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Anaesthesia for urological surgery

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Abstract

Anaesthesia is commonly used to facilitate urological procedures and many patients are elderly with multiple co morbidities. Urological procedures range from minor day case to major surgery in which extensive resources are needed both intra and postoperatively. For simple day case procedures like cystoscopy or ureteroscopy, general anaesthesia is most commonly used because it allows for early ambulation. Transurethral resection of the prostate (TURP) needs special attention. TURP syndrome due to excessive absorption of the irrigation fluid can be catastrophic if not managed early. Avoiding contributing factors and choosing regional anaesthesia which allows for early detection are key. Careful perioperative planning and risk stratification is important in major urological cancer surgery. Most of these procedures will require general anaesthesia (due to longer operative time and more extensive surgical trauma). Postoperative pain management in the form of epidural or patient controlled multimodal analgesia are essential. Postoperative high dependency care is beneficial.

Keywords general anaesthesia; postoperative care; preoperative assessment; regional anaesthesia; surgery; transurethral resection of prostate syndrome; urology

Introduction

Anaesthesia is commonly used to facilitate urological procedures and many patients are elderly with multiple co morbidities. Urological procedures range from minor day case procedures, to major surgery in which extensive resources are needed both intra and postoperatively (HDU-ICU). Consequently anaesthesia may encompass local, monitored anaesthesia care (MAC), regional or general techniques.¹

Preoperative assessment

A thorough assessment of the patient history, including any anaesthetic records, is important in detecting any underlying co

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Learning objectives

After reading this article, you should be able to:

- formulate an anaesthetic plan and analgesic regime for the management of common urological procedures
- identify the clinical manifestations of the TURP syndrome and how to manage it
- name commonly used drugs in anaesthesia with a potential for significant accumulation in patients with renal impairment or that may induce nephrotoxicity

morbidities and to assess the degree of major organ function. Exercise tolerance is a good predictor of propensity to postoperative complications and can be assessed as metabolic equivalent tasks (METS) where 1 MET is the metabolic equivalent of a resting adult. <4 METS or the inability to walk up 2 flights of stairs is associated with increased risk.

Special attention should be paid to the drug history and their effects on renal function.

Physical examination and lab investigations can be performed based on history and physical examination. Most perioperative medical complications involve the cardiac and/or respiratory systems so these deserve special attention. Renal function may also be compromised and many patients will require testing preoperatively.

The lithotomy position is most commonly used during urological surgeries and patient suitability for this may need to be assessed and any limitation of movement in hip/knee joints documented.

Intraoperative care

Standard American Society of Anesthesiologists (ASA) monitoring (Non-invasive blood pressure (NIBP), electrocardiograph (ECG), pulse oximetry, capnometry, temperature) should be used in all patients. Further more invasive monitoring will depend on the type of surgery and patient co-morbidity.

For obvious anatomical reasons, Urological surgery is a field where regional anaesthesia is widely practiced. Benefits of regional anaesthesia include lesser effects on the respiratory function, faster postoperative oral intake, pain relief, a lower incidence of postoperative deep vein thrombosis (DVT), and it allows easier detection of neurological symptoms during transurethral resection of the prostate (TURP) surgery (see below).

General anaesthesia (GA) is mostly chosen for very short procedures (day case cystoscopy), for lengthy major surgery (radical cystectomy, nephrectomy) or when particular positioning is required e.g. lateral or head down. It is, of course, possible to combine regional and general anaesthesia with the use of epidural techniques. This can have the advantage of reducing general anaesthetic drug requirements and can facilitate more prolonged postoperative analgesia. Epidural anaesthesia can also help reduce intraoperative blood loss and bowel distension during pelvic and intra-abdominal cancer surgery.

Renal function may be impaired and, therefore, it is prudent to choose drugs which are not likely to further compromise renal function and which are not metabolized in the kidney. Where this is not possible, then the pharmacodynamic effects must be

113 closely monitored. For example muscle relaxants such as atracurium or cisatracurium would be preferable to rocuronium but if
114 there was a good reason to use rocuronium then neuromuscular
115 function can be assessed and the effects reversed with sugammadex if necessary. Suxamethonium is best avoided in patients
116 with renal impairment in which serum potassium may be raised.

