Editorial

International Association for Ambulatory Surgery

As ambulatory surgery has developed over the last 25 years, the countries where there has been the most rapid growth have formed associations of ambulatory or day surgery. The purpose of these associations is to support the concept of ambulatory surgery by sharing experience, promoting research and encouraging the continual quest for the highest quality treatment. Despite facing or having faced similar problems these national associations have had no formal interchange of ideas. In March 1991, however, the First European Congress on Ambulatory Surgery was held in Brussels. This meeting drew together many delegates from Europe and also a few from non-European countries such as the USA and Australia. Informal discussions amongst some of those attending the meeting came to the conclusion that an International Association for Ambulatory Surgery and international meetings would be beneficial, not only to countries where ambulatory surgery is established but also to those wishing to develop this form of treatment. Consequently, at the Second European Congress on Ambulatory Surgery in March 1993 in Brussels, an ad hoc committee organized by Dr Claude de Lathouwer and with members from 12 countries was established to form the International Association for Ambulatory Surgery.

This committee subsequently met in London in September 1993 and in Orlando in May 1994. A draft constitution and statutes have now been drawn up and *Ambulatory Surgery* has been recognized as the official publication of the new group. The International Association will be launched at the Third European Congress on Ambulatory Surgery which will be co-titled the First International Congress, to be held in Brussels on the 16th and 17th March, 1995.

Full membership will be open to national associations of ambulatory surgery and associate membership to groups developing ambulatory surgery in countries without a national association. Full details of the International Association for Ambulatory Surgery will be published in a future edition of this journal.

Quality issues

There is no doubt that the new International Association will be heavily involved in quality issues in ambulatory surgery. In the December issue of *Ambulatory Surgery*, quality will be looked at in a series of invited papers, edited by Dr Tom Ogg. Preoperative management, care in the day unit and postoperative outcomes will all be examined from the point of view of quality and its measurement. If ambulatory surgery is to prosper in the future it will be because it is high quality treatment and not because it is cheaper than inpatient surgery.

Monitoring of quality is essential to maintain and improve the standards of ambulatory surgery, particularly in face of the rapid move to this form of treatment which is being engendered by the purchasers of health care, often purely on the basis of cost.

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Reviews

Regional anaesthesia for outpatient surgery

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Regional anaesthesia is an ideal anaesthetic technique for many outpatient surgery procedures. With proper preparation, selection and planning, regional anaesthesia will provide excellent operating conditions for the surgeon and a very satisfactory anaesthetic state for the patient in a cost-effective way. Its minimum effect on major organ functions, intense sensory blockade, low potential for postoperative side effects, and its ability to provide postoperative pain control, offers an excellent set up for these patients who will go home soon after the surgery.

Key words: Anaesthesia, outpatient, ambulatory, regional; surgery, outpatient

The most common form of anaesthesia used for outpatient surgery is general anaesthesia. It is preferred over regional anaesthesia by both surgeons and patients in this setting. Surgeons prefer general anaesthesia because they consider its initiation faster, which means less 'waste of time' before starting the operation. Patients often prefer general anaesthesia as a result of anxiety about the surgery and a feeling that going to sleep for the procedure will 'solve the problem'. In addition, many patients have concerns that are based on misinformation about the complications of regional anaesthesia. The majority of practising anaesthesiologists prefer general anaesthesia for outpatient surgery because they believe that general anaesthesia provides better comfort and safety for the patient and better surgical conditions for the surgeon. Some anaesthesiologists dislike regional anaesthesia because they lack confidence in their own ability to perform a successful block in an expeditious way. Others are overly concerned about the potential side effects of regional anaesthesia (e.g. postdural puncture headache and backache, prolonged motor blockade, and delay in discharge due to inability to void after spinal or epidural anaesthesia).

Possible advantages of regional anaesthesia for outpatient surgery

The primary goal of outpatient anaesthesia is to provide an anaesthetic that is safe and effective, can be administered expeditiously, provides an appropriate surgical condition with minimum effects on organ functions and minimum side effects, and ensures a quick return of normal physiological and psychomotor functions soon after the operation.

With the proper selection of patients, surgical procedures, anaesthetic techniques, local anaesthetic agents and adjuvants, regional anaesthesia can be a safe and effective alternative to general anaesthesia and very satisfying for the anaesthesiologist and the patient. Table 1 lists the possible advantages of regional anaesthesia over general anaesthesia.

Regional anaesthesia may indeed be the ideal anaesthetic for outpatient operations in many situations. It anaesthetizes only a part of the body, with limited depression of major organ function and there may also be some advantages in having the patient awake during certain types of surgery. For example, with endoscopic

Table 1. Possible advantages of regional anaesthesia over general anaesthesia

Less physiological trespass, less depressant effects on major organ functions (e.g. cardiovascular, hepatic, renal, respiratory, metabolic)
Use of less pharmacological agents
Quicker recovery of physiological and psychomotor functions and shorter discharge time
Patient participation in the evaluation of intraoperative surgical pathology and therapeutic options (via video)
Quicker diagnosis of certain intraoperative complications (e.g. pneumothorax or pneumo-mediastinum during laparoscopic surgery)
Less postoperative side effects (e.g. nausea and vomiting, sore throat, muscle pain, dizziness)
Better control of immediate postoperative pain
More cost-effective

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surgical techniques and instant video screening of surgical pathology, surgeons can involve an awake patient under regional anaesthesia in decision-making about surgical options.

Are the objections against regional anaesthesia for outpatient surgery valid?

Many of the objections against regional anaesthesia for outpatient surgery are not valid. The issues involved in these objections can be addressed by considering the following questions:

1. Does the use of regional anaesthesia hamper the efficiency of the outpatient surgery facility?
2. Is regional anaesthesia necessarily more anxiety-provoking for the patient?
3. Does regional anaesthesia provide good surgical conditions and patient comfort?
4. Should occasional failure of regional anaesthesia preclude its use for outpatient surgery?
5. Are there more intraoperative and postoperative side effects after regional anaesthesia compared to general anaesthesia?
6. Is regional anaesthesia cost effective?

Does the use of regional anaesthesia hamper the efficiency of the outpatient surgery facility?

Operating room turn-over time

In today's outpatient surgery units the top administrative priority seems to be rapid and efficient turn-over of cases. With a quick turn-over of cases, administrators, surgeons, nurses, and anaesthesiologists all benefit. The opponents of regional anaesthesia argue that the initiation of regional anaesthesia not only takes a longer time than general anaesthesia, but there is also a chance of failure with the regional technique. These problems can hamper a quick turn-over of cases.

Not all regional anaesthetic techniques take a longer time to initiate. In experienced hands, for example, a subarachnoid block should take no longer to initiate than general anaesthesia. For an anaesthesiologist who is trying to do all the cases in one operating room single-handedly, however, initiation of certain slow-onset types of regional anaesthesia, such as brachial plexus block or epidural anaesthesia, may indeed take longer than general anaesthesia. So, whenever possible these blocks should be initiated ahead of time in a different room (anaesthesia induction room or holding room) by a second anaesthesiologist. Once regional anaesthesia is established and tested ahead of time, the operation can be started in less time than is required to initiate general anaesthesia. It also takes less time to get the operating room ready for the next case when regional anaesthesia is used. This is due to fewer disposable items needing to be replaced between cases. Furthermore, patients receiving regional anaesthesia are ready to be transferred as soon as the operation is completed whereas a patient under general anaesthesia must be awakened, pharmacologically reversed, extubated, and the airway safety ensured before the patient can be transferred to the postanaesthesia care unit (PACU). This makes the turn-over time even shorter for regional anaesthesia patients. Thus, when properly planned and selected, the operating room turn-over time should not be any longer for regional anaesthesia as compared to general anaesthesia and it can be shorter.

PACU turn-over time

Do patients who receive regional anaesthesia stay in the recovery room longer than those who receive general anaesthesia for the same operation? This is likely only if the patient has had a prolonged sympathetic, motor and sacral parasympathetic block and is unable to walk or void soon after the operation. Prolonged motor block and sacral parasympathetic block can be avoided by carefully selecting the type and dose of local anaesthetic and additives used. Avoidance of inappropriate local anaesthetic (e.g. tetracaine, etidocaine, bupivacaine) and inappropriate additives (e.g. epinephrine), will reduce the PACU stay after regional anaesthesia. Also, since regional anaesthesia causes less nausea and vomiting and less uncontrolled postoperative pain compared to general anaesthesia and the patient needs less medication to control these side effects, discharge criteria are met earlier and the patient can be discharged sooner. Several studies have shown that recovery time is actually shorter after regional anaesthesia compared to general anaesthesia[1–4].

Is regional anaesthesia necessarily more anxiety-provoking for the patient?

It is to be expected that every patient will be anxious before an operation to a greater or lesser extent. It is the duty of the healthcare professionals, especially the anaesthesiologist, to prepare the patient appropriately both psychologically and pharmacologically before the operation to reduce anxiety. Patients who are anxious about regional anaesthesia believe they cannot handle the additional strain of the 'needlesticks' for regional anaesthesia and of staying awake during the operation. Inappropriate anxiety, however, can be relieved with proper education, explanation and reassurance and by the appropriate use of anxiolytics, sedatives, analgesics and amnesics.

Some patients are unduly fearful about the complications of regional, especially spinal anaesthesia. These concerns include: fear of getting permanently paralyzed, prolonged and severe headache, backache and the necessity of lying flat in bed for a prolonged time. Sometimes these concerns are fixed in patients' minds and cannot be easily changed. In others, concerns can be dispelled by education about the recent advances in technology, about new spinal needles, about newer and shorter-acting medications and by citing the results of many large studies showing the safety of regional anaesthesia[5–9]. Educating patients about causes, prevention and treat-

ment of postdural puncture headache, and providing reassurances that they do not have to stay flat in bed after the operation is also very important.

It is a common observation that patients usually reject regional anaesthesia when approached by an inexperienced anaesthesiologist and often accept it readily when approached by an experienced and confident anaesthesiologist. A Preanaesthesia Clinic visit or prior visit to the anaesthesiologist may serve to reduce patient anxiety and dispel misunderstandings about the complications of regional anaesthesia. In most situations, after a short supportive conversation, the patient feels comfortable about regional anaesthesia. Many patients are simply unaware of the many advantages of regional anaesthesia (i.e. less nausea and vomiting, better pain control, less physiological trespass) and of the fact that they do not necessarily have to be totally awake during the procedure.

On the other hand, it is unwise to force regional anaesthesia upon unwilling patients and upon those who are severely anxious about needles and unduly concerned about the side effects of regional anaesthesia. In addition to the psychological and pharmacological preparation of the patient, judicious use of an intravenous anxiolytic agent, such as midazolam 1–2 mg iv, often works wonders in transforming an overly anxious patient into a cooperative and smiling subject during the placement and conduct of a regional block. There are some indications that pretreatment with a benzodiazepine may increase the threshold for local anaesthetic-induced systemic toxicity[10]. In young children regional anaesthesia should be initiated after the child is asleep.

Does regional anaesthesia provide good surgical conditions and patient comfort?

Some surgeons dislike regional anaesthesia, believing that it may not provide good surgical relaxation. Since very few outpatient operations require intense muscle relaxation, this is not a valid objection against regional anaesthesia. Inadequate analgesia or so-called 'patchy block' however, may make the patient complain of pain and discomfort and prevent the surgeon from getting a quiet field of operation. Preoperative preparation, explanation of what to expect, and judicious use of pharmacological agents including analgesics and sedatives and even light general anaesthesia should obviate most of these problems.

To reap the benefits of regional anaesthesia, both the anaesthesiologist and the surgeon must be willing to modify their practice pattern to suit the conditions offered by regional anaesthesia. Indeed, the surgeon's cooperation and support is essential if regional anaesthesia is to be successful at a given outpatient surgery centre. The anaesthesiologist must therefore take the lead in educating the surgeon and nurses with data about the situations where regional anaesthesia will benefit the patient.

Should occasional failure of regional anaesthesia preclude its use for outpatient surgery?

A major reason many anaesthesiologists are reluctant to use regional anaesthesia is that, unlike general anaesthesia which 'always works', there is a recognizable failure rate for regional anaesthesia. The failure rate depends to a large extent on the experience of the anaesthesiologist and the choice of the appropriate regional block for the patient and for the surgical procedure. It is to be expected that it will sometimes be impossible to perform, and at other times regional anaesthesia alone will not be enough for the surgery, but an experienced anaesthesiologist is usually able to reduce the failure rate to a minimum. Planning ahead is one key to success; plan to place the block ahead of time rather than be rushed into it at the last moment. A so-called 'failed' regional block can be converted into a 'successful anaesthetic' by supplementation with sedatives (e.g. midazolam, propofol), systemic analgesics (e.g. fentanyl, alfentanil or remifentanil), additional nerve blocks (e.g. ulnar and median nerve blocks after axillary block), or light general anaesthesia (e.g. propofol, inhaled anaesthetics). Small analgesic doses of ketamine (1.0 mg kg^{-1} or less, iv) often work well to make inadequate block successful[11].

Are there more intraoperative and postoperative side effects after regional anaesthesia compared to general anaesthesia?

Intraoperative side effects

Although regional anaesthesia usually poses fewer intraoperative problems than a general anaesthetic technique, some specific side effects should always be kept in mind. The side effects of regional anaesthesia include arterial hypotension and bradycardia following central neuronal block, pneumothorax after certain types of blocks, systemic toxicity and allergic reactions to local anaesthetics.

Hypotension and bradycardia

Since the mechanism of hypotension and bradycardia following high spinal or epidural anaesthesia is well known, its prevention and management is fairly simple. Judicious and prompt administration of intravenous fluids and an appropriate vasopressor therapy should remedy the situation. When doing either spinal or epidural anaesthesia in young healthy patients, one should always be ready to treat the rare case of severe sudden bradycardia, or even cardiac arrest with aggressive resuscitative measures, including early use of epinephrine[12]. Fortunately, the majority of outpatient operations can be performed with either a low spinal or low epidural block, which does not involve profound sympathetic denervation and rarely poses serious problems.

Pneumothorax

The regional blocks that have higher risks of pneumothorax are supraclavicular and interscalene brachial

plexus blocks and intercostal blocks. These are usually avoided for outpatient surgery unless their potential benefits outweigh the risks.

Systemic toxicity and allergic reactions

Systemic toxicity is always a possibility during regional anaesthesia. This occurs when either an intravascular (venous or arterial) injection is made, or a gross overdose of the local anaesthetic is given. Prevention of intravascular injection by careful aspiration for blood before each incremental dose is injected and careful avoidance of an overdose are the best methods to prevent this complication. One should always be on the lookout for symptoms and signs of systemic toxicity (i.e. change in mental status, twitching and convulsions, hypotension, arrhythmias) and be ready to treat and resuscitate with oxygen, hyperventilation, benzodiazepine, succinylcholine and physiological support. The central nervous system toxicity is a self-limiting process, the plasma level of the local anaesthetic drops quickly as it gets cleared by the liver, so the main emphasis is to keep the patient well oxygenated and ventilated for the short time it requires for the symptoms to stop. Cardiotoxicity, which may occur after bupivacaine, needs to be aggressively treated with epinephrine and antiarrhythmic agents. Allergic reactions are unusual, but can occur after the ester type of local anaesthetics (procaine, chloroprocaine) and are very rare after the amide types (lidocaine, prilocaine, bupivacaine).

Standards for intraoperative patient monitoring and preparation during regional anaesthesia should be the same as for general anaesthesia, as recommended by the American Society of Anesthesiologists Standards for Basic Anesthetic Monitoring[13].

Postoperative side effects

Outpatient surgery patients differ from inpatients because they must be ready to go home soon after the operation, and they do not have a trained healthcare professional at home to detect and take care of any complications that may arise. So, it is imperative that outpatients be educated before surgery about possible postoperative side effects and complications, and the attendant has a clear understanding of what to do should they occur.

Anaesthesia-related side effects in Post Anaesthesia Care Unit (PACU)

Certain anaesthesia-related side effects are more common after general anaesthesia than regional anaesthesia. They are: nausea and vomiting, unrelieved postoperative pain, drowsiness, dizziness, malaise[2,4,14]. Postoperative pain, especially immediate pain, can be controlled more easily if the patient has received regional anaesthesia during the operation. More drowsiness is to be expected after general anaesthesia than after regional anaesthesia, unless there has been excessive use of intraoperative and postoperative sedatives and other central nervous system (CNS) depressants during regional anaesthesia.

Inability to ambulate, inability to void

Other immediate postoperative side effects that may be more common after central neuroaxial blocks, like spinal and epidural anaesthesia, than after general anaesthesia are: possible delay in the ability to ambulate, delay in the ability to void, and backache. The inability to ambulate is related to the motor weakness and possibly the orthostatic hypotension due to sympathetic block that occurs with the central neuronal blocks, and the amount of CNS depressants the patient has received. Inability to void is usually related to the prolonged sacral parasympathetic block and possible atony of the bladder following prolonged distention of the bladder after autonomic block.

The incidence of these side effects can be greatly minimized by the proper choice a short-acting local anaesthetic agent and additives. Randel and colleagues[4] found discharge time after knee arthroscopy was shorter after epidural anaesthesia compared to general anaesthesia. Epinephrine as an additive should not be used without consideration of its ability to prolong the block and possible consequence (e.g. delayed discharge). The use of epinephrine with local anaesthetic for spinal anaesthesia and excessive intravenous hydration should be avoided for elderly males as they are often associated with a delay in voiding in these patients.

Postoperative side effects after discharge

Common anaesthesia-related side effects that occur after discharge and at home are nausea and vomiting, unrelieved pain, malaise, drowsiness, dizziness, muscle pain, backache and headache. Among these, only headache and backache are more common after central regional blocks than after general anaesthesia.

Postdural puncture headache (PDPH)

Postdural puncture headache is the most important concern following spinal anaesthesia and to some extent after epidural anaesthesia. PDPH is a unique and characteristic type of headache. It usually appears 24–72 h after the dural puncture; the headache may involve the occiput, frontal region and the neck, and it is postural in nature, i.e. it is made worse during sitting or in an erect position and is relieved on reclining and by abdominal pressure. It is often associated with other symptoms like nausea and diplopia. The headache occurs due to the leakage of cerebrospinal fluid (CSF) through the hole in the dura created by the spinal or epidural needle. The severity and the duration of the symptoms depend on the size of the hole/s and the existing CSF pressure in the lumbar region. The headache is more common in young individuals, especially females.

