Principles of anaesthesia in urological surgery

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Anaesthesia for urological surgery poses particular challenges for the anaesthetist related to the patient population and procedure type. The aim of this article is to cover the general principles of anaesthesia, with dedicated sections relevant to practising urological surgeons. This represents vast amounts of knowledge that cannot be covered in one article. We will focus upon preoperative preparation for surgery and anaesthesia, perioperative management including monitoring and analgesia, and postoperative management including fluid balance, critical care and recovery.

Significant proportions of urological surgical patients have some degree of renal failure and this may be related to the surgery required. Anaesthetic care of patients with chronic renal impairment and transplant surgery will be covered in a future review.

INTRODUCTION

A large proportion of urology patients are very young or elderly. These patients can undergo multiple minor procedures or major reconstructive surgery with marked physiological disturbance. The role of the anaesthetist is to manage perioperative physiology in addition to the provision of anaesthesia and analgesia.

PREOPERATIVE PREPARATION FOR SURGERY AND ANAESTHESIA

ASSESSMENT

The objective of preoperative assessment is to identify and optimize any disease state. It is important to differentiate between chronic stable disease and deteriorating clinical states which need further specialist input. Concurrent medical therapy can be checked and optimized for the surgical period with appropriate tests arranged at this stage [1,2].

PRE-ASSESSMENT CLINICS

In this surgical group, young patients may have complex histories, i.e. cerebral palsy, and elderly patients may have multisystem disorders. Both groups represent challenges to the anaesthetist if reviewed on the day of surgery. The introduction of 'pre-assessment' clinics has streamlined surgical admissions and reduced cancellation rates. These clinics are usually led by a specialist nurse with anaesthetic consultant input and support. They provide an excellent environment for informing and obtaining the consent of the patients.

Pre-operative assessment can be considered under the following headings:

- Airway
- Breathing
- Circulation
- Drugs, anaemia, diabetes and patient positioning.

AIRWAY

The anaesthetist makes the choice of technique used for airway management after a full assessment. The following factors are taken into consideration:

Patient factors

- Full stomach/risk of soiling of airway
- Postoperative ventilation requirement
- Poor respiratory function/reserve
- Neuromuscular disorders.

Surgical factors

- Intra-thoracic/abdominal surgery requiring muscular relaxation
- Patient positioning
- Prolonged surgery
- Laparoscopy/pneumoperitoneum.

The following patients should be referred for anaesthetic opinion:

Patient characteristics suggestive of a difficult airway:

- Large overbite
- Mouth opening <2 cm
- Immobile cervical spine e.g. ankylosing spondylitis
- Short neck
- Obesity with or without short stature
- Unstable cervical spine
- Previous difficult intubation
- Congenital facial abnormalities
- Previous head and neck surgery/ radiotherapy
- Previous tracheostomy
- Thyroid surgery/goitre

BREATHING

A functional assessment is often as revealing as sending patients for pulmonary function tests and a careful respiratory history may be adequate. Patients who cannot show adequate exercise tolerance due to pathology or immobility require a formal assessment of respiratory function [3].

An arterial $PaO_2 < 8$ kPa and shortness of breath at rest are strong indicators that postoperative ventilation may be required. Patients with poor lung function often benefit from regional anaesthetic techniques, although this evidence is not universal [4]. Patients unable to lie flat are unsuitable for regional anaesthesia.

CIRCULATION

Significant cardiovascular morbidity is a common factor in elderly patients. The stress response to surgery and anaesthesia can precipitate cardiac events in poorly optimized patients. Perioperative cardiac events, e.g. myocardial infarction (MI) or arrhythmia, carry a higher mortality and morbidity than if they occurred outside the perioperative period.

Factors that should be discussed with a cardiologist and the anaesthetist are:

- Angina pain at rest or minimal exertion;
- Symptoms of syncope, cardiac failure and shortness of breath on exercise;
- Recent history of an unstable coronary syndrome or MI.
- Rheumatic fever with cardiac involvement;
- Previous cardiac surgery;
- Presence of an implanted pacemaker;
- Uncontrolled hypertension.

