

Review article

Anaesthetic considerations for paediatric ambulatory surgery

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Abstract

Successful anaesthetic management of children undergoing ambulatory surgery requires that the anaesthesiologist be actively involved in all aspects of management. Guidelines should be established in consultation with the surgeons, nurses, and administrators to ensure proper selection and preoperative preparation of patients. The psychological evaluation and preparation of the child, and the use of pharmacologic premedication when indicated, will ensure a pleasant experience for all involved. The anaesthesiologist should choose a specific anaesthetic agent and a technique that is appropriate for each individual child. Early ambulation and discharge are very desirable in ambulatory patients. Long-acting drugs and techniques that are associated with excessive drowsiness or nausea and vomiting should not be used. Special attention must be paid to the analgesic requirements of the child. Regional blocks should be used whenever possible to supplement general anaesthesia and to limit the need for narcotics during recovery. Postoperative vomiting should be anticipated and managed appropriately. Specific criteria for discharge ensure the safety and protection of the child and staff. © 1997 Elsevier Science B.V.

Keywords: Ambulatory surgery; Paediatrics; Individual requirements; Early ambulation and discharge

1. Introduction

Children are excellent candidates for ambulatory (out-patient or day) surgery. The typical paediatric surgical patient is generally healthy and has no serious systemic disorders. Furthermore, most surgical procedures in children are simple and require less complicated techniques than those used in adults. Paediatric ambulatory patients also benefit from the minimization of parental separation and the reduction of exposure to hospital-acquired infections.

2. Patient selection criteria

A successful ambulatory surgery program requires that well-defined patient selection criteria be established and strictly adhered to by all surgeons who have admitting privileges in the facility. The three primary factors that must be considered when selecting a child for ambulatory surgery are the condition of the patient; the attitude of the parents; and the type of surgical procedure to be performed. These factors must be balanced with the capability of the surgical facility and the ability of its staff to deal with any expected or unexpected complications.

2.1. The patient

The child should be in good health; if not, any systemic disease must be under good control. Some anaesthesiologists and surgeons still restrict ambulatory

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surgery to patients classified as ASA physical status 1 and 2, while others accept ASA physical status 3 or even 4 patients, provided that their medical condition is well controlled.

Many children with chronic diseases are appropriate candidates for ambulatory surgery as long as their diseases are under control. Physically handicapped, psychologically disturbed, or mentally retarded children are especially comforted by continued presence of a parent or guardian that is usually fostered in ambulatory surgical facilities.

The premature infant, however, is not a suitable candidate for ambulatory surgery because of potential immaturity of respiratory center, temperature control, and gag reflexes. Recent studies have reported a high incidence of perioperative complications such as apnea in these infants.

The age at which the premature infant attains physiologic maturity and no longer presents an increased risk for postoperative apnea must be considered individually. Criteria on which these decisions are based include growth and development, persistent problems during feeding, time to recovery from upper respiratory infections, history of apnea, and presence or absence of anaemia, metabolic, endocrine, neurologic, or cardiac disorders.

It is generally considered that infants younger than 46 weeks' postconceptual age (PCA, which is the sum of gestational and post-natal ages) and/or preoperative history of apnea or anaemia are at greatest risk, although some authors have reported apnea in infants as old as 60 weeks' PCA. Children with lower gestational age are more susceptible to apnea. As the child matures, the tendency toward apnea greatly diminishes; however, the age when all infants may be safely anesthetized on an ambulatory basis is unknown. Until more extensive, prospective studies are carried out, it seems prudent to have a high index of suspicion. Many anaesthesiologists admit to the hospital all ex-premature infants who are younger than 50 weeks' post-conceptual age so that they may be monitored postoperatively for apnea, bradycardia, and oxygen desaturation. The choice of this particular age is rather arbitrary. It is best to individualize this decision and, when in doubt, to err on the conservative side. If the infant has bronchopulmonary dysplasia (BPD), anaemia or other neonatal problems, this period may need to be extended. Should any questions arise, in-patient care and postoperative monitoring are recommended. Infants with apnea in the recovery room should also be admitted and monitored [1].

2.2. The child with a runny nose

A child who presents with a runny nose may have a completely benign, non-infectious condition (e.g. sea-

sonal or vasomotor rhinitis), in which case elective surgery may safely be performed. On the other hand, the runny nose may be a prodrome to, or actually be, an infectious process, in which case elective surgery may need to be postponed. Since an estimated 20–30% of all children have a runny nose a significant part of the year, every child with a runny nose must be evaluated on an individual basis.