Contrary to the commonly held belief[15–17] that early postoperative ambulation after spinal anaesthesia has no effect on the incidence of PDPH, it has recently become

obvious that the incidence of PDPH is higher after outpatient than inpatient surgery, especially in young patients. A few papers from Europe[18–20] claim that the incidence of PDPH following spinal anaesthesia in young patients undergoing outpatient surgery is unacceptably high and may be as high as 37%. Reports from the United States[21–23], including studies by Perz, Mulroy, and Neal, supported the conclusion that the incidence of PDPH after surgery in young outpatients is indeed higher than in inpatients, but in the order of 5–10%.

Following the publication of these reports, most anaesthesiologists restricted their use of spinal anaesthesia only to older patients (> 50 yr) scheduled for outpatient surgery.

The use of finer needles[24,25], directing the bevel of the needle longitudinally to the fibres of the dura rather than transversely[26], and the use of the lateral rather than the midline approach[27], are some of the measures advocated to reduce the incidence of PDPH. Until the introduction[28,29] and recent widespread adoption of the non-cutting pencil-point spinal needles (i.e. Whitacre and Sprotte needles), no significant difference in practice habits were noticed. With the increasing use of these needles, especially 25 or 27 gauge Whitacre needles, the incidence of PDPH has dropped sharply and spinal anaesthesia for outpatient surgery has become acceptable for all age groups[30–33]. At present, the overall incidence of PDPH following spinal anaesthesia in young patients is less than 2% or about the same as after epidural anaesthesia. Besides this, the severity of headache after spinal anaesthesia (due to smaller and less traumatic dural puncture) is likely to be less than after epidural anaesthesia. As a result, the fear of PDPH following spinal anaesthesia is no longer a relevant reason to avoid this useful technique for outpatient surgery.

Backache

Brown reported that backache occurs after spinal, epidural and even after general anaesthesia[34]. Backache is usually related to the prolonged recumbency during and after an extensive surgery, but is certainly made worse by the needlesticks in the back (sometimes multiple) during the performance of the regional block. Trauma to the ligaments, periosteum and bone during placement of spinal and epidural anaesthesia are the likely causes. Since thicker needles are used for epidural compared to spinal anaesthesia, epidural anaesthesia is associated with more backache[4]. Backache, when it occurs, is self-limiting and usually lasts for a few days. Simple analgesics and bed rest are recommended when needed.

A different kind, or more severe, backache after epidural anaesthesia that has been associated with the use of chloroprocaine has been reported[35,36]. This backache may be quite incapacitating requiring hospitalization and treatment with narcotics. Studies have shown that the incidence and severity of backache is related to the volume (> 25 ml) and repeated injections of chloroprocaine (Nesacaine MPF)[37,38]. The possible mechanisms of this localized severe muscle pain include direct muscle irritation by the low pH of chloroprocaine and the calcium chelating effect of the preservative disodium ethylene diamine tetra-acetic acid (EDTA), an antioxidant[39].

Permanent neurological complications

The concerns about permanent neurological complications following spinal anaesthesia are widespread among patients. Direct trauma to neural tissues, ischaemic or chemical injury to the spinal cord, compression of the spinal cord following epidural haematoma or abscess and infection are some of the dreaded possible complications of regional anaesthesia. These complications must be kept in mind and all possible preventative steps taken. Unintentional injection of chloroprocaine into the subarachnoid space has been reported to cause permanent neurological deficits (cauda-equina syndrome). Low pH and the preservative, sodium bisulfite, in the formal preparation of commercially available chloroprocaine were thought to be the cause of this complication[40,41]. Fortunately several large studies[5–9] have shown that the incidence of permanent neurological complications following spinal and epidural anaesthesia are extremely rare.

Is regional anaesthesia cost-effective?

There is little disagreement that regional anaesthesia is a cost-effective form of anaesthesia care for outpatient surgery. A successful regional block, which can be accomplished with a single agent provides most of the components of a balanced anaesthetic regimen: intraoperative analgesia (sensory block); muscle relaxation (abolition of muscle tone, and occasionally motor blockade); control of sympathetic overactivity (sympathetic block); and postoperative pain control. Hypnosis or anxiolysis, when needed, can be provided by systemic agents. The cost of the local anaesthetic to produce the anaesthetic state by regional anaesthesia is much less than that of general anaesthesia. The drugs needed for general anaesthesia include intravenous agents, volatile and gaseous agents, narcotic analgesics, muscle relaxants, reversal agents and many other adjuvants. All these are expensive. There are fewer indirect costs with regional anaesthesia when all the disposable anaesthesia items are needed for general anaesthesia are considered. Furthermore, in the postoperative period there is less need for analgesics and antiemetics after regional anaesthesia. Among other indirect costs, there is a saving in operating room (OR) time and PACU time because of the quicker OR and PACU turn-over with regional anaesthesia.

Indications of regional anaesthesia for outpatient surgery

Regional anaesthesia is most appropriate for operations on the extremities, surface operations on face, trunk, perineum, and some limited pelvic and abdominal operations. Common outpatient operations performed under regional anaesthesia are: orthopaedic operations

of upper and lower extremities (e.g. knee arthroscopic surgery, hand surgery); gynaecological surgery of the perineum (e.g. cone biopsy, D&C); general surgical procedures on body surface (e.g. hernia repair, breast biopsy, excision of lumps and bumps); a variety of plastic surgery procedures; most ophthalmic surgery procedures; and some otolaryngeal procedures.

Regional anaesthesia for laparoscopic surgery

Laparoscopic surgery, one of the commonest outpatient procedures, is not usually performed under regional anaesthesia, because significant shoulder discomfort may be present when the abdomen is overdistended with insufflating gas and the patient is placed in a steep Trendelenburg position. In this position, unless ventilation is controlled, respiratory functions may be compromised, especially in obese patients. Increased intraabdominal pressure may encourage gastric regurgitation and pulmonary aspiration.

Nevertheless, in some centres in the United States, regional anaesthesia is routinely used for these procedures[2,3] with great success. If the patient is motivated and the surgeon is gentle, skilful, and can do the surgery with minimal distention of the abdomen with only a minimum Trendelenburg position in a relatively short time (30 min or so), spinal or epidural anaesthesia can be successfully and advantageously used for pelvic laparoscopic procedures. Use of nitrous oxide in place of carbon dioxide as the insufflating gas is better tolerated by the awake patient. A high sensory block, up to a level of T_{2-3} thoracic segment, is necessary for the comfort of the patient. Spinal anaesthesia with lidocaine and fentanyl provides more intense analgesia and better muscle relaxation than epidural anaesthesia and may be the preferred regional block for pelvic laparoscopic surgery.

Characteristics of local anaesthetic agents and adjuvants suitable for outpatient surgery

Selection of appropriate local anaesthetic agents and adjuvants for regional anaesthesia for outpatient surgery will make all the difference between failure or success. Most of the common problems that arise are due to the wrong choice of local anaesthetic agent, especially for spinal or epidural anaesthesia, and to some extent choice of the wrong regional anaesthetic technique. For example, a prolonged stay in the PACU and prolonged discharge time, delayed return of motor function after the operation, delayed voiding after the operation, and to some extent backache after epidural anaesthesia, can in some cases be ascribed to the wrong choice of local anaesthetic agent or the adjuvant used and possibly to the use of the wrong dosage.

Local anaesthetic agents

Traditionally, for inpatient operations, it is better that the regional block lasts half an hour longer than the expected duration of the operation rather than a few minutes too short. So the traditional recommendations have always been to choose a longer-acting agent 'just in case' the operation lasts longer than expected.

For outpatient surgery, however, a longer-acting local anaesthetic agent for spinal and epidural anaesthesia should not automatically be selected (to cover an unexpectedly longer duration of surgery). Instead, one should select an agent to fit the expected duration of the operation and remain prepared to supplement with systemic analgesics or with light general anaesthesia, if the operation lasts longer. With the advent of propofol, a quick-acting intravenous agent and the quick-acting synthetic narcotics, fentanyl, alfentanil, remifentanil, with a short duration of action, has made these decisions easier. If this plan is not feasible, then the use of a continuous epidural technique should be considered, so that a short-acting agent may be used by intermittent injections or by a continuous infusion via a syringe pump.

The local anaesthetic agents that are suitable for outpatient surgery are either short-acting agents (e.g. procaine, chloroprocaine) or intermediate-acting agents (e.g. lidocaine, prilocaine and mepivacaine). Although long acting, bupivacaine and ropivacaine should be used very rarely; they may be used for peripheral or caudal blocks in children. Extra-long-acting drugs like tetracaine and etidocaine are contraindicated for outpatient surgery.

Dextrose

Dextrose (glucose) is added to the local anaesthetic solution for spinal anaesthesia to make the solution hyperbaric in relation to CSF. Hyperbaric solution allows the anaesthesiologist to direct the local anaesthetic to the desired spinal segments, either to restrict the extent of the block (e.g. 'saddle block') or to increase the extent of the block to the thoracic segments, without greatly reducing or increasing the amount of drug or the volume used. The age-old practice of adding glucose to the local anaesthetic, especially to lidocaine, has recently been questioned[42,43]. A high concentration of glucose (10%), because of its hyperosmolarity can be neurotoxic. A few case reports of neurotoxicity (cauda-equina syndrome) following the intermittent injection technique via a spinal catheter has been implicated to glucose-containing lidocaine[44-46]. A study by Ross suggests that a large local accumulation of the repeatedly injected lidocaine with dextrose combined with a minimum spread to the other segments probably caused the neurotoxicity[47]. The controversy about dextrose-containing lidocaine for single shot spinal anaesthesia is new and is not likely to be resolved soon. Several authors are re-exploring the possibility of using plain lidocaine 2%, bupivacaine 0.5% or procaine 2.5%, without dextrose for spinal anaesthesia in isobaric conditions with good results[48]. Alternatively, a lower concentration of dextrose (less than 7.5%) may be tried.

Epinephrine

There are several reasons why epinephrine is added to the local anaesthetic agent. It is used primarily to increase the duration of the block, but it is also used to reduce the peak plasma level of the local anaesthetics (reduced chance of systemic toxicity) and to improve the quality of the block. While the addition of epinephrine (1 : 200 000–1 : 400 000 concentration) to the local anaesthetic is quite appropriate for outpatient surgery on some occasions, one must be very careful about its use in the elderly, diabetics and in patients with arteriosclerosis. Inappropriate use of epinephrine may give rise to prolonged motor, sensory and autonomic block and a delay in discharge time.

Bicarbonate

Bicarbonate is often added to the local anaesthetic agent to hasten its onset of action[49]. Addition of bicarbonate increases the pH of the local anaesthetic agent and thus increases the non-ionized portion of the local anaesthetics in the mixture which can penetrate the cell membrane faster. The addition of bicarbonate (1 mEq 10^{-1} ml) makes the most difference in local anaesthetic agents which have a lower pH, (e.g. chloroprocaine, lidocaine and mepivacaine). However, the reduction of the onset time is not of much clinical significance, especially if the regional block is planned and performed ahead of time. The pH adjustment of bupivacaine and etidocaine is not supported in studies by DiFazio[50] and because of the limited base solubility (precipitation) this practice may be dangerous. Therefore addition of bicarbonate, as an additive to the local anaesthetic, has limited clinical value in outpatient anaesthesia practice.

Narcotics

Narcotics are often added to the local anaesthetic mixture to augment the sensory blockade of spinal and epidural anaesthesia without increasing the degree of the autonomic blockade. Fentanyl (a μ agonist) is the most common narcotic used for this purpose. Sufentanil may also be used. Addition of fentanyl to the local anaesthetic agent seems to provide a more profound analgesia for the intraoperative period and more prolonged analgesia for the immediate postoperative period.

When used in moderate doses, epidural or subarachnoid fentanyl is safe for outpatient use. The dose of fentanyl as adjuvant to spinal anaesthetic is: 10–25 μg, and for epidural anaesthesia 50–100 μg. With these doses, the minor side effects of intraspinal narcotics, such as pruritus, and nausea and vomiting, are rarely seen; and delayed respiratory depression, the major side effect, is unknown. The longer-acting narcotics like morphine and meperidine, however, should not be used for spinal or epidural injection during outpatient surgery. Whether intra-articular injection of morphine with bupivacaine provide additional postoperative analgesia following knee arthroscopy is still controversial[51,52].

Appropriate regional anaesthetic blocks for outpatient surgery

Apart from the various forms of infiltration blocks, the common regional anaesthetic techniques used for outpatient surgery are intravenous regional anaesthesia (IVRA), axillary brachial plexus block and spinal, epidural and ankle blocks. Less commonly-used regional anaesthetic techniques for outpatient surgery are wrist, elbow, knee, popliteal and femoral-sciatic block. Other common and valuable blocks, especially for children, are: ilio-inguinal and ilio-hypogastric, penile and caudal blocks. For ophthalmic operations, retrobulbar and peribulbar blocks are universal.

Technical details of how to perform these blocks and doses of the appropriate local anaesthetic agents have been described in many text books[53,54]. A brief description of a few common blocks for outpatient surgery follows.

Intravenous regional anaesthesia (IVRA)

Intravenous regional anaesthesia is one of the most common regional anaesthetic blocks performed for outpatient surgery. This block is most suitable for operations on the upper extremities, especially hand surgery, which lasts for less than 90–120 min. It can also be used for operations on the lower extremities. The advantages of IVRA are that it is simple to perform, has a quick onset and offset of action and usually provides good surgical conditions. Additionally, when used carefully it has minimum side effects and sequelae. It works best when exsanguination is complete and the local anaesthetic agent is injected in a distal vein (back of the hand). Lidocaine 0.5% or prilocaine 0.5% (30–40 ml, or 3 mg kg^{-1}) is a suitable local anaesthetic for IVRA of the upper extremity. A larger volume (75–100 ml) with a lesser concentration (0.25–0.35%) of local anaesthetic is necessary for the lower extremity. Bupivacaine is contraindicated, because of its potential for serious cardiotoxicity, should the local anaesthetic escape into the circulation prematurely. Chloroprocaine is contraindicated because it can cause thrombophlebitis.

For delicate hand operations, oozing from the surgical wound ('weeping') may pose some problems for the surgeon during IVRA, but this can be easily rectified if the surgeon exsanguinates the hand for a second time with a sterile Esmarch bandage just before the incision.

Although IVRA is fairly safe, it should be used carefully as it does have the potential for serious complications, including death[55]. The most common cause of morbidity and mortality is systemic local anaesthetic toxicity which can occur because of gross overdose of local anaesthetic agent, as a result of a tourniquet failure or abrupt removal of the tourniquet after the operation is over. Intravenous regional anaesthesia should not be used for an operation which is likely to last less than 30 min. A double tourniquet is usually applied on the upper arm, as proximal as possible; the proximal tourniquet is inflated at first. In some cases, however, it is necessary to

switch from the proximal to the distal, when tourniquet pain becomes unbearable. This should be done very carefully, after making sure that the distal tourniquet is in fact appropriately inflated before the proximal one is released. Otherwise local anaesthetic may escape into the circulation with loss of analgesic effect and possibly causing serious systemic toxicity. Similarly, at the end of the operation, the tourniquets should be released intermittently with 10–15 s intervals between them.

Axillary block

Among the various types of brachial plexus block, the axillary approach is the most common for outpatient surgery. Disadvantages of axillary block include: fairly long onset time of 20–30 min, and high failure rate (15–20%). Lidocaine (1.5%), prilocaine (1.5%) or, in some situations, bupivacaine (0.25–0.5%) are appropriate agents. To ensure a quicker onset and longer duration of action, some anaesthesiologists prefer to use a mixture of 2% lidocaine and 0.5% bupivacaine in equal volumes. A volume of 30–40 ml is recommended.

Many methods of axillary block are practised. The highest success rate among these methods is the transarterial method (i.e. where the axillary artery is deliberately punctured by the advancing needle to identify the sheath around it and the injections are made just outside the arterial wall). Other methods include eliciting paraesthesia, eliciting a motor response when stimulated by a nerve stimulator attached to a sheathed needle (with a current of 0.1–0.5 MA), and using a perivascular approach. One strategy to convert a partially failed axillary block into a successful one is to perform additional individual nerve blocks as necessary (e.g. ulnar nerve at elbow or at wrist, musculocutaneous nerve in the belly of the coracobrachialis muscle in the axillae, intercostal-brachial nerve block in the upper arm, median nerve block at the elbow or wrist and radial nerve block at the wrist).

Ankle block

For operations on the foot, ankle block is a simple yet very effective anaesthetic technique. The major nerves supplying the foot are tibial (also called posterior tibial), deep peroneal (also called anterior tibial), superficial peroneal, saphenous and the sural nerves. These nerves can be blocked easily at the ankle, and a superficial ring block around the ankle blocks the rest of the nerves supplying the foot. Lidocaine 1% with or without epinephrine is appropriate for this block.

Popliteal block

This is a fairly easy, but rarely used, block for foot and ankle surgery. Unlike femoral-sciatic nerve blocks it does not cause prolonged weakness of the entire lower extremity. The popliteal nerves are blocked at the back of the thigh, just above the knee joint, where the sciatic nerve is divided into two parts, the tibial and the common peroneal nerves (they are also called the medial and lateral popliteal nerves). These nerves lie next to the popliteal artery in the popliteal fossa.

Ilio-inguinal and ilio-hypogastric nerve blocks

These nerves can be blocked easily by local infiltration 3 cm inferior and medial to the anterior superior iliac spinous process. These are useful blocks for operations in the groin, such as inguinal hernia repair both in adults and in children. They provide good postoperative pain control for a considerable period of time.

Caudal block

Caudal blocks are commonly performed in children for operations in the groin, perineum and lower part of the body. The great advantage of a caudal block is that it provides prolonged postoperative pain relief after the operation. Bupivacaine 0.25% solution, 0.5–1.0 ml kg^{-1} is an appropriate dose in children, depending on the level of the block intended.

Knee block

Knee block is a simple yet very successful block for knee arthroscopic procedures. After thorough aseptic precautions, the points of entry of the trocars are identified and infiltered with a local anaesthetic agent, usually lidocaine or bupivacaine. Intra-articular instillation of bupivacaine 0.5% (30 ml) with or without a narcotic completes the block. This block not only provides good intraoperative surgical anaesthesia, but also prolonged postoperative analgesia[56,57].

Other peripheral blocks

Many other less commonly used blocks including femoral-sciatic nerve block and wrist block are sometimes indicated. For ophthalmic operations, retrobulbar and peribulbar blocks are appropriate for outpatient surgery[58].