117 Non-steroidal anti-inflammatory drugs (NSAID) and cyclo-
118 oxygenase 2 inhibitors (coxibs) can interfere with renal autor-
119 egulation. Total intravenous anaesthesia (TIVA) with propofol
120 and remifentanyl is safe in renal dysfunction. Patients may be
121 more sensitive to the pharmacodynamics effects in the presence
122 of uraemia and protein binding may be reduced leading to higher
123 free drug fractions. Consequently careful titration of drugs with
124 target controlled infusion (TCI) is a suitable technique.

125 Postoperative nausea and vomiting (PONV) is not a particular
126 problem for this type of surgery but can be reduced by good pain
127 management (minimizing opioid use, where possible), adequate
128 hydration and prophylactic antiemetic use.

130 Postoperative care

131 Postoperative pain management aims to provide good analgesia
132 with little or minimal residual sedation to facilitate faster
133 discharge. For day case procedures, short acting opioids like
134 fentanyl along with paracetamol can be safely used.

135 Postoperative pain management in inpatients usually includes
136 patient controlled analgesia (PCA) or epidurals. If PCA to be
137 used, one should keep in mind the renal functions and the
138 cumulative effects of opioids metabolites. Some anaesthetists
139 advocate using fentanyl in comparison to morphine as fentanyl
140 has no active metabolites, where morphine is metabolized by the
141 liver to morphine 6 glucuronide (M6G) which then excreted by
142 the kidneys.² Drugs like paracetamol can be used safely.

144 Endoscopic procedures of the lower genitourinary tract

145 Examination of the bladder and lower genitourinary tract (GU) are
146 very common procedures both for the diagnosis and treatment of
147 diseases. Cystoscopy can be performed with a flexible fibroscope
148 under local anaesthesia (lignocaine lubricant gel) with or without
149 mild sedation. Rigid cystoscopy is indicated for the diagnosis of
150 the lower GU pathology, and/or dilatation of urethral strictures.

151 General anaesthesia in the lithotomy position is most
152 commonly used as most of these procedures are short day cases
153 requiring early ambulation. Spinal anaesthesia may also be used
154 and one must ensure a block to around the T10 dermatome to
155 achieve satisfactory conditions for surgery.

157 Transurethral resection of the prostate (TURP)

158 Benign prostatic hyperplasia occurs in around 40% of men above
159 60 years old so, consequently, transurethral resection of the
160 prostate is the most common surgical intervention in the uro-
161 surgical patients. During the procedure, a resectoscope is inser-
162 ted through a modified cystoscope and facilitates the prostatic
163 tissue to be cut and coagulated. Significant bleeding may occur
164 due to opening of venous sinuses.

165 Various complications can develop during the procedure.
166 Most important of these is bleeding and the TURP syndrome.
167 Other complications may include hypothermia, bladder perfora-
168 tion, coagulopathy and postoperative sepsis.

169 Patients are usually elderly (>60 years) with multiple co
170 morbidities. Chronic renal impairment is not unusual in the
171 elderly and where there has been significant urinary tract outflow
172 obstruction. A detailed pre-anaesthesia check must be per-
173 formed. The mortality for TURP ranges between 0.5 and 0.7%
174 mainly due to heart failure, pulmonary oedema and renal failure.
175 Cross matched blood should be available.

176 Care must be taken during patient positioning (lithotomy). Two
177 persons are needed to move the legs simultaneously up or down to
178 avoid stressing the spinal ligaments. Pressure points must be
179 padded, most importantly to avoid the straps of the legs from
180 exerting excessive pressure on contact points. Iatrogenic nerve
181 palsies recorded before include, injury to the common peroneal
182 nerve (loss of dorsiflexion of the foot) due to strap pressure against
183 the head of the fibula; injury to the saphenous nerve (numbness of
184 the medial calf) due to tight straps over the medial aspect of the legs;
185 and injury to the obturator component of the femoral nerve due to
186 excessive flexion of the thigh against the groin.

187 Unless contraindicated, regional anaesthesia (single subarach-
188 noid injection) is recommended popular technique for TURP, as it
189 allows early identification of the neurological manifestation of the
190 TURP syndrome. Also the vasodilatation produced and the venous
191 pooling helps reduce the circulatory overload, and decreases the
192 incidence of postoperative (DVT). If GA is chosen, it is best achieved
193 with controlled ventilation via a supraglottic airway device. High
194 airway pressures must be avoided as this increases bleeding from
195 the prostatic bed. A large calibre intravenous cannula is sited in case
196 of significant bleeding. A forced air warmer, fluid warmer and body
197 temperature irrigation fluids should be used to maintain
198 normothermia.

