Anaesthetic strategies towards developments in day care surgery

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Summary

Ambulatory surgery is growing worldwide. The challenge of providing anaesthesia for longer and more complex surgery in sicker and elderly patients is a reality. To maintain the safety and good outcomes of ambulatory anaesthesia, high-risk patients will need to be evaluated carefully. Anaesthetic techniques that use short-acting drugs and minimize postoperative morbidity and mortality should become the focus. Policies on management of postoperative pain, nausea, vomiting, voiding and discharge from hospital will maintain good outcome measures.

Keywords: ANAESTHESIA, outpatient; AMBULATORY SURGICAL PROCEDURES, day surgery, patient selection, preoperative assessment; POSTOPERATIVE COMPLICATIONS, postoperative nausea and vomiting, pain.

Introduction

There has been a rapid growth in day care (ambulatory) anaesthesia throughout the world. Ambulatory surgery is growing worldwide with about 66% of all anaesthetics being administered in the United States for surgery performed on a day care basis [1]. This has followed the recent advances in anaesthetic and surgical techniques. Minimally invasive and robotic surgeries are leading to developments in surgery. The development of newer anaesthesia techniques and short-acting drugs is associated with rapid recovery and minimum side-effects in the perioperative period.

The challenges that meet the anaesthetist in ambulatory anaesthesia include patient selection, optimization of preoperative function and choice of appropriate anaesthetic techniques. This review addresses strategies towards the appropriate development of anaesthesia for day care surgery.

Patient selection

Increasingly complex procedures are being performed in sicker and elderly patients on a day care basis [2].

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Patient selection is therefore, the key to successful ambulatory surgery. Morbidity and mortality are primarily related to perioperative rather than perianaesthetic factors. Medically well-controlled patients have no higher risk of complications than patients with no systemic disease [3]. Predictors of admission following outpatient laparoscopic cholecystectomy include American Society of Anesthesiologists (ASA) physical status >2, and/or a diagnosis of acute cholecystitis or biliary pancreatitis [4]. The evidence suggests that ambulatory surgery is safe in the well-controlled, high-risk patient, but not for all types of surgery. At our institution, exclusion criteria from day surgery include, unstable ASA grade 3 and 4 patients, morbid obesity, complex sleep apnoea and history of acute substance abuse or sickle cell disease.

Preoperative assessment

As more complex surgery is performed on sicker patients, the role of the anaesthetic preoperative assessment becomes more critical. The anaesthetist must remain the central figure in the decision to proceed with anaesthesia and surgery. The perioperative assessment may take the form of an computerized questionnaire to be completed by the patient, a nurse or the family doctor. These are then overlaid with

automatic investigation selections and a referral system to an anaesthetist, particularly for high-risk patients. The anaesthetic preassessment clinic provides an excellent opportunity for anaesthetists to screen the high-risk patient, avoids unnecessary cancellations and provides satisfaction to the patients [5,6]. The patient can also be given the necessary information about the preoperative preparation and the management of postoperative events including pain. Information may be given to patients by the doctors or nurses, or by information leaflets and videos. The cost benefit of any of these techniques has yet to be evaluated.

An essential part of preoperative assessment is laboratory investigations for evaluating the clinical condition and identifying patients at high risk. A complete history and physical examination can accurately predict fitness for surgery in 96% of patients [7]. Laboratory tests are useful only if the tests are going to alter management or affect mortality and morbidity, or are indicated for proper management.

Surgical considerations

Traditionally, surgical case selection has revolved around surgery, which can be performed within a reasonable period of time (<90 min), and which does not require highly specialized operating equipment or postoperative care. Surgery should not be associated with excessive blood loss or fluid shifts, and postsurgical pain should be manageable at home. As new innovations in pain control, surgical techniques, equipment and a better understanding of perioperative physiology have developed, there has been a trend to performing more complex surgery on an ambulatory basis [8].

Minimally invasive surgical techniques have grown during the last decade. The advantages of less pain, shorter hospital stays, better pulmonary function, reduced postoperative ileus, decreased inflammatory responses and immunodysfunction have put minimally invasive surgery at the forefront of most development in ambulatory surgery. Laparoscopic cholecystectomy is now a routine outpatient procedure [9]. Other procedures now being done laparoscopically include gastric fundoplication, vaginal hysterectomy, splenectomy, adrenalectomy and donor nephrectomy. Common surgical procedures performed on a day case basis are listed in Table 1 [10]. The scope of day surgery is, however, being expanded greatly to more complex procedures.