Spinal and epidural anaesthesia

When indicated, the central neuroaxial blocks, such as spinal and epidural anaesthesia are appropriate for outpatient surgery. The primary objections to these blocks include patient anxiety, longer time to institute the block, possibility of dural puncture headache, backache, prolonged motor block and delay in voiding. Proper selection of the patient, explanation, psychological preparation, judicious use of pharmacological anxiolytics, innovations in timing of the block, proper selection of the local anaesthetic agent and the adjuvants, and experience and care of the anaesthesiologists should override most of these objections.

Subarachnoid vs. epidural block for outpatient surgery

While selecting a central neuroaxial block, the possible advantages and disadvantages of subarachnoid block vs. epidural block must be considered. Compared to epidural block, subarachnoid block is simpler to perform, can be established in a shorter time, has a shorter onset time, a higher success rate and it provides a more intense analgesia and greater degree of muscle relaxation for surgery and it causes less backache. It may cause more intense sympathetic block with more profound hypotension for the same level of block. The duration of a single-shot spinal anaesthesia is restricted by the choice of the local anaesthetic agent and the additives. The continuous form of spinal anaesthesia is not appropriate for outpatient operations. As described earlier, with the introduction of the pencil-point needles (Whitacre, Sprotte), the main objection against spinal anaesthesia, postdural puncture headache, has all but disappeared even in young patients. The main advantage of epidural block over spinal is that the duration of anaesthesia may be tailored by the use of shorter-acting local anaesthetics with incremental injections via an indwelling epidural catheter. Postoperative analgesia via epidural catheter is not a practical consideration for the outpatient at this time. Thus, for outpatient surgery, at present, subarachnoid block may indeed be the preferred central neuroaxial block, unless the duration of surgery is long and unpredictable.

Inappropriate regional blocks for outpatient surgery

The regional anaesthetic techniques that are associated with possible pneumothorax are considered relative contraindications for outpatient surgery. This is because pneumothorax may not become apparent, even on chest X-ray, until several hours after the procedure. These blocks are: supraclavicular and interscalene brachial plexus blocks and intercostal blocks. Prolonged motor weakness of the lower extremity after femoral-sciatic nerve block may be a disadvantage in some situations. Subarachnoid block is no longer considered inappropriate for outpatient surgery, even in young individuals, although a continuous spinal technique should be avoided.

Inappropriate patients and surgical procedures for regional anaesthesia

Obviously, every patient is not suitable for regional anaesthetic techniques. An unwilling patient should never be 'talked into' accepting regional anaesthesia. Of course, the patient must be educated about the pros and cons of regional anaesthesia during the preoperative period, especially when a regional anaesthetic technique is clearly superior (e.g. patients with severe chronic obstructive pulmonary disease, or a patient with coronary artery disease undergoing a superficial operation in the perineum or lower extremity).

Unless there is a strong reason to avoid general anaesthesia (e.g. severe cardiorespiratory disease), for really short outpatient surgical procedures (less than 30 min duration) like D&C, cone biopsy, etc., general anaesthesia with a short-acting general anaesthetic (e.g. propofol with a laryngeal mask airway) may indeed be preferable to regional anaesthesia. Similarly, in a patient who has a back problem, spinal or epidural anaesthesia is probably not appropriate unless the risks of general anaesthesia are greater. Regional anaesthesia may often be advantageous for obese patients undergoing short peripheral operations, however, if the bony landmarks are obscure and the patient is concerned about backache, it is probably inappropriate to make innumerable attempts to perform a regional block, leaving the patient dissatisfied and permanently opposed to any regional anaesthesia in the future.

It is always important to determine the patient's coagulation status during preoperative evaluation before any regional anaesthesia is contemplated, especially a central neuroaxial block. Coagulation status is best determined by taking a history about bleeding tendency during normal day-to-day activities like easy bruising when scratched accidentally, prolonged bleeding after a small cut or frequent bleeding during brushing of teeth. When such a history is present and regional anaesthesia is still under consideration, a preoperative laboratory coagulation profile should be ordered.

Discharge criteria after regional anaesthesia

When should the outpatient receiving regional anaesthesia be discharged after surgery? The usual clinical discharge criteria (i.e. fully awake and alert, stable vital signs, absence of any respiratory distress, minimum postoperative nausea and pain) still apply for all patients whatever the type of anaesthesia received[59].

For central neural blockade, it is necessary to ascertain that the autonomic and motor functions have returned to normal before discharge[60]. Successive measurements of arterial pressure in orthostatic conditions will detect any residual sympathetic block[61]. Return of proprioception of the great toe is a good sign of adequate recovery. Most facilities require that the patient is able to void and ambulate before discharge.

Patients who receive a peripheral block (e.g. brachial plexus block) need not wait until complete recovery of the motor and sensory functions. It is imperative, however, that the limb is adequately protected by a sling and the patient and the attendant are educated about the possibility of injury to the insensitive limb from trauma and fire (e.g. from smoking and cooking).

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Ambulatory surgery in the '90s

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Ambulatory surgery is on the increase. As with any new development, there are issues of appropriate utilization and patient safety. This article reviews some of these issues and presents a framework for evaluating the effectiveness and quality of modern ambulatory surgery.

Key words: Safety; assessment; anaesthesia; patient management

The spectacular growth and development of ambulatory surgery in the past decade can hardly go unnoticed. Indeed, it is generally agreed that 50–60% of all surgical procedures are being done on an outpatient basis and the developments in minimally invasive surgical procedures may push this figure even higher. Our surgical forefathers would stand in awe at these changes. The time spent in a health care facility for a patient undergoing cataract correction including intraocular lens implant has decreased by two orders of magnitude; from an old standard of 10 days (2400 h) to 4 h, which is now a reasonable stay. Cholecystectomy as a same-day procedure – unthinkable 15 yr ago – is relatively common today. Many procedures previously requiring hospitalization, even for a few days, are now done on an outpatient or ambulatory basis.

Given this remarkable evolutionary development, the Pre- and Post-Operative Care Committee of the American College of Surgeons, in the Fall of 1991, decided it was time to explore this phenomena. The Committee's deliberations led to structuring a postgraduate course on ambulatory surgery presented at the Annual Clinical Congress in October 1993. This article summarizes some of the important issues presented and discussed there; it is a synthesis of the ideas and concepts of many individuals.

Four major areas were discussed in lecture, debate, panel discussion and audience interactive question and answer sessions. The latter, a most interesting adjunct to the educational experience, will not be explored further here.

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The areas of discussion were:

1. Preoperative assessment of the ambulatory surgery patient
2. Anesthesia and analgesia for ambulatory surgery
3. Patient management in ambulatory surgery
4. Quality assurance in ambulatory surgery

A matter of definition

With technological and economic pressures rising, the definition of ambulatory surgery appears to be in flux. In general, the expectation is that the patient will return home that day, without an overnight stay. Technically, this definition excludes recovery centers and 23-h admissions, important for purposes of describing and comparing facilities and outcomes. Clearly there are economic considerations for institutions, regulatory bodies, third party payors and patients related to the definition. This discussion is about those patients who go home after an ambulatory surgical procedure, usually without an overnight or 23-h stay. The economics will not be discussed, as that is a subject worth exploration unto itself. Economic aspects of specific patient evaluation and risk assessment will be noted.

Preoperative assessment

The critical and overriding issue in ambulatory surgery must be patient safety. Selecting patients for surgical procedures in this setting is a crucial process. Overall in this setting there are few valid predictors of patient risk. Moreover, the factors that result in significant morbidity or the occasional mortality are themselves difficult to identify. How, then, is it decided that a given patient is an appropriate candidate for ambulatory surgery?

The process is multifactorial and indeed multidimensional. Just because a procedure can be done as an out-

Table 1. Essential points to consider – decision making in ambulatory surgery

Patient history
Diabetes, bleeding disorder, smoking, alcohol intake
Possible pregnancy, previous surgery, previous anesthesia, family history of malignant hyperthermia
Current medications
History of steroids, history of anticoagulants, diuretics, digoxin, non-steroidal anti-inflammatory agents, antidepressants, chemotherapy
Age
Extent of systemic physiologic compromise
Renal, pulmonary, liver, cardiovascular
Expected blood loss
Physical exam
Airway assessment, scoliosis

Table 2. Stratification of surgical procedures – ambulatory surgery

Category A
Non-invasive with minimal blood loss (< 250 ml)
Endoscopic procedures, skin, eye, subcutaneous or superficial lymph tissue
Minimal risk, independent of anesthesia
Category B
Invasive procedures with mild blood loss (< 500 ml)
Laparoscopic procedures, hernia repairs, arthroscopy, invasive biopsy, tonsilectomy, dilatation & curettage, extensive cosmetic surgery, hand reconstruction
More invasive procedures or those for which patients will require a prosthesis or significant postoperative care are generally excluded.

patient procedure does not mean it should be done as one. To minimize risks, an appropriate patient evaluation is necessary and then an active decision made concerning the patient's risk in an ambulatory setting. In the preoperative evaluation, appropriateness of setting, type of anesthesia and duration of procedure are scaled against the patient's overall health status, presence of intercurrent disease, the planned procedure, and home support systems. This process remains very much an art; to the general credit of the medical profession there are few reported problems. Whether an innate conservatism works to minimize risk or a very good screening process is in place is not clear. If there was a predominant general theme in the presentations, it was the lack of objective data to address the safety of ambulatory surgery.

Stratification by the American Society of Anesthesiologists (ASA) physical status classification alone is questionable. This evaluation tool was not designed for use in an ambulatory surgical application. There was a general belief amongst the faculty and audience that ASA I and II patients had surgery at free-standing sites while the slightly more physiologically deviated patients, ASA III and IV, were treated in hospital-associated facilities. The latter presumably because of a perceived increased risk for an untoward event necessitating admission. On this issue, there is a paucity of data which limits and thus constrains a meaningful discussion. The economics of 'skimming' low risk patients to free-standing sites was noted but not explored. Ambulatory surgery was performed at a hospital site by 74% of the attendees; 59% did not have access to a free-standing facility. Of note, 85% said they would use a free-standing site if they had access to one.

If patient safety is the objective and minimizing risks the primary tactic, what tools and aids are available to assist in the decision making? Elements considered helpful are listed in Table 1. Patient factors and planned surgical procedure, including site, are primary determinants of risk. A stratification schema for ambulatory surgical procedures is shown in Table 2, after Pasternak[1]. Calculating risk is a complex process using elements of history, physical examination findings, and appropriate laboratory tests to make the assessment.

Because of significant system-wide functional and economic implications it seems reasonable to develop a rationale for an effective and appropriate use of preoperative laboratory testing. Key factors to consider are noted in Table 1 with emphasis on patient age, sex, underlying physiologic status, presence of chronic disease and acute illness superimposed on the baseline state. The timing of the preoperative studies is also a factor and in some instances performing certain tests (e.g. UA, H/H) is actually part of state regulatory facility licensing.

The timing of preadmission testing (PAT) with respect to ambulatory surgery requires comment. For low-risk 'healthy' patients, few could argue with doing them on the same day, possibly preceded by a nurse-conducted telephone survey. For patients with significant intercurrent disease – diabetes, heart disease, COPD, chronic renal failure – an earlier interview (7–10 days before planned surgery) may be more appropriate to assess stability. Even then, some tests must be done on the day

Table 3. Preoperative testing schema – general-regional anesthesia

	HGB/Hct	*PT/PTT platelets BT*	*Electro-lytes*	*BUN creatinine*	*Liver function*	*CXR*	*ECG*	*Glucose*
Neonates	×							
All women	×						> 50 yr	
Male > 65 yr	×						> 40 yr	
Cardiovascular disease				×		×	×	
Pulmonary disease						×	×	
Hepatic disease		×			×			
Renal disease	×		×	×				
Bleeding disorder		×						
Diabetes			×	×				×
Smoking history	×					×		
CNS disease			×	×			×	×
Anticoagulant use	×	×						
Diuretic use			×	×				
Digoxin use			×	×				
Chronic steroid use			×					×

of surgery to assure patient safety: a blood glucose on a diabetic or a serum potassium for patients with renal failure or on diuretics. These studies establish a baseline for that day, an essential element in determining whether discharge criteria have been met.

In surgery and anesthesia there is a need to address the issue of appropriate preoperative laboratory testing, independent of site. That test ordering has been changed from general to specific is well documented[2]. Although a dollar savings was demonstrated, an unpredictable cost was identified: justified tests were omitted along with unwarranted tests. The authors argued that the net change was not beneficial. The analysis points out the need to define an algorithm or a system that matches patients and needed tests.

Truly 'healthy' patients probably need no preoperative laboratory screening[3]. Site specific, few ambulatory surgery patients are 'healthy'; an argument can be made that preadmission testing should be selective and undertaken only for specific indications[4,5]. If one accepts necessary laboratory tests as part of risk assessment and the establishment of baselines as being important, it is possible to identify specific tests which could be used for the majority of patients. The first consideration with respect to which tests should be performed is related to the anesthetic proposed. If general or regional anesthesia is proposed, a more extensive list of required tests is used compared to procedures done with only local anesthetics or monitored anesthetic care, see Table 3.

Certain variables are considered when dealing with children; blood tests are often not required. One should always consider the possibility of the presence of an infection – upper respiratory or urinary tract – around the time of a proposed elective procedure. A good history is essential to exclude such a possibility. As patient safety is the critical issue, rescheduling to minimize the risk of a concurrent infection is not unreasonable. This principle is generally applicable to the population as a whole; our pediatric surgical colleagues have educated us by placing a greater emphasis on it.

The demographics

With more ambulatory procedures being done on sicker patients, it seems reasonable to consider the demographics of the population with respect to concurrent and intercurrent illness. Natof[6] showed a significant incidence of pre-existing disease present in the ambulatory surgery population as a whole. Hypertension, asthma, renal and heart disease, obesity, diabetes, central nervous system disease, liver disease and allergies head the list. Given a population with significant illness it makes sense to screen for problems and, if identified, correct them before elective surgery, implement appropriate measures to minimize the risks or perform the procedure on an inpatient basis.

Is age a limiting factor for ambulatory surgery?

As the population ages the question of an age limit for ambulatory surgery becomes obvious. Few would argue that older patients have a higher incidence of concurrent illness and less physiologic reserve, increasing their risk. The real question is whether age in itself is a limiting factor. Aging is a naturally occurring phenomena with a normal scenesence of physiological processes. The effects may be manifest as little functional impairment or exaggerated because of an intercurrent/concurrent disease. Scenesence may thus limit physiological reserves so that the stress of a surgical procedure places excess demands and the physiologic response mechanism cannot respond, resulting in untoward or unexpected outcomes. Obviously, with significant underlying disease the responses may be further blunted[7]. It is reasoned that physiologic status is a more appropriate measure of a patient's ability to respond to a surgical procedure than chronological age. There are few outcome predictor systems available and those generally used risk assessment tools (e.g. ASA classification) were not designed for the ambulatory environment. In addition the events they predict for inpatients are infrequent in the ambulatory

surgical population. Mortality in ambulatory surgery is so rare an event[8] that it should be considered random and perhaps age- and population-independent. There is insufficient data to identify cause because of the infrequent nature of the event. Whether mortality by itself is an adequate measure of quality of care or a quality assurance measure in an ambulatory surgical environment can be argued.

The patient's ability to undergo the proposed procedure, with the chosen anesthetic is the issue of risk assessment; that assessment is based on an appreciation of the underlying physiology and not age alone. How to minimize the risk is the question. The basic elements of history, physical exam, screening tests and disease-directed laboratory tests are critical elements of the risk assessment process.

Table 4. Reasons for admission after ambulatory surgery – unplanned

	n
Nausea and/or vomiting	20
Pain	20
Cardiac problems	17
Airway difficulty	7
Wound and/or bleeding	19
Iv antibiotics	3
Urinary tract problems	7
Control diabetes	5
Other	11
Bigger procedures	3
Unable to ambulate	2

Anesthesia

There remains an assumption on the part of the population in general and some elements of the medical profession specifically that ambulatory surgery has less risk than the same procedure done as an inpatient. To some extent this may be true. Moreover, there is a perception that general anesthesia is to be avoided and procedures done under 'local' are less stressful and therefore better for the patient. With improved anesthetic and surgical techniques and methods for appropriate patient assessment it seems reasonable to question these assumptions.

In reality, straight local anesthesia is rarely practised. Indeed, if a case could be performed using this technique alone one could question the validity of using an ambulatory surgery site. Procedures done under local anesthesia are nonetheless anxiety provoking and can be associated with catecholamine release, inducing vasoactive responses potentially harmful to a patient. Any number of commonly used antihypertensives or psychotropic agents temper this response, potentially increasing patient risk by eliminating a protective reflex.

The most likely ambulatory surgery scenario is monitored anesthesia care (MAC) where intravenous sedation or an anxiolytic is used in conjunction with local infiltration, field block or regional anesthesia (e.g. axillary block, bier block, ankle block, etc.). Few would argue that a calm relaxed patient is a prerequisite for performing an efficient procedure; there will be fewer interruptions to deal with patient restlessness. However, MAC requires skilled personnel and the ability to convert, rapidly if necessary, to a general endotracheal anesthetic technique should the conditions require it. This is a low frequency-high impact event, a good quality measure; there is no hard reference data addressing this event. When the audience was asked if it was possible to screen patients for low frequency significant events, 82% of attendees felt they could.

Modern general endotracheal anesthesia and the pharmacopeia available for dealing with the immediate side effects make it a safe choice for many ambulatory surgery patients. In many ways general anesthesia affords a better, more accurate and therefore safer level of physiologic control, especially for patients with significant cardiopulmonary disease when compared to local anesthesia. General anesthesia is a safe and effective technique in ambulatory surgery. Obviously, this statement does not endorse its use for endoscopy or similar procedures as the practice standard there is iv sedation and pain medication.

Can this patient go home?

Another element in the risk assessment equation is defining post-procedure stability. If unstable, an admission may be required. It is generally agreed that the unplanned admission rate for ambulatory surgery, as previously defined, is 1–2%. This is certainly a low incidence event and its frequency may or may not reflect the quality of care provided by the surgeon and/or facility.

To appreciate the extent of the unplanned admission problem the incidence and knowledge of precipitating causes is needed. Then, working backwards, if one could identify a population at risk for admission following a procedure, that information could be used to effect a more appropriate scheduling. There is scant data available in the literature on the magnitude of this problem. Data from my institution was analyzed to determine the frequency of admission and the reasons for unplanned admissions to obtain a perspective on the problem. In the period from May 1990 to September 1993 we did 5000 cases per year in our hospital-based surgicenter; there were 90 unplanned admissions in this time. By broad category the reasons for admission are shown in Table 4. All urinary tract problems occurred in males; four were over 70 years of age. Cardiac problems occurred in 12 women and five men; 11 of the 17 were over 70 years of age. All of the diabetics were ophthalmology patients and four were under 50 years of age. Admission for pain was required by 12 women and eight men. This brief analysis has some interesting observations. Looking at the distribution of reasons by type it would appear that older women are represented in the pain and cardiac area more frequently than men. Diabetes admissions for control of blood sugar were younger patients, no doubt representing their basic underlying instability.

