciousness, during which the patient will be unaware of their surroundings and of painful stimuli. Regional and local anaesthesia are states in which parts of the body are rendered insensible to painful stimuli. These states may be accompanied by sedation which alters the patient's level of consciousness. The effects of anaesthesia and of the surgical procedure may have profound physiological consequences for the patient, and require monitoring and if needed correction throughout anaesthesia.

The continuous presence of an appropriately trained and experienced anaesthetist is essential during anaesthesia. Monitors with appropriately set alarms may detect critical incidents and provide an early warning of the consequences of an error. The anaesthetic record is an important medical document, which should contain the relevant physiological measurements and relevant observations during every anaesthetic.

Case Study

A 52 year old lady is on a surgical list for an elective cholecystectomy for a recent episode of acute cholecystitis secondary to gall stones. She weighs 70 Kg and her height is 162 cm. She was previously fit and well and her investigations, including full blood count, urea, electrolytes and liver function tests were normal. Blood was grouped and saved. On the day of the operation she has been assessed by an anaesthetist and consented for a general anesthetic.

The availability and function of all anaesthetic equipment should be checked before starting. Consideration should be given to the induction and maintenance of anaesthesia, the position of patient on the operating table, the equipment necessary for monitoring, the use of intravenous fluids or blood for transfusion and the post-operative care recovery facilities that will be required.

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Guidance from the Royal College of Anaesthetists for provision of anaesthetic services for intra-operative care[1]

a) An appropriately trained and experienced anaesthetist must be present throughout the conduct of all general and regional anaesthetics and procedures requiring sedation given by an anaesthetist. This is the main determinant of the safety of patients during anaesthesia.

b) An anaesthetic assistant who is trained and competent must be present throughout the entire anaesthetic procedure, and provide exclusive assistance to the anaesthetist.

c) All anaesthetic equipment must be checked before use according to the published guidelines.

d) The recommended standards of monitoring must be met for every patient.

e) Policies and equipment must be in place to protect patients and staff from cross infection.

f) If appropriate resources are not available, the level of clinical activity should be limited to ensure a safe provision of intra-operative care.

The following ancillary anaesthetic equipment must also be available at all sites where patients are anaesthetised:

- oxygen supply
- facemasks
- suction
- airways (e.g. 'Guedel')
- laryngoscopes
- tracheal tubes and connectors
- intubation aids (e.g. bougies, forceps etc)
- laryngeal mask airways
- heat-moisture exchange filters
- self-inflating bag
- trolley/bed/operating table that can be rapidly tilted head-down

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Monitoring

The recommended standards of monitoring must be met for every patient.

The equipment to monitor the anaesthetic machine:

- Oxygen analyzer
- Device to display airway pressure whenever positive pressure ventilation is used, with alarms that warn if the pressure is too high or too low
- Vapour analyser whenever a volatile anaesthetic agent is in use
- Capnograph

The equipment to monitor the patient:

- Pulse oximeter
- Non-invasive blood pressure
- Electrocardiograph
- Capnograph
- Means of measuring the patient's temperature
- Nerve stimulator when a muscle relaxant is used.

Some patients will require additional monitoring equipment, such as invasive pressure which should be readily available, and cardiac output monitors to which there should be access.

Figure 1

Figure 2

Intraoperative monitoring

Induction

The WHO Surgical Safety Checklist was completed by all staff members who would be present in the operating theatre. This was done prior to inducing the patient. In the UK, it is customary to establish suitable anaesthesia in the induction room and transfer the patient to the operating theatre. After identification and the regular safety checks, the patient is cannulated and connected to the standard monitoring in the induction room. For induction the patient should lie on a tiltable table or a trolley.

The lady in this case is preoxygenated to provide some degree of reserve during periods of apnoea. Anaesthesia is induced using fentanyl 100 mcg and propofol 180mg intravenously. Since the patient needs to be paralysed for the the procedure and needs an endotracheal intubation, atracurium 35 mg (muscle relaxant) is given. Muscle relaxants causes temporary paralysis of the muscles and are used for producing an adequate surgical condition or for inserting endotracheal tube. In this case a muscle relaxant is used to achieve both intubation and achieve adequate ventilation whilst the patients abdomen is insufflated with carbon dioxide. A commonly used laryngeal mask airway does not prevent inhalation of gastric or oropharyngeal contents. A nasogastric tube and nasopharyngeal temperature probe are inserted. The eyes are kept shut with tape.

Operating Room

The patient is transferred to the operating theatre and positioned supine on the table with arms on her side wrapped up and securely held. An intravenous drip of Hartmann's solution passing through a warming coil gives the anaesthetist continuous access to administer intravenous drugs. Limbs are padded at pressure points where nerves may be in danger of being damaged by compression. Intermittent compression devices are placed around the calf to prevent deep vein thrombosis and forced air devices are used to prevent hypothermia.

The second WHO Checklist was run before the incision.

Figure 3

INTRAOPERATIVE CARE

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Intraopertive environment

Maintenance

Anaesthesia was maintained by oxygen and air mixture with sevoflurane, an inhalational anaesthetic agent. Since the patient was paralysed by muscle relaxant, intermittent positive pressure ventilation is used to ventilate and end tidal CO_2 was maintained in the normal range. Augmentin 1.2g, the antibiotic as advised by hospital policy, was administered before the surgical procedure commenced. Analgesics included morphine 10 mg given in intermittent doses along with Paracetamol 1g and diclofenac 75 mg intravenously administered during the course of the procedure. Blood pressure drop was corrected by boluses of ephedrine in aliquots of 3mg IV and boluses of fluid. Antiemetic, ondansetron 5HT3 receptor anagonist was used to reduce the incidence of post-operative nausea and vomiting. The patient received 1.5 L of Hartmann's solution during the procedure.

Reversal

At the end of the procedure when the gall bladder was removed and the skin sutured, local anaesthetic bupivacaine 0.25% 20 ml was infiltrated into the wound. The muscle relaxation was reversed by a combination of neostigmine and glycopyrolate and the patient was allowed to breathe spontaneously. When patient regained her airway reflexes, extubation was done and she was transferred to recovery ward. The third WHO Checklist was completed before patient left the operating theatre. Her care was handed over the to a recovery nurse with a review of intraoperative care and advice for further management.

The WHO Surgical Safety Checklist 2

Avoidable surgical complications account for a large proportion of preventable medical injuries and deaths globally. Adverse events have been estimated to affect 3% to 16% of all hospitalized patients, and more than half of such events are known to be preventable3. The aim of the Safe Surgery Saves Lives program is to remedy these problems.

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Surgical operating teams have 10 essential objectives which the WHO Safe Surgery guidelines support.

1. The team will operate on the correct patient at the correct site.
2. The team will use methods known to prevent harm from administration of anaesthetics, while protecting the patient from pain.
3. The team will recognize and effectively prepare for life threatening loss of airway or respiratory function.
4. The team will recognize and effectively prepare for risk of high blood loss.
5. The team will avoid inducing an allergic or adverse drug reaction for which the patient is known to be at significant risk.
6. The team will consistently use methods known to minimize the risk for surgical site infection.
7. The team will prevent inadvertent retention of instruments and sponges in surgical wounds.
8. The team will secure and accurately identify all surgical specimens.
9. The team will effectively communicate and exchange critical information for the safe conduct of the operation.
10. Hospitals and public health systems will establish routine surveillance of surgical capacity, volume and results.

These objectives should be achieved by following checklists. These safety lists are checked before inducing the patient, prior to surgical incision and after the procedure is completed. Implementation of checklists was associated with concomitant reductions in the rates of death and complications among patients who were undergoing noncardiac surgery in a diverse group of hospitals[3].

MISSING - PLEAS SEND!

Table 1

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Example of WHO Surgical Safety Checklist

Before induction (Sign in)

a) The patient has verified his or her identity, the surgical site and procedure, and consent.
b) The surgical site is marked or site marking is not applicable.
c) All members of the team are aware of whether the patient has a known allergy.
d) The patient's airway and risk of aspiration have been evaluated and appropriate equipment and assistance are available.
e) If there is a risk of blood loss of at least 500 ml (or 7 ml/kg of body weight, in children), appropriate access and fluids are available.

Before incision (Time out)

a) The entire team (nurses, surgeons, anesthesia professionals, and any others participating in the care of the patient) orally confirms that all team members have been introduced .
b) Confirms the patient's identity, surgical site, and procedure.
c) Reviews the anticipated critical events.
d) Surgeon reviews critical steps, operative duration, and anticipated blood loss.
e) Anesthesia staff review concerns specific to the patient.
f) Nursing staff review confirmation of sterility, equipment availability, and other concerns.
g) Confirms that prophylactic antibiotics have been administered ≤60 min before incision is made or that antibiotics are not indicated.
h) Confirms that all essential imaging results for the correct patient are displayed.

