Patient selection in ambulatory surgery

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Purpose of review

To evaluate the evidence regarding decisions made in the perioperative management of patients undergoing ambulatory surgery for the following: the elderly, hyperreactive airways disease, coronary artery disease, diabetes, obesity, obstructive sleep apnea, the ex-premature infant and the child with an upper respiratory infection.

Recent findings

Major morbidity and mortality following ambulatory surgery is exceedingly low. Minor adverse cardiac events during the intraoperative period are associated with hypertension and the elderly. Minor adverse respiratory events during the intraoperative period are associated with obesity. Respiratory events during the postoperative period are associated with obesity, smoking and asthma. Prolonged stays following ambulatory surgery are predominantly caused by surgical factors or minor symptoms such as pain or nausea. Surgical factors are also the main causes of unplanned admissions. Age greater than 85, significant co-morbidity and multiple admissions to hospital in the 6 months preceding ambulatory surgery, however, are associated with higher readmission rates.

Summary

Evidence indicates that ambulatory anesthesia is currently very safe. Ambulatory surgery, however, is being offered to a population with increasing co-morbidity. As the population undergoing ambulatory surgery changes over time, the evidence regarding patient outcomes will need re-examination.

Keywords

ambulatory anesthesia, ambulatory surgery, outpatient, patient selection

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Abbreviations

OSA obstructive sleep apnea
PCA post conceptual age
URI upper respiratory infection

0952-7907

Introduction

The driving force for changes in patient selection in ambulatory surgery has come about due to a number of factors. Improvements in anesthesia and pain control, minimally invasive surgical techniques, patient expectations and changing attitudes in recovery have all played a role. Economics and the reduction in the number of hospital beds, however, are the primary stimuli for change. The population undergoing ambulatory surgery is evolving in response to these influences. Historically, surgeons and anesthesiologists may have decided which patients are having ambulatory surgery empirically. The suitability of patients has been based on tradition rather than being evidence based. Often the 'less fit' patient has been excluded on the basis that risks and complications will be reduced if they are inpatients rather than outpatients.

Perioperative risk is dependent upon surgical, anesthetic, establishment and patient factors [1•]. Patient selection has both social and medical components. The focus of this review, however, will be the evidence regarding medical conditions and selection for ambulatory surgery. Very few reviews have focused directly on the evidence for patient selection in ambulatory surgery and specific medical conditions [2••,3••]. The common principles for all patients with medical comorbidity include screening, optimization, consideration regarding the type of anesthetic and identification of patients that would benefit from admission postoperatively. Preoperative evaluation clinics are being used to achieve these goals. They may also reduce unnecessary investigations, reduce cancellations, decrease the work on the day of surgery and provide a convenient time to give patients information, allowing them to make informed decisions.

What is the risk of having an operation?

Arbous *et al.* [4] undertook a 2-year prospective study of 800 000 patients in Holland. In this study the incidence of 24 h perioperative mortality was 8.8 per 10 000 anesthetics and anesthesia related mortality 1.4 per 10 000 anesthetics. Lower mortality figures are reported with voluntary rather than mandatory reporting of deaths. With voluntary reporting the risk of anesthesia-related deaths is of the order of 0.5 per 10 000 anesthetics [5].

Is the risk of ambulatory surgery higher than inpatient surgery?

Warner *et al.* [6] did a prospective study over 2 years examining the major morbidity and mortality within a

30-day period of ambulatory surgery. They included 38 598 patients undergoing 45 090 procedures at the Mayo clinic. The total incidence of 30-day perioperative mortality was 1 : 11 273. Of the four patients who died, two were involved in road traffic accidents. The non-accidental mortality rate was 1 : 22 545. This mortality figure is a similar order of magnitude to the anesthetic-related mortality rather than total mortality for inpatients. Major morbidity was also low in this study (1 : 1455). Epidemiological data may indicate that this incidence is lower than that expected in the general population. More than one-third of the morbidity occurred more than 48 h postoperatively. Other studies have also found that ambulatory surgery is very safe. The safety of undertaking surgery in the outpatient setting for ASA 3 patients has been supported by a recent retrospective study [7•]. ASA 3 patients had similar rates of unplanned admissions, contact with healthcare workers and complications compared with ASA 1 or 2 patients. Previous prospective studies, however, have shown that higher ASA status is associated with higher unanticipated admission rates [8].