Obviously a more refined analysis on a much larger,

more sophisticated scale is required. The fact remains that even these events are infrequent. It will require a major multicenter trial really to identify the patients at risk. Nonetheless, these early emerging patterns could be helpful in guiding those efforts directed at early risk identification. The missing piece is the number of patients treated as inpatients who could have been treated as outpatients; the current selection process may be effective.

Ideally, discharge criteria should be established to assure a minimum of unplanned admissions and a minimum of admissions within 24 h of ambulatory surgery; two potential measures of quality. As the 23-h admission creeps into wider application, the data becomes fuzzy and more elusive. Absolute definitions of ambulatory surgery and its variations are necessary to avoid a semantics game while providing the ability to compare appropriate populations.

What then are the discharge criteria for ambulatory surgery?

The issue of when to discharge a patient home is not very complex and really very practically oriented. If the patient has stable vital signs relative to preoperative values that morning, is able to ambulate, void, and feed him/herself, discharge is reasonable. It is often said that the ability to lift the emesis basin to the mouth is an additional criteria. Management of pain in the immediate perioperative period is a critical factor. Judicious use of local anesthetic agents in the wound if possible is helpful. Excessive pain after reasonable doses of medication is a major cause for admission following ambulatory surgery; it is usually a preventable event but other reasons must be identified.

It should go without saying that a proper home environment with support is critical for discharge. Clearly most patients cannot drive themselves home; it is highly desirable to have another individual at home at least for the first night. The use of a Visiting Nurse Association (VNA) or other professional groups can perhaps extend this criterion with caution. Assessment of the home support environment, transportation, and other social and societal issues should be done prior to scheduling or at the latest at the time of PAT.

Perioperative analgesia

This is a topic unto itself with respect to differences in approach and concept. It is difficult to do it specific justice in the space provided so only a few principles will be noted. As in the management of perioperative pain for inpatient surgery, it helps to prepare the patient with early discussions of expectations. Then, it is crucial to keep ahead of the pain by (a) using local long-acting injectable anesthetics, and (b) having the patient begin to take pain medication before the pain becomes significant. The latter is generally accepted by directed dosing of pain medication at specific intervals and not on a 'prn pain' basis for at least the first 24 h. The first dose should be timed to the expected loss of effect of local anesthesia to maximize the benefit.

Narcotics, synthetic narcotics and various non-steroidal anti-inflammatory agents make up the bulk of anodynes used. Non-steroidal agents are used when bleeding risks are minimal or when the risk of a post-procedure bleed with hematoma is minimal. The addition of acetaminophen to a synthetic narcotic (opiate) is reasonably effective. However, a number of patients have gastrointestinal upset with non-steroidal agents or codeine and most do not appreciate the constipating effect of this class of pharmocologic agents.

If patients can be kept reasonably comfortable with respect to pain and the expected pattern of pain explained this is generally not a problem area. Any acute, significant, not-easily-explained pain in the perioperative period demands investigation.

Postoperative follow-up and evaluation

Because there are no patients to see the concept of postoperative rounds in the traditional sense has been replaced by other modes of communication directly with the patient, or through other care providers. Clearly a physician is responsible for the decision to discharge from a postanesthesia care unit (PACU) after ambulatory surgery. A physician need not personally examine the patient to determine appropriateness for discharge, if discharge criteria approved by the facility's medical staff are in place and have been rigorously adhered to by the nursing staff. This decision is not at all unilateral and is based on input from the operating physician, nurses and anesthesiologists as part of the process. Postoperative rounds are then by phone and/or through the use of VNA-like organizations as needed. The surgeon should call patients the evening of surgery to assess status and answer any questions. Similarly, the nursing staff and anesthesiology staff should call within 12–24 h to see if any problems have arisen. Depending on the surgical specialty, follow-up may be scheduled daily or in a week or at other perceived appropriate intervals. To assist in the follow-up and to minimize office visits, changes in surgical technique may have been implemented, such as the use of clips and/or subcuticular closure.

As patients do not usually return to the site for follow-up, there is some concern that anesthesiologists do not have the opportunity to see the outcome of their efforts. This is a real problem with no obvious solution. The next day call is one step in resolving this dilemma. Indeed, the same can be said of teaching institutions where surgical residents often do not have the opportunity to follow ambulatory surgery patients because of office logistics.

Q/A issues

If one assumes ambulatory surgery is safe, effective and even economical, how does one proceed to assess the quality of care provided by the surgeon and the system? This topic is quite real, for pressures to reform health care costs are driving more and more procedures to the

outpatient arena in the absence of well-defined outcome measures. One popular measure of quality is the unplanned admission rate and to an extent, taken broadly, it may indeed reflect quality. To be a really useful measure more analysis is required, including patient stratification criteria and risk assessment. Moreover, although the ASA classification is not a good risk predictor for the setting – or, more appropriately it has not yet been demonstrated to be effective – it may be one of the few standard patient classification references that allows comparisons across sites and patients. Significantly, many free-standing units tend to do ASA I and II patients, while hospital-based facilities tend to be the site for more ASA III and IV patients. If one is to compare sites for quality, and relate the outcome evaluation to cost, these variables must be considered. When institutions care for the same group of patients, an effective comparison of outcome and cost is possible. Once again, the rational reduction is to create a patient classification schema that affords the ability to accomplish this goal. That effort must, of necessity, be multidisciplinary to be effective.

Are there limits for ambulatory surgery?

If one considers that the length of stay for cataract surgery has decreased by two orders of magnitude over the last 20 years and cholecystectomy is routinely a 1-day stay or an outpatient procedure, the possibilities seem limitless. Driven largely by technology, but also various economic pressures, our ability to perform surgical procedures more effectively has grown rapidly. The only issue left to raise is one of propriety: should we be doing these procedures on an outpatient basis? Just because we can does not automatically mean we should for every patient. There are still inherent risks that need to be considered. Moreover, in some cases advances in technology have caused new surgical techniques to be accepted without the benefit of scientific clinical trials. These are exciting times in surgery and anesthesia. There are many challenges that lie ahead. Assuring safe and efficient ambulatory surgery is one of the most critical and we must all work to accomplish that objective.

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Effectiveness of naproxen in laparoscopic sterilization: a double blind randomized placebo controlled study

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Effectiveness of naproxen suppositories on ambulation was studied following laparoscopic sterilization. In a double-blinded randomized placebo study, 20 patients received 500 mg naproxen suppositories and 20 patients placebo suppositories. Postoperatively 10 naproxen patients and 11 placebo patients reported high pain scores, indicating severe pain and requiring opiates. Times to reach street fitness were equally prolonged in both groups. Most patients in both groups required 3 days to resume normal duties and post-discharge weakness was a common complaint. Our conclusion was that premedication with naproxen 500 mg suppositories in day-case laparoscopic sterilization therapeutically behaves like other commonly used non-steroidal anti-inflammatory drugs (NSAIDs) and does not substantially contribute to ambulation.

Key words: Anaesthesia: day-case/ambulatory, analgesics: naproxen, procedure: laparoscopic sterilization/ Fallope rings

Introduction

Prostaglandins released from traumatized ischaemic fallopian tubal tissue are assumed to play a role in the high incidence of lower abdominal cramp-like pains following laparoscopic sterilization under general anaesthesia (GA)[1]. Consequently prescribing non-steroidal anti-inflammatory drugs (NSAIDs) would seem to be indicated. However reports as to the efficacy of these agents have yielded inconsistent results. When using NSAIDs beneficial effects on postoperative pain reduction, reduced need for postoperative opiates and rapid ambulation have been claimed[2,3], while similar results could not be demonstrated in other studies[4,5]. In the above quoted studies which produced favourable results, naproxen was the NSAID used, suggesting clinical effectiveness for this agent.

Additionally, its good safety record and its long duration of action would seem to make naproxen a suitable analgesic in this category of day surgery patients.

We therefore evaluated the effects of premedication with naproxen 500 mg suppositories on postoperative and post-discharge outcome in 40 patients after laparoscopic sterilization with Fallope rings.

Patients and methods

Forty ASA grade I patients, scheduled for day-case laparoscopic sterilization under GA, participated in this institutionally approved placebo-controlled, randomized double-blind study. Written informed consent was obtained from each subject before entering the study.

Before surgery patients were familiarized with pain scales to be used both after awakening in the Post-Anaesthesia Care Unit (PACU) and when at home. Pain measurement was by verbal response to a 10 cm visual analogue scale (VAS) with 0 indicating no pain on the left at the start and 10 indicating agonizing pain on the right end of the scale[7].

During their stay in the hospital pain scores were assessed by an observer blinded to patient allocation. Patients were allocated by random numbers to two treatment groups. One hour before transport to the operating theatre, each patient had a suppository placed, containing either 500 mg naproxen ($n = 20$) or placebo ($n = 20$). Study medication was supplied by Sarva Syntex (Rijswijk, the Netherlands) and randomization was achieved

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with computer-assisted generation of random numbers in the hospital pharmacy, where study medication (identical-looking suppositories) was put into consecutively numbered coded envelopes.

The rectal route for drug absorbtion was selected to avoid gastrointestinal disturbances and fewer mucosal lesions are produced by naproxen administered as suppositories[14]. Induction of anaesthesia was with propofol and sufentanil, 10 or 30 μg, depending on body weight. Intubation and ventilation were with vecuronium. Anaesthesia was maintained with nitrous oxide in 40% oxygen and propofol. If necessary, residual neuromuscular blockade was reversed with neostigmine/atropine. All patients received 20 ml kg^{-1} iv Ringer's solution containing dextrose[8]. For laparoscopy a two-puncture technique was used and pneumoperitoneum was induced with carbon dioxide and Falope rings were applied in all cases.

Pain scores were recorded at 30, 60 and 120 min after arrival in the recovery ward in the outpatient step-down unit. On patient's demand and/or staff discretion 7.5–10 mg s.c. morphine sulphate was administered. If patients were also complaining of lower abdominal cramps, additional naproxen was available.

Discharge was considered if all vital signs had remained stable and patients could void, were alert, could dress and had no symptoms of nausea. Time from induction of anaesthesia up to time of fitness for discharge was recorded as T = street fitness. On discharge all patients were given two naproxen suppositories to use at home at their own discretion. If pains at home were still not completely relieved, patients could take additional acetaminophen 1000 mg. The following morning patients were contacted by telephone and enquiries were made as to the intake of analgesics and whether they had noticed any other unusual signs or symptoms.

Within a week after discharge, each patient was asked to report after how many days they had felt able to resume normal duties and whether they had noticed other unusual symptoms they wished to report.

Statistical analysis

Between-group differences were analysed with the unpaired Student's *t*-test (two-tailed) and comparison of pain scores between groups with the Wilcoxon's rank sum test (two-tailed). Results are expressed as medians with range[10]. Differences between proportions were analysed with the χ^2 or Fisher's exact test where appropriate. $P < 0.05$ indicated significance.

Results

Demographic and logistic data are presented in Table 1, showing similarity for both groups of patients. There was no protocol deviation and all patients who were initially recruited completed the study.

Analysis of our data showed that postoperatively, in the placebo group as well in the naproxen premedicated group, patients reported equally high pain scores, which could be considered severe (Figure 1)[7]. There were also no detectable differences in postoperative consumption of analgesics and in order to include VAS ratings down to around three, 13 placebo patients required opiates compared to 11 patients in the naproxen group. Fourteen patients in the placebo group and 11 patients in the treatment group were given additional naproxen postoperatively. There were no differences between both groups in times to reach street fitness and three patients in each group required overnight admission (Table 1).

When comparing these data, no significant differences could be detected (Table 2). On the morning following surgery VAS scores in both groups of patients had returned to values around two[6].

In relation to preoperative information supplied to the patients, out of 40 subjects studied, 18 placebo patients and 15 naproxen treated patients commented that the procedure experienced was much worse than had been expected, and 18 naproxen treated patients compared to 14 placebo patients could resume normal duties on the fourth postoperative day. Unwanted side effects are presented in Table 3.

Table 1. Characteristics of the study population*

	Placebo	*Naproxen*	*P*
Age (yr)	34.3 ± 4.7	36.1 ± 5.2	ns
Height (cm)	166 ± 7.6	167 ± 7.6	ns
Weight (kg)	67.4 ± 9.5	68.5 ± 13.6	ns
Duration of surgery (min)	17 ± 5.8	16 ± 4.6	ns
T = Street fitness (min)	370 ± 105	320 ± 94	ns
Number of admissions	3	3	ns

*Values are means ± SD. P, probability; ns, not significant (Student's *t*-test).

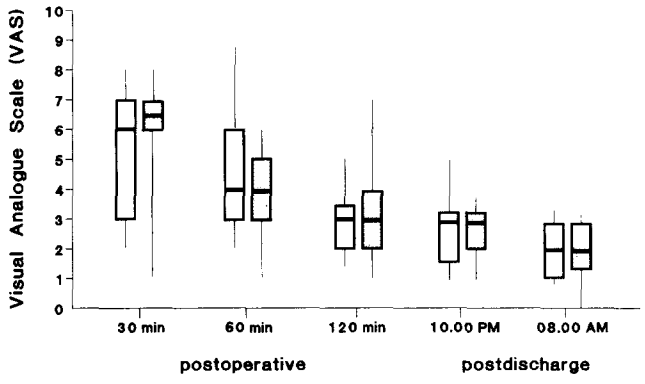

Figure 1. Distribution of pain scores at 30, 60, and 90 min postoperatively and after discharge. Postoperative pain scores plotted on the visual analogue scale (VAS). Because the data are not normally distributed, box plots are used; the box representing values in the second and third quartiles. The median value is represented by the horizontal bar in the box. Both upper and lower values are shown above and below each box[9]. Open boxes represent the naproxen group and shaded boxes represent the placebo group. Wilcoxon rank sum test; $P < 0.05$ indicating significance.

Table 2. Number of patients requiring analgesics in the postoperative period

	Placebo (n = *20*)	*Naproxen* (n = *20*)*
Naproxen	4	2
Opiates	3	3
Naproxen + opiates	10	9
No analgesics	3	6

*No statistically significant differences were obserbed between both groups.

Discussion

Results of this study indicate that following day-case laparoscopic tubal ligation with Fallope rings, patients premedicated with naproxen suppositories reported equally high postoperative pain scores as placebo patients, with roughly half of the patients in each group requiring parenteral opiates. Our data are in agreement with earlier studies, reporting insufficient postoperative analgesia following administration of other commonly used NSAIDs[4,5], where indomethacin and diclofenac were the agents used.

In relation to its pharmacological profile, there seems to be no indication to assume better quality analgesia for naproxen compared to these other agents[14]. Clinically this should not be considered as entirely unexpected, because both fallopian tubes are intraperitoneal structures and acute disruption of their integrity constitutes an acute phase 1 nociceptive stimulus, in which NSAIDs are likely to be ineffective[11].

On the following day many patients in both groups were still complaining of lower abdominal discomfort and general weakness (Table 3), sometimes lasting several days, which might be compatible with phase 2 hyperalgesia[11,12].

As fitness for discharge in both groups could often only be considered late in the afternoon, coupled with an overall overnight admission rate of 15%, it is unlikely that premedication with naproxen suppositories in the population that we studied had contributed substantially to rapid ambulation.

It could be argued that compared to orally administered formulations of naproxen sodium[15], longer times will be needed to reach therapeutic levels, due to delayed resorbtion from suppositories. With tablets too, lower plasma levels of the active drug component could result from delayed gastric emptying times in these preoperatively otherwise unpremedicated anxious patients.

Although effectiveness of preoperative naproxen sodium tablets in this category of patients was reported, we choose to administer rectal formulations to avoid direct mucosal irritation, possibly leading to a higher incidence of postoperative nausea which is an undesirable side effect in day-care patients. Besides, administering suppositories long before induction of anaesthesia should provide for effective blood concentrations at the time of surgery when Fallope rings are placed.

It is possible that a relationship exists between the reported high pain scores and increased subjective assessment of postoperative pain after gynaecological surgery[13] in patients who may be emotionally ill-prepared for inconvenience after sterilization, as patients were generally unaware of the possibility of the appearance of severe postoperative pains. Also considerable variation exist between individuals as to pain perception, explaining the extremes in VAS scores as depicted on the box plots (Figure 1).

Application of Fallope rings has been implicated as being more painful than tubal occlusion with Filshie clips and as such could have contributed to reporting of higher self-assessed pain scores. However in one study, using indomethacin, this could not be demonstrated[4].

In agreement with results which appeared in similar previously published studies where other commonly prescribed NSAIDs were used, we concluded that therapeutic benefits to be derived from perioperative administration of 500 mg naproxen suppositories as the main analgesic agent in laparoscopic tubal ligation with Fallope rings, are only modest.

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Table 3. Number of patients experiencing side effects

	Placebo (n = *20*)	*Naproxen* (n = *20*)*
Nausea, vomiting	6	6
Tinnitus, headache, dizziness	4	6
Feelings of instability, tiredness, weakness	11	8
Shoulder pain	10	7
Normal duties at day 4 postoperatively	14	18

*No statistically significant differences were observed between both groups.

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Comparison of alfentanil and halothane anaesthesia in paediatric ambulatory ENT surgery

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Forty children undergoing adenoidectomy were randomized to receive halothane (0.5–1.5%) or alfentanil (50 μg bolus followed by 0.5–1.5 μg kg^{-1} min^{-1} infusion) anaesthesia. All patients received N_2O and vecuronium. All patients in the alfentanil group required supplemental boluses of alfentanil (10 μg kg^{-1}) to control intraoperative hypertension. Emergence, recovery and discharge times as well as postoperative analgesic requirements were not significantly different between the two groups. We conclude that both techniques are suitable for paediatric ambulatory surgical patients.

Key words: Anaesthesia, paediatrics, ENT

Introduction

Alfentanil is a synthetic opioid analgesic with a rapid onset and short duration of action. It differs from fentanyl in its more rapid equilibration between blood and brain, with a half life of 1–2 min as opposed to 5–7 min for fentanyl[1]. Alfentanil's short duration of action is due to its rapid redistribution to other tissues and its short terminal elimination half life[2]. Such a short-acting opioid may be particularly useful in ambulatory paediatric anaesthesia. This study compares the effect of alfentanil and halothane anaesthesia on postoperative pain and rate of recovery from anaesthesia in children undergoing brief ear, nose and throat (ENT) procedures.