Before the patient leaves the operating room (Sign Out)

a) Nurse reviews items aloud with the team.
b) Name of the procedure as recorded.
c) That the needle, sponge, and instrument counts are complete (or not applicable).
d) That the specimen (if any) is correctly labelled, including with the patient's name.
e) Whether there are any issues with equipment to be addressed.
f) The surgeon, nurse, and anaesthetist review aloud the key concerns for the recovery and care of the patient.

The checklist is based on the first edition of the WHO Guidelines for Safe Surgery[3].

Summary

Intraoperative care is complex and involves dozens of steps which must be optimized for individual patients. Better functioning teams have shown improved outcomes[3]. Teamwork and communication seems to be the key factors in achieving this.

References

1) **http://www.rcoa.ac.uk/docs/GPAS-Intraop.pdf**

2) World Alliance for Patient Safety. WHO guidelines for safe surgery. Geneva: World Health Organization, 2008.

3) Haynes AB, Weiser TG, Berry WR et al. N Engl J Med 2009, 360:491-9.

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Abstract

Post-operative patients can be a vulnerable group and they should be monitored in an appropriate area and assessed by trained nursing staff and doctors. In order for these patients to receive optimal post-operative care we must take all the organ systems into account. Management includes optimisation of the respiratory and cardiovascular systems, fluid and electrolyte management, prevention and control of sepsis, and nutrition. You should only accept responsibility for management of a post-operative patient if you feel you have been adequately equipped with the skills necessary to do so. If not, never hesitate to call for assistance from someone who will be more experienced in dealing with these patients.

This article will discuss the assessment of the postoperative patient, followed by discussion of the most common postoperative complications, their differential diagnosis, and their investigation and management.

Assessment of the postoperative patient

All patients should be clinically assessed when they return to the ward after an operation. Patients at risk of deterioration, such as those following high risk surgery, emergency surgery or operations taking place out of hours, and American Society of Anaesthesiology (ASA)* Grade 3 patients should be assessed more frequently i.e. within 2 hours of the first postoperative assessment.[2]

ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

Table 1: The ASA physical status classification system is a classification system adopted by the American Society of Anaesthesiologists for assessing preoperative physical fitness[1].

Review the patient's past medical history, medications and any allergies, as well as checking what operation the patient had, note any intraoperative complications from the operative note and review the anaesthetic record for complications, drugs administered and postoperative instructions.[2]

Basic examination should include heart rate, blood pressure, respiratory rate, temperature, peripheral oxygen saturation and urine output, as well as a pain assessment. The rest of your examination and further investigations will depend on your initial findings but a modified early warning score (MEWS) can be a very useful tool in identifying patients at risk of catastrophic deterioration.

Score	3	2	1	0	1	2	3
Respiratory rate (per min)		<8		9-14	15-20	21-29	>29
Heart rate (per min)		<40	41-50	51-100	101-110	111-129	>129
Systolic BP (mmHg)	< 70	71-80	81-100	101-199		>200	
Urine output (ml/kg/hr)	Nil	<0.5					
Temperature (°C)		<35	35.1-36	36.1-38	38.1-38.5	>38.6	
Neurological (AVPU)				Alert	Reacting to voice	Reacting to pain	Unresponsive

Table 2: Modified Early Warning Score[2]. A doctor is informed if the MEWS is 4/more.

Hypoxia

Differential diagnosis:

1. Atelectasis / collapse
2. Hypoventilation (secondary to pain / opioids)
3. Pneumothorax / Haemothorax
4. Pleural effusion
5. Pneumonia
6. Pleural effusion

Hypoxaemia can occur in the postoperative period and there are a number of different reasons for this (see above). Check the patient's saturation, effort of breathing, respiratory rate, if the trachea is central or not which may indicate a pneumo- or haemo-thorax and listen for breath sounds. Any patient who develops hypoxia post-operatively and in whom there is a suspicion of pulmonary complications should have an arterial blood gas, a sputum culture and an ECG. Chest X-ray should also be performed if you suspect major collapse, pleural effusions, pneumothorax or haemothorax.

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These patients should all be prescribed oxygen and a device that will achieve the necessary SpO_2 should be used. If a patient fails to maintain SpO_2 >90% or PaO_2 >8.0kPa, referral should be made to the intensive care team to assess the need for assisted ventilation.

Hypotension

Hypotension is a common postoperative complication that can cause hypoperfusion of vital organs and serious complications. The level at which damage to vital organs occurs is dependent on the preoperative blood pressure and therefore measurements should always be reviewed with reference to this but a drop of more than 20 – 30% from baseline, a systolic blood pressure <100mmHg, or symptoms/signs of vital organ hypoperfusion, should warrant intervention.

Differential diagnosis

1. Hypovolaemia – due to failure to replace preoperative fluid deficit, evaporative losses during surgery, and blood loss

2. Decreased preload secondary to sympathetic nervous system blockade from a regional block causing increased venous capacitance

3. Decreased cardiac output secondary reduced stroke volume due to myocardial ischaemia/infarction or pulmonary embolism

4. Decrease cardiac output secondary to arrhythmia

5. Decreased afterload secondary systemic sepsis, anaphylactic or transfusion reactions

If hypotension occurs, give supplemental oxygen, increase the rate of infusion of intravenous fluids or insert an intravenous cannula if not already present as hypovolaemia is the most likely cause of hypotension in a postoperative patient. Check the heart rate and rhythm as well as checking for bilateral breath sounds. Note any recent drug administration and stop any infusion or medication which may be causing vasodilation. If there is no palpable pulse, an unrecordable blood pressure and the patient is unconscious, cardiopulmonary resuscitation should be commenced and the cardiac arrest team called. Arterial blood gas can be a useful way of rapidly assessing haemoglobin, metabolic disturbance and electrolyte imbalance.

Fluid management

There is significant controversy over whether crystalloids or colloids are better for fluid resuscitation but intravascular expansion with one or other will correct hypovolaemia. In the first instance, crystalloid is often sufficient but colloids (gelatins, hydroxyethyl starch) are useful as they remain in the intravascular space longer. Crystalloid solutions such as normal saline or Hartmann's (Ringer's lactate) solutions do not possess any oncotic properties and therefore only 25% of their volume remains in the intravascular space after infusion. Hartmann's solution is recommended as the first-line therapy as its electrolyte concentration is similar to physiological body fluid. Infusion of large volumes of normal saline can lead to metabolic acidosis secondary to hyperchloraemia.[8]

If fluid administration (~500mls) does not improve hypotension, the other causes of hypotension must be considered.[6] Sympathetic nervous system blockade due to regional anaesthesia will usually respond to fluid administration but occasionally an alpha-adrenergic agent (e.g. phenylephrine) will be necessary and should be administered by an anaesthetist or intensive care specialist. If there is an epidural infusion running this should temporarily be stopped to allow the block to recede. Ultimately, definitive treatment of postoperative hypotension should be directed at the underlying cause.

Hypertension

Systemic hypertension is defined as a systolic blood pressure >160mmHg or a diastolic blood pressure of >90mmHg. Postoperative hypertension usually lasts between four to eight hours. Patients commonly have a moderate rise in blood pressure immediately postoperatively due to pain and anxiety but significant hypertension increases morbidity and should be treated. Pain, anxiety, hypothermia and hypoxaemia are all reversible causes of hypertension, and should be considered prior to commencing antihypertensive treatment.[9]

Differential diagnosis

1. Pre-existing hypertension – these patients often have exaggerated postoperative blood pressure responses; anti-hypertensive medications may have been omitted.

2. Enhanced sympathetic nervous system activity secondary to pain, anxiety, full bladder OR due to hypoxia, hypercarbia, acidosis, hypoglycaemia, myocardial ischaemia.

3. Intracerebral bleed, increased intracranial pressure.

4. Metabolic disorders – phaeochromocytoma, thyrotoxicosis, malignant hyperthermia.

5. Medications given intraoperatively – ketamine, atropine/ glycopyrolate (decrease parasympathetic activity).

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Uncontrolled hypertension is an independent predictor of morbidity, mortality and unplanned critical care admission. If left untreated, it can depress left ventricular function, increase myocardial oxygen demand, be a cause of stroke, acute myocardial infarction and arrhythmias, as well as causing postoperative bleeding and disruption of suture lines.