198 TURP syndrome

199 TURP syndrome refers to the symptoms and signs that occur as
200 a result of the absorption of large amounts of irrigation fluid. It
201 can present either intra or postoperatively. Prompt recognition
202 and treatment is essential to limit morbidity and mortality
203 associated with this condition.³

204 Many factors contribute to the development of TURP syndrome.
205 The type of irrigation fluid is shown in Table 1; (surgery should
206 ideally be less than 1 h); the hydrostatic pressure of the irrigation
207 fluid should be <60 cm above the heart level; and the prostatic
208 venous pressure should not be low (maintain normovolaemia).

209 The average amount of irrigation fluid absorbed is 20 ml/min
210 (1–1.5 L during the average procedure (1 h)), but this may increase
211 if the precautions listed above not taken into consideration.

213 Ideal irrigation fluid

214 Isotonic (prevent haemolysis)
215 Electrically inert (prevent current dissipation from diathermy)
216 Transparent (no impairment of surgical field visualization)
217 Sterile (prevent infection)
218 Inexpensive

219 No ideal irrigation solution exists. Most commonly used solu-
220 tions are 1.5% glycine (288 mmol/L), 2.7% sorbitol (195 mmol/
221 L) or 3% mannitol. Among them, glycine is most commonly
222 used. Glycine is a non-essential amino acid, metabolized in the
223
224

Commonly used drugs in anaesthesia with a potential for significant accumulation in patients with renal impairment

Muscle relaxants	Rocronium, vecronium
Analgesics	Pethidine, morphine
Induction agents	Barbiturates
Anticholinergics	Atropine, glycopyrolate
Cholinesterase inhibitors	Neostigmine, edrophonium
Antibiotics	Penicillins, cephalosporines, aminoglycosides, vancomycin
Antihypertensives	Clonidine, methyldopa, hydralazine, diuretics
Miscellaneous	Inotropes, digoxins

Table 1

liver to ammonia. It has some cardiac and CNS toxicity and is an inhibitory neurotransmitter in the retina. A large amount of glycine slows down the transmission of impulses from the retina to the cerebral cortex causing transient blindness in some cases (resolves spontaneously within 24 h).

The use of glycine solution with a tracer amount of ethanol for detecting and quantifying irrigating fluid absorption has been pioneered by Hahn and his colleagues in Sweden.⁴ Alcometers can be used easily during both general anaesthesia and regional to help in early detection of glycine toxicity.

During regional anaesthesia, the patients may complain of nausea, chest tightness, shortness of breath, dizziness, restlessness, confusion and blurring of vision. These signs will, of course, be masked by general anaesthesia and diagnosis delayed. Patients may have an increase or decrease in blood pressure with refractory bradycardia. On the ECG nodal rhythm, ST segment changes, U waves and widening of the QRS complexes may be observed.

The best way to manage TURP syndrome is to prevent it. Avoiding contributing factors (see above) and choosing regional anaesthesia which allows for early detection are important.

Management of TURP syndrome

- Notify the surgeon
- Stop surgery after coagulating bleeding points
- Airway, Breathing, Circulation
- Supplementary oxygen and ventilate if needed
- Fluid restriction
- Check urea, electrolytes, haemoglobin and arterial blood gases F_2 semide 20 mg iv
- Mild hyponatraemia ($\text{Na} > 120$), fluid restriction may suffice
- Severe hyponatraemia ($\text{Na} < 120$), use hypertonic saline
- Slow correction (< 0.5 mmol/hour), to avoid central pontine myelinosis
- Seizures: anticonvulsant e.g. midazolam, diazepam or thiopentone
- Hypotension: inotropic support and invasive monitoring
- Admit to intensive care unit postoperatively

Laser prostatectomy

A laser can be used to destroy the enlarged prostate tissue as a minimally invasive procedure and an alternative to TURP. A Cochrane review⁵ of 20 studies involving 1898 subjects found laser techniques to be useful and relatively safe alternatives to TURP. The small number of enrolled subjects and differences in study design limit any definitive conclusions regarding which type of laser technique is the most effective. Improvements in symptoms and urine flow slightly favoured TURP, though laser procedures had fewer side effects and shorter hospitalization times. The follow-up durations of these studies ranged from 6 to 36 months and men with extremely large prostates were generally excluded from the trials. The risk of needing a reoperation for recurrent symptoms was higher following laser procedures. Study results were insufficient to adequately compare laser techniques with other minimally invasive procedures. More studies, using randomized treatment assignment, enrolling larger numbers of subjects, and comprehensive measures of treatment effectiveness and side events, are needed to better define the long-term safety and durability of laser techniques for treating LUTS associated BPO.