Materials and methods

Forty ASA physical status I or II ambulatory patients (ages 2–10 yr) undergoing adenoidectomy were the subjects of this single blind study. The protocol was approved by the Institutional Review Board and written informed consent was obtained from the parents in every case. None of the children received preoperative medication. Anaesthesia was induced with 70% nitrous oxide, oxygen, and halothane (1–4%) administered via a face mask. Patients received 0.1 mg kg^{-1} of vecuronium intravenously to facilitate tracheal intubation. Following intubation patients were randomized to one of two study groups using a sealed envelope technique.

In group 1 patients halothane was discontinued following tracheal intubation. Alfentanil 50 μg kg^{-1} bolus iv was administered, followed by an alfentanil infusion at a rate of 0.5–1.5 μg kg^{-1} min^{-1}. The infusion rate was adjusted to maintain arterial blood pressure within ± 20% of preoperative baseline. If, despite the maximum infustion rate of 1.5 μg kg^{-1} min^{-1}, blood pressure was higher than 20% of preoperative values, additional boluses of alfentanil (10 μg kg^{-1}) were administered.

In group 2 patients anaesthesia was continued with halothane, nitrous oxide and oxygen. The inspired halothane concentration was adjusted between 0.5 and 1.5% to maintain arterial blood pressure within ± 20% of baseline values.

In either group if the heart rate decreased to below 20% of baseline values, atropine 0.01 mg kg^{-1} was administered intravenously. All patients received an intravenous infusion of lactated Ringer's solution during surgery equal to four times the calculated hourly maintenance requirement.

Intraoperative monitoring included precordial stethoscope, noninvasive blood pressure, electrocardiography, pulse oximetry, axillary temperature and respiratory gas analysis by mass spectrometry.

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Table 1. Study demographics and recovery variables

Variable	*Group 1 (n = 20)*	*Group 2 (n = 20)*	P
Age (yr)	3.6 ± 1.2	3.2 ± 1.0	NS
Weight (kg)	17.3 ± 5.1	17.7 ± 2.8	NS
Anaesthesia (min)	50.2 ± 14.0	47.6 ± 7.1	NS
Surgery (min)	25.6 ± 12.0	23.1 ± 9.3	NS
Emergency (min)	7.0 ± 3.8	8.9 ± 3.3	NS
Recovery (min)	12.8 ± 12.4	8.7 ± 7.2	NS
Discharge (min)	129 ± 52	123.7 ± 48.6	NS
Lowest SPO_2	90.9 ± 6.7	91.8 ± 3.7	NS

NS = not significant.

After the completion of surgery, halothane or alfentanil infusion was discontinued. Residual neuromuscular blockade was antagonized by the intravenous administration of neostigmine 0.06 mg kg^{-1} and atropine 0.02 mg kg^{-1}. The nitrous oxide was then discontinued and the trachea was extubated when the child was breathing spontaneously, able to cough or gag, and made purposeful movements (emergence). After extubation the patients were transferred to the Postanaesthetic Care Unit (PACU). All the anaesthetic records were kept in a sealed envelope by the bedside to protect the blinded nature of the study.

Upon arrival in the PACU, objective pain assessments and recovery variables were assessed every 5 min by a research nurse blinded to the type of anaesthetic technique employed. Patients' recovery was assessed and recorded using the Steward recovery score[3]. Objective pain assessments were carried out every 5 min using a 10 point objective pain score[4]. Intravenous fentanyl 1–2 μg kg^{-1} was administered to any patient who achieved a pain score of six or more points on two consecutive 5 min observations in PACU, and patients with less severe pain were treated with acetaminophen. All patients were observed in PACU and subsequently in a Short Stay Recovery Unit (SSRU) to determine the time they met predetermined discharge criteria. Home discharge criteria included stable vital signs, absence of respiratory distress, bleeding or pain, ability to ambulate appropriate for age, minimal nausea and vomiting, and the ability to tolerate clear liquids. All patients were monitored for a minimum of 3 h before being discharged from the hospital, to detect any possible delayed respiratory depression.

Parents of all patients were contacted by phone within 24 h of discharge to determine the child's return of normal appetite, need for additional analgesics at home, occurrence of nausea and/or vomiting and degree of alertness.

Demographic data of the groups were compared using Student's *t* test. Differences in recovery scores, pain scores, analgesic requirements, incidence of nausea and vomiting were compared using Pearson's χ^2 test. Repeated measurement of analysis of variance (ANOVA) was also used to compare pain scores in both groups.

Results

Twenty children received alfentanil, oxygen and nitrous oxide as their maintenance anaesthetic (group 1). Twenty children received halothane, oxygen and nitrous oxide (group 2). Patients in both groups were comparable with regard to age, weight, preoperative heart rate, arterial blood pressure, and duration of anaesthesia and surgery (Table 1).

All patients who received alfentanil infusion required supplemental boluses of alfentanil to control intraoperative hypertension. The number of patients who required 1, 2, 3, or 4 boluses each to supplement the infusion was six, seven, four and three respectively. Six patients in group 1 required atropine for treatment of sinus bradycardia perioperatively, but this was not statistically different from those in group 2 ($n = 4$).

Emergence, recovery and discharge times were not significantly different between the two groups (Table 1).

No statistically significant difference was found between the percentage of patients in each group who received fentanyl and acetaminophen in the PACU or SSRU. The number of patients who had decreased SPO_2 (<90% for 30 s) or vomited in the recovery period did not differ between the two groups.

Using repeated measures analysis of variance (ANOVA) no difference was detected in overall pain scores or in changes in pain scores over time for each group. However, there was a significant decrease in pain scores for both groups over time ($P < 0.0001$).

There was no difference in the parents' report on the course of recovery after discharge from the hospital or their satisfaction with the anaesthetic experience.

Discussion

This study was undertaken to investigate postoperative analgesia and recovery after two different general anaesthetic techniques for adenoidectomy in ambulatory paediatric patients.

The purpose of general anaesthesia is to abolish the conscious appreciation of pain during surgery and to provide good operating conditions without compromising vital functions[5]. Each of the two anaesthetic techniques provided good operating conditions. As a predominantly intravenous technique was being compared

with an inhalational one, it was not possible objectively to compare depths of anaesthesia; the depth of anaesthesia was judged on clinical grounds and the minimum concentration of anaesthetics which satisfied these conditions was administered[5]. In healthy children undergoing adenoidectomy, 50 μg kg^{-1} bolus of alfentanil provided a short-lived (10–15 min) suppression of the haemodynamic response to surgical stimulation even when supplemented with N_2O and up to 1.5 μg kg^{-1} min^{-1} of alfentanil infusion. Other investigators have shown that the same dose of alfentanil (50 μg kg^{-1}) combined with N_2O was effective for 15 min only; additional increments of 12.5 μg kg^{-1} were required to control the hypertensive response to surgical stimulation[6]. It appears that for procedures lasting less than 1 h either a higher initial bolus dose, a higher infusion rate of alfentanil, or both should be considered.

The emergence and recovery findings in this study are different from previous studies in children and adults[6,7]. Whereas those studies found that recovery was more rapid after alfentanil than after halothane, the time to extubation (emergence) and recovery was not significantly different in our patients. It is possible that the need for repeated boluses of alfentanil may have delayed emergence in our patients. One can only speculate that a higher initial bolus or infusion rate may have allowed lower infusion requirements towards the end of surgery, and would possibly have promoted faster emergence.

In the recovery period nausea and vomiting were more frequent in the alfentanil group and although these differences were not statistically significant, this may have prevented early discharge of these patients according to our predetermined criteria.

Studies carried out to compare recovery after general anaesthesia using psychomotor testing found no differences between those who received alfentanil or halothane, and in both groups there was a delay in return to normal for some hours after either technique[5]. There is a need to warn parents that even though children are being discharged home 2–3 h after anaesthesia, they should not be allowed to perform these tasks requiring serious motor coordination such as riding a bicycle.

This study demonstrated that both anaesthetic techniques result in rapid awakening from anaesthesia, and also rapid recovery, so that patients in both groups met the criteria to be discharged from hospital in similar times. Both techniques are therefore suitable for paediatric ambulatory patients.

Acknowledgements

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Day case inguinal hernia repair under local anaesthesia with sedation

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A series of 639 consecutive unselected patients with inguinal hernias were scheduled for ambulatory hernia repair. The objective of the study was to determine the feasibility of the method using local anaesthesia in combination with propofol sedation. Ninety-five per cent of the patients were discharged the same day. Overall morbidity was 5.9%. There was no mortality. Patient acceptability was high (92%). Our method is applicable to all types of inguinal hernias allowing the ambulatory treatment of patients with large or bilateral hernias.

Key words: Inguinal hernia repair, ambulatory surgery

Introduction

A significant amount of progress has been made in the last decade in expanding the use of ambulatory surgery for the repair of inguinal hernias[1,2]. A separate day care unit was opened at Hospital El Tomillar (Area Hospitalaria Valme) in early 1992, to facilitate the movement from inpatient to outpatient care for patients with inguinal hernias. The population of our National Health District is mainly rural, low-income and often travels long distances to the hospital.

Our objective was to determine the feasibility of ambulatory hernia repair using local anaesthesia in combination with propofol sedation in the Department of Health Care in Seville.

Patients and methods

The study population comprised all patients (n = 710) attending the outpatient clinic of our surgical day unit during a two year period. There was no selection of the type of inguinal hernia accepted for surgery. Inclusion criteria were: (a) patient acceptance; (b) anaesthetic risk (American Society of Anesthesiologists) ASA I, II or III with systemic diseases well controlled preoperatively; (c) social (housing conditions, telephone, responsible accompanying person). Six hundred and thirty-nine patients were scheduled for ambulatory hernia repair. Day patients were admitted between 8 and 8.30 a.m., operated on during the morning, and discharged in the late afternoon. Seventy-one patients (10%) were excluded for the criteria (a), (b) or (c) and were treated as inpatients. Of the 639 patients, 595 (93%) were men and 44 (7%) were women with an age range of 12–84 yr (mean 49 yr). The weight range was 25–110 kg (mean 74 kg). The anaesthetic ASA ratings were: 390 ASA I (61%), 217 ASA II (34%) and 32 ASA III (5%).

Table 1. Hernia type. Primary and recurrent hernias

Hernia type	*Primary* n	%	*Recurrent* n	%	*Total* n
Indirect	354	58.6	49	42.9	403
Direct	196	32.4	58	50.9	254
Combined	55	9	7	6.2	62
Total	605	100	114	100	719
80 Bilateral repairs					

The hernia anatomic types are shown in Table 1. Eighty patients had bilateral hernia operation at one time. There were 114 (15.9%) recurrent repairs. We used antibiotic prophylaxis (cefotaxim 1 g), in procedures expected to involve the insertion of prosthetic material (polypropylene mesh, Marlex).

Anaesthestic technique

In the operating room all patients were premedicated by the anaesthesiologist with 2 mg of midazolam and 1–1.5 ml of fentanest iv. This was followed by a bolus of propofol 0.3–0.5 mg kg^{-1} and the simultaneous administration of a slow propofol infusion with an infusion pump at an initial rate of 4 mg kg^{-1} h^{-1} and local infiltration (by the surgeon) with 0.25% bupivacaine plus

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Table 2. Surgical techniques

	No. of cases	*%*
Bassini-Shouldice	289	40.2
Lichtenstein	391	54.4
Ferguson	29	4.0
Plug	10	1.4
Total	719	100

Table 3. Times of discharge

Times	*No. of cases*	*%*
Same day (0–6 h)	607	95
24 hours	21	3.2
>48 hours	11	1.8
Total	639	100

Table 4. Early complications

	No. of cases	*%*
Wound bleeding	3	0.4
Haemoperitoneum	1	0.1
Femoral nerve block	6	0.8
Total	10	1.3

Table 5. Late complications

	No. of cases	*%*
Wound seroma	5	0.7
Haematoma	15	2.0
Abcess	4	0.5
Scrotum haematoma	9	1.3
Total	33	4.6

1 : 200 000 epinephrine. The propofol infusion rate was adjusted according to the clinical response, but without preventing the patient's cooperation. Systolic and diastolic arterial pressures and ECG were monitored throughout the operation. Arterial oxygen saturation was measured continuously with a pulse oximeter.

The operations were performed by a consultant or a senior surgical registrar. After exposure of the inguinal region, the patient was asked to cough and to strain, thus any defect was accurately outlined. We routinely did an intraoperative stress test after the repair was completed. We irrigated the wound at the completion of the procedure with an additional 4 ml of bupivacaine. The surgical techniques are shown in Table 2[1,3–5]. Bilateral hernias were repaired consecutively under the same anaesthetic.

After the operation, patients stayed in the recovery room for 30 min and were then returned to the ambulatory area where they were requested to walk every 15 min. When the patients could void and walk they were released home. Each patient was given written instructions, an explanation of the possibility of bleeding and occasional ecchymosis. Patients were also instructed to take the analgesic tablets on arrival home whether pain-free or not. Patient follow-up was by telephone or domiciliary visit by nurses of our Home Hospitalization Service (specially trained nurses from our surgical day unit). Satisfaction with care was measured by a standard questionnaire 2 months after surgery.

Results

The average operative times were 34 min for unilateral hernia repair, 61 min for bilateral and 41 min for recurrent hernia repair. Six hundred and seven patients (95%) left the hospital as day cases (Table 3) with a mean time spent in the day unit of 4 h. Thirty-two patients (5%) could not be discharged home the same day because of severe pain (two cases), early complications (10 patients), patient's preference (nine cases), geographical factors (seven cases) and inappropriate selection (four patients).

Morbidity (5.9%) is shown in Tables 4 and 5. No adverse reactions occurred during or after sedation. No urinary retention or chest infection was encountered. There was no mortality.

The home management of the patients was by our home care service in 566 patients (88.5%) and by telephone in 73 patients (11.5%). Minor pain was experienced by 543 patients (85%), moderate pain by 89 patients (14%) and severe pain by 7 patients (1%). Only three patients (0.4%) required readmission after discharge from hospital.

Seventy-two per cent of questionnaires were returned 2 months after operation. The degree of satisfaction with the ambulatory hernia repair was 92%. The information (pre- and postoperative) was reported to have been adequate by 87% of the patients. One hundred and twenty-seven patients (20%) had had a previous inpatient repair and all these patients preferred the day case procedure. Seventy-five per cent of the patients returned to their normal occupation in 4 weeks.

Discussion

Nearly all groin hernioplasties can be performed safely on a day-patient basis[3,6,7]. Propofol sedation in combination with local anaesthesia is a safe alternative, decreasing the fear and anxiety of patients and allowing the ambulatory treatment of patients with large or bilateral hernias[8,9]. Our results support this belief; 95% of patients could be discharged the same day. This is important to the patients by reducing disability and encouraging them to return to their homes, usual diet and activities immediately. To the family of the patient, it eliminates the concern and the inconvenience of trips back and forth to the hospital.

The use of bupivacaine with epinephrine has the ability to produce long-lasting postoperative pain relief for

up to 6–8 h[7–10]. Such relief can be extended to 12 h postoperatively by irrigating the wound at the end of the procedure with an additional 4–5 ml of 0.25% bupivacaine[10]. This method of reducing postoperative pain allows an earlier discharge.

The overall morbidity rate of 5.9% is similar to rates reported by others[1,7,11]. No urinary retention was encountered, which compares favourably with rates of 13% in patients when using general or spinal anaesthesia[9–12]. There was no mortality.

Patient acceptability was high. Ninety-two per cent of patients who returned the questionnaire favoured the procedure and said they would have it performed in the same way again if required. The most grateful patients were those who had had previous repairs under spinal or general anaesthesia and were hospitalized.

Apart from pain, uncertainty about the postoperative course is an important reason for the patient being reluctant to go home after a hernia repair[13,14]. In our experience, the Home Hospitalization Service has been a valuable means to offer security to the patients and to decrease the level of uncertainty about the postoperative care.

Recurrence rates are beyond the scope of this study. In forthcoming papers we will determine the long-term outcome following our method of hernia surgery.

We conclude that the ambulatory treatment of most groin hernias is feasible in our Health Care District, offering important social and economic advantages. Our results are sufficiently promising to encourage the continuation of this method for the repair of most inguinal hernias. The key to successful ambulatory hernia repair is having a facility with a clear separation of the ambulatory from the inpatient area.

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Blood contact and exposures among ambulatory surgery personnel

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This paper describes the risks of blood exposure to healthcare workers in ambulatory surgery. Circulating nurses observed and asked personnel about blood contact and exposure, and recorded data on 376 consecutive ambulatory surgery cases in a community hospital. Contact with blood occurred in 11 cases (2.9%); two punctures occurred (0.5%). Orthopaedic surgery was associated with blood contact (odds ratio 5.9, 95% confidence interval 1.4–24). Punctures occurred during injecting or suturing. Contact with intact skin was most commonly to legs and feet, through protective clothing strikethrough. Rates of exposure are lower than those in studies of inpatient surgeries, but this remains an area of risk to healthcare workers and needs further study.

Key words: Ambulatory surgery, bloodborne pathogens, occupational health

Researchers have identified operating room personnel as having a high risk for blood exposure. From early general studies of occupational bloodborne exposure risk[1–3], specific research in the operating room has identified categories of personnel, types of surgery and certain activities that are associated with blood contact[4–9]. However, to our knowledge, this is the first report of such data from a hospital ambulatory surgery department.

Research available on exposure to blood in inpatient operating rooms has shown a wide range of exposure rates, because of differences in (1) the definition of exposure, (2) in methods to determine that an exposure has occurred, (3) in surgeries performed in the study sites, and possibly (4) in the effectiveness of preventive strategies. Gerberding and her colleagues used circulating nurses as observers to study all contacts with blood, including puncture, mucous membranes, non-intact and intact skin, but included contact with other body fluids as well as those with blood in their definition of exposure[4]; they found a parenteral exposure rate of 1.7% and cutaneous exposure rate of 4.7%. Popejoy et al. used circulating nurses as observers, and found a 2.2% rate of punctures, calculated as the number of person-procedures per total number of surgeries[5]. Panlilio studied all contact with blood, using dedicated observers, and found that contact occurred in 30.1% of all surgeries, with a 4.9% rate of punctures[6]. Quebbeman and his colleagues, using dedicated operating room nurses as observers, reported that 50% of surgical procedures involved contact with blood, and cuts or needlesticks occurred in 15% of the operations[7]. Tokars and his colleagues used trained observers and reported percutaneous injuries in 6.9% of surgeries[8].