The American College of Cardiology and American Heart Association published guidelines for assessing patients with cardiac disease undergoing noncardiac surgery. Patients able to walk a flight of stairs without breathlessness have a reasonable functional reserve and are unlikely to have significant disease. Specific tests are unwarranted unless a major procedure is scheduled. Patients who cannot exercise enough to assess left ventricular function require further tests, such as a stress echocardiogram or exercise tolerance tests [5].

Hypertension is widespread and stable control is necessary to reduce the risk of perioperative cerebrovascular accident or cardiac event. Uncontrolled or newly diagnosed hypertension in surgical patients is managed jointly by anaesthetists and cardiologists.

DRUGS

Polypharmacy is common in elderly patients; most drugs have little bearing on anaesthesia and should be continued throughout the perioperative period. The following drug groups are particularly relevant to urology:

- Angiotensin-converting enzyme inhibitors are prescribed for heart failure and hypertension. They should be omitted on the day of surgery as they can lead to persistent hypotension under anaesthesia. Serum electrolytes may be disturbed and should be checked before surgery.
- Warfarin is prescribed for various reasons. Surgery should not be undertaken with an International normalized ratio (INR) of >2 unless in an emergency, when fresh frozen plasma can be given to normalize clotting. Vitamin K is of limited use in acute situations as it has a slow onset and leads to difficulty re-establishing effective control of INR.
- Anti-platelet drugs are prescribed for patients with ischaemic heart disease. Aspirin irreversibly inhibits platelet function for up to 7 days. Thienopyridines such as clopidogrel are newer antiplatelet drugs acting via suppression of platelet ADP. They should be discontinued for 7 days before surgery unless a continued antiplatelet effect is required (in exceptional circumstances).
- β-blockers act upon the heart to reduce chronicity and inotropy. They have been shown to reduce adverse cardiac events, specifically acute MI, when prescribed from 1 week before to 1 month after surgery [6,7].
- α-blockers used for hypertension or symptomatic control in prostatic enlargement lead to marked hypotension during regional anaesthesia, and that may be difficult to reverse.
- Diuretics are prescribed for hypertension, cardiac, renal and hepatic impairment. It is important to establish the reason for prescription and check for common side-effects of the drug, e.g. frusemide may cause hypokalaemia.

ANAEMIA

The optimum delivery of oxygenated haemoglobin to end organs and peripheries is essential. It is important that preoperative anaemia is investigated and appropriately managed before elective surgery. Preoperative transfusion is controversial and should be discussed with the anaesthetist involved (see below).

INSULIN AND DIABETIC CONTROL

Diabetes is a common multisystem disease and often affects the renal system via microcirculatory changes or direct effects. Many urological patients will consequently be diabetic. Preoperative assessment is directed at establishing the impact on other organ systems and planning diabetic control through the perioperative period. Oral hypoglycaemics and insulin may be used alone or in combination for all types of diabetes.

Patients undergoing minor procedures may omit oral hypoglycaemic drugs and resume medication and diet after surgery. Patients undergoing major surgery or who are insulin-dependent should have an insulin and dextrose regimen titrated to effect. This should be instituted before surgery and maintained throughout the recovery period. This can speed recovery and reduce the hospital stay. Reductions in wound infection rates by increasing diabetic control are now widely accepted.

In the critical-care setting tighter control of blood glucose levels has led to a reduction in mortality, morbidity and length of stay. Outside of critical care accidental hypoglycaemia remains a safety issue and this has led to doctors permitting higher blood glucose levels than with traditional sliding scales. In the light of this new critical care evidence, practice may change [8].