Can complication or adverse event rates in ambulatory surgery be reduced by undertaking procedures as inpatients?

This is a very difficult question to answer for a number of reasons. Firstly, major morbidity and mortality are currently low in the ambulatory setting. Secondly, the ambulatory population is undergoing a metamorphosis. Thirdly, most of the data regarding outcomes with specific medical conditions are based on inpatients. We know, however, that the rate of unanticipated admission [8,9] and readmission are low [10,11]. The rates of unanticipated admission are quoted between 0.28 and 1.42% in the literature [12]. Medical causes account for less than 20% of these admissions, with surgical causes being the most common. In the first 30 days following surgery 1% of patients are readmitted to hospital [11]. Mezei and Chung also quoted a 0.15% surgery complication-related readmission rate. The rates of major complications are low for patients undergoing ambulatory surgery [6,7•]. The vast majority of patients make an uneventful recovery following ambulatory surgery.

Does patient selection alter postoperative symptom rates and are these events important?

Postoperative and postdischarge symptoms in patients undergoing ambulatory surgery are common [13]. Minor symptoms such as pain or nausea and vomiting not only predict the length of hospital stay [14] but also influence unanticipated admission rates [8]. Many patients, however, have risk factors for symptoms such as nausea and vomiting. Surgical and anesthetic factors are likely to have a greater bearing on these symptoms rather than alteration of patient selection.

What is the evidence regarding age or specific medical conditions and outcome following ambulatory surgery?

The evidence regarding outcomes after ambulatory surgery will be examined for the following: elderly people, hyper-reactive airways disease, coronary artery disease, diabetes, obesity, obstructive sleep apnea, the ex-premature infant and the child with an upper respiratory infection.

Elderly people

Numerous studies with inpatients clearly demonstrate that perioperative mortality increases with age, particularly with major surgery and emergency procedures [15]. In the outpatient setting, however, Fleischer *et al.* [16•] have demonstrated the risk is low for elderly patients. Seven-day mortality figures for patients over 65 were 35 per 100 000 procedures at the physician's office, 25 per 100 000 procedures at ambulatory surgery centres and 50 per 100 000 procedures at outpatient hospitals. Increasing age is associated with an increased incidence of adverse intraoperative events but not postoperative events [17]. Hypertension, a common disease of elderly people, is independently associated with an increased rate of intraoperative cardiovascular events [18]. The influence of age on unanticipated admission rates in the ambulatory setting is inconsistent. Some large prospective trials indicated that it had no effect [8]. A recently conducted retrospective study of patients older than 70 years has demonstrated admission and postoperative complication rates only marginally higher than the general population [19•]. Fleischer *et al.* [16•] showed that co-morbidity, age greater than 85 and hospitalization within the preceding 6 months increased the rates of readmission after ambulatory surgery. Canet *et al.* [20] have indicated that postoperative cognitive dysfunction can be reduced by performing minor surgery on an outpatient basis. Some procedures commonly performed on elderly patients such as transurethral resection of bladder tumours (TURBTs) are associated with high admission rates [11]. Routine blood tests do not appear to influence postoperative events for cataract surgery [21]. Even abnormal blood tests do not predict outcome. In summary, elderly people are predisposed to intraoperative cardiac events, perioperative outcomes may be influenced in those over 85 years old and patients undergoing TURBTs have high admission rates.