Indications for treatment of postoperative hypertension include a blood pressure greater than 30% above resting blood pressure, signs or symptoms of complications, for example, headache, bleeding, visual disturbances, angina or ST segment depression. Treatment should aim to reduce blood pressure to near preoperative baseline levels for the individual patient, as any lower may lead to hypoperfusion of vital organs in patients with pre-existing hypertension. Direct treatment towards any reversible causes of increased sympathetic nervous system activity by administering analgesics for pain or sedatives for anxiety but if hypertension persists administration of antihypertensives may be necessary.

Treatment

Ideally, acute postoperative hypertension is treated with an intravenous antihypertensive, which is rapidly acting and has a short duration of action (e.g. sodium nitroprusside, nitroglycerin, hydralazine).[9] This is to ensure the appropriate blood pressure is achieved both quickly and safely but the use of these agents also requires invasive blood pressure monitoring and this is often impractical on the ward. More useful agents on the ward are calcium antagonists, beta blockers, angiotensin-converting enzyme inhibitors and fenoldopam (which is a selective dopamine-1 receptor agonist) but each of these carry their own side-effects and contraindications.

Pain

Pain is defined as an unpleasant sensory of emotional experience associated with actual or potential tissue damage. Acute pain is associated with acute injury as is the case in the postoperative period.

Optimising post-operative pain relief has a significant impact not only on the mental wellbeing of the patient but also on their physiological state. Adequate postoperative pain management leads to a reduced risk of sympathetic activity and acute cardiorespiratory events, in addition to improved wound healing and earlier hospital discharge.

Assessment

A good history will elicit the type, nature and duration of pain. Examination and other clinical observations, such asheart rate, blood pressure andrespiratory ratewill also aid your assessment. This will elicit whether pain is due to the operative procedure alone or if it is secondary to an underlying disease process. If the pain is disproportionate to the operative procedure and the amount of analgesia already received, this should alert you to something more sinister. For example, extreme pain in a fixated fractured limb may be indicative of compartment syndrome.[2].Different scoring systems have been developed to quantify pain and are useful when attempting to assess severity.They can help guide appropriate analgesia. Examples of scoring systems include:

- **Visual analogue scale**
  - Scored between 'no pain' and 'pain as bad as it can be'.

- **Verbal response score**
  - Scored according to words, e.g. mild, severe
  - Or scored according to a number, e.g. 2 out of 4

- **Autonomic response**
  - Tachycardia, hypertension, sweating

- **Dynamic pain scores**
  - Pain on movement, ability to take a deep breath, ability to cough

Treatment

The WHO analgesia ladder, originally used as a tool for cancer pain, is an effective aid in helping to guide the prescription of adequate analgesiain the post-operative period. It is always prudent to check the anaesthetic chart to note when drugs were administered so as not to exceed safe dosage levels in the immediate post-operative period.

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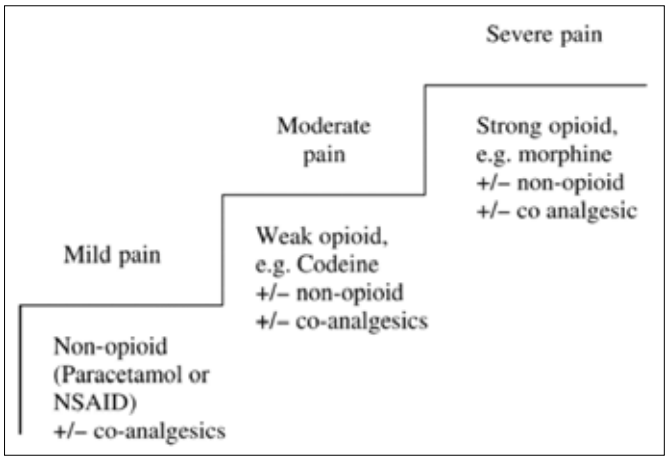

Figure 1: The WHO analgesia ladder[3].

1. ASA Physical Status Classification System Available from ***http://www.asahq.org/clinical/physicalstatus.html***

2. Gardner-Thorpe J, Love N, Writghtson J, Walsh S, Keeling N. The value of Modified Early Warning Score (MEWS) in surgical in-patients: a prospective observational study. Ann R Coll Surg Engl 2006; 88: 571-575

3. Prostate cancer: palliative care and pain relief. British medical bulletin. Online ISSN 1471-8391 - Print ISSN 0007-1420 ***http://bmb.oxfordjournals.org/content/83/1/341/F2.expansion***

Patients already on high doses of opiates for chronic pain will require larger doses than would be normally expected to achieve effective pain relief in the post-operative period. Consideration of opioid side effects may necessitate concomitant prescription of laxatives, anti-emetics, and potentially naloxone, to relieve constipation, nausea,vomiting and respiratory depression respectively. [14]

Special considerations:

1.Patient Controlled Analgesia

Patient controlled analgesia (PCA) isa pump for intravenous opiate administration controlled by the patient via a button. It has a lockout time period which ensure no opiate overdose. Two major advantages of this system are that there is no need for a nurse to administer analgesia and the patient receives almost immediate pain relief. It is also useful in providing analgesia to those who are nil by mouth post-operatively or who are vomiting. Disadvantages are that the patient needs a dedicated cannula to administer the drug. If a patient has a PCA it is important to check the type of opiate used (morphine, fentanyl, oxycodone, remifentanil), the bolus dose and lockout time. The patient should not be prescribed or administered any other opiate whilst using aPCA device.

2. Epidural Analgesia

Epidural analgesia is reserved for patients who are expected to be in significant pain post-operatively i.e. following laparotomy for general, urological, gynaecological or lower limb orthopaedic surgery. A mixture of local anaesthetic and opiate is usually used as an infusion via an epidural catheter. No other opiates should be administered whilst the epidural is in use. Trained staff competent in epidural catheter care and monitoring of these patients is required on the ward. Removal of an epidural catheter should be at least 12 hours post subcutaneous thromoprophyalxis administration to minimise haematoma formation. On removal of the epidural catheter it is important to ensure that other alternative analgesia is prescribed.[14]

When a PCA or epidural does not provide adequate pain relief or there is a problem with the equipment the Acute Pain team should be informed and review requested at an early stage.

Post-operative Nausea and Vomiting

Postoperative nausea and vomiting (PONV) is a common complication of surgery. Severe cases can cause increased bleeding, suture dehiscence, increased intracranial pressure and intra-ocular pressure, and aspiration pneumonitis. Prolonged vomiting can also result in loss of hydrogen and potassium ions giving a metabolic alkalosis thus increasing morbidity. PONV prevents the early discharge of daycase patients, causes an increased length of hospital stay, not to mention much discomfort for the patient.

Differential diagnosis

1. Pain
2. Hypotension
3. Opioids
4. Intestinal obstruction
5. Anxiety
6. Anaesthetic inhalational agents
7. Infection

The vomiting centre is a complex network of neurons that are situated in the medulla. Afferent inputs to this centre are from the chemo-receptor-trigger zone, vagal afferents from the gastro-intestinal tract and vestibular afferents to name a few. Four major neurotransmitters are involved: Dopaminergic (D2), histaminergic (H1), cholinergic (muscarinic) and serotinergic (5HT3). Therefore treatment of PONV focuses on drugs that act on these receptors. Examples of different types of anti-emetic drugs used to treat PONV are:

- **Ondansetron – a 5HT3 antagonist**
- **Cyclizine – a H1 antagonist**
- **Prochlorperazine / metoclopramide – D2 receptor antagonists**

When PONV persists despite treatment with one anti-emetic, further management of PONV should include another drug whose action is on a different receptor. Intravenous fluids are also useful in alleviating nausea as well as replacing losses from excessive vomiting.

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Pyrexia

Fever following major surgery is defined as a core body temp greater than 38ºC. This can be a common feature post-operatively and inflammatory markers may be temporarily raised as part of the body's 'stress response' to surgery. If this does not resolve, development of post-operative fever, if associated with shock or organ dysfunction can cause mortality between 20-40%. Early identification and management of infection is key in preventing this high mortality rate.

Identification of pyrexia in addition to other symptoms defines systemic inflammatory response (SIRS). Post-operative sepsis is defined as SIRS in addition to a documented site of infection.

The response is defined by the presence of two or more of the following:

- Temperature >38ºC or <36ºC
- Heart rate >90 beats per minute
- Respiratory rate > 20 breaths per minute
- White cell count > 12,000 or < 4000

Differential diagnosis

1. Lower respiratory tract infection
2. Urinary tract infection (may be catheter-related)
3. Wound infection / collection
4. Anastomotic breakdown (in bowel surgery)
5. Thrombophelbitis from cannula site
6. Central venous catheter infection
7. Deep vein thrombosis

Management

It is important that blood cultures are taken as soon as pyrexia is identified in addition to other investigations to aid diagnosise.g. sputum cultures, urine samples, wound swabs for microbiology. Prompt treatment with appropriate antibiotics should be initiated as soon as possible. If the source of infection is not known then broad- spectrum antibiotics can be used until microbiology results are available.