PATIENT POSITIONING

It is important to assess before surgery the ability of the patient to safely tolerate the surgical position. Examples are: hip replacement and lithotomy position, or ankylosing spondylitis and the lateral table-break position for nephrectomy. Procedures such as laparoscopic radical prostatectomy use a Trendelenburg tilt in conjunction with insufflation of the peritoneal cavity for prolonged periods. This may lead to marked physiological disturbance. Patients scheduled for such procedures with an exercise tolerance of <4 metabolic equivalents (unable to climb a flight of stairs without stopping) as a result of cardiorespiratory disease should be discussed with an anaesthetic colleague.

PERIOPERATIVE MANAGEMENT

The main choice is whether to use a local, regional, general or a combined anaesthetic technique. Sedation is used as an adjunct to local or regional anaesthesia. Patient and surgical factors affect the anaesthetic choice. These include the patient's comorbidity and the wide range of surgical procedures. Individual cases should be considered on their merits, as the anaesthetic risk depends upon these. Regional anaesthesia is not intrinsically safer than general anaesthesia.

Perioperative management can be considered under these subheadings:

- Local anaesthesia
- Central neural blockade
- General anaesthesia.

LOCAL ANAESTHESIA

Many areas of the body are amenable to local anaesthetic infiltration to provide analgesia. Surgeons are aware that many operations can be done under local anaesthesia alone. Knowledge of the following is essential for safe practice.

Signs and symptoms of local anaesthetic toxicity:

- CNS; dizziness, circumoral tingling, confusion, convulsion, coma.
- Cardiovascular system: tachycardia, hypertension with adrenaline; bradycardia and hypotension with no adrenaline. Both may be followed by severe or fatal arrhythmia.

Maximum safe doses of local anaesthetic: (with adrenaline dose)

- Bupivacaine 2 mg/kg (2 mg/kg)
- Lidocaine 3 mg/kg (7 mg/kg)
- Prilocaine 6 mg/kg (8 mg/kg).

All these drugs are toxic in overdose and can be lethal if given intravenously. Where permitted adrenaline may be added to increase the length of analgesia but does not reduce the toxicity of accidental intravenous injection.

How to calculate dose/volume of drug that can be given:

Note that a 1% solution contains 10 mg/mL of drug, e.g. a 75-kg man allowed 150 mg bupivacaine = a maximum of 30 mL 0.5% solution

The components of a safe environment for local anaesthesia:

If large amounts of local anaesthetic are to be used intravenous access should be established and patient monitoring instigated with resuscitation facilities immediately available.

NEURAL BLOCKADE

Peripheral nerve blocks:

Both surgeons and anaesthetists can use the following nerve blocks [9,10].

- Penile block: the dorsal nerves of the penis (S2–4 pudendal) may be blocked on either side of the penile vessels at the caudal edge of the symphysis pubis. This is suitable for circumcision and similar surgery. The genital branch of the genitofemoral nerve needs to be blocked for surgery on the skin at the base of the penis.
- Ilioinguinal (L1) and iliohypogastric (L1) may be blocked below the external oblique aponeurosis medial and caudal to anterior superior iliac spine. This is suitable for scrotal, testicular, and hydrocele surgery.
- Genitofemoral (L1,2) may be blocked at the deep ring above the midpoint of the inguinal ligament, deep to external oblique aponeurosis. This allows surgery on the scrotum and labia majora.
- A paravertebral block is made by anaesthetists, at the appropriate level to surgery, deep to the transverse process of the thoracic or lumbar spine. This provides long-lasting unilateral analgesia over 3–5 nerve rami for renal, ureteric and low abdominal surgery. A catheter may be sited for postoperative drug delivery.

Central nerve blockade (CNB)

A conscious patient permits the rapid assessment of neurological change and there may be minimal disturbance of respiratory function. After surgery there is a quicker return to oral intake. Postoperative cognitive dysfunction may occur less frequently with conscious elderly patients and CNB than with general anaesthesia [11]. Three types of CNB are encountered by urologists:

Spinal anaesthesia

Small doses of bupivacaine (10–30 mg) with or without opioid (opioids act synergistically) are injected intrathecally resulting in sensory, motor and sympathetic block. The position of the patient may be manipulated to influence the degree of spread of local anaesthetic. For example, the lithotomy position causes the cephalad spread of anaesthetic. The advantages are a rapid, reliable onset of surgical anaesthesia of predictable, effective duration (60–90 min). The failure rate is 5–10%, requiring either a second attempt or conversion to general anaesthesia.