The pre-anaesthetic assessment of these patients consists of a complete history, a physical examination, and an interpretation of certain laboratory data. Early in the clinical course of disease, the history will be the most important factor in the differential diagnosis. Specifically, allergic problems should be actively sought. Parents can usually tell whether their child's runny nose is 'the usual runny nose' or something different that may require cancellation of elective surgery. The physical examination is not always conclusive; normal findings may be present during the early part of an infectious process. Chronic allergic rhinitis, on the other hand, may be associated with local infections within the nasopharynx resulting in purulent nasal discharge. A white blood cell count $\geq 12\,000$ – $15\,000$ with a shift to the left suggests an infectious process.

If surgery is postponed because of simple nasopharyngitis, it can be usually scheduled in 1–2 weeks. If a flu-like syndrome that involves both upper and lower respiratory tract is present, surgery should be postponed until at least a month after the child has recovered.

2.3. The parent

Parents of paediatric ambulatory patients should be capable of understanding and willing to follow specific instructions related to ambulatory surgery. In most cases, it is up to the physician to educate them and make them feel secure and comfortable.

2.4. The procedure

The planned surgical procedure should be associated with only minimal bleeding and minor physiologic derangements. Superficial procedures are selected most often. The length of the procedure is not in itself a significant drawback. Most experts believe that almost any operation that does not require a major intervention into the cranial vault, abdomen, or thorax can be performed on an ambulatory basis. Patients with infected lesions are not good candidates because of the need for separate facilities in the recovery area.

The five most frequently performed ambulatory surgical procedures at the Children's National Medical Center (CNMC) during the past 2 years were herniorrhaphy, myringotomy, adenoidectomy with or without

myringotomy, circumcision, and eye-muscle surgery. Recent experience indicates that ambulatory adenotonsillectomy is also safe and cost-effective and that there is little benefit in keeping these patients in the hospital more than a few hours after surgery. Young children (< 3 years) who are undergoing tonsillectomy for the relief of severe airway obstruction, with or without sleep apnea, continue to suffer from the same symptoms in the immediate postoperative period and should, therefore, be admitted to the hospital for close observation and monitoring postoperatively.

3. Preoperative requirements and screening

The preoperative requirements for safe conduct of anaesthesia in paediatric ambulatory patients are the same as those for in-patients, including a complete history and physical examination, indicated laboratory tests based on the findings from history and physical examination, consultations when indicated, and an appropriate fasting period. In order to minimize delays and cancellations, it is desirable to complete as many of these requirements as possible before the day of surgery.

Many ambulatory surgical units actively participate in the preoperative screening of their patients. The degree of involvement varies from a simple telephone call to the parents a day or two prior to surgery to the establishment of a formal screening clinic to clear all patients before admission into the operating suite. Many anesthesiologists function as the medical directors of their facilities, and perform the role of the perioperative physician. At CNMC, the parents of each child are contacted by telephone shortly after the operation is scheduled. A second call is made 48 h or less before surgery. During the initial call, information is sought concerning past or present risk factors, such as a history of prematurity or cardiac or respiratory problems. This information helps to determine if additional preoperative evaluation or consultation is required prior to the day of surgery. In some cases, it may lead to a re-evaluation of the appropriateness of scheduling the procedure on an ambulatory basis. During the second phone call, an assessment of the child's present health is made. Fasting (NPO) orders are reinforced, and practical matters related to parking, what to bring to the hospital, and expected duration of stay are explained.

On the day of surgery, all patients are screened for acute illness and NPO status. Vital signs are recorded. Any consultation reports are evaluated, and the need for special preoperative psychological or pharmacologic treatment is considered before the child arrives into the operating room area.

4. Preoperative preparation

The time between the patient's arrival at the hospital and the induction of anaesthesia is usually quite short. There is little time to orient the child to all the events that will take place during his or her stay. Most centers, therefore, encourage children and families to participate in presurgical preparation programs a few days before surgery, and studies have shown that children who attended those programs were much more cooperative during induction than those who did not. Such findings, however, must be interpreted carefully, since parental motivation, travelling distance, socioeconomic conditions, and the child's age; the forces that motivate parents to bring their children to these programs, are the same factors that may in themselves lead to better cooperation.