Hypothermia

Hypothermia is defined as a core body temperature of less than 36ºC. It occurs in patients post-operatively because of anaesthetic-impaired thermoregulation (lack of shivering and reduced metabolic activity), cold theatre environment and open body cavity causing increased heat loss to the environment. Hypothermia left untreated post-operatively can lead to a number of complications including:

- Coagulopathy
- Impaired drug metabolism
- Cardiac events including myocardial ischaemia and arrhythmias
- Delayed wound healing
- Increased oxygen consumption (with shivering)
- Increased rates of surgical wound infection
- Longer hospital stay.

Management

Maintenance of normothermia can be achieved with the use of passive insulators such as cotton blankets or drapes, which can reduce heat loss by 30%. If hypothermia persists, forced air warming should be initiated and the use of warmed intravenous fluids is recommended. [12]

Conclusion

This article should help equip you knowledge and understanding of the common problems that can occur in the post-operative patient, and give you tools to help address these problems in the first instance. However, it is possible that despite your interventions no improvement is seen and therefore it is important to know when to call for help from senior surgical colleagues, the acute pain team or the critical care outreach team or intensive care team. Call for more senior assistance when:

1. Your interventions have failed to improve the patient

2. The patient has started to deteriorate further

3. It becomes apparent that the patient may need a higher level of care i.e. HDU or ICU for invasive monitoring, inotropic or respiratory support which are unavailable on the ward

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Multiple Choice Questions

1. Post-operative hypotension:

a) is defined as a drop in baseline blood pressure by 20-30%, or a systolic blood pressure <100mmHg. (T)
b) if left untreated can cause hypoperfusion of vital organs. (T)
c) is most likely caused by hypovoalemia. (T)
d) should always be treated with 1000mls of Hartmann's solution in the first instance. (F)
e) will not be affected by epidural infusons. (F)

2. Post-operative pain:

a) is a contributory factor in myocardial ischaemia. (T)
b) can be assessed using a verbal rating scale. (T)
c) which persists whilst on a PCA can be supplemented with oral codeine. (F)
d) management is effective when guided by the WHO Analgesia ladder. (T)
e) management in patients with chronic pain may be more difficult. (T)

References

1. Ford, J. A., MacKay, C., Peach, C., Davies, P. and Loudon, M. (2011), Putting guidelines into practice: a tailored multi-modal approach to improve post-operative assessments. Journal of Evaluation in Clinical Practice. doi: 10.1111/j.1365-2753.2011.01780.x
2. Scottish Intercollegiate Guidelines Network – Postoperative management in adults. Available from **http://www.sign.ac.uk/pdf/qrg77.pdf**
3. ASA Physical Status Classification System Available from **http://www.asahq.org/clinical/physicalstatus.html**
4. CP Subbe, M Kruger, P Rutherford, L Gemmel. Validation of a modified Early Warning Score in medical admissions. QJM 2001 94(10): 521-526
5. Gardner-Thorpe J, Love N, Writghtson J, Walsh S, Keeling N. The value of Modified Early Warning Score (MEWS) in surgical in-patients: a prospective observational study. Ann R Coll Surg Engl 2006; 88: 571-575
6. Levin P. Postoperative hypotension **http://www.anes.ucla.edu/perioperative/page1/page5/Hypotension**
7. Roberts I, Alderson P, Bunn F, Chinnock P, Ker K, Schierhout G. Colloids versus crystalloids for fluid resuscitation in critically ill patients. Cochrane Database Syst Rev 2004 Oct 18;(4):CD000567
8. Al-Khafaji A, Webb AR. Fluid resuscitation. CEACCP 2004 Vol 4;(4): 127-131
9. Haas CE, LeBlanc JM. Acute postoperative hypertension: a review of therapeutic options. Am J Health Syst Pharm 2004 Aug 15;61(16):1661-73
10. Rose DK, Cohen MM, DeBoer DP. Cardiovascular events in the postanesthesia care unit: contribution of risk factors. Anesthesiology. 1996 Apr;84(4):772-81.
11. Levin P. Postoperative hypertension. **http://www.anes.ucla.edu/perioperative/page1/page5/Hypertension**
12. American Society of Anaesthesiologists Task Force on Acute Pain Management. Practice guidelines for acute pain management in the perioperative setting. Anaesthsiology 2004:100: 1573-1581
13. Charlton, E. World Federation of Societies of Anaesthesiologists. The Management of Post-Operative Pain. Issue 7 (1997) Article 2 **http://www.nda.ox.ac.uk/wfsa/html/u07/u07_003**
14. Nagaratnam M, Sutton H, Stephens R. Prescribing analgesia for the surgical patient. British Journal of Hospital Medicine. January 2007:Vol 68; No 1
15. World Health Organisation Pain ladder **http://www.who.int/cancer/palliative/painladder/en/**
16. Prostate cancer: palliative care and pain relief. British medical bulletin. Online ISSN 1471-8391 - Print ISSN 0007-1420 **http://bmb.oxfordjournals.org/content/83/1/341/F2.expansion**
17. Ballantyne JC, Carr DB, Chalmers TC, Dear KB, Angelillo IF, Mosteller F. Postoperative patient-controlled analgesia: meta-analyses of initial randomized control trials. J Clin Anesth 1993; 5:182-93
18. Gan et Al. Consensus Guidelines for Managing Postoperative Nausea and Vomiting. Anesth Analg 2003;97:62–71
19. Gan et al. Society for Ambulatory Anesthesia Guidelines for the Management of Post-opertaive Nausea and Vomiting. Anesth Analg 2007;105:1615-28
20. Bone RC, Balk RA, Cerra FB, et al. ACCP/SCCM consensus conference: definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest 1992; 101: 1644-55
21. Perioperative hypothermia (inadvertent): NICE Guideline **http://guidance.nice.org.uk/CG65/NICEGuidance**

POSTOPERATIVE RECOVERY

M Verghese

Management. Practice guidelines for acute pain management in the perioperative setting. Anaesthsiology 2004:100: 1573-1581

1. Charlton, E. World Federation of Societies of Anaesthesiologists. The Management of Post-Operative Pain. Issue 7 (1997) Article 2 **http://www.nda.ox.ac.uk/wfsa/html/u07/u07_003**
2. Nagaratnam M, Sutton H, Stephens R. Prescribing analgesia for the surgical patient. British Journal of Hospital Medicine. January 2007:Vol 68; No 1
3. World Health Organisation Pain ladder **http://www.who.int/cancer/palliative/painladder/en/**
4. Prostate cancer: palliative care and pain relief. British medical bulletin. Online ISSN 1471-8391 - Print ISSN 0007-1420 **http://bmb.oxfordjournals.org/content/83/1/341/F2.expansion**
5. Ballantyne JC, Carr DB, Chalmers TC, Dear KB, Angelillo IF, Mosteller F. Postoperative patient-controlled analgesia: meta-analyses of initial randomized control trials. J Clin Anesth 1993; 5:182-93
6. Gan et Al. Consensus Guidelines for Managing Postoperative Nausea and Vomiting. Anesth Analg 2003;97:62–71
7. Gan et al. Society for Ambulatory Anesthesia Guidelines for the Management of Post-opertaive Nausea and Vomiting. Anesth Analg 2007;105:1615-28
8. Bone RC, Balk RA, Cerra FB, et al. ACCP/SCCM consensus conference: definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest 1992; 101: 1644-55
9. Perioperative hypothermia (inadvertent): NICE Guideline **http://guidance.nice.org.uk/CG65/NICEGuidance**

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PAEDIATRIC ANAESTHESIA & SAFEGUARDING CHILDREN

K McPherson & C Frith

Paediatric anaesthesia & Safeguarding children. Good Clinical Care.

Abstract

Anaesthesia for the paediatric population requires an understanding of the physiological, anatomical and behavioural differences of children and adults.

Preassessment of children for anaesthesia and surgery is vital in preparing for safe anaesthesia, tailored to the individual and to the requirements for surgery.

Parents will frequently accompany their child to the anaesthetic room, and it is important to engage with both child and parent as to what to expect in theatres.

All doctors at F1 and F2 level are expected to demonstrate awareness of safeguarding children. Foundation doctors are also expected to recognise and act on suspicious signs which may be indicative of abuse.