Epidural anaesthesia

Larger volumes (5–20 mL) of local anaesthetic with or without opioid are delivered into the peri-dural space. The drugs diffuse to exert an effect on the spinal cord and nerve roots. Advantages over spinal anaesthesia are that incremental doses can be given and use may be continued into the postoperative period for analgesia.

Caudal epidural anaesthesia

Large volumes (10–40 mL) of local anaesthetic are delivered to the caudal space, via the sacral hiatus, which is a continuation of the epidural space. In adults it only contains sacral and lumbar nerve roots with the dura mater ending at the level of S2. Caudal epidural injection provides supplementary anaesthesia to the saddle area for perineal surgery. The space may be difficult to locate reliably and the sacral hiatus is absent in ≈10% of the population. It is relatively easy to perform in children. Caudal anaesthesia has an association with prolonged femoral nerve block, slower mobilization and urinary retention.

CNB is not to be undertaken lightly; the very rare adverse effects can be fatal or debilitating, especially those affecting the spinal canal. Previous specific informed consent must be obtained for this type of anaesthesia.

There are contraindications, side-effects and predictable effects common to all types of CNB

- Absolute: local and systemic sepsis; coagulopathy.
- Relative: pre-existent neurological disease; cardiovascular pathology; lack of consent.

Side-effects caused by:

Physical processes:

- Direct nerve trauma.
- Cord compression due to vertebral canal haematoma.
- Abscess.
- Stroke.
- Meningism/meningitis.
- Post-dural puncture headache.

Drugs:

- Intravascular injection of opioids, local anaesthetic or adrenaline.
- Local anaesthetic toxicity.
- Opioid itching and respiratory depression.

Predictable physiological responses:

- Motor and sensory nerve blockade.
- Sympathetic blockade with unopposed vagal effects.
- Urinary retention.

Because of the significant effects on the cardiovascular, respiratory and CNS it is

essential to use regular cardiovascular, respiratory and neurological observations, including distribution of motor and sensory block, as well as analgesic effectiveness.

A common misconception is that regional anaesthesia requires less preoperative assessment and is easier than general anaesthesia. All patients need to be prepared to the same standard for both techniques. There is no evidence to suggest that regional anaesthesia has reduced long-term morbidity and mortality for urological surgery [4].

GENERAL ANAESTHESIA

General anaesthesia is the technique of choice for a wide range of patient or surgical factors, e.g. intra-abdominal or thoracic procedures, cardiovascular instability or long procedures. It involves the induction, maintenance and emergence from anaesthesia by pharmacological agents. It is beyond the scope of this article to discuss the individual pharmacokinetics and pharmacodynamics of drugs used in anaesthesia. Induction may be carried out either by inhalation of halogenated hydrocarbons such as sevoflurane or intravenous injection of the phenol propofol or barbiturate thiopentone.

Areas of special interest are:

- Management of the airway.
- Simple and complex patient monitoring.
- Temperature control.
- Physiological effects of pneumoperitoneum.

AIRWAY

The airway may be supported by a facemask, the laryngeal mask airway or by intubation of the trachea. The laryngeal mask airway is seated over the larynx and allows spontaneous or controlled ventilation.

Indications for tracheal intubation are:

- To protect the airway from soiling.
- To facilitate mechanical ventilation.

Muscle relaxation may be required to facilitate surgery and is achieved by neuromuscular blocking drugs. Neuromuscular blockade cannot be reversed for up to 20 min after giving the last dose and therefore further doses to aid closure of the wound lead to prolonged anaesthesia.