Hyper-reactive airway disease

A large number of studies have examined respiratory complications in inpatients. Intraoperative events such as bronchospasm occur in 2% of asthma patients [22]. Postoperative respiratory events in patients with chronic obstructive pulmonary disease (COPD) were almost doubled in one large prospective study [23]. The combination of a forced expiratory volume in 1 s (FEV1) lower than 50% and major surgery demonstrated an even

more profound effect on postoperative events [24]. The role of lung function tests, however, is a very controversial one for major surgery and of limited value for minor surgery. Asthma patients experiencing symptoms are at a hugely increased risk of postoperative respiratory complications [24]. A prospective study of 17 000 outpatients by Chung *et al.* [18] showed that smoking and asthma would increase postoperative respiratory events four and fivefold, respectively. Smoking is also associated with increased wound complications. Cessation of smoking for 4 weeks preoperatively has been shown to improve outcomes [25]. Another multicentre prospective study of outpatients revealed that both asthma and COPD increased intraoperative events twofold [26]. In summary, hyper-reactive airways disease and smoking are predictive for perioperative respiratory events. Delaying surgery until respiratory symptoms have improved and cessation of smoking have been demonstrated to improve outcomes.

Coronary artery disease

The large prospective trial by Warner *et al.* [6] clearly demonstrated the low incidence of major morbidity in ambulatory surgery. The incidence of myocardial infarction was estimated to be 1 : 3000. The guidelines by the American Heart Association stratified risk according to the type of surgery, patient functional capacity and the clinical predictors [27]. According to these criteria, intermediate clinical predictors included mild ischemic heart disease, prior myocardial infarction (over 1 month old), compensated heart failure, diabetes mellitus and renal insufficiency. These patients could undergo low-risk surgical procedures without further cardiac investigations. Intermediate risk surgery could be undertaken without further investigation if the patient demonstrated a good functional capacity such as ability to climb a flight of stairs. Howell *et al.* [28••] in a recent metaanalysis stated that anesthesia and surgery should not be cancelled on the grounds of preoperative arterial pressure alone. Patients with arterial pressures greater than 180 systolic and 110 diastolic are more prone to perioperative ischemia, arrhythmias and cardiovascular instability. There is no clear evidence, however, that deferring these patients reduces perioperative risk.

The prospective study of ambulatory patients by Chung *et al.* [18] demonstrated that patients with heart failure and hypertension had the highest frequency of intraoperative events. This study was of an insufficient size to demonstrate an association between coronary artery disease and intraoperative events. In summary, patients with coronary artery disease can safely undergo ambulatory surgery usually without further investigation. Although hypertension predicts intraoperative cardiac events, there is little evidence that delaying surgery reduces risk.

Diabetes

Insulin-dependent diabetes was one of six risk factors validated to predict major cardiac complications in the perioperative period [29]. A large prospective study of 18 500 patients has shown that patients with diabetes are at an increased risk of respiratory events [30]. Wound infections are also more prevalent in patients with diabetes, particularly when postoperative glucose readings are high. In the outpatient setting, however, diabetes is not an independent predictor of mortality [16•] or morbidity [18]. The management of insulin therapy during the perioperative period is very controversial for inpatients and evidence is scant for outpatients. A recent systematic review of metformin therapy did not identify any episodes of lactic acidosis [31]. Whether metformin therapy should be omitted has been questioned following this review. In summary, patients with diabetes are at an increased risk for having perioperative cardiac and respiratory events. In the ambulatory setting, however, this condition is not an independent predictor of major morbidity.

Obesity

Many patients with obesity have associated medical conditions. The prevalence of cardiovascular disease increases as the body mass index increases [32]. Hypertension, congestive heart failure and obstructive sleep apnea are all more common in obese patients. A large prospective study in the outpatient setting has demonstrated that obese patients have an increased rate of perioperative respiratory but not cardiac events [26]. Postanesthetic care unit events, particularly respiratory, are also more common in this setting [18]. Obesity, however, does not appear to increase the rates of unanticipated admission [8,33]. A small study of 100 morbidly obese patients has shown that large neck circumference and increased mallampati score but not body mass index are associated with intubation difficulties [34]. Performing blocks to avoid the difficulty with intubations and respiratory events is not problem free. There is an increased incidence of block failure and complications [35•]. In summary, obesity predisposes to an increased rate of perioperative respiratory events but not rates of unanticipated admission.