Introduction

Children are a diverse group of ages, differing from adults mentally, physically and emotionally. As such, doctors looking after children in healthcare settings need to be mindful and informed of these differences, and of the specific needs and importance of safeguarding the paediatric patient.

Children from birth to adolescence will present for surgery for a variety of reasons, in both the emergency and elective settings. An understanding of key physiological parameters in the "well" child is paramount, and forms a benchmark for identifying abnormal parameters, see Table 1.

Age (years)	Heart rate (beats per minute)	Respiratory rate (breaths per minute)	Systolic blood pressure (mmHg)
>1	110-160	30-40	70-90
1-2	100-150	25-35	80-95
2-5	95-140	25-30	80-100
5-12	80-120	20-25	90-110
>12	60-100	15-20	100-120

Table 1: Normal reference values for children by age group.

Adapted from APLS – 4th Edition[1]

There is appreciable change in physiological, anatomical and psychological development as the child ages, though it is important to remember that variations exist between children of the same ages, whose weight, emotional and physical development may be spread over a wide range. For this reason in anaesthesia, most drug doses for paediatric patients are calculated on a weight more often than on an age-related basis. An easy way to estimate weight in a child in an emergency setting is by the use of this formula:

Weight (in Kg) = 2(age in years +4) (Resus Council UK)[2]

Obtaining a child's weight forms an important part of the anaesthetist's assessment before surgery.

Recognition of the anatomical differences that exist between adults and children is of key importance when managing paediatric anaesthesia. For the anaesthetist, it is the differences in the airway that are most significant. Children may be more prone to upper airway obstruction, given their large tongues, narrow nares, and lymphoid tissue, contributing to narrowed upper airway dimensions in comparison to the adult.

Their head size is larger in relation to their body than in adults, with more anterior larynx and large U-shaped epiglottis. Such differences alter the optimal positioning of the patient for tracheal intubation. Most commonly in children, the head is kept in a neutral position for tracheal intubation with a straight, rather than a curved blade, used for laryngoscopy. The relatively larger occiput in very young children may require support from pillow or blanket under the shoulders, avoiding unnecessary flexion of the head and upper airway obstruction in neutral position.

Unlike adults, in whom the glottis forms the narrowest part of the airway, in children, it is the cricoid cartilage. Trauma following instrumentation of the airway with intubation attempts can cause circumferential oedema and reduction in this small-diameter area, with critical airway obstruction. Similarly important to remember in children is the short length of the trachea. Vigilant attention to adequately securing the endotracheal tube at the appropriate length is very important, as moving the patient may cause displacement of the endotracheal tube either out of the trachea, or shift endobronchially.

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These anatomical variations together with the physiological differences of increased metabolic rate and oxygen consumption mean that children will be more prone to rapid desaturation and hypoxaemia than seen in healthy adults.

Preoperative Visit

The preoperative visit made by the anaesthetist is a vital information gathering exercise, facilitating planning the conduct of safe anaesthesia, tailored to the individual and the procedure. This encounter has a number of functions:

1. To engage child and parent in the process of their anaesthetic and surgery. This includes an assessment of parent's and child's expectations and pairing these with your estimation of likely events. When complaints arise they are frequently the result of miscommunication by healthcare professionals and a disparity between patient's expectations and their actual experience. If these can be explored prior to anaesthesia and surgery there is greater reassurance and clarity both for clinician and patient.

2. To provide an opportunity for the anaesthetist to form a rapport with the child by introducing his or herself. It aids in reducing "stranger anxiety" when they meet again in the anaesthetic room. A caveat note here recognises that children are not stupid, and one meeting does not constitute a vast sharing of trust, nor the acquisition of a new "friend". Nonetheless, recognition of a familiar face to parent and child in the unfamiliar environment of the anaesthetic room is helpful.

3. History-taking & examination.

4. Specific advice and instructions for anaesthesia.

5. To share information on what to expect in the anaesthetic room and guidance on postoperative course, including analgesia. Useful leaflets are available as aids from the Royal College of Anaesthetists.[3]

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Preoperative assessment

An understanding of the type and urgency of the surgery is important, as this will affect your anaesthetic technique. Discussion with the surgeon prior to the anaesthetic visit of any specific surgical requirements, anticipated duration of surgery, positioning of patient and post-operative destination e.g. home, to the ward or critical care, aids the anaesthetist in making a clear plan and communicating relevant information to child, parent and anaesthetic nurse in preparation for theatre.

Regional blockade, such as epidural or peripheral nerve block may be an important adjunct in analgesia for some operations, and it is important to discuss this with the surgeon, who will themselves have specific preferences.

As the anaesthetist, your very first encounter with the child is likely to be on the same day as their surgery. As such a thorough and focused history and examination is very important.

History

An anaesthetic history will be similar in format to the generic medical and surgical history routinely taken by all doctors, but will additionally focus on specific anaesthetic concerns. In paediatrics a birth and developmental history is important in eliciting if there are any congenital defects, prematurity, or developmental delay that may impact on cardio-respiratory reserve.

Specific questions will include:

- Mode of delivery.
- Prematurity, and any requirement for neonatal ICU or ventilatory support
- Evidence of developmental delay; Reaching developmental milestones?
- Immunisation status
- Family history of inherited diseases, e.g. sickle cell
- Previous anaesthetics, including family history
- Drug history and any known allergies
- History of recent illness and specifically upper respiratory tract infection (URTI)

Recent URTI is associated with perioperative respiratory complications, including laryngospasm (the reflex closure of the vocal cords), desaturation, breath holding and bronchospasm in reactive airways. As such, postponement of non-urgent surgery by 4-6 weeks is recommended in children with features of URTI.[4]

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Fasting status

Enquiry as to fasting status is vital in the preoperative assessment of all patients in reducing aspiration risk. Current guidelines for adults are the same as those for children, i.e. 6 hours for solids and 2 hours for clear fluids. There is specific guidance for babies who are either breast or formula-milk fed.[2]

- **Breast milk: 4 hours preoperative fasting**
- **Formula milk: 6 hours preoperative fasting**

Examination

Examination forms an important part of the anaesthetic assessment, and will focus on:

- Cardio-respiratory systems (vital signs, cardiac murmur, presence of wheeze/chest signs)
- Airway assessment, including dentition
- Assessment of veins for cannulation
- Weight and height, important in calculation of drug doses

Investigations

Children undergoing routine minor surgery may have little or no preoperative testing. Those undergoing major surgery, and those with known co-morbidities, such as cardiac disease will require more work-up pre-operatively. Tests might include, electrocardiogram, echocardiogram, radiological, blood tests and cross-matching of blood if significant blood loss is anticipated. Check and document all relevant investigations.

Premedication

Premedication refers to drugs administered prior to transfer to the anaesthetic room. They may include anxiolysis, antisialogogues, topical anaesthesia, analgesia, and antacid prophylaxis.

Historically, many children were given sedative medication prior to anaesthesia, though this practice is less commonplace today. It is important to confirm with the consultant anaesthetist you are working with as to their preference. In some instances a sedative may be prescribed, typically oral midazolam. The dose is 0.5mg/kg orally, with onset time of 20-30 minutes.[5] Communication with nurses as to the timing of this premedication is key in achieving optimal sedative effect in time for surgery.

Copious secretions can be problematic for the anaesthetist and may contribute to laryngospasm. As such, in some cases a premedication of atropine may be prescribed for its antisialogogue properties.

Children undergoing day-case surgery may benefit from oral analgesia prior to surgery, which shortens the interval post surgery for repeated doses of simple analgesia, and may reduce intraoperative opiate requirements. Check with your consultant and record clearly on the drug and anaesthetic chart any preoperative prescriptions you have made. Typical analgesia prescribed preoperatively includes oral paracetamol and ibuprofen (20mg/kg loading dose & 5mg/kg respectively).[5] It is many anaesthetists' practice to give per rectum analgesia (paracetamol and diclofenac). Again check with your consultant what their practice is, and importantly consent and document this discussion with the parent. The availability of intravenous preparations has to some extent outmoded this practice.

Intravenous access can be challenging in the paediatric population, and is understandably a distressing part of anaesthesia for children. Topical anaesthesia is commonly prescribed preoperatively by the anaesthetist, and should be applied on at least one site where veins have been identified.