MONITORING

The reasons for monitoring patients throughout the perioperative period are:

- Anaesthetic agents reduce respiratory drive and lying supine leads to a reduction in the functional residual capacity of the lungs.
- Anaesthetic agents reduce myocardial contractility and inotropy, and this combined with peripheral vasodilatation results in hypotension.
- Surgery causes blood loss and fluids shifts, depleting the intravascular volume.
- Measuring expired concentrations of carbon dioxide and anaesthetic agents helps to ensure effective ventilation and depth of anaesthesia.

Monitoring is undertaken before induction and continues until recovery. It consists of:

- Clinical observations; colour, respiratory rate, pulse.
- Simple monitoring; electrocardiogram, pulse oximetry, capnography and noninvasive blood pressure.
- Advanced monitoring; central venous and arterial pressures, blood gas analysis.
- Other; temperature measurement, urine output, respiratory volume and pressure measurements.

A commonly used noninvasive monitoring technique is the oesophageal Doppler probe. This device measures the velocity of red blood cells in the descending aorta and then derives blood flow rates. Further analysis allows assumptions about cardiac output and intravascular volume status. This can be viewed in real-time, guiding fluid and inotrope therapy by dynamic change.

TEMPERATURE CONTROL

During surgery patients may become hypothermic. Increased heat loss is due to impaired thermoregulatory control during anaesthesia. In the elderly, autoregulation is already impaired and children have a relatively large surface-area to body-mass ratio. Core temperature correlates well with temperature measurements from the nose, ear and rectum. Factors predisposing to heat loss are the cool dry atmosphere of the operating room, leading to heat loss via conduction, convection and evaporation [12].

The clinical effects of hypothermia are:

- Shivering which increases metabolic demands;
- Increased pain and anxiety;
- Increased wound infection rates;
- Coagulation abnormalities;
- Cardiac arrhythmia;
- Delays in extubation;
- Prolonged hospital stay.

Useful techniques to reduce heat loss:

- Insulation by air trapping blankets/sterile cotton wool;
- Use of heat reflective materials in hats and leggings;
- Warming of both intravenous fluids and operative fluids;
- Warm air blowers/blankets;
- The humidity and temperature of the operating room may be increased;
- Avoid wet drapes.

PNEUMOPERITONEUM

Laparoscopic surgery requires insufflation of carbon dioxide gas into the peritoneal cavity, allowing surgery and visualization of the viscera. Intra-abdominal pressures up to 20 cmH_2O are used with the following anaesthetic implications:

- Diaphragmatic splinting;
- Increased intragastric pressure;
- Initially increased venous return leading to relative hypertension. Further increases in pressure reduce venous return and cause hypotension;
- Diffusion and possible embolization of carbon dioxide into the bloodstream;
- Trendelenburg and lithotomy positions will exacerbate these effects of the pneumoperitoneum [13].

POSTOPERATIVE

After anaesthesia the patient is transferred to the recovery room to ensure maintenance of the airway, stabilization of respiratory and cardiovascular function, effective analgesia and observations relating to surgical complications. Postoperative care can be subdivided into the requirements for critical

TABLE 1 The strategies to reduce blood transfusion

Factors		
Patient	Surgical	Anaesthetic
Preoperative iron therapy	Efficient coagulation	Hypotensive anaesthesia
Erythropoietin	Choice of technique	Cell salvage
Preoperative autologous donation of blood		Acute normovolaemic haemodilution
		Anti-fibrinolytic drugs

care, fluid management, analgesia and specific urological situations.

CRITICAL CARE

The care of complex surgical cases and high-risk patients requires more monitoring, nursing interventions and expert medical care than can be provided on the open surgical ward. In the UK, this critical care is delivered in an intensive care unit (ICU), high-dependency unit (HDU), and monitored ward beds. The decision to admit a patient to a critical-care environment should be discussed between the surgeon and the anaesthetist.

The Intensive Care Society (UK) has agreed on levels of care for different patient groups, which are listed below. Most urology patients require level 0 and 1 care on the surgical ward. However, given the comorbidity and age of some patients, combined with major surgery, a proportion will require level 2 care for 24–36 h in an HDU/ITU setting. In our current practice it is rare that urology cases require level 3 care in an ITU [14].