The methods differed but the risk factors that emerged were similar. Risk of exposure increased with the length of surgery[4,6,7,9], was associated with job classification as a surgeon[6–9], type of surgical procedure or surgical speciality, in particular vascular procedures and intra-abdominal gynaecologic procedures[4], trauma, burn or orthopaedic emergency procedures[6], vaginal hysterectomy[8] and thoracic surgery[9]. In all reports of inpatient surgeries, the conclusions were that accidental contact with blood occurred regularly, and all surgical personnel were at risk of contact. Although ambulatory surgery may be different in the types and complexity of procedures performed, and the severity of patient illness, there remain many similarities that warrant the study of this setting as well, to quantify risk of blood exposure.

Methods

Study hospital

The study hospital was a community hospital located in Washington state, with an average of 1050 inpatient and

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ambulatory operative procedures per month. The hospital was one of several in a large, multicentre study of inpatient operative procedures reported elsewhere[9].

Procedures included in the study

Operative procedures included all consecutive cases performed in the ambulatory surgery suite from 24 August to 30 November 1992. Procedures excluded were endoscopic procedures, vaginal deliveries, and procedures done outside the ambulatory surgery suite.

Definitions

Definitions used for the study were the same as those of White and Lynch in their study of inpatient operative blood exposures to personnel[9]. *Cutaneous exposure* was defined as visible blood on the skin of a healthcare provider; *parenteral exposure* was defined as visible blood on nonintact skin or mucous membranes of a healthcare provider, or when a puncture or cut with a used sharp occurred. Parenteral exposure was divided into three types: puncture or cut, blood contact with mucous membranes, and blood on nonintact skin. *Blood contact* was defined as all exposures, both cutaneous and parenteral.

Data collection

The nurse educator in the operating room was the coordinator of data collection for the project. She instructed the circulating nurses on the data collection form and definitions of exposures; written training material and a videotape were provided by the authors. The circulating nurses were instructed to ask 'Did anyone have a blood exposure?' at the end of every case, and whenever someone on the surgical team behaved as if contact with blood may have occurred. Dedicated observers were not used. The hospital sent completed forms to one author (PL) weekly; these forms were reviewed for completeness, and questions about the data were resolved by telephone discussions with the nurse educator.

Data on the surgical procedures included time of day, surgical service, case status (scheduled or emergency), anatomic location, and length of surgery rounded to the nearest hour (0 for those less than 30 min). Information on blood contacts included job classification, activity at the time of contact, device causing the injury (in the case of punctures or cuts), anatomic location of exposure, and whether or not the patient was exposed to blood of the healthcare worker.

Data analysis

First, descriptions of the outpatient surgeries were done using cross tabulations and the calculation of proportions, in order to characterize the types of cases performed in this setting. Second, the blood contacts that occurred during the data collection period were described, also using cross tabulations and proportions. The blood contact rate for cases was the number of cases in which at least one blood contact occurred divided by the total number of cases performed. This case-contact rate was then divided into the parenteral exposure rate and the cutaneous exposure rate.

Second, bivariate analyses examined whether there were differences between operative cases with and without blood contact. Cross tabulations were made to examine such differences, and univariate statistics used included the Fisher's exact test for examinations of the relationship between characteristics of the surgery and the occurrence of blood contact. A stepwise logistic regression was performed on variables found significant, to evaluate the independent contribution of each variable to the dependent variable, blood contact, while controlling for the influence of the other variables. For all analyses, significance was set at alpha = 0.05 (two-tailed).

Results

Descriptive information

There were 376 ambulatory surgical cases reported; the most common services were general surgery (32.4%) and orthopaedic surgery (26.3%). As might be expected, the majority were performed on weekdays and during the 7 am–3 pm shift (94.9%), and only five of the 355 cases reporting on these variables were emergencies (1.4%). The mean length of surgery for all cases was 0.9 h.

Blood contact occurred during 11 cases for a case-contact rate of 2.9%. Two of the 11 blood contacts were punctures, for a parenteral exposure rate of 0.5%; the remaining nine were cutaneous exposures on intact skin (2.4%). Table 1 shows the services in which blood contact occurred; general surgery was the most common service, but orthopaedic surgery had the highest proportion of cases with contacts (7/99, 7.1%), and both punctures occurred during orthopaedic cases. All 11 contacts occurred on weekdays and during the 7 am–3 pm shift, and 10 of the 11 were during scheduled cases (data on this variable were missing for the 11th case). There was no significant difference in the mean length of surgery for those cases during which blood contact occurred as compared to those during which contact did not occur, although rounding the length of surgery to the nearest hour may have masked the presence of a difference in length of surgery between the two groups.

Table 2 shows the job classification of those who had blood contacts. Surgeons had over half the contacts (6/11, 54.5%) and experienced both punctures. Table 3 shows the activity performed and the physical location of the blood contact. Of the cutaneous exposures, contact with intact skin occurred most commonly on legs and feet, via protective clothing strikethrough without a specific activity mentioned; spatter and sawing resulted in cutaneous exposure on the face and neck. Both percutaneous exposures occurred on the fingers during injecting or suturing. No patients were exposed to a healthcare worker's blood.

Univariate analyses indicated that orthopaedic surgery was a significant predictor of cutaneous exposure (Fisher's exact test, $P = 0.009$). When a logistic regression

Table 1. Surgical service by whether or not blood contact occurred in 375* ambulatory surgeries, 1992

Surgical service	*Blood contact*		*No blood contact*		*Total*	
	n	*(%)*	n	*(%)*	n	*(%)*
General	1	(9.1)	121	(33.2)	122	(32.5)
Orthopaedic	7	(63.6)	92	(25.3)	99	(26.4)
Gynaecology	1	(9.1)	35	(9.6)	36	(9.6)
Oral maxillofacial	1	(9.1)	23	(6.3)	24	(6.4)
Neurosurgery	0	(0.0)	6	(1.6)	6	(1.6)
Thoracic	0	(0.0)	1	(0.3)	1	(0.3)
Obstetrics	0	(0.0)	1	(0.3)	1	(0.3)
Burn	0	(0.0)	1	(0.3)	1	(0.3)
Other	1	(9.1)	84	(23.1)	85	(22.7)
Total	11	(100.0)	364	(100.0)	375	(100.0‡)

*Data were missing for one case.
‡Percentages do not add up to 100, due to rounding.

Table 2. Job classification by type of blood contact among 11 healthcare workers who had blood contact during 376 ambulatory surgeries, 1992

Job classification	*Parenteral exposures: punctures*		*Cutaneous exposures: intact skin number*		*Total contact*	
	n	*(%)*	n	*(%)*	n	*(%)*
Surgeon	2	(100.0)	4	(44.4)	6	(54.5)
Scrub assistant	0	(0.0)	3	(33.3)	3	(27.3)
Circulator	0	(0.0)	2	(22.2)	2	(18.2)
Total	2	(100.0)	9	(100.0)	11	(100.0)

Table 3. Activity at time by location of blood contact among 11 healthcare workers who had blood contact during 376 ambulatory surgeries, 1992

Activity at time of contact	*Fingers, hands*		*Face, neck*		*Legs, feet*		*Total*	
	n	*(%)*	n	*(%)*	n	*(%)*	n	*(%)*
Parenteral: punctures								
Suturing and injecting	2	(40.0%)	0	(0.0%)	0	(0.0%)	2	(18.2%)
Cutaneous intact skin								
Protective clothing strikethrough (no specific activity)	0	(0.0%)	0	(0.0%)	3	(75.0%)	3	(27.3%)
Manipulating IVs	1	(20.0%)	0	(0.0%)	0	(0.0%)	1	(9.1%)
Sawing	0	(0.0%)	1	(50.0%)	9	(0.0%)	1	(9.1%)
Incising	0	(0.0%)	0	(0.0%)	1	(25.0%)	1	(9.1%)
Surprise splatter of blood (no specific activity)	0	(0.0%)	1	(50.0%)	0	(0.0%)	1	(9.1%)
Unknown	2	(40.0%)	0	(0.0%)	0	(0.0%)	2	(18.2%)
Total	5	(100.0%)	2	(100.0%)	4	(100.0%)	11	(100.0%)

was done to examine the influence of orthopaedic service on blood contacts, while controlling for other descriptors of surgery, orthopaedic surgery remained a significant predictor of blood contact (odds ratio 5.9, 95% confidence interval 1.4–24).

Discussion

In this series of 376 ambulatory surgeries in a community hospital, blood contact occurred in 2.9 per 100 cases, and punctures occurred in 5 per 1000 cases. The exposures in these cases were either contact with intact skin or punctures; there were no occurrences of blood contact with nonintact skin or mucous membranes. The orthopaedic service was associated with the highest number of contacts with blood, as well as the two punctures that occurred. Of interest is that contact via protective clothing strikethrough occurred most commonly to legs and feet, rather than to chest and arms; this may indicate an area needing greater protection from run-off.

These rates are lower than those found in studies of inpatient surgery. Predictors of blood exposures in those studies included characteristics that may distinguish inpatient from ambulatory surgery.

1. *Thoracic procedures*[4] have been identified as high-risk, but only one of 376 outpatient surgeries in this study was from that service and none were vascular procedures. Thoracic surgery performed in the ambula-

tory surgery setting is less serious and less bloody than inpatient thoracic cases. By contrast, orthopaedic surgery was found to be a predictor in this study. Many orthopaedic surgeries may be safely performed in an ambulatory setting, and these procedures may be the most bloody cases, and important to examine for preventive strategies.

2. *Length of surgery*, also a predictor of exposure in the inpatient setting, averaged less than one hour and was not important in predicting blood contact. Again, the nature of outpatient surgery may select for shorter cases. Alternatively, length may be a predictor in this setting as well, but a larger cohort of cases and a more precise measure of length of surgery may be needed to detect a relationship between length and exposure.

3. *Job class* has also been associated with exposure. Tokars and his colleagues found that 89% of injuries were sustained by resident or attending surgeons[8]. In this study, the 11 blood contacts were split more evenly between surgeons (54.5%) and nursing personnel (45.5%); both punctures, however, were experienced by surgeons.

Limitations to this study include the small number of cases studied; a larger study is planned, which will give enough power to detect predictors of this relatively rare event. This study provides evidence, however, that contact with blood, both cutaneous exposures on unprotected skin or via soaked protective clothing and percutaneous exposures do occur in ambulatory surgery. Although no exposures to mucous membranes or nonintact skin occurred, the contacts with intact skin and the activities during the contacts indicate that these exposures could occur as well. Preventive strategies should not only be directed against injuries, but also should include prevention of contact with unprotected skin and protective clothing strikethrough.

Acknowledgements

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Ambulatory transurethral resection of the prostate

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Despite the plethora of new treatment modalities for patients with benign prostatic hyperplasia, conventional transurethral resection of the prostate remains the most effective procedure in terms of patient satisfaction and urodynamic improvement. Traditional nursing and surgical techniques have dictated that it requires an inpatient hospital stay. This pilot study looks at the feasibility of performing the operation as a day-case procedure on a group of selected patients.

Key words: Prostate, transurethral resection, benign prostatic hyperplasia

Introduction

The hospital inpatient stay for patients undergoing transurethral resection of prostate (TURP) has fallen from a mean of 14 days in 1975 to a mean of about 6 days more recently[1]. Any further reduction in this inpatient stay is conventionally limited by the need for a period of postoperative bladder catheterization and irrigation to wash out bleeding from the prostatic bed. However, some recent reports[2] have suggested that bladder irrigation is unnecessary and certain urological centres now routinely perform TURP in this way. It should therefore be possible, using modern anaesthetic techniques, to perform TURP on certain selected patients as a day-case procedure. We conducted this pilot study on such a group of selected patients and performed TURP without an overnight stay.

Patients and method

Patients

A total of 18 men who fulfilled a number of selection requirements were included in the study. The usual parameters of symptoms (assessed using the AUA score, urinary flow rate and bladder residual volume on ultrasound) were used to select patients for surgical treatment. The patients were also selected according to age (mean 64 yr, range 57–72 yr), their medical fitness for day-case anaesthesia (ASA grade I–II) and prostatic size (with an estimated 40 g of tissue or less as determined by digital rectal examination). Other essential inclusion criteria included proximity of home to hospital (within half an hour's journey), the presence of partner/carer to escort them home and stay with them for at least 24 h, and access to a telephone. A community urological nurse saw the patient prior to surgery and the same nurse was available for the first 24 h after surgery for telephone advice and a home visit on the first postoperative morning. All patients provided informed consent to take part in this study.

Method

The selected patients were operated on at the beginning of a morning operating list in the Day Surgery Centre. No premedication was administered. After establishing an intravenous infusion, anaesthesia was induced with midazolam/thiopentone, and maintained with nitrous oxide, oxygen and ethrane. Respiration was spontaneous using a face mask and pharyngeal airway or a laryngeal mask airway. Analgesia was provided with a caudal block, using 20 ml 0.0175% bupivacaine, thereby avoiding any motor block and consequent weakness of the legs. During the course of the operation and early postoperative period, 2 l of crystalloid were infused with a view to inducing a diuresis. A standard TURP was performed by one of two surgeons and postoperatively the bladder was irrigated through a 3-channel urethral catheter until the irrigant cleared or for up to 6 h. With the irrigation stopped, the catheter remained in situ and the patient was encouraged to drink. The patient left the hospital that afternoon and, after review at home by the community nurse, was next seen as an outpatient on the third postoperative day when the urethral catheter was

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removed. Suitable analgesics and a course of antibiotics were provided during this period. On further review at 8 weeks the patient was asked to fill in a questionnaire about his experience and feelings of the operation performed in this way.

Results

All 18 patients who were selected for the study underwent surgery and attended follow-up as arranged. Anaesthesia and surgery were performed without complication in all patients. The mean resection weight of the glands was 19.4 g (range 6–46 g); histology revealed invasive adenocarcinoma in one gland and foci of adenocarcinoma in a further three specimens. A total of 16 of the 18 patients went home that evening as planned while the remaining two were admitted because of bleeding and the need for prolonged bladder irrigation. A further two patients were admitted later that night or the following morning because of clot retention in one case and an inability to look after the catheter in another. This meant that four of the 18 required some form of inpatient care.

All the ambulatory patients attended clinic on the third postoperative day and had the catheter removed uneventfully. Subsequent visits revealed improvements in urinary symptoms as are achieved after conventional inpatient surgery.

Discussion

Simple demographic studies indicate that the population of men over the age of 65 (and thus susceptible to the development of symptomatic benign prostatic hypertrophy) is increasing rapidly in both North America and Europe. This, combined with spiralling health costs, has led to an extensive search for a more economical means of treating patients with this condition[3]. Pharmacotherapy, balloon dilatation, cryotherapy, prostatic stents and microwave thermotherapy have all been evaluated but none to date can match the efficacy of TURP in terms of urodynamic improvement or relief of symptoms[4]. Although some of these therapies have a continuing role to play in the management of these patients, there is a high overall failure rate with a significant proportion of patients subsequently requiring TURP. It would thus appear that the most cost-effective treatment for the majority of patients with demonstrable bladder outflow obstruction is still transurethral surgery. In an attempt to contain the costs of this conventional surgery, efforts have been made to prevent sepsis and other medical complications which extend the hospital stay, though this remains on average well over 6 days[5]. Any further significant reduction in cost would therefore require a reduction in the period of stay in hospital.

In 1934 the average hospital stay for TURP was 16 days[6], which although being better than the average for open prostatectomy of 30 days would be unthinkable today. Changing medical practice and attitudes have been responsible for the gradual reduction since then but it has been argued that any further reduction would not be practicable[7]. This is undoubtedly true for the majority of patients who, due to their age and comorbid conditions, require more prolonged postoperative observation and recovery. There is recent evidence to suggest, however, that the greatest increase in surgery for benign prostatic hyperplasia is occurring in the younger age group (50–59 yr)[8]. The result of this pilot study suggests that these patients are capable, for medical and social reasons, of undergoing this type of surgery on an ambulatory basis. The patients were selected on a number of criteria: medical fitness, social circumstances and prostate size and added to these a clear understanding by the patient of the operation is almost mandatory. This selection process will actually remove a large proportion of patients who require prostatic surgery from being considered for ambulatory surgery.

In this study, four of 18 patients required admission on the night of surgery or the following morning. These were for problems with bleeding or the catheter itself; though all four of these had prostatic resection weights well over the mean of 19.4 g, one of them had a malignant gland and one of the patients was unable to get home because his wife was unable to drive in the dark due to poor vision. The study made use of a community-based nurse who provided both a home visit on the morning after surgery and a telephone contact service on the day of the procedure. We believe that this provided important reassurance to the patient and prevented unnecessary calls to local family doctors during the night. Before surgery, local doctors had been informed of both the study and the individual patients participating.

All the patients were asked at a subsequent outpatient visit to complete a questionnaire about the overall experience of ambulatory TURP. The majority of patients admitted that they had had considerable anxiety about undergoing the surgery without a hospital stay, but in retrospect they said it was easier than expected and they had appreciated recovering in their own home.

Although this study is limited by the relatively small number of patients, it suggests that ambulatory TURP is an option worthy of further consideration. Its success or otherwise would appear to be related to several factors: (a) very careful patient selection, (b) the provision of a community nurse to provide help and reassurance once the patient is out of hospital, and (c) acceptance that overnight admission will be necessary in a proportion of patients. As the pressure increases to improve healthcare efficiency, reductions in inpatient stay continue to be sought. As long as patient safety is not compromised in any way, patients also appear to appreciate this goal and the results of this study suggest that ambulatory TURP is worthy of further trials.

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Epidural anaesthesia in ambulatory surgery

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There is a growing demand for the performance of more surgical procedures on a day care basis. Regional anaesthetic techniques allow early and painless return of function after surgery. In 1991 and 1992 we used epidural anaesthesia for day care surgery in 180 patients and we reviewed the merits and problems involved with this regional technique.

Key words: Regional anaesthesia, epidural anaesthesia, outpatient anaesthesia complications

Patients and methods

Epidural anaesthesia was administered to 180 day care patients who had surgery below the umbilicus (Table 1). There were 136 males and 44 females. The average age of the patients was 39 SD 14 yr (range 15–75 yr), their mean weight was 73 SD 11 kg and their mean height was 1.69 SD 8.9 m. Most of them were graded as ASA I (n = 75 (41%)) and ASA II (n = 101 (56%)), only three patients were graded as ASA III (1%).

The skin and subcutaneous tissue were infiltrated, in all cases, with anaesthetic solution before the epidural space was located by the loss of resistance technique.