Anaesthetic technique

An intravenous or an inhalational technique may be used to induce general anaesthesia. It is a matter of preference and experience on the responsible anaesthetists' part as to which will be their preferred mode.[6] It is important to communicate to the child and parent what to expect from these techniques, and that the plan may change should the anaesthetist encounter difficulty with cannulation, or the child is distressed. Minimising distress in the anaesthetic room is important, both for future visits, and for immediate airway management. A crying and stressed child is likely to have increased secretions and anaesthetic requirements for induction drugs. Parents may have misconceptions or pre-existing preferences for one technique over the other from their own experiences as children. It is important to clearly describe and emphasize the safety-driven aspects of your chosen practice.

Finally, it is a good idea to plan ahead for postoperative analgesia, and advise parent and child what types of medications they are likely to require.

Anaesthetic Room

In the UK a parent commonly accompanies their child to the anaesthetic room. This concept should be introduced at the pre-operative assessment, and the parent and child (where appropriate) should be briefed as to what to expect on arrival.

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Understandably parents may be anxious over loss of control, a foreign environment and the possibility of adverse events during their child's anaesthetic. In some cases this anxiety may be communicated to the child and raise the child's anxiety. For this reason parental presence is not absolutely compulsory as it may prove detrimental to child's experience or indeed to the conduct of anaesthesia. Paediatric nurses, and increasingly Paediatric Play Specialists play an important role in providing a calm and comforting experience to both parent and child.

Evidence demonstrating objective benefit of parental presence at induction to either parent or child anxiety is equivocal.[7] In many cases pre-medication with drugs such as midazolam, or distraction techniques such as video games appear to be a suitable substitute for parental presence. However for certain subsets of children, for example those with behavioural issues, developmental delay or those undergoing repeat procedures, parental presence appears to be beneficial and in fact is often extremely helpful for hospital staff.

A Cochrane review published in 2009,[8] assessed other non-pharmacological interventions in induction of anaesthesia in children. It looked at 17 trials with interventions including hand-held video games, clown doctors, parental acupuncture, hypnotherapy, and low sensory stimulation. It concluded that although promising, all required further investigation to firmly establish any evidence-based role in anxiety reduction, but suggested that they are all likely to be useful in some way to reduce anxiety.

The anaesthetic room will be arranged in a child and parent friendly way, and it is important to think about these practicalities before they arrive e.g. placement of a chair relative to the anaesthetic machine etc.

As a foundation doctor in anaesthesia you will always be with either a senior anaesthetic trainee, or a consultant, the following is guidance as to what to expect.

IV induction

- A suitable topical anaesthetic should have been administered in good time to common sites of cannulation.
- Preparation with a selection of cannulae, saline flushes and dressings is essential.
- With the help of a skilled assistant, the child's arm should be placed under the axilla of the parent, whilst the child is distracted by the Paediatric Nurse or Play Specialist. This positioning should obstruct the child's view of proceedings.
- Children between 3 months and 2 years can often be difficult to cannulate due to the presence of fat pads: have a low threshold for seeking more experienced help!

The choice of intravenous induction agent will depend on several factors including the nature and duration of surgery, whether a laryngeal mask will be used or the child will be intubated with an endotracheal tube, whether the patient is starved, and the preferences of the anaesthetist in charge of the case. Two commonly used IV induction agents are propofol and thiopentone. The IV induction dose commonly used in paediatrics is 2 – 4mg/kg, higher than that used in adults. Common side effects include pain on injection, some involuntary excitatory movements, and in the unwell child a depression of the blood pressure may be seen. Thiopentone is a barbiturate, more commonly used in the emergency settings for its rapid onset of action. It too causes a reduction in cardiac output, stroke volume and systemic vascular resistance which may result in a tachycardia and a drop in blood pressure in the unwell child. It may rarely cause anaphylaxis, and should be avoided in children with porphyria. Fentanyl, a synthetic opioid, may also be used as an adjunct to, or as the main component of, an intravenous induction, an example of the latter is in paediatric cardiac surgery.

Inhalational Induction

- It is important to warn the parent that the child is likely to become floppy and will need support as they become anaesthetized, and that they may also exhibit abnormal movements.
- For smaller children involving the parent to hold the facemask is a helpful way of initiating the process, and encouraging them to blow up the reservoir bag "like a balloon". Facemasks are often scented.
- Sevoflurane is the inhalational agent of choice as it is rapidly acting and less irritant that other volatile agents.
- Once asleep it is important to establish IV access

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Monitoring during induction can sometimes be difficult, as smaller children often dislike having monitoring equipment attached, however pulse oximetry as a minimum should be employed.[9] Blood pressure and ECG monitoring may also be used in older children pre-induction.

Analgesia and Post-operative Care

Children and particularly neonates differ significantly to adults in their response to drugs. Studies have shown that prescribing errors are more common in the paediatric population than in the adult population.[10] As a Foundation Doctor using the BNF for Children routinely when prescribing in paediatrics is an important way to avoid mistakes, furthermore using local guidelines and advice from trust pharmacists on more unfamiliar drugs will reduce drug errors.

Drug dosage and dose interval varies with age and weight of the child, furthermore some drugs are prescribed by body surface area, thus requiring more calculations. The Royal College of Paediatrics and Child Health (RCPCH) recently published the Paediatric Prescribing Tool in response to concerns over gross prescribing errors in Paediatrics.[11]

Two common challenges in the post-operative care of children are:

1. Pain
2. Post-operative nausea and vomiting (PONV).

1. Pain

In order to manage pain effectively, doctors must first assess pain. This can be a challenge in the paediatrics, the gold standard is the child's "self-report" of pain, however for children who are not yet verbalizing other approaches include behavioural observations, and physiological assessment. No single pain assessment tool has been shown to be effective across all age groups, however a commonly used tool that you should be familiar with is the Wong-Baker FACES Pain Rating Scale, valid for children aged 3-18yrs. The child is asked to choose which face best describes the way they are feeling, see

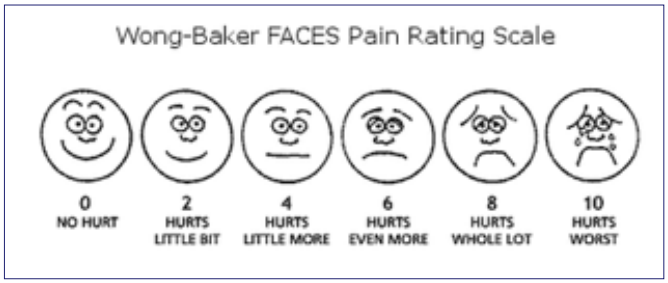

Figure 1. Wong-Baker FACES Pain Rating Scale[12]

There is clear guidance available from the association of paediatric anaesthetists (APAGBI) on appropriate modes of pain relief for many types of surgery, for example tonsillectomy, and dental surgery.[13] The treatment of pain should include both non-pharamcological and pharmacological interventions, as a multi-modal approach to pain has been shown to reduce opioid requirements. The WHO pain ladder can be used as a guide to titrate analgesia, its principle is based upon the concept that combined analgesia is more effective than one modality.

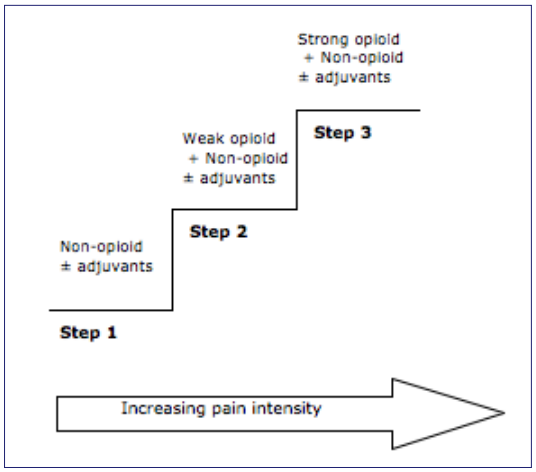

Figure 2. WHO Pain Ladder.

Non-opioid analgesics include paracetamol, and non-steroidal anti-inflammatories (NSAIDs) such as ibuprofen. You should be familiar with these commonly prescribed drugs, for their route and dosage, see the BNF for Children. Weak opioids include codeine, and stronger opioids include morphine which can be given orally, or sometimes intravenously in the form of a patient or nurse controlled analgesia system.

2. PONV

Paediatric patients have a higher rate of post-operative vomiting than adults. Risk of vomiting is related to patient factors, anaesthesia technique, peri-operative drugs, and type of surgery. Patient factors for increased risk of PONV include children aged over 3, previous PONV, a history of motion sickness and post-pubertal girls. Specific surgeries that are particularly associated with a high risk of PONV include strabismus surgery, and adenotonsillectomy.