Level 0: Patients needs can be met through normal ward care in an acute hospital.

Level 1: Patients at risk of their condition deteriorating, or those recently relocated from higher levels of care whose needs can be met on an acute ward with additional advice and support from the critical care team.

Level 2: Patients requiring more detailed observation or intervention including support for a single failing organ system or postoperative care and those stepping down from higher levels of care.

Level 3: Patients requiring advanced respiratory support alone or basic respiratory support, together with support of at least two organ systems. This level includes all complex patients requiring support for multiorgan failure.

PERIOPERATIVE FLUID MANAGEMENT

This involves the dynamic assessment and treatment of rapid shifts in fluid balance, with regular assessment and correction of haematological and biochemical markers. The aim is to maintain normovolaemia with adequate haemoglobin concentration to ensure oxygen delivery to the tissues, whilst keeping electrolytes within the normal range.

When considering fluid management of an individual patient, factors that should be considered include:

Preoperative

- Reduced fluid intake from starvation or to the disease process, i.e. acute abdomen.
- Increased fluid losses from vomiting, ileostomy output, bowel preparation.

Intraoperative

- Evaporative loss from open abdomen 10-30 mL/kg/h.
- Third space loss to bowel, omentum and retroperitoneum.
- Bleeding.
- Nasogastric losses.
- Normal insensible losses and maintenance.

Postoperative

- Ongoing third space losses.
- Paralytic ileus.
- Nasogastric losses.
- Bleeding.
- Maintenance.

In the presence of normal renal function and haemodynamic variables, a maintenance fluid rate of 40 mL/kg/day (1.6 mL/kg/h) should maintain a urine output 0.5–1.0 mL/kg/h. This allows for normal insensible losses whilst maintaining intravascular volume.

For example, an 80-kg man should receive 3000 mL and pass 1000–2000 mL of urine in 24 h. Preoperative fasting with no intravenous fluids for 8 h deprives this patient of 1000 mL. This needs to be replaced early during surgery.

Postoperative fluid balance in cases with complex or ongoing losses should be closely monitored both clinically and with hourly input and output charts. Should the hourly urine volume reduce, prompt and appropriate correction of intravascular depletion may prevent postoperative renal insults. In some urological procedures, accurate assessment of urine output may be difficult, e.g. bladder irrigation.

Fluid replacement ideally replaces 'like for like', i.e. colloid and packed red blood cells for haemorrhage, and crystalloid for maintenance and third-space losses. The fluid choice should also be guided by an appreciation of the electrolyte demands of the patient; 24 h electrolyte requirements for an adult are Na^+ 1–2 mmol/kg, K^+ 1 mmol/kg and maintenance of normal range for magnesium and phosphate. To reduce the incidence of hyperchloraemic acidosis the current practice is to use fluids with lower chloride ion content than 0.9% saline, e.g. Hartmanns or Gelofusine.

Electrolyte abnormalities specific to urology occur in those patients who have neobladder formation, ileal conduits and Mitrofanoff constructions. Where urine flows over or through intestinal conduits a metabolic acidosis occurs, with hyperchloraemia and low serum bicarbonate levels [15]. TURP syndrome becomes symptomatic from the hyponatraemia caused by absorption of irrigating fluid. If these patients need active management this should occur in a critical-care environment [16].

BLOOD TRANSFUSION

When to transfuse red blood cells has become topical in recent years, with increasing costs and fears of prion and viral transmission. In the critical-care setting, haemoglobin levels of ≥80 g/L are satisfactory. However, a minimum haemoglobin level of ≥100 g/L may be more commonly used on the surgical ward. Preoperative anaemia should be thoroughly investigated and managed before elective surgery [17]. Table 1 shows the strategies to reduce transfusion [18–20].

ANALGESIA

Analgesia throughout the operative period can be provided systemically or by neural blockade, or combined techniques. It is important to provide effective and consistent levels of analgesia as the patient moves through the perioperative period.