5. Pharmacologic premedication

The value of and need for pharmacologic premedication in paediatric ambulatory patients is controversial. Although a majority of children do not need preoperative sedation, provided that they have received proper psychological preparation and established a good rapport with the anesthesiologist, some do. Midazolam 0.5 mg/kg can be administered orally 20–45 min before induction to facilitate separation from the parents and improve the child's cooperation during induction [2]. Alternatives to midazolam include oral ketamine (6 mg/kg) and Oral Transmucosal Fentanyl Citrate (5–10 µg/kg) [3]. When premedication is not used routinely, the anesthesiologist must be prepared to administer a preinduction agent to the occasional difficult or extremely frightened child.

6. Preinduction agents

Preinduction of anaesthesia refers to the use of such drugs as ketamine or other rapidly acting medications for last-minute sedation.

Rectal administration of methohexital is a commonly used technique in preschool children. A dose of 25 mg/kg (10% solution) has an onset time of 6–10 min and produces enough sedation to peacefully separate an upset child from his or her parents [4]. Rectal [5] or intranasal administration of midazolam (0.2 mg/kg) also has been reported to produce anxiolysis and sedation in preschool children with a rapid onset (5–10 min) and no evidence of delayed recovery [6].

Low-dose (2 mg/kg) intramuscular ketamine can be used in young children who do not cooperate with other methods of induction [7]. The onset time is short (2–3 min), and recovery is not prolonged. When ke-

tamine is followed by an inhaled technique, there is minimal likelihood of delirium or bad dreams during recovery.

7. Anaesthetic agents and techniques

Smooth induction of anaesthesia in the unpremedicated child is probably the most difficult aspect of paediatric ambulatory surgery. No single approach is effective for all children in all situations. The choice of a particular agent and technique must be based on the needs of the individual child; it should not be used merely because it is the routine choice in a particular institution or because it is the only method with which the anaesthesiologist is comfortable.

7.1. Inhalational techniques

Inhalational induction is a popular choice in paediatric anaesthesia. Techniques that reduce the anxiety associated with inhalation induction, and therefore promote patient cooperation, include the use of transparent masks, painting the inside of the mask with a drop of food flavour of the child's choice, allowing the child to sit up, and encourage the parents to be present during the induction [8].

For the past 30 years halothane has been the most commonly used inhalational anaesthetic in paediatric patients. It is usually combined with nitrous oxide to provide rapid and smooth onset, as well as quick recovery following operations lasting 1 h or less. Nausea and vomiting are not common. With prolonged administration of halothane, recovery time is longer than when isoflurane is used.

Although considered by many to be the standard inhalational agent in adult anaesthesia practice, isoflurane is not commonly used as an induction agent in paediatric ambulatory patients. It has a pungent odour which makes inhalational induction more difficult and associated with more airway irritation than halothane. The slightly lower blood solubility, compared to halothane, does not result in any clinically significant difference in the speed of recovery when either agent is used for the usually short (< 1 h) procedures typically performed in ambulatory patients. Isoflurane is more compatible with catecholamines than halothane, and is frequently used if these agents must be infiltrated by the surgeon to improve haemostasis.

Enflurane has very similar physical characteristics to isoflurane, however, because of its pungency, it is not a very popular agent in paediatric ambulatory patients.

Desflurane has chemical and physical characteristics that are extremely attractive for surgical ambulatory

patients. The low solubility, close to that of nitrous oxide, should allow for very fast induction and recovery, as well as ease of controlling the anaesthetic depth. Desflurane is not indicated for start of anaesthesia induction in children because it results in a high incidence of airway irritation, coughing and laryngospasm that results in desaturation severe enough to require emergent use of succinylcholine in many patients. Desflurane, however, can be easily introduced following other induction agents, typically halothane or sevoflurane. This results in significantly faster emergence and recovery than when halothane is used [9]. Recovery following unsupplemented desflurane anaesthesia can be associated with a very high incidence of agitation and dysphoria. This can be modified or prevented by the judicious use of opioids, midazolam or propofol. Although these treatments do not usually delay emergence from anaesthesia, they often prolong discharge home time.

Sevoflurane has solubility characteristics closer to those of desflurane than to isoflurane. The drug has a very pleasant smell which makes it the least irritating inhalational induction agent available [10]. Sevoflurane can, therefore, be used for both induction and maintenance of anaesthesia in children. Clinical experience with sevoflurane so far has been extensive in Japan. Sevoflurane results in smooth induction with no airway irritation, and significantly faster emergence and recovery when compared to halothane [11]. Since its introduction in the United States last year, it has quickly become the inhalational induction agent of choice for children.