Two anti-emetics commonly used in both the prevention and treatment of PONV in children are the 5HT3 anatagonist ondansetron, and the steroid dexamethasone. Drugs such as metoclopramide, cyclizine and prochlorperazine often prescribed in adults have been shown to have no evidence to support their use in children in PONV.[14] The APAGBI recommend ondansetron at a dose of 0.15mg/kg, and/or dexamethasone 0.15mg/kg in the treatment of PONV in children.

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Safeguarding Children

F1 and F2 doctors are expected to demonstrate awareness of safeguarding children, particularly in specialities where children are encountered day-to-day, e.g. in paediatrics. It is important to recognise that in specialities such as Emergency Medicine, General Surgery and Anaesthesia, you may also come across children who may be of a concern regarding safeguarding.

Your NHS trusts should provide you with child protection awareness training if you are exposed to this patient population. It should also be clear who the Named Nurse and Designated Doctor for Child Protection are at the Trust in which you work.

Lord Laming in his report outlined the failings of the child protection systems in the UK and the resulting death of 8 year old Victoria Climbie.[15] Within it a note is made that a locum paediatric SHO was involved in her care, and although she "had a broad understanding of the role of social services in the protection of children, she was unfamiliar either with the relevant terminology or with the particulars of local child protection arrangements....". This underlines the need for junior doctors to involve senior clinicians in every step of a case of safeguarding.

Among many recommendations Lord Laming made in his report he advised "that no child about whom there are child protection concerns is discharged from hospital without the permission of either the consultant in charge of the child's care or of a paediatrician above the grade of senior house officer". As a result, all Foundation Doctors must be aware of local trust policy, and ensure they act appropriately.

Guidance has been issued as a joint document from the Royal College of Anaesthetists, APAGBI and RCPCH, as to the role of the anaesthetist in Safeguarding Children.[16]

Situations where anaesthetists may be exposed to issues of child protection include:

- Direct disclosure to anaesthetists of abuse by the child (rare)
- During pre-operative assessment for surgery, the anaesthetists may notice unusual or unexplained signs, or unusual behaviours of the parent and child, that may be indicative of physical, sexual or psychological abuse
- During surgery – exposure of the child intra-operatively may reveal unusual signs that may be suggestive of child abuse.

Foundation doctors are also expected to recognise suspicious signs which may be indicative of abuse:

- Unusual or excessive bruising, particularly in the non ambulant baby/child.
- Cigarette burns.
- Bite marks.
- Unusual injuries in inaccessible places e.g. neck, ear, buttocks.
- Intra-oral trauma, including frenula
- Genital/ anal trauma (where no clear history of direct trauma is offered or part of the clinical
- presentation).
- Trauma without adequate history eg. Intra abdominal injury.

The safety of the child is paramount, and overrides all other duties. A suggested flow chart for dealing with safeguarding concerns from anaesthetists is shown in Figure 3.

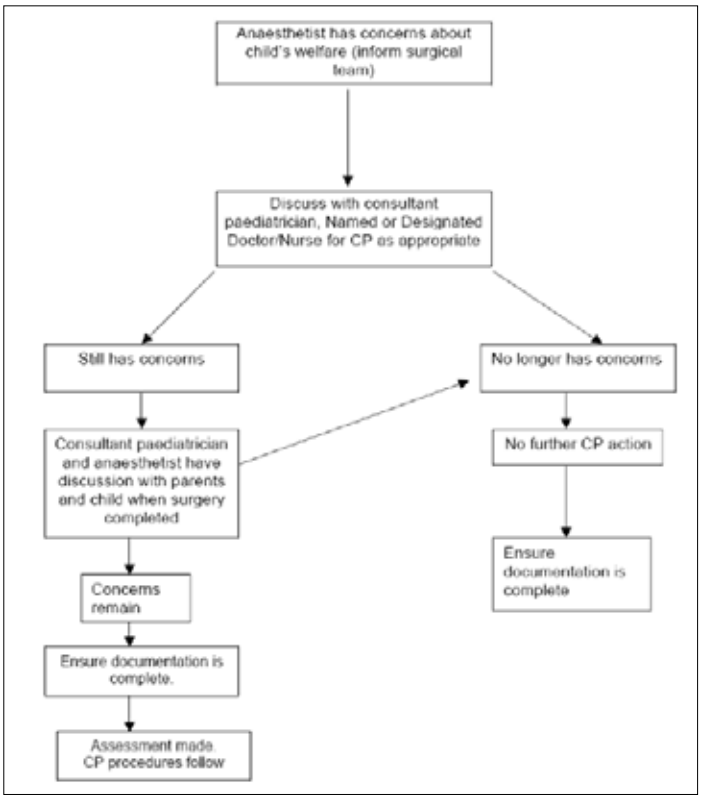

Figure 3. Safeguarding Children Flow Chart.

Adapted from "Child Protection and the Anaesthetist:
Safeguarding Children in the Operating Theatre" Intercollegiate Document March 2007.[16]

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All doctors have a duty to protect children, and, everyone involved in the care of a child should be aware of their duties, as an anaesthetist these include:

1. To act in the best interests of the child which are always paramount.
2. To be aware of the child's rights to be protected.
3. To respect the rights of the child to confidentiality.
4. To contact a paediatrician with experience of child protection for advice (On-call paediatrician for CP, Named or Designated Doctor/Nurse).
5. To be aware of the local Child Protection mechanisms.
6. To be aware of the rights of those with parental responsibility.

Conclusion

In this article we have outlined that paediatric anaesthesia requires a sound knowledge and appreciation of the differences in physiology, anatomy and pharmacology between children and adults. Furthermore dealing with the anxieties of parent and child requires both skill in communication, and a multi-disciplinary team approach. As a doctor you may be exposed to children at risk of safeguarding issues no matter which specialty you may be working in, be vigilant and raise any concerns you may have with senior colleagues.

References

1. Advance Paediatric Life Support: The practical approach, edited by Kevin Mackway-Jones et al. 4th Edition. BMJ Publishing Group, Blackwell Publishing Ltd, 2005.
2. Resus Council, UK. **https://www.resus.org.uk/pages/faqPLS.htm**
3. Royal College of Anaesthetists. Your child's general anaesthetic. Third edition, May 2008. **http://www.rcoa.ac.uk/docs/PI_ycga.pdf**
4. Bhatia N, Barber N. Dilemmas in the preoperative assessment of children. BJA CEACCP 2011, Vol. 11, 6:214-18.
5. British National Formulary for Children 2011-12, BMJ Publishing Group Ltd, London, 2011.
6. Zielinska M, Holtby H, Wolf A. Pro–con debate: intravenous vs inhalation induction of anesthesia in children. Paediatr Anaesth. 2011, 21(2):159-68.
7. Chundamala J, Wright J, Kemp S. An evidence-based review of parental presence during anesthesia induction and parent/child anxiety. Can J Anesth/J Can Anesth 2009, 56:57–70.
8. Yip P, Middleton P, Cyna AM, Carlyle AV. Non-pharmacological interventions for assisting the induction of anaesthesia in children. Evidence-Based Child Health: A Cochrane Review Journal 2009, 6: 71–134.
9. Association of Anaesthetists of Great Britain and Ireland. Recommendations for standards of monitoring during anaesthesia and recovery, 4th Edition, March 2007. www.aagbi.org
10. Davis T. Paediatric prescribing errors. Arch Dis Child 2011, 96:489-91.
11. Royal College of Paediatrics and Child Health (RCPCH) and Neonatal and Paediatric Pharmacists Group (NPPG). Paediatric Prescribing Tool. 2011, **http://www.rcpch.ac.uk/training-examinations-professional-development/quality-training/paediatric-prescribing-tool/paediatr**
12. Wong DL, Hockenberry-Eaton M, Wilson D, Winkelstein ML, Schwartz P. Wong's Essentials of Paediatric Nursing, ed. 6, St Louis, 2001, p1301.
13. Association of Paediatric Anaesthetists: Good Practice in Postoperative and Procedural Pain, 2008. http://www.britishpainsociety.org/book_apa_**part1.pdf**
14. Association of Paediatric Anaesthetists: Guidelines on the Prevention of Post-operative nausea and vomiting in children 2009, **http://www.apagbi.org.uk/sites/apagbi.org.uk/files/APA_Guidelines_on_the_Prevention_of_Postoperative_Vomiting_in_Children.pdf**
15. The Victoria Climbie Inquiry, Report of an Inquiry by Lord Laming, Presented to Parliament January 2003. **http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_110711.pdf**
16. Child Protection and the Anaesthetist: Safeguarding Children in the Operating Theatre Jointly developed and produced by the Royal College of Anaesthetists, the Association of Paediatric Anaesthetists, and the Royal College of Paediatrics and Child Health, March 2007. **http://www.rcoa.ac.uk/docs/child_protection1.pdf**

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ANAESTHESIA: A USEFUL GUIDE TO PRE-OPERATIVE INVESTIGATIONS

L Tompsett & G Van Hasselt

This article aims to give an insight into the indications and rationale behind pre-operative patient investigation in preparation for anaesthesia and surgery. This helps to develop an understanding about 'optimising' patients, and form an approach to abnormal results.