Good analgesia that allows effective coughing and earlier mobilization of patients is essential to reduce postoperative respiratory complications. NSAIDS act by inhibiting the enzyme cyclooxygenase, to inhibit the formation of prostaglandins, prostacyclins and thromboxane, that sensitise pain receptors to stimulation. Gastric mucosal blood flow can be reduced and this leads to gastric erosions. A single dose of NSAID may precipitate acute renal failure, particularly in the dehydrated and elderly. Platelet adhesiveness is reduced, leading to increases in blood loss during and after surgery. Bronchial smooth muscle relaxation may be reduced and in 10–20% of asthmatics bronchospasm may occur.

Paracetamol is an extremely safe analgesic and antipyretic drug that is used for treating mild to moderate postoperative pain. It does not have the same anti-inflammatory effects as NSAIDs, but neither does it cause gastrointestinal, respiratory or renal adverse effects. In overdose paracetamol can cause fulminant hepatic failure. Paracetamol can be given orally, rectally and more recently an intravenous preparation has been made available in the UK.

The WHO suggests using an 'analgesic ladder' to provide effective pain management.

Step 1: Mild discomfort can be treated with regular paracetamol.

Step 2: Moderate pain can be treated with addition of codeine or DF118.

Step 3: Severe pain should be treated by use of strong opioid drugs such as morphine.

NSAIDs may be administered at any level. Examples are ibuprofen and diclofenac.

Patient controlled analgesia (PCA) is a technique that allows patients to titrate their own analgesia. This is a controlled infusion device that is pre-programmed to allow set doses of drug to be given in set periods, and that is triggered by the patient. Normal regimens allow the administration of 1 mg of morphine every 5 min. Compared to nurse-delivered intramuscular injection with opioids, PCA offers a more rapid analgesic delivery. PCA is safe and effective when used appropriately, but patient suitability is an important factor, as an understanding of how to use the device is required. The system is rarely applicable to paediatric surgery, although nurse-controlled devices may be used [21].

Continuous epidural analgesia can be used to control pain for up to 5 days after surgery. A combination of local anaesthetic and opioid are continuously infused into the epidural space via an indwelling catheter. Low concentrations of local anaesthetic provide analgesia with minimal motor blockade. Patients need to be nursed in an appropriate environment for the reasons previously described [22].

CONCLUSION

The role of the anaesthetist begins with preoperative assessment and extends throughout the inpatient stay. The principles guiding the anaesthetic management have been discussed, but the true art of anaesthesia is to tailor the plan for each individual.

The preoperative assessment and stabilization of chronic health conditions improves outcomes, reduces cancellation rates and increases health service efficiency. The common techniques of neural blockade that can be used for analgesia and anaesthesia have been described. General and regional anaesthesia have merits but the ultimate choice of technique is a compromise between the patient, anaesthetist and surgeon. Patient safety should be paramount in decision-making processes.

From admission through to discharge, the physiology of the patient must be monitored and supported, to reduce complications and promote rapid healing. These measures can be as simple as a correct dynamic fluid balance reducing renal insults, or maintaining good blood glucose control.

In this era of patient-led care, effective analgesia is a basic humanitarian right (WHO) which promotes rapid healing and well-being. In response to this, more acute-pain services are being created. The current world of technology and Internet access has seen a shift in patient awareness of anaesthetic and surgical options. It is right that both surgeons and anaesthetists are able to answer the questions posed as patients are encouraged to question medical decisions.

The new plan for surgical training proposed by the Royal College of Surgeons (UK) has increased the amount of training time spent in anaesthesia and critical care, recognizing that essential skills can be learnt. Not only will this improve continuity of care during the peri-operative period, but it allows for improved consent for patients at all stages.

Advances in training, supervision, pharmaceuticals and medical devices, combined with the use of national guidelines, have dramatically improved patient safety in the operating department in the last 20 years. A multidisciplinary approach to care delivered throughout the peri-operative period will improve patient care and continue this trend.

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