The anaesthetist who performed the block chose the local anaesthetic, the dose, and whether to use a single or continuous shot technique. The drugs used were mepivacaine 2% or lidocaine 2% in all cases. The patients received intravenous fluids, vasopressors such as ephedrine and sedatives during the course of the operation, according to the advice of the anaesthetist in charge. All the epidurals were performed by regular anaesthetic staff.

When the operation was finished they remained in the phase I recovery room until they regained full motor and sensory function in their legs and the perianal sensation had returned.

They then stayed in the phase II recovery room and when they tolerated oral fluids, demonstrated the ability to micturate and fulfilled the rest of the Kortilla criteria they were discharged from the unit.

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Table 1. Types of operation performed under epidural anaesthesia in day care unit (n = 180)

	n	%
Inguinal herniorraphy	96	54
Other surgical procedures: fistulectomy, umbilical herniorraphy, pylonidal cyst excision, haemorrhoidectomy	44	25
Arthroscopy	27	15
Other orthopaedic procedures: Hallux valgus correction, metatarsal osteotomies, removal of intramedullary nails, ganglion removal, synovial cyst excision	12	7

Once the patient was at home he/she received two telephone calls in the first 24 and 48 h and was visited by a nurse from the ambulatory surgery unit the day after the operation. On the other hand, all the patients could contact the hospital in case of any unusual difficulties by a telephone line open 24 h a day. Provision was made for the admission of any patient unfit to be discharged.

In order to prevent postoperative pain the patients undergoing inguinal herniorraphy and arthroscopy received a local injection of 10–20 ml 0.25% bupivacaine before the closure of the wound. Apart from that, all the patients received 50 mg of diclofenac parenteral after surgery. During the first 48 h at home they received daily 150 mg of diclofenac + 300 mg of ranitidine + 5 mg of diazepam, or in the case of peptic ulcer disease or hiatus hernia they received daily 120 mg of dihydrocodeinone tartrate + 300 mg of ranitidine + 5 mg of diazepam + 15 g of paracetamol.

Results

The mean duration of surgical procedures was 49 SD 29 min (range 5–190 min), the mean duration of the epi-

Table 2. Differences in time to discharge depending on the premedication and the type of local anaesthetic used

	n	*Time to discharge* (SD) *min*
Non-premedicated	55	289.9 (66.7)
Premedicated	104	275.6 (61.2)
Lidocaine	22	274.8 (46.1)
Mepivacaine	78	272.2 (67.2)

dural block (the time from the performance of the epidrual block until the patient could micturate) was 199 SD 59 min, the mean time from the end of the operation until discharge was 203 SD 62 min and the mean time from the onset of the anaesthesia until discharge was 280 SD 63 min. There was no statistical difference in time to discharge home between patients premedicated with benzodiazepines and patients who received no premedication. Likewise, time to discharge home was not affected by the type of the local anaesthetic agent (mepivacaine or lidocaine) used (Table 2).

The most common complication was bradycardia which was present in eight patients (4.4%), four patients (2.2%) had hypotension, two (1.1%) had nausea, one (0.5%) had urinary retention and required catheterization but afterwards could micturate and was discharged on the same day.

The reasons for immediate hospital admission were pain in the operated zone in seven patients (five of them underwent anal surgery), dural puncture in two patients who did not have headache in the next 48 h and more extensive surgery in two cases.

Six patients were admitted after their discharge: two for fever produced by viral infection and by tracheobronchitis; one for thrombophlebitis; one for necrotizing fasciitis and one for postspinal headache that was treated successfully with extravascular fluids, rest and mild analgesics.

Discussion

The ideal outpatient anaesthetic technique should be easy to administer, readily reversible and provide the essential features of rapid outpatient recovery, namely alertness, ambulation, analgesia and alimentation with minimal complications. Iatrogenic side effects, such as nausea and vomiting and pain, however, may hamper patient recovery and delay discharge[1]. Somnolence, pain and nausea, which are considered minor side effects in inpatients are therefore important complications for the outpatient.

Epidurals have been administered in day care units[2] and in pain clinics on an outpatient basis with satisfactory results. The low incidence of accidental dural puncture during an epidural block makes this technique ideal for ambulatory surgery, in contrast to the intradural technique which is limited in use because of the high incidence of postspinal headache, even with a 25-gauge needle in young people[3,4].

Alertness is a major advantage of the epidural technique[3]. It not only facilitates discharge but is also useful intraoperatively, where the minimally sedated patient can often participate in viewing the actual findings of arthroscopy and save the surgeon considerable time in explanations during the postoperative visit. Patient participation can also reduce the potential for misunderstanding or dissatisfaction.

Epidural block can also improve postoperative alimentation because of a lower rate of nausea and vomiting in comparison with inhalation anaesthesia and narcotic techniques[5].

The main drawback with epidural anaesthesia in the day care unit appears to be the additional time required to perform it, but with adequate planning and facilities for separate induction areas, the time spent is not greater than it would be to induce and recover a patient after general anaesthesia. Parnass[6] studied the influence of general anaesthesia vs. epidural in 260 patients undergoing ambulatory knee arthroscopy surgery and found earlier discharge times and a lower incidence of pain in the epidural group, with patient satisfaction being equal in both groups.

Other concerns about epidural anaesthesia are the incidence of postural hypotension and urinary retention which may limit ambulation and discharge. Urinary retention is more likely with the longer-acting local anaesthetics and it is generally not a problem if short-duration blocks are employed[7]. Orthostatic hypotension is also rarely a problem once there is full return of perianal sensation and proprioception in the foot. Sarma[8], in a retrospective study of 683 day care surgical patients who received epidural anaesthesia, found no serious postepidural sequelae and most patients (90%) were discharged within 5 h after the operation.

Early ambulation can be achieved with epidural block, this creates a compromise in the form of absence of postoperative analgesia for some other operations[3]. This can be overcome by the infiltration of a long-acting local anaesthetic by the surgeon during the operation. This is particularly effective in outpatient hernia surgery and arthroscopy surgery and allows the patient to ambulate home with minimal discomfort. Local injection of bupivacaine at the end of the outpatient procedure has not been associated with an increased incidence of wound infection[7].

Conclusion

Epidural anaesthesia was used in 180 outpatients and was found to be a safe and effective technique. No serious postepidural sequelae were noted and most patients (96%) were discharged within 5 h after the operation.

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Announcement

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Ambulatory cataract surgery: the patients' perceptions

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There has been a slower uptake of ambulatory cataract surgery in the UK than the USA. We believe the primary aim of ambulatory cataract surgery is improved patient care. This prospective study assessed the perceptions and individual characteristics of patients undergoing ambulatory cataract surgery. This study demonstrates that 97.7% of patients undergoing ambulatory cataract surgery recommend this procedure as the treatment of choice. We conclude that ambulatory cataract surgery has many benefits, has a high level of patient satisfaction, and is suitable for the majority of patients.

Key words: Ambulatory cataract surgery, day-case cataract surgery

The widespread uptake of ambulatory cataract surgery in the UK has not come to fruition. Presently only 8% of elective cataract extractions are performed on an ambulatory basis. In the USA more than ten times this many ambulatory cataract procedures are performed[1]. Indeed, this was predicted a decade ago when the Commission on the Provision of Surgical Services published its guidelines on day-case surgery, predicting the widespread uptake of day-case intraocular surgery to be unlikely in the near future[2,3].

This prospective study was designed to look at patients' overall perceptions of ambulatory cataract surgery, as well as the factors which might influence their perceptions. In doing so, we may be able to improve the care to our patients, and add weight to the argument that we should be doing more ambulatory cataract surgery[4]. This would be on the basis of our patients' perceptions of ambulatory cataract surgery, rather than purely on the cost benefits of this method of treatment.

Patients and methods

This study took place in the Day Surgery Unit (DSU) at The Birmingham and Midland Eye Hospital. At the time of the study there was no dedicated operating theatre and the adjacent theatre suite was used for ambulatory patients.

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For a 6-month period, 135 consecutive ambulatory cataract surgery patients were enrolled into the study, under the care of seven consultant ophthalmologists. Patients were enrolled on the day of surgery. This was within 1 month of their preoperative assessment clinic, where a full explanation of ambulatory surgery was given and informed consent obtained. Common to all patients was a mandatory first dressing the morning after surgery. Preoperative assessment and first dressings took place in the Day Surgery Unit. The presence of a travelling escort, if patients were not using hospital transport, and someone present at their home on the first night after surgery, were considered prerequisites for selection to the ambulatory cataract surgery programme.

Local anaesthesia and surgery was performed by both consultant and junior doctors, and this forms part of the ongoing surgical training within the hospital. Data collection was centred around the patients' overall perceptions, in addition to factors which might influence these, before, during and after surgery. This was achieved by combining prospective data with that from a postal questionnaire.

Prospective data collection

The following were recorded: time of arrival; distance travelled; method of transport; surgeon; type of anaesthetic; complications pre, per- and postoperatively; number of patients requiring earlier follow up than expected and the reasons for this; final visual acuity and refraction; reasons for aborted ambulatory surgery and previous history of inpatient ophthalmic surgery, and whether this was under local or general anaesthesia.

Table 1. Previous experience of cataract surgery

	First eye	*Second eye*	
	97	Previous LA	4
		Previous GA	28
Total	97		32

LA, Local anaesthesia; GA general anaesthesia.

Table 2. Details of three patients who would not recommend ambulatory cataract surgery

	Patient 1	*Patient 2*	*Patient 3*
Previous inpatient surgery	yes	no	no
Sounds in theatre	yes	no	no
Pain during surgery	yes	yes	no
Understood procedure after preoperative clinic	yes	no	yes
Cost of taxi	no	no	yes

Anonymous postal questionnaire

Data collection was designed to cover the aspects of ambulatory surgery which could influence the patients' perceptions of this mode of treatment. Particular care was given to a covering letter which explained that the questionnaire was anonymous and could in no way influence their future care. The structured questions related to pain, light discomfort during surgery, noise during surgery, and finally whether they would recommend this form of treatment. Each reply was then matched to the corresponding prospective data sheet and rendered anonymous prior to insertion into the database.

Results

In the 6 months 135 consecutive ambulatory cataract patients were studied. Six patients failed to return their questionnaire or were lost to follow up and were excluded, leaving 129 patients; 60 male and 69 female.

The two main groups of patients were those who had experienced previous inpatient surgery, and those for whom this was 'first eye' surgery. Patients who had undergone previous intraocular surgery as inpatients numbered 32; four under local anaesthesia (LA) and 28 under general anaesthesia (GA). Patients in the 'first eye' group numbered 97 (Table 1).

The key question was, would patients recommend ambulatory surgery. From 129 responses, 126 confirmed they would recommend ambulatory cataract surgery. The three patients who would not recommend ambulatory cataract surgery are considered in Table 2. These three patients all gave different reasons, and only one had experienced previous inpatient surgery. All three had uncomplicated surgery, routine follow up and final corrected visual acuity of 6/9 or better.

Table 3. Transport arrangements

Method	*No. of patients*	*%*
Friend or relatives car	75	58
Taxi	18	14
Public transport	16	13
Hospital car	17	13
Ambulance	3	2
Total	129	100

Influential factors

The remainder of the data base provided us with information which could influence overall perceptions, and could also be audited to improve patient care. These factors were: visual acuity; distance from home to the hospital; methods of transport; time of arrival; a good preoperative explanation of what their treatment involved; pain during the procedure and the influence of previous ophthalmic surgery on their overall perceptions of ambulatory cataract surgery.

Transport arrangements covered in Table 3, showed that only 20 patients (15%) required hospital transport: 17 (13%) in the form of a car, and three (2%) an ambulance. Patients were recommended not to use public transport. The remaining 109 patients (85%) made their own way to the hospital with the help of their escorts.

On the day of surgery 122 patients (94.6%) arrived at the designated time. No patients were late for afternoon surgery. Of the seven (5.4%) who arrived late for the morning sessions, six (4.7%) came within 30 min of the scheduled arrival time of 08.00 h, and one (0.8%) arrived at 09.45 h. The distances travelled ranged from 1–22 miles (mean 5.2), and there was no correlation between type of transport or distance travelled, and either late arrival or poor perceptions.

One hundred and twenty-eight patients (99.2%) felt they did understand the treatment following the preoperative assessment clinic and their expectations matched the reality of events on operation day. The one patient who did not understand felt that this, combined with pain at the end of the operation, left her unable to recommend ambulatory cataract surgery.

Final visual acuity of 6/9 or better was achieved in 114 patients (88.4%), with 15 (11.6%) achieving 6/12 or worse. This did not correlate with poor perceptions.

Sounds in the operating theatre disturbed seven patients (5.4%). Surgeons talking disturbed four patients, music one patient, and other people's voices or background noise two patients.

From the total of 129 patients, 128 (99.2%) had local anaesthesia (LA) and one (0.8%) had general anaesthesia (GA) with a laryngeal mask. In the LA group, 94 (73.4%) had peribulbars and 34 (26.6%) had retrobulbars. There were no significant differences in pain during surgery between the peribulbar and retrobulbar groups in this series: mild discomfort was reported by three patients (3.2%) in the peribulbar group, and one (2.9%)

Table 4. Method of anaesthesia employed in ambulatory cataract surgery patients

General anaesthesia		*Local anaesthesia*	
Laryngeal mask	1	Peribulbar	94
		Retrobulbar	34
Total	1		128

in the retrobulbar group. Perioperative sedation was not used (Table 4).

Peroperative complications occurred in three patients (2.5%). Two posterior capsular ruptures with vitreous loss rendered one patient aphakic, the other having primary insertion of an anterior chamber lens (ACL). The aphakic patient subsequently returned for insertion of secondary ACL. The third patient had persistent anterior chamber haemorrhage from underneath the wound and was the only patient to be kept in for overnight observation. All of these patients recommended ambulatory surgery.

Nine patients (7%) were given early outpatient appointments, eight (6.2%) with raised intraocular pressure and one with a wound leak. None of these patients required any further intervention, but one additional patient required surgery for an iris prolapse, diagnosed at the first outpatient visit.

Discussion

Three separate but related issues must be considered before ambulatory cataract surgery becomes more commonly favoured in the UK.

First, comparative studies report no difference in visual outcome or complication rates between inpatients and ambulatory patients[5,6]. We are also unaware of any reports of surgeons reverting from ambulatory cataract surgery back to inpatient surgery[7].

The second issue to be considered is cost. With an ageing population and a lower threshold for surgical intervention, we can expect an increase in the demand for cataract surgery[8]. Some authors have quoted a 60–80% increase in the expected number of cataract extractions over the last two decades of this century[9]. These epidemiological facts, within the framework of the National Health Service, will mean correspondingly increased financial requirements, tied to a more slowly expanding fiscal policy. If the financial benefits of ambulatory surgery are to be realized, it must be supported by greater numbers of medical staff, an adequate infrastructure and new dedicated day surgery units with the necessary capital investment to support all these factors. A more conservative approach, failing to address such factors adequately, will not give sufficient savings over traditional inpatient surgery, and these points are well recognized[3,10]. With proper dedicated facilities for ambulatory surgery savings of 30–50% have been estimated[11].

Third, if we are to get support for ambulatory surgery, we must examine the perceptions of those who have experienced this form of treatment. It would be difficult to raise support for any expansion in ambulatory cataract surgery if our patients regarded it as an interior form of treatment.

This study was aimed at assessing the perceptions of those patients who had been selected for ambulatory surgery. Comparative analysis between the perceptions of inpatients and ambulatory patients is difficult to quantify objectively and was not the aim of this study. Previous work has shown satisfaction to be similar between these two groups[12]. Also included within our series was a subset of 32 patients who were able to make a direct comparison from their own previous experiences of inpatient ophthalmic surgery (see Table 1).

The response rate to the questionnaire was both rapid and impressive (95.6%). The answer to the core response of whether or not they would recommend ambulatory cataract surgery showed overwhelming support for this method of treatment (97.7%). The three patients (2.3%) not recommending ambulatory cataract surgery gave a variety of reasons for not doing so (see Table 2). Patients 1 and 2 were female and patient 3 was male. All had good visual outcomes at 6/9 or better, all had local anaesthesia, and only patient 1 had experienced inpatient surgery under general anaesthesia. Patient 3 had only been concerned about the cost of the transport, and had travelled by taxi to and from the hospital. The other two patients gave more complex reasons for not recommending ambulatory cataract surgery. Patient 1 experienced pain during the procedure and would have preferred a general anaesthetic. She was also disturbed by active teaching during her operation. These points should be borne in mind as it is important what is said during all surgery under local anaesthetic. Clearly it was the type of anaesthetic rather than the ambulatory nature of the procedure that was her main concern. It is important to consider the patients' requirements individually and ambulatory surgery under general anaesthetic is safe and may be preferable in certain patients[13]. Pain was also a factor with patient 2, as was poor understanding after the preoperative assessment clinic. These clinics are prerequisite for patient selection, anaesthetic choice, and the building of patient confidence and expectations of what their treatment, follow up, and outcome will be. Protected time for assessment, explanations and informed consent by senior medical and nursing staff helps with accurate selection, and boosts patient confidence in their chosen mode of treatment.

Our study supported earlier authors findings that age, sex, transport methods and distance travelled did not influence either their late arrival for ambulatory cataract surgery, or their overall perceptions[14]. It is also interesting that final visual acuity did not influence the overall perceptions of patients.

Ambulatory cataract surgery has many advantages including reduced risk of exposure to hospital-borne infections, maintenance of mobility in the elderly, minimal separation from family and friends and decreased interruption from daily routines including special diets and medications[15]. Combining these with the similar complications rates, increased demand overtaking

monetary supply and approval from our patients, as discussed above, we believe ambulatory cataract surgery to be the treatment of choice.

We also believe that the majority of patients are suitable for ambulatory surgery and the patients in our study clearly perceived it as a treatment worth recommending.

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Ambulatory surgery complications and patient fitness

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The effect of patient fitness on perioperative and post-discharge complications has been reviewed in 6565 consecutive day cases. American Society of Anesthesiology (ASA) classification class III patients had a significantly higher incidence of complications (5.98%) than combined ASA I and II patients (2.48%). Most complications were directly related to the surgery performed. The increased incidence of complications in ASA III patients was partly due to increased medically-related complications but also to a disproportionately high incidence of post-discharge surgical complications in patients undergoing lens extraction under local anaesthetic. Too few ASA III patients underwent general anaesthesia in this series to provide a reliable measure of the influence of anaesthesia on medically-related complications in less fit patients.