Obstructive sleep apnea

Studies comparing obese patients and those with obstructive sleep apnea (OSA) are difficult to interpret due to the high prevalence of undiagnosed cases (up to 80% of patients are undiagnosed) [36]. The severity of OSA is assessed using the apnea index. There are no studies showing a clear association between the disease severity and perioperative complications, however. Patients with OSA are more likely to be difficult to intubate and have a higher rate of postanesthetic care unit (PACU) complications [37,38]. Patients treated with nasal continuous

positive airway pressure in the long term have improvements in right heart failure and hypertension. Whether perioperative complications are reduced by treatment is unclear. The case reports of severe morbidity and mortality, however, involve untreated patients who have often received narcotics. The general consensus of anesthesiologists appears to be that it is safe to discharge patients after monitored care anesthesia or regional anesthesia if it is anticipated that postoperative narcotics will not be required [39•]. In summary, patients with OSA may be more difficult to intubate and have higher rates of PACU complications. There is very little research in OSA patients undergoing anesthesia and so more studies are needed in this area.

The ex-premature infant

Postoperative apnea has a high incidence of 25% in premature infants [40]. The incidence is inversely related to gestational and post conceptual age (PCA), with an incidence of less than 5% when the PCA is over 60 weeks. A hematocrit level less than 30% is also correlated with the likelihood of apnea. The optimal length of monitoring postoperatively is poorly defined. A systematic review has clearly demonstrated that caffeine reduces the rate of apnea in younger ex-premature infants [41]. Some randomized control trials have demonstrated a reduced apnea rate with regional rather than general anesthesia [42,43]. Many of the trials, however, had a high withdrawal rate and these findings are not universal. In summary, the risk of apnea declines as the PCA increases. The evidence regarding choice of anesthetic technique and optimal length of monitoring, however, is less well defined.

The child with an upper respiratory infection

The definition of an upper respiratory infection (URI) and fever may vary in the literature. Patients with two or more nonspecific symptoms and confirmation by a parent are commonly accepted criteria to have a URI. Children who are ill-looking, lethargic, have a high fever, purulent nasal discharge and lower respiratory infections or those less than 1 year are frequently excluded from studies. Large prospective trials have demonstrated a correlation between URI symptoms and perioperative respiratory events [44]. One study demonstrated an association with minor desaturations (less than 95%) but not major desaturations (less than 85%) [45]. Episodes of laryngospasm are more common with inexperienced anesthesiologists generally but the association with URIs is less well defined. The respiratory events associated with URIs appear to be transient and minor but not causing higher pneumonia or admission rates. Intubations rather than using laryngeal mask airways increase the incidence of respiratory events [46]. The incidence of adverse respiratory events is 30% with active URIs, 24.2% in those with symptoms in the last 4 weeks and 18% in controls [47]. Symptoms within the past 2 weeks are associated with a similar incidence of respiratory events as current symptoms. In summary, there is an association between URIs and perioperative respiratory events of a minor nature. The frequency of these events may be reduced by deferring surgery for 4 weeks if deemed reasonable, management by an experienced anesthesiologist and the use of the laryngeal mask.

Conclusion

Economic pressures together with other factors are resulting in an expansion of ambulatory surgery. The number of operations being offered in this setting is rising, and the population receiving surgery has increasingly significant coexistent disease. Inpatient studies are often the only evidence available for many outcome measures. Much research in ambulatory surgery has focused on anesthetic techniques and improvement in patient symptoms. Prospective trials are required to evaluate specific groups of higher risk patients undergoing ambulatory surgery, so that strategies to reduce adverse events can be developed. Perioperative morbidity in the ambulatory setting will increase in the future and so strategies of risk reduction need to be developed.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 656–657).

1 • Gupta A. Strategies for outpatient anaesthesia. Best Pract Res Clin Anaesthesiol 2004; 18:675–692.

A narrative review classifying the risks for ambulatory surgery. Some strategies for risk reduction are mentioned.

2 •• Bryson GL, Chung F, Finegan BA, *et al.* Patient selection in ambulatory anesthesia: an evidence-based review: part 1. Can J Anesth 2004; 51:768–781.

The conditions highlighted in this review include elderly people, heart transplantation, hyper-reactive airway disease, coronary artery disease and obstructive sleep apnea. Panelists with an interest in ambulatory surgery attempted to answer clinically relevant questions using the evidence from the literature. The level of evidence available was graded.

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