7.2. Intravenous techniques

Intravenous induction is the method of choice in most older children. It is expected that the availability of the eutectic mixture of the two local anaesthetics lidocaine and prilocaine (EMLA), which can be used to perform painless venipuncture in children, will encourage more anaesthesiologists to offer, and more children to accept an intravenous induction. The use of EMLA in Europe and Canada has already increased the acceptance of i.v. induction in children. The use of EMLA in ambulatory patients requires careful planning, since at least 1 h of contact time under an occlusive dressing is required for full effect. In most cases EMLA should be applied to two potential i.v. sites to have a back-up site available in case the first venipuncture is not successful.

When thiopental sodium is used in healthy unpremedicated children, a relatively large dose (5–6 mg/kg) may be required in order to ensure smooth and rapid transition to general inhalational anaesthesia. Children who receive barbiturate induction tend to be sleepier and require more airway support for the first

15 min of the recovery period than those who have received halothane. This difference disappears by 30 min.

Recent studies on the use of propofol in children indicate that it results in smooth induction with a lower incidence of side effects and faster recovery than thiopental. Propofol can be used in a dose of 2.5–3.5 mg/kg for induction of anaesthesia in children who accept venipuncture [12]. Pain on injection can be minimized or even prevented by using the large antecubital veins for the drug administration. If the hand veins must be used, lidocaine can be mixed with propofol (1–2 mg lidocaine/1 ml of propofol) immediately prior to its injection, with excellent results. When propofol induction is followed by halothane maintenance, recovery is significantly faster than when thiopental induction is followed by halothane. Recovery is fastest if propofol induction is followed by a propofol infusion for the maintenance of anaesthesia. Because of their higher volume of distribution and increased clearance, children require a higher infusion rate (125–300 $\mu\text{g}/\text{kg}/\text{min}$) than adults. This is especially true for younger children, and during the early part of maintenance.

Propofol anaesthesia has been consistently shown to be associated with an extremely low incidence of postoperative vomiting even following surgical procedures that normally result in vomiting e.g. strabismus surgery [13].

7.3. Anti-emetics

Routine use of anti-emetic prophylaxis is not indicated in all paediatric patients. For children undergoing procedures known to be associated with a very high incidence of postoperative vomiting, e.g. eye-muscle surgery, the use of propofol has been shown to be very effective in preventing this complication. Although some of the traditional anti-emetic drugs are at least partially effective, their use is associated with significant side-effects such as prolonged recovery and extrapyramidal symptoms (droperidol 50–75 $\mu\text{g}/\text{kg}$), or gastrointestinal disturbances (metoclopramide 0.15 mg/kg). More recently, ondansetron has been reported to reduce vomiting in children following such vomiting-prone procedures as tonsillectomy, where more conventional anti-emetics have little or no effect [14].

For patients with persistent postoperative vomiting, our current approach is to stop any attempt at offering oral fluids and ensure adequate intravenous hydration. Intravenous metoclopramide is administered in a dose of 0.15–0.2 mg/kg. Occasionally rectal promethazine 0.5 mg/kg (Phenergan[®] 12.5–25 mg), or prochlorperazine 0.1 mg/kg (Compazine[®] 2.5–5 mg) are administered in the hospital and/or given to the parents to use at home.

8. Perioperative fluid management

8.1. Preoperative fasting

The need for prolonged period of fasting (e.g. NPO after midnight) before anaesthesia induction in otherwise healthy children has been recently questioned [15]. Several studies have shown that ingestion of clear liquids up to 2–3 h prior to scheduled induction does not increase the risk for pulmonary aspiration syndrome; consequently, some anaesthesiologists have altered fasting guidelines to allow clear liquids 2–3 h prior to surgery. It is important to note that these guidelines apply to clear liquids only (not solids) in otherwise healthy children. Possible benefits of shorter fasting times include minimizing thirst and discomfort while awaiting surgery, less hypovolemic-induced hypotension during induction and less concern about hypoglycemia.

The need for routine administration of intravenous fluids during paediatric ambulatory anaesthesia is controversial. If the procedure is of short duration and the anaesthetic technique is one that ensures rapid recovery and return of normal appetite with minimal nausea and vomiting, many believe that the patient does not require infusion of fluids. If fluids are not administered intravenously, the period of preoperative fasting should be minimized to avoid possible dehydration and hypoglycemia.

Intravenous fluid therapy during and after surgery is specifically indicated in longer operations (over 30–60 min); in procedures known to be associated with a high incidence of postoperative nausea and vomiting (e.g. strabismus surgery); and in young children who have been fasting for a prolonged period of time.