Anaesthesia

The ideal anaesthetic for ambulatory surgery remains a vexed issue. The anaesthetic technique will range from local anaesthesia, sedation and regional anaesthesia to general anaesthesia used on its own or in

Table 1. Procedures suitable for outpatient surgery (From: Anesthesia 15th edition. Ed: Miller RD. Churchill Livingstone)

Dental:	Extraction, Restoration, Facial Fractures.
Dermatology:	Excision of skin lesions
General:	Biopsy, Endoscopy, Excision of masses, Haemorrhoidectomy, Herniorraphy, Laparoscopic procedures, Varicose veins surgery
Gynaecology:	Cone biopsy, D&C, Hysteroscopy, Laparoscopy, Polypectomy, Tubal ligation, Vaginal hysterectomy
Ophthalmology:	Cataract, Chalazion excision, Nasolacrimal duct probing, Strabismus repair, Tonometry
Orthopaedics:	ACL repair, Arthroscopy, Bunionectomy, Carpal tunnel release, Closed reduction of fractures, Hardware removal, Manipulations
Otolaryngology:	Adenoidectomy, Laryngoscopy, Mastoidectomy, Myringotomy, Polypectomy, Rhinoplasty, Tonsillectomy, Tympanoplasty
Pain Clinic:	Chemical sympathectomy, Epidural injections, Nerve Blocks
Plastic Surgery:	Basal cell carcinoma excision, Ceft lip repair, Liposuction, Mammoplasty, Otoplasty, Scar revision, Septorhinoplasty, Skin graft
Urology:	Bladder surgery, Circumcision, Cystoscopy, Lithotripsy, Prostate biopsy, Vasovasotomy.

combination. Preferences of the patient, anaesthetist, surgeon and the facilities of the unit will determine the choice of the anaesthetic. In recent years, anaesthetic drug development has centred on rapid- and shorter-acting drugs.

Propofol

Propofol is used commonly for induction of anaesthesia as it provides a smooth induction and facilitates easy insertion of the laryngeal mask. The use of propofol for maintenance of anaesthesia also reduces nausea and vomiting, an important consideration in day case anaesthesia [11]. Avoidance of operating room pollution is another advantage. Availability of target-controlled infusion systems makes the use of propofol for maintenance of anaesthesia more rational and predictable, and easy to use [12]. The system can also be used for patient-controlled sedation [13]. The infusion maintains cardiovascular stability with an overall high satisfaction rate.

Midazolam

Midazolam is the cornerstone of sedation techniques. Its hypnotic effects combined with anterograde amnesia make it ideal for allaying patient anxiety while regional blocks are being performed, and during surgery itself. Its cardiovascular stability and minimum respiratory effects add to its ease of use. Narcotics and propofol are used as adjuncts to compensate for its lack of analgesic effects. The addition of alfentanil to midazolam is advantageous in providing sedation for insertion of a block [14]. It reduces the amount of propofol used for induction of anaesthesia. Despite increased postoperative sedation, it has been shown not to prolong recovery times [15].

Muscle relaxants: succinylcholine, mivacurium, rapacuronium

Muscle relaxants may be required to provide atraumatic intubating conditions, and paralysis of the abdominal musculature and diaphragm. Succinylcholine provides a rapid onset and offset but is associated with myalgias, although their frequency can be reduced with a small dose of a non-depolarizing relaxant. Mivacurium 0.2 mg kg^{-1} has an onset time of about 3 min. Its main advantages are lack of

cumulation and a relatively short duration of action, but it may release histamine. Like succinylcholine, its duration of action can be prolonged in patients with abnormal pseudocholinesterases. Rapacuronium 1.5 mg kg^{-1} was reported to have an onset time of 96 s at the adductor pollicis and 62 s at the vocal cords [16]. It provides good intubating conditions at 1 min with duration of action of 10–16 min. Higher doses may be associated with significant side-effects.

The question of reversal of non-depolarizing neuromuscular block is discussed elsewhere in this issue [17].