The anaesthetic management of laser prostatectomy is similar to TURP, with the benefit of less fluid absorption so that the risk of TURP syndrome is reduced. Also, the precise laser beam causes less bleeding compared to the ordinary resectoscope.

Endoscopic procedures of the upper genitourinary tract

Ureteroscopy is used to outline the anatomy of the upper urinary tract and kidneys, remove renal calculi, stent the ureters and for renal biopsies.

Most of these patients have renal impairment secondary to genitourinary tract obstruction, so renal function should be checked.

Generally these are done as day case procedures in the lithotomy position under general anaesthesia without muscle relaxation (often using a LMA). Postoperative pain is usually mild and can be easily managed with simple analgesics such as paracetamol. As usual, NSAIDs will be contraindicated in the presence of renal insufficiency.

Percutaneous stone removal

This is indicated for the removal of large (staghorn) stones. Patients are usually healthy but may have had haematuria which may require a full blood count check if severe. As before, renal obstruction can result in impairment of function.

The procedure first involves stenting of the ureter (in the lithotomy position), then the patient is placed prone to insert a guide wire percutaneously into the renal pelvis to conduct the nephroscope.

Due to the prone position, general anaesthesia with the use of a reinforced endotracheal tube is a suitable technique. Special attention should be paid to appropriate protection and padding for pressure points such as the eyes, nose and nerves, and keeping the head in the neutral position. It is also important to document that such measures have been taken. The chest and pelvis must be supported while the abdomen is free.

Postoperative pain can be managed with opioids and/or paracetamol. Again, NSAIDs are avoided if there is impaired renal

function. A chest radiograph can be ordered if there is a suspicion of pneumothorax.

Major (radical) surgery

There is a wide variety of major urological procedures performed, mainly for the treatment of tumours of the genitourinary tract. Such surgery requires careful perioperative planning and risk stratification in order to formulate a management strategy.

The main concerns are long operative time, fluid and blood loss with consequent possible blood transfusion, large surgical incision and the need for more aggressive pain management. This is coupled with a generally elderly patient population and a more marked surgical stress response. Most of these procedures will require general anaesthesia (due to longer operative time and more extensive surgical trauma). Contemporaneous epidural analgesia is a useful addition as it reduces intraoperative anaesthetic drug requirements, reduces respiratory complications, facilitates weaning and produces excellent postoperative analgesia. Patient controlled multimodal analgesia is an acceptable alternative. Cross matching of enough blood units and maintaining normothermia with fluid and forced air warming devices is mandatory. As most surgery is neoplastic, cell saver devices are seldom used. A large bore intravenous cannula is inserted and invasive monitoring such as arterial and/or central venous line insertion can be considered depending on the extent of surgery and co-morbidity. Point of care testing for arterial blood gases and blood parameters (Hb, electrolytes, and coagulation) can be useful. Prearrangement of a high dependency or intensive care unit bed is advisable.

Radical prostatectomy

Prostatic carcinoma is the most commonly diagnosed cancer in men and is present in 75% over 75 years old and. Radical prostatectomy is indicated under the age of 70 years with localized disease and who have a life expectancy of at least 10 years. As the name implies, it involves removing the whole prostate gland, the seminal vesicles, the ejaculatory ducts and a portion of the bladder neck. The patient is placed in the hyperextended supine position with the iliac crest over the break in the operating table. Care must be taken not to put excessive strain on the back. The OR table is also tilted head down to make the operative field horizontal.

Precautions for rapid fluid and blood administration must be in place. Epidural analgesia is useful as described above.

Many surgeons will combine radical prostatectomy with laparoscopic pelvic lymph node dissection. Here there are added concerns. Often a steep head down trendelenburg position and rotation from side to side is needed to assist surgical exposure. There is a risk of CO₂ absorption from the peritoneum. The surgeon may ask for injection of a dye (indigo carmine to visualize the ureters) and this can cause changes in the blood pressure. As surgery is prolonged with high intra-abdominal pressures and involves the pelvic region, DVT prophylaxis must be ensured.