9. Postoperative analgesia

The need for analgesics following surgery depends upon the nature of the procedure and the pain threshold of the patient. It does not depend upon whether the child is an ambulatory or an in-patient. Postoperative pain or discomfort can be managed by one or a combination of the following methods.

9.1. Mild analgesics

For infants under 6 months of age, a combination of care and nursing (or a bottle) is all that is usually needed following a procedure that is not associated with severe pain.

For older infants and young children, acetaminophen (Tylenol[®]) can be used either orally or rectally in a dose of 60 mg (1 grain) per year of age.

For more persistent, moderately severe pain a Tylenol®/codeine combination is available in an elixir form containing 120 mg Tylenol® plus 12 mg codeine/5 ml. The recommended dose is 5 ml of the elixir for children 3–6 years of age, and 10 ml for those between the ages of 7 and 12.

9.2. Non-steroidal anti-inflammatory drugs (NSAID)

NSAIDs, e.g. ketorolac, have proved effective in relieving postoperative pain following minor operations in children. Early administration immediately following induction seems to provide optimal postoperative analgesia. More studies are required to determine the optimal dose and route of administration of ketorolac, as well as its efficacy as an analgesic following more painful ambulatory surgical procedures in children.

9.3. Potent narcotic analgesics

When narcotics are indicated in the recovery period, a short-acting drug should be chosen. Intravenous use allows more accurate titration of the dose and avoids the use of 'standard' dosages based on weight, which may lead to a relative overdose. Fentanyl, up to a dose of 2.0 µg/kg, is our drug of choice for intravenous use. Meperidine (0.5 mg/kg) and codeine (1.0–1.5 mg/kg) can be used intramuscularly if an intravenous route is not established.

9.4. Regional analgesia

Regional anaesthesia can be combined with light general anaesthesia to provide excellent postoperative pain relief and early ambulation, with minimal or no need for narcotics. By placing the block before surgery starts but after the child is asleep, one can reduce the requirement for general anesthetic agents during surgery, which in turn may result in a more rapid recovery, earlier discharge, more rapid return of normal appetite, and less nausea and vomiting.

The types of blocks that can be used safely in the paediatric ambulatory surgical patient are limited only by the skill and interest of the anesthesiologist. Generally, the techniques chosen should be simple to perform, have minimal or no side effects, and not interfere with motor function and early ambulation.

Ilioinguinal and iliohypogastric nerve block can be performed by infiltration of 0.25% bupivacaine solution (in doses up to 2 mg/kg) in the region medial to the anterior superior iliac spine. This block has been used successfully to provide excellent postoperative analgesia for paediatric ambulatory patients following elective inguinal herniotomy or orchiopexy.

Dorsal nerve block of the penis can be performed by simple injection of 1–4 ml of 0.25% bupivacaine without epinephrine deep to Buck's fascia 1 cm from the midline. This has been shown to provide over 6 h of analgesia following circumcision with no complications. Alternate approaches to penile block are a midline injection or subcutaneous infiltration, which presumably blocks the nerve after it has ramified into the subcutaneous tissue. Topical application of lidocaine on the incision site at the conclusion of surgery has also been shown to be effective.

Caudal block provides excellent and reproducible postoperative analgesia following a wide variety of surgical procedures such as circumcision, hypospadias repair, orchiopexy, and herniotomy. By using bupivacaine, 0.25% solution in a dose of 0.5–0.7 ml/kg, no motor paralysis is produced. Caudal block has been extensively used in our ambulatory surgical unit, with most children discharged home free of pain between 1 and 2 h postoperatively. Analgesia (as measured by subsequent need of a mild oral analgesic) lasts 4–6 h with this technique.

10. Discharge criteria

Rapid recovery and early ambulation are major objectives in ambulatory surgery. When dealing with paediatric ambulatory patients, we must guarantee safe discharge not only from the recovery room but also from the hospital. In our institution, all children recover from anaesthesia in the same recovery area. Ambulatory patients are then transferred to a special short-stay recovery unit.

In order to provide uniform care and to ensure a complete legal record, many institutions have developed specific discharge criteria for ambulatory patients. At CNMC, discharge criteria include the following: appropriateness and stability of vital signs; absence of respiratory distress; ability to swallow oral fluids, cough, or demonstrate a gag reflex; ability to ambulate consistent with the developmental age level; absence of excessive nausea, vomiting, and dizziness; and a state of consciousness appropriate to the developmental level. Recent studies suggest that children should not be required to drink before discharge from the hospital [16].