Opioids: fentanyl, remifentanil

Opioids have traditionally been used in anaesthesia to prevent acute hyperdynamic responses to laryngoscopy, tracheal intubation and painful stimuli, and reduce the required dose of both inhalational agents and propofol. Larger doses of opioids are needed to provide haemodynamic control and this may delay recovery and produce side-effects. Longer-acting drugs may confer the benefit of postoperative analgesia, but this benefit is overshadowed by side-effects such as somnolence, nausea and vomiting. Traditionally, fentanyl is used in small doses (1–1.5 µg kg^{-1}) to achieve these aims [18]. There is an increasing number of short surgical procedures that involve intense surgical stimulation. As a result there has been a move towards using shorter-acting opioids such as alfentanil and remifentanil. The duration of action of alfentanil increases with the duration of infusion. Remifentanil has a short duration of action that is independent of the length of infusion.

Remifentanil provides improved anaesthetic stability without detrimental effects on awakening times, with a low incidence of nausea and vomiting [19]. Postoperative analgesia is, however, needed earlier, analgesics for the postoperative period must already be administered before the patient wakes up. The normal bolus dose is 1 µg kg^{-1} given over 30 s. It needs to be administered by infusion for maintenance at rates of 0.01–1.0 µg kg^{-1} min^{-1}. Postoperative analgesia is provided with local anaesthesia infiltration, small doses of opioids and non-steroidal anti-inflammatory drugs.

Concern has been raised about the cost of drugs, but a more expensive anaesthetic, such as with propofol

and remifentanil, is associated with the faster recovery, fewer side-effects and an earlier discharge in comparison with isoflurane or propofol in combination with fentanyl [20].

Volatile anaesthetics

The advent of sevoflurane has renewed interest in inhalational induction and maintenance. It is useful in needle-phobic patients, difficult airway scenarios and in paediatric patients. In a study comparing different induction and maintenance techniques, there was no difference in emergence between patients having a sevoflurane induction and maintenance compared with those who had a propofol induction and maintenance [21]. When comparing sevoflurane with isoflurane for maintenance, the emergence is faster with sevoflurane with drowsiness and nausea and vomiting being significantly greater with isoflurane [22]. Sevoflurane is also of benefit in patients with irritable airways, such as smokers. The elderly have better awakening times with sevoflurane.

While being unsuitable for inhalation induction, desflurane is ideal for maintenance of anaesthesia with faster early recovery compared with both sevoflurane and propofol [23,24]. Earlier concerns about desflurane in spontaneously breathing patients seem unfounded.

Regional anaesthesia in ambulatory surgery

Whether regional anaesthesia is superior to general anaesthesia remains a point of debate. Regional anaesthesia used alone or in combination offers many advantages, such as better pain relief after surgery, selective analgesia, reduction of systemic analgesic consumption and elimination of opioid-related side-effects and complications of general anaesthesia. Regional anaesthesia also helps in achieving early discharge, is cheap and is associated with fewer unanticipated hospital admissions [25].

Selection of appropriate patients, procedures and the co-operation of surgeons hold the keys to success in regional anaesthesia. Commonly encountered objections include patient desire to be asleep, long induction time for blocks causing delays, failed blocks and, rarely, specific regional anaesthetic complications. Education of patients and healthcare professionals and the use of proper techniques can address these objections. It is now possible to extend local analgesia to self-administration by patients [26]. Regional analgesia is used commonly in upper and lower limb surgery, hernia repair, carotid endarterectomy, and dental and ophthalmic surgery.

Postoperative nausea and vomiting

Despite the advent of 5HT3 antagonists, postoperative nausea and vomiting (PONV) continues to be a problem. The predictors of PONV are gender, age, previous PONV, history of motion sickness, duration of anaesthesia and type of surgery. Based on these, one can consider the role of prophylactic antiemetics for high-risk groups. The role of droperidol and 5HT3 antagonists has been studied and recently there has been interest in the use of steroids for prophylaxis [27]. Despite these developments, there is no treatment or prophylaxis that has been proven to be completely efficacious, cost effective and satisfying to patients. From our knowledge of the vomiting pathways, it would be logical to 'risk stratify' patients and treat high-risk patients with a combination of drugs. A suitable plan would be to start with low-dose droperidol, add ondansetron and then steroids. For the high-risk patient, these could be used in combination prophylactically.