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There has been growing interest in the last few years in laparoscopic and robot assisted prostatectomy. These procedures are less invasive and produce a quicker recovery and return to daily activities. The blood loss is markedly reduced especially with robotic surgery. The anaesthetic implications are similar to other laparoscopic surgical procedures, although the operations can be quite long and may necessitate a prolonged time in the head down, trendelenburg position. Patients can be managed postoperatively in the general ward.

Nephrectomy

Nephrectomy is a major procedure performed to remove renal tumours or non-functioning kidneys. It may also be used to retrieve healthy kidneys for living related organ donation. Apart from the healthy kidney donors, most of patients presenting for nephrectomy have impaired renal function. Some may have a paramalignant syndrome such as polycythaemia, hypercalcaemia or hypertension. General anaesthesia is usually required because of the long operative time as well as patient discomfort from the position. Most nephrectomies are performed in the modified lateral position with a kidney rest under the iliac crest (Figure 1). The loin is hyperextended over the table break to open the flank space, and the upper arm is suspended above the patient. It is important to ensure that arms are not overstretched. Potential intraoperative complications include massive bleeding, hypotension due to the position causing retraction of the IVC, and pneumothorax due to opening of the pleura during surgery. Occasionally the tumour may involve the IVC necessitating the clamping leading to hypotension. In rare cases of extensive tumour extension, thoracotomy may be needed, while very rare cases where IVC thrombosis has spread to the heart, cardiopulmonary bypass may even be needed. Epidural analgesia is recommended in radical nephrectomy. Other options include a paravertebral block (single shot or continuous via a catheter), PCA and/or regular paracetamol. NSAIDs are generally avoided



Figure 1 Modified lateral (hyperextended) position using a kidney rest under the iliac crest to improve the exposure of the flanks.

449 due to the poor renal reserve in these patients and potential for
450 bleeding.

451 Laparoscopic nephrectomy has become the standard of care
452 now in many places for removal of small sized kidney tumours.
453 Also, laparoscopic donor nephrectomy is increasingly becoming
454 the preferred method in kidney retrieval.⁶ The procedure requires
455 the patient to be in the lateral decubitus position with intra-
456 abdominal insufflation of CO₂ and its attendant effects. Major
457 complications include sepsis, bowel injury, rhabdomyolysis and
458 acute renal failure. The procedure may be converted to open and
459 the anaesthetist should explain this to the patient beforehand and
460 have a clear plan should this eventuate.

463 Radical cystectomy

464 This involves excising the urinary bladder and forming a urinary
465 conduit, usually ileal or colonic, to direct the flow of urine. In
466 men, surgeons may have to remove the seminal vesicles and
467 proximal urethra while in women excising the anterior vaginal
468 wall and uterus may be included. Cigarette smoking is a risk
469 factor for bladder carcinoma, ischaemic heart disease and
470 chronic obstructive lung disease are common co morbidities.
471 Many patients may have already undergone chemotherapy.
472 Preoperative assessment should identify any adverse effects of
473 the cytotoxic drugs (e.g. bone marrow depression, renal
474 impairment with cisplatin, pulmonary fibrosis with bleomycin,
475 neuropathy from vincristine).

476 General anaesthesia with epidural analgesia is recommended.
477 As with other radical surgeries, invasive monitoring may be useful.

481 Mannitol can be given before dissection near to the renal
482 vessels to help reduce ischaemic renal injury (secondary to renal
483 vasospasm). During urinary diversion to the ileum, it will no
484 longer be possible to measure the urine output. Postoperatively,
485 the most commonly encountered complication is hyper-
486 chloraemic metabolic acidosis and hypokalaemia secondary to

488 urinary absorption from the GI tract. Ileus is very common and
489 nasogastric drainage may be helpful.

490 Minor urological procedures

491 **Circumcision:** in babies younger than 3 months, it can be per-
492 formed as day case surgery under local anaesthesia in the form of
493 a dorsal penile nerve block or caudal epidural block.⁷ Older
494 children usually require general anaesthesia with a block for
495 postoperative pain management with paracetamol or NSAIDs as
496 required.

497 **Orchidectomy:** is indicated in case of injury, torsion or to treat
498 testicular carcinoma. General anaesthesia with supraglottic airway
499 can be chosen. Supplemental ilioinguinal block may be performed
500 to help reduce the need for postoperative pain medications. ◆

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