Every child, regardless of age, must have an escort home. The escort is given written instructions concerning the child's home care and a telephone number to call to request further advice or to report complications. Staff counsel all parents about postoperative care; many units have also designed handouts that specify the care that should be provided and the signs that might herald a complication.

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A focus on the five senses of the day surgery patient: a quality assurance initiative

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Abstract

The current trends of managing the patient along the day surgery pathway, through open communication and education, both written and verbal, have proven successful through the evaluation of patient surveys. Being prepared for what is to happen, and knowing what to expect, is essential in helping to alleviate the inevitable anxiety the patient may feel. However I believe there is more that can be done to reduce the feelings of fear in the day surgery patient.

Consequently the quality improvement initiative proposed, aims at introducing alternative, non-pharmaceutical ways to enhance the nursing care already practised to help alleviate some of the stress and anxiety the patient faces pre-operatively.

The purpose of this initiative is to improve the way we manage our patients in the day surgery setting by looking for ways to 'do things better', by focusing on a holistic approach. With this in mind I have researched ways of improving the perception the patient has, of their brief encounter with the Day Surgery Unit at Stirling and Districts Hospital, through a focus on the five senses of the patient. © 1997 Elsevier Science B.V.

I think in day surgery more than any other area of healthcare our most effective marketing executive is our last satisfied patient (Edmondson, 1994)

1. Introduction

The management of quality care of the day surgery patient is an issue that is of paramount importance to all nurses who have the pleasure of working in this dynamic and exciting field.

In the past, quality assurance in the healthcare setting was defined as 'conformance to pre-set standards' (Donabedian, 1980). The Oxford dictionary defines quality assurance as a 'formal guarantee of a degree of excellence'. The question is however, who decides what areas of performance require improvement in the quality of care given to these patients, and who measures the outcomes of these initiatives.

The very nature of day surgery is of a rapidly and

continually changing speciality, responding to the technological advances in both anaesthetics and surgical techniques. Consequently, it is impossible to rely solely on predetermined standards to measure the quality of care.

The day surgery facilities of today require nursing staff, together with the other members of the team who care for these patients, to continually evaluate what they do, how they do it, and how they can 'do it better'.

With the advent of advanced anaesthetic technology, it has been proven that patients recover faster, with less after effects of the anaesthetic, through the omission of the traditional premedication drug. This practice is now common for many operations, especially those suited to day surgery, allowing rapid recovery, enabling them to go home the same day.

Although the procedure performed in the day surgery is often termed 'minor', it is still considered a major event in the life of the patient.

Patients face many of the same fears in all surgical settings, whether ambulatory or in hospital. They fear pain, the unknown, anatomic loss or alterations, possible embarrassment or loss of dignity, financial problems, and appearing ignorant when asking or answering questions. Patients may be worried about a potential change in ability to function within the family unit, an impending unfavourable diagnosis, or even death (Burden, 1993 p. 7).

2. Touch

A warm hand shake and a welcoming smile is the first step in establishing a relationship based on trust.

Clinical expertise is a prerequisite to working in the specialty, but the ambulatory surgical nurse also brings humanity to each patient's world. I would like to believe that every patient looks up to see a smiling and caring face, a nurse who will go 'one step beyond' to ensure that the patient not only is safe but feels respected and important (Burden, 1993 p. 124).

Once the patient has been admitted to the unit through the usual process of a nursing interview, which ensures the patient is adequately prepared for their procedure and after care, they change into theatre clothes, it is at this stage that the patient experiences an increase in apprehension, as they strip away their identity upon removing their own clothes.

Traditionally patients about to undergo a surgical procedure are asked to take off their clothes, and are subjected to the indignity of wearing a backless, thin, often too short hospital gown. This applies to both men and women, and often leaves the patient with a distinct feeling of vulnerability and a loss of identity.

Taking into consideration the procedure about to be undertaken, I believe the patient should be encouraged to maintain a sense of 'self' through the wearing of articles of clothing of their own, as long as they are clean, and will not be a hindrance to the surgeon, or in danger of being damaged or soiled during surgery. It is at the discretion of the nurse admitting the patient to suggest appropriate articles of clothing and give the patient a sense of responsibility by asking if they would feel more comfortable if, for example, they were to keep their underwear on.

The patient information brochure produced by the day surgery unit requests the patient to bring their own dressing gown, as it is also a comfort to wear something that is familiar. This also identifies the patient as an individual.

It is a known physiological response that when one is frightened or anxious, the body reacts by shutting down the peripheral blood vessels in order