Postoperative pain control in ambulatory surgery

Postoperative pain is one of the main barriers to increasing the range of ambulatory procedures. Undertreatment of pain is common in outpatients, with 40% suffering moderate to severe pain in the first 24 h [28]. Opioids are the mainstay of treating pain but nerve blocks and wound infiltration, and non-steroidal anti-inflammatory drugs are alternatives. These can be supplemented by non-pharmacological techniques such as cryoanalgesia, hypnosis and relaxation, transcutaneous electric nerve stimulation (TENS), and acupuncture.

A multimodal approach to the treatment of pain using a combination of opioids, non-steroidal anti-inflammatory drugs and local anaesthetics is superior to any modality alone [29]. The value of regional anaesthetics in the treatment and prevention of

postoperative pain needs to be emphasized. Usual non-selective non-steroidal anti-inflammatory drugs have several side-effects and, in future, selective COX-2 inhibitors may avoid some of the complications.

Recovery

Recovery is a continual process, the early stages of which overlap the end of intraoperative care. Patients cannot be considered fully recovered until they have returned to their preoperative physiological state. The entire process may last many days. It can be divided into early recovery (phase 1) from discontinuation of anaesthesia until recovery of protective reflexes and motor function, immediate clinical recovery and transfer to the ambulatory surgical unit (phase 2), and full recovery and return of the patient to their preoperative level of social and psychological function (phase 3). The use of bispectral index (BIS) monitor may help in reducing the dose of anaesthetics with a faster emergence and quicker recovery [30,31].

Fast tracking

Newer anaesthetic techniques allow more rapid awakening. It has been suggested that early recovery may be completed in the operating room with patients being transferred directly to the ambulatory surgical unit, bypassing the postanaesthetic care unit [32].

Anaesthetic technique is a major determinant of recovery after surgery. Regional anaesthesia and the use of short-acting agents facilitate fast tracking. Prevention of early postoperative complications will facilitate the success of a fast tracking programme. Minimum use of opioids, use of non-steroidal analgesics, local anaesthetic infiltration of wound sites and use of other short-acting agents are beneficial in fast tracking.

Discharge

It is a doctor's responsibility to ensure that a patient is sufficiently recovered to leave the ambulatory surgical unit. A written policy establishing specific discharge criteria is a sound basis for discharge of patients. In an effort to develop an easy and reproducible set of criteria, Chung and colleagues developed the Postanesthesia Discharge scoring system (PADS) for determining 'home-readiness' [33]. This provides a reliable guide for discharge and anaesthesiologists can delegate the discharge process to nurses. It is based on stability of vital signs, and absence of PONV, pain and surgical bleeding.

Traditionally patients have been asked to drink and void prior to discharge. However, there is increasing evidence to suggest that these two criteria may be unnecessary. There is no difference between the drinking and the non-drinking groups in terms of PONV [34]. Risk factors for postoperative urinary retention include a history of postoperative urinary retention, spinal/epidural anaesthesia, pelvic or urological surgery and perioperative catherization. It is possible to discharge certain patients home without voiding, providing they live within 30 min of a hospital and are given written instructions asking them to return to hospital if they have not voided after 8 h. Ultrasound monitoring of bladder volume, while not essential, may be useful in high-risk patients [35].

Patients treated under regional anaesthesia have unique discharge requirements. Return of motor and sensory function to the lower limbs may be needed for discharge, although it may not be so crucial for surgery involving the nonweight-bearing areas.

Quality management in ambulatory surgery

Quality management is essential to the practice of anaesthesia. It is important to measure the quality of care objectively. Mortality and morbidity do not reflect the quality of care. Table 2 lists the common quality indicators in ambulatory surgery units.

Table 2. Outcome measures

Cancellation and delay	
Adverse events	(a) Cardiovascular
(minor morbidity)	(b) Respiratory
	(c) Postoperative pain
	(d) Postoperative nausea and vomiting
	(e) Minor sequelae
Prolonged postoperative stay	
Unanticipated hospital admission	
Return hospital visit and readmission	
Postoperative functional level and resumption of activity	
Patient satisfaction	

Conclusion

Incidence of ambulatory surgery will continue to grow in the new millennium. As anaesthetists, we will be faced with more complex patients having more complex surgery. Our role in patient selection and assessment of patients' medical conditions cannot be ignored. The areas of patient education, postoperative pain control and quality management will need to be addressed, while we continue to learn and modify our anaesthetic techniques to meet new challenges.

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