Key words: Complications, outcome, patient fitness

Introduction

The concept of ambulatory surgery is not new; anaesthetic practice began as an outpatient-based service until Lister's demonstration of antisepsis in the early 1860s prompted the delivery of hospital-based surgery and anaesthesia[1]. However the number of procedures judged suitable for ambulatory surgery has increased dramatically since the 1980s. This increase has been due to improvements in anaesthetic and surgical techniques, willingness by providers to undertake more complex procedures and the fiscal advantages of same-day surgery[2].

Recent studies have shown ambulatory surgery to be both effective and safe for fit patients[3–7]. Less is known about outcome for less fit patients, typically those corresponding to American Society of Anesthesiology (ASA) fitness classification levels III and IV[2] (Table 1). An increasing proportion of elderly and less fit patients together with cost advantages may see more ASA III and IV patients managed as ambulatory patients in the future. Information on outcome for such patients is needed to refine guidelines for the selection and management of patients with pre-existing medical conditions. Presently such information is limited. Although outcome, measured as incidence of major complications in a 2-week interval from the procedure, has been shown to be not significantly worse for ASA III patients than for fitter patients[4], the range of different anaesthetic techniques used in the patient groups were not identified. Previous studies measuring outcome by unanticipated hospital admission on the day of surgery have shown that the admission rate may be higher for less fit patients[8]. Other work has suggested that unanticipated admissions may be more affected by age than ASA status and that such admissions were more likely to be related to the type of anaesthesia or surgical procedure than patient fitness[5]. A recent multi-centre study[7], mostly restricted to general anaesthesia, found reduced patient fitness was associated with an increased risk of some adverse perioperative events. However that study did not include unanticipated hospital admissions and the data on post-discharge complications was incomplete.

In this study we have sought information on the effect of patient fitness on perioperative and post-discharge

Table 1. ASA Classification

ASA I	Normal healthy patient
ASA II	Patient with mild systemic disease
ASA III	Patient with significant systemic disease that does not pose a constant threat to life
ASA IV	Patient with significant systemic disease that does pose a constant threat to life
ASA V	Moribund patient not expected to survive with or without surgery

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complications, in the first 6565 cases in the Day Surgery Unit at the Royal Adelaide Hospital, during the period between May 1989 and March 1993.

Methods

The Day Surgery Unit at the Royal Adelaide Hospital is an architecturally integrated but functionally separate unit associated with a major adult teaching hospital. All patients were assessed prior to the day of surgery by an assessment team of anaesthetists and trained assessment nurses who streamlined this process by the use of a patient questionnaire[9,10]. Patient ASA status was assessed and recorded preoperatively by an anaesthetist. Other perioperative data for patients, procedures, anaesthesia and complications was recorded prospectively and entered into a computerized database for analysis.

Complications were defined in accordance with the Federated Ambulatory Surgery Association (FASA) definition[3] for major complications as 'untoward events associated with the ambulatory surgical experience, with the potential for serious harm'. Perioperative complications included all unanticipated admissions on the day of surgery as well as some anaesthetic complications that did not result in admission. Post-discharge complications were limited to complications that were associated with the ambulatory procedure, that required hospital readmission within an interval of 14 days after discharge. These were identified by searching the hospital mainframe computer database for details of all patients who presented to the hospital within 14 days of discharge after ambulatory surgery.

Statistical analysis

Comparison of the incidence of complications in different patient categories was carried out with χ^2 analysis.

Results

Patients and procedures

The nature of the surgical caseload is illustrated in Figure 1. ASA status was not available in 82 cases; of the remaining 6483, 4149 (64.0%) were ASA I, 1809 (27.9%) were ASA II, 509 (7.9%) were ASA III and 16 (0.2%) were ASA IV. Figure 2 shows the distribution of patients according to ASA class and how the age profile of patients changes with ASA classification; the average age increasing with decreasing patient fitness. General anaesthesia was the most frequently used anaesthetic technique (60.1% of all cases), followed by local anaesthesia with intravenous sedation (25.2%), local anaesthesia without sedation (11.6%) and regional anaesthesia (3.1%). The frequency of use of different anaesthetic techniques in different ASA groups is shown in Figure 3, which also shows how the use of general anaesthesia declined with decreasing patient fitness.

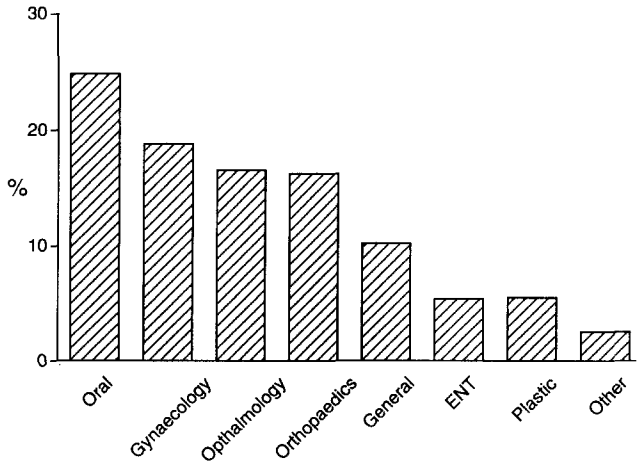

Figure 1. Surgical caseload.

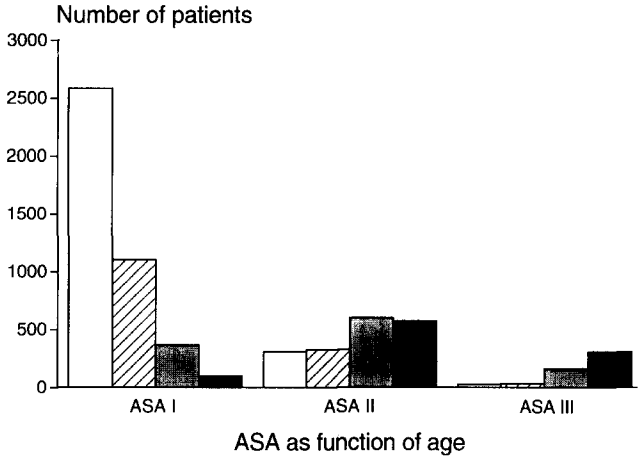

Figure 2. ASA distribution with patient age profile. □ 0–29; ▩ 30–49; ▨ 50–69; ■ 70+.

Unanticipated hospital admissions

The overall rate of unanticipated hospital admissions on the day of surgery was 1.50%. The admission rate for combined ASA I and II patients (1.40%) was less than that for ASA III patients (2.20%), but the difference was not statistically significant. There were no admissions on the day of surgery in the 16 ASA IV patients.

Complications

ASA I, II and III patients

There were 178 (2.75%) complications in the 6467 patients in ASA classes I, II and III in the combined perioperative and post-discharge periods, up to postoperative day 14. There were no patient deaths or serious morbidity. The majority of complications were directly related to surgery (surgically-related) (2.20%), with complications related to pre-existing medical conditions (medically-related) the next most common (0.29%)

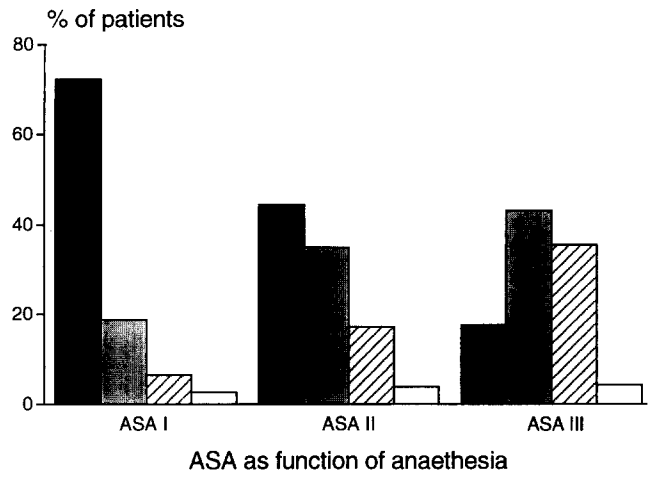

Figure 3. Use of different anaesthetic techniques in ASA groups. ■ General anaesthesia; ▨ local anaesthesia with intravenous sedation; ▩ local anaesthesia; □ regional anaesthesia.

(Table 2). The incidence of all complications was significantly less in combined ASA I and II patients (2.48%) than in ASA III patients (5.89%) and the incidence of surgically (2.04%) and medically-related (0.20%) complications in ASA I and II patients were both significantly less than in ASA III patients (3.93% and 1.38% respectively) (Table 3). The numbers of anaesthetic-related and socially-related complications were too small for any useful comparison between fit and less fit patients.

The incidence of both surgically-related and medically-related complications in fitter and less fit patients are shown separately for the perioperative and post-discharge periods in Tables 4 and 5 respectively. In the perioperative period, there was no significant difference in the incidence of surgically-treated complications between combined ASA I and II (1.02%) and ASA III patients (1.18%), but the incidence of medically-related complications in ASA I and II patients (0.10%) was significantly less than in ASA III patients (0.59%). However, for post-discharge complications, the incidence of surgically-related complications (1.02%) was significantly lower in ASA I and II patients than in ASA III patients (2.75%), as also was the case with medically-related complications (0.10% and 0.79% respectively).

Table 6 contains details of all surgically-related post-discharge complications. A major proportion of these occurred after ophthalmic surgery, most commonly lens extraction under local anaesthesia. About one third of these ophthalmic complications involved ASA III patients.

There were 11 (0.61%) medically-related complications in the ASA II group. This incidence was less than for ASA III patients (1.38%) but the difference was not statistically significant.

One patient, assigned ASA I, presented postoperatively with symptoms consistent with myocardial ischaemia.

ASA IV patients

There were 16 patients in this group. One patient died from an exacerbation of chronic respiratory disease several days after a flexor retinaculotomy performed under local anaesthesia. There were no other perioperative or post-discharge complications in this group. Details of patients, procedures and anaesthetic techniques used for these cases are included in Table 7. The small number of patients in this group precluded any further analysis.

Discussion

In this review of ambulatory surgery outcome we sought the effect of patient fitness on the incidence of complications from the time of surgery up until the 14th post-operative day. Most complications (80%) were direct complications of the surgery performed. Patient fitness should have no direct influence on surgically-related complications. In this study the higher incidence of these complications in ASA III patients compared to combined ASA I and II patients was largely due to a disproportionate number of post-discharge surgically-related complications in ASA III patients undergoing eye surgery.

The effect of patient fitness should be most obvious in the less frequent medically-related complications. There was a significant increase in the incidence of these complications in the less fit ASA III patients compared to combined ASA I and II patients. This difference appeared to be consistently maintained for both perioperative and post-discharge complications, although when separated into these groups, the numbers of complications were not large enough to allow for completely reliable statistical comparison.

It could be argued that the comparison of medically-related complications between the combined ASA I and II groups and the ASA III group is misleading since ASA I patients should have, by definition, no pre-existing medical problems, and the grouping of ASA I and II patients therefore reduces the incidence of these complications below that expected for ASA II patients alone. We have used the combined ASA I and II groups because this represents the patient population commonly chosen as suitable for ambulatory surgery. The incidences of medically-related complications in the combined ASA I and II and the ASA III groups therefore may have some predictive value for complication rates anticipated as less fit patients are added to a typical ambulatory surgery patient case load. In this study, the incidence of medically-related complications in ASA II patients (0.61%) was approximately half that for ASA III patients (1.38%). Although this difference was not statistically significant, the observed incidences may be reasonable estimates of those expected if larger patient numbers were reviewed.

The incidence of medically-related complications however should also depend on the anaesthetic type and is likely to be highest in patients undergoing general anaes-

Table 2. Complications for all (ASA I, II and III patients) in combined perioperative and post-discharge periods

	*GA** n = *3887*	*LA/SED†* n = *1630*	*LA‡* n = *750*	*REGL§* n = *200*	*No.*	*Incidence %*
Surgery related	75	44	21	2	142	2.20
Medically related	9	4	4	1	19	0.29
Anaesthesia related	9	0	1	0	10	0.15
Socially related	3	2	1	1	1	0.11
Total					178	2.75

*GA, General anaesthesia; †LA/SED, local anaesthesia with intravenous sedation; ‡LA, local anaesthesia without sedation; §REGL, regional anaesthesia.

Table 3. Complications in the combined perioperative and post-discharge periods for ASA I and II patients, compared to those for ASA III patients

ASA I and II (n = *5958)*	*GA* n = *3756*	*LA/SED* n = *1497*	*LA* n = *532*	*REGL* n = *173*	*No.*	*Incidence %*
Surgery related	73	37	10	2	122	2.04*
Medically related	6	2	3	1	12	0.20
Anaesthesia related	9	0	0	0	9	0.15
Socially related	3	2	0	0	5	0.08*
Total					148	2.48*
ASA III (n = 509)	*GA* n = *131*	*LA/SED* n = *133*	*LA* n = *218*	*REGL* n = *27*	*No.*	*Incidence %*
Surgery related	2	7	11	0	20	3.93*
Medically related	3	2	1	1	7	1.38*
Anaesthesia related	0	0	1	0	1	0.20
Socially related	0	0	1	1	2	0.39*
Total					30	5.89*

*Difference significant ($P<0.05$).
Abbreviations as in Table 2.

Table 4. Perioperative complications for ASA I and II patients compared to those for ASA III patients

ASA I and II (n = 5958)	*GA* n = *3756*	*LA/SEDN* n = *1497*	*LA* n = *532*	*REGL* n = *173*	*No.*	*Incidence %*
Surgery related	44	14	3	0	61	1.02
Medically related	3	1	1	1	6	0.10*
Anaesthesia related	8	0	0	0	8	0.13
Socially related	3	2	0	0	5	0.08*
Total					80	1.34
ASA III (n = 509)	*GA* n = *131*	*LA/SEDN* n = *133*	*LA* n = *218*	*REGL* n = *27*	*No.*	*Incidence %*
Surgery related	0	3	3	0	6	1.18
Medically related	2	1	0	0	3	0.59*
Anaesthesia related	0	0	0	0	0	–
Socially related	0	0	1	1	2	0.39*
Total					11	2.16

*Difference significant ($P<0.05$).
Abbreviations as in Table 2.

thesia. Information on medically-related post-discharge complications should be of particular use in establishing guidelines for the selection and management of less fit patients undergoing general anaesthesia. The number of ASA III patients who received general anaesthesia in this series was too small to allow any useful comparison in outcome between fit and less fit patients.

In conclusion, most complications observed were directly related to the surgery performed with the second most frequent complications related to pre-existing

Table 5. Post-discharge complications for ASA I and II patients compared to those for ASA III patients

ASA I and II (n = 5958)	*GA n = 3756*	*LA/SEDN n = 1497*	*LA n = 532*	*REGL n = 173*	*No.*	*Incidence %*
Surgery related	29	23	7	2	61	1.02*
Medically related	3	1	2	0	6	0.10*
Anaesthesia related	1	0	0	0	1	0.02
Socially related	0	0	0	0	0	–
Total					68	1.14*
ASA III (n = 509)	*GA n = 131*	*LA/SEDN n = 133*	*LA n = 218*	*REGL n = 27*	*No.*	*Incidence %*
Surgery related	2	4	8	0	14	2.75*
Medically related	1	1	1	1	4	0.79*
Anaesthesia related	0	0	1	0	1	0.20
Socially related	0	0	0	0	0	–
Total					19	3.73*

*Difference significant ($P<0.05$).
Abbreviations as in Table 2.

Table 6. Details of post-discharge surgically-related complications

	n	*ASA I/II*	*ASA III*
Oral surgery	9	9	0
Ophthalmic	35*	23	12
Gynaecology	13	13	0
Orthopaedics	9	9	0
Plastic surgery	4	3	1
General surgery	4	3	1
Otolaryngology	1	1	0
Total	75	61	14

*32 of these procedures were carried out under local anaesthesia and three under general anaesthesia.

Table 7 Details of ASA IV patients

Procedure	*Anaesthetic Type*		
	GA	*LA/SEDN*	*LA*
Lens extraction and implant		3	3
Removal of skin lesion		2	2
Ectropion repair		2	
Excision of breast lesion			1
Oesophagoscopy and dilatation	1		
Carpal tunnel repair			1
Infusaport insertion	1		

medical conditions. Although the overall rate of these medically-related complications was only 0.29%, there was a significant increase in ASA III patients (1.38%) compared to those in the combined ASA I and II group (0.20%). This increase appeared to be evenly divided between complications in the perioperative period and the post-discharge interval to the 14th postoperative day. The incidence of these medically-related complications should depend on the type of anaesthesia used, but in this study there were too few ASA III patients who underwent general anaesthesia to allow a comprehensive study of complications in this relevant patient group. Multi-centre studies could provide adequate ASA III patient numbers to measure the impact of anaesthesia on medically-related complications.

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Letter to the Editors

Recovery after laparoscopic day surgery

We read with interest the recent article regarding unplanned admissions following day surgery (*Ambulatory Surgery* 1994; **2**: 43–8). In our unit we are performing day-case laparoscopic cholecystectomy, laparoscopic inguinal hernia repair, and diagnostic and staging laparoscopy. We too found that nausea, drowsiness, anxiety, coexisting medical problems and the lack of a carer at home were the most common reasons for patients being admitted for overnight stay.

We have avoided some unnecessary admissions by pursuing the following principles.

1. All patients are called to a preadmission clinic where their suitability for day surgery is assessed. Age above 60 yr, lack of a carer at home, and the presence of concomitant medical illness leading to an ASA grading of more than II were considered contraindications for day-case laparoscopic surgery.
2. Laparoscopic procedures are new and patients' perceptions of what is involved vary widely. Psychological preparation and satisfactory preoperative counselling is important. This is done during the preadmission clinic where the details of stay and operation are explained to them. They get to see the ward and meet the doctors and nursing staff who will look after them when they come in. This reduces their anxiety about the procedure. Premedication can then be avoided.
3. For induction and maintenance of anaesthesia, all patients receive propofol, which speeds up recovery and has a lower incidence of nausea and vomiting[1].
4. In addition, all patients receive prophylactic antiemetics during and after the operation.
5. Prior to the surgical incision, all patients receive preemptive analgesia[2] in the form of per-rectal diclofenac and local infiltration of bupivacaine with adrenaline.
6. Shortly after their return to the ward, the patient is seen by one of the doctors and informed about the success of the operation. The patient is encouraged to drink fluids, walk to the toilet to pass water, etc. This visit by the doctor reassures the patient and ward nursing staff.
7. In the evening, the patient is seen by the surgeon who did the operation, and suitability for discharge is assessed. Decisions taken by the operating surgeon/consultant are more readily accepted by the patient and lessen the anxiety associated with 'early' discharge.

Following the above principles has minimized the postoperative admission rate after day-case laparoscopic procedures and the very few cases which do require admission are due to surgery-related problems.

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