The National Institute for Clinical Excellence (NICE) published the clinical guideline: 'Preoperative tests: The use of routine preoperative tests for elective surgery' in June 2003. NICE's recommendations are based predominantly on the grade of surgery, the patient's age and their co-morbid state. These are simply guidelines and additional tests may be suggested from the patient's history and examination, or for those patients requiring emergency surgery.

Most hospitals have complementary guidelines tailored to different specialities or specific elective operations, usually available on the hospital's intranet site. The overall aim is to rationalise preoperative tests and to ensure the patient is optimised for surgery. Optimisation aims to ensure the patient is in the best possible condition prior to anaesthesia and surgery and helps reduce peri-operative morbidity and mortality. A good history and physical examination of the patient will be informative about which investigations should be considered.

Anaesthesia: A useful guide to pre-operative investigations. Good Clinical Care.

History and Physical Examination

Things that would concern anaesthetists include:

- *Cardiovascular System:* Evidence of heart failure, a new or any pathological murmur, unstable angina, a myocardial infarction within the last year, presence of a pacemaker or issues with poorly controlled high or low blood pressure.

- *Respiratory System:* Patients on home oxygen or nebulisers, those with a limited exercise tolerance, and those with recent or recurrent chest infection.

- *Gastro-Intestinal System:* Acid reflux, gastric dysmotility, evidence of bowel obstruction.

- *Renal:* End stage renal failure, worsening renal function, high potassium, or fluid overload.

- *Airway:* Patients with limited neck extension, limited mouth opening, known difficult intubation or previous head and neck radiotherapy or surgery.

- *General:* Skeletal deformities, congenital syndromes, and burns.

- *Other*: malignant hyperpyrexia, suxamethonium apnoea, neuromuscular disorders.

If any of these is cause for concern, then ask for an anaesthetic review prior to listing the patient for surgery. Many conditions can be 'optimised' or improved to reduce the risk of morbidity. For example untreated persistent hypertension may necessitate referral back to the GP for investigation and control.

The majority of elective cases can be seen by the anaesthetist in the pre-assessment clinic but it may be necessary to contact the anaesthetist on-call if the patient is an inpatient and requires more urgent surgery.

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Blood Tests

Full Blood Count (FBC)

Haemoglobin (Hb) plays an important role in oxygen delivery and in most cases should be above 8g/dl for surgery to proceed, although in patients with ischaemic heart disease, the haemoglobin should be above 10g/dl. If patients are anaemic a cause should be sought and corrected if possible. Low iron levels may indicate the need for iron transfusions. Some patients may require a pre-operative blood transfusion or erythropoietin therapy to raise their haemoglobin.

Occasionally patients may be polycythaemic and require venesection pre-operatively if their haemoglobin is excessively high, as polycythaemia predisposes to thrombosis. Platelet count should also be documented and should ideally be above $100x10^9$/L for surgery to proceed safely. White cell count is important as overtly septic patients are more prone to becoming unstable intra-operatively and sepsis is a contra-indication to epidural, spinal or invasive line insertion. If in doubt speak to an anaesthetist or haematologist. Consideration should be given to cross-matching anaemic patients as well as those where excessive blood loss is anticipated.

Urea and Electrolytes (U&E)

The majority of elective cases will have normal renal function. However, some patients may have evidence of stable chronic renal failure. This is not usually a problem unless they have an acute on chronic renal failure or have a high potassium level. Worsening renal failure must prompt a review of patient's medications and fluid status. A high potassium level will require treatment prior to anaesthesia as malignant arrhythmias can occur with the concurrent use of some anaesthetic drugs. Some patients may need dialysis pre or post operatively to correct extreme renal abnormalities such as high potassium, urea, acidosis or fluid overload.

Clotting

Depending on the operation, most anaesthetists and surgeons consider an INR of <1.3 acceptable for surgery, or if spinal or epidural anaesthesia are planned. Drugs that affect clotting, such as clopidogrel or warfarin (and to a lesser extent dypiridamole and aspirin) should generally be stopped 2 weeks preoperatively to reduce the risk of bleeding at the surgical site and of haematoma formation caused by regional anaesthesia needles or vascular access.

However, this is not always the case as there may be cardiac considerations that require continuation of anticoagulation. These patients require a multi-disciplinary approach, involving discussion with the relevant specialities to balance the benefits and inevitable risks. As a general rule, clotting abnormalities should be corrected pre-operatively and the advice and involvement of haematologists sought. Consideration should also be given to peri-operative thromboprophylaxis.

Liver Function Tests (LFT)

If the patient has a history of alcohol abuse or liver disease, LFTs may indicate liver dysfunction, influencing the choice of drugs anaesthetists may give. Abnormal LFTs may give a clue to a clotting problem, as the liver synthesises Vitamin K, an important precursor in the clotting pathway. A low albumin is usually an indicator of chronic disease, and often heralds poor healing and slow recovery.

Blood sugar (BM)

Blood sugars must be recorded in diabetics, and the provision for a sliding scale planned on admission if necessary (insulin dependent and poorly controlled diabetics). Diabetics should ideally be first on the operating list.

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Thyroid Function Tests (TFT)

If the patient has known thyroid abnormalities, there would usually be recent thyroid function tests available. Patients who are not euthyroid are more prone to developing complications peri-operatively, such as a thyroid crisis, tachyarrythmias and atrial fibrilation with hyperthyroidism or bradycardias and poor awakening with hypothyroidism.

Electrocardiogram (ECG)

The ECG must be interpreted in light of the patient's previous history and compared to old ECGs if available. Any new changes must prompt further enquiry into the patient's cardiac history. If in doubt ask a cardiologist to review the patient and ECG. Atrial fibrillation should be rate controlled to less than 100bpm. If not, intervention is required so that surgery can proceed safely. The atrial contraction component accounts for 30% of cardiac output, and loss of this contribution in AF can cause dangerous hypotension leading to myocardial ischaemia and other organ damage.

These patients are also at risk of stroke, and their anticoagulation status needs assessing. Anaesthetists must know about patients who have trifasicular block (consisting of first-degree heart block, right bundle branch block and left axis deviation) or complete heart block, as pacemakers are required pre-operatively. Pacemakers or devices such as internal cardiac defibrillators (ICDs) need annual checking to ensure they are working correctly, and that the battery life is still acceptable.

Echocardiogram (Echo)

An Echo is useful if the patient has a new murmur or worsening symptoms of heart failure, particularly if there is a history of valve disorder or ischaemic heart disease. Anaesthetists are interested in the left ventricular function and the valve gradients.

Chest X-ray (CXR)

Any history of chest trauma or a suspected pneumothorax makes CXR mandatory. CXR is also useful if the patient has had recent pneumonia or has a known pleural effusion. If the patient has COPD, bullous disease can sometimes be seen on CXR, but if the patient is stable with no recent deterioration, a CXR is generally not required.

Peak Expiratory Flow Rate (PEFR)

A peak flow rate is a simple bedside test useful in asthmatics or patients with COPD to assess the extent to which their disease is limiting air flow, and may provide information about reversibility.

Spirometry

This allows quantification of lung function and is useful at distinguishing between obstructive and restrictive lung disease. It can also be useful in assessing suitability for surgery in larger operations and those requiring lung resections or pneumonectomies.

Urinalysis

Useful in detecting un-diagnosed diabetes and urinary tract infections. Pregnancy testing (with consent) should be considered in all women of child-bearing age.

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Arterial blood gases (ABG)

These can be a useful baseline in patients with respiratory disease and can indicate those patients that may have problems with carbon dioxide retention and respiratory failure post-operatively. This is an invasive test and would usually only be done if very significant respiratory or systemic (showing acid base imbalance) disease was present. An anaesthetist would normally request this investigation.

Summary

Each patient is different and the level of pre-operative investigation should be considered on an individual basis. The ultimate aim is to ensure that patients are fully optimised prior to their operation, making their anaesthesia and surgery safer and their recovery quicker and smoother.

Anaesthetists act as the patients advocate and will seek out opportunities for better optimisation.

Knowing early about challenging patients enables optimisation, and pre-empts the disruption and upset that cancellation and postponement causes. An anaesthetist is always available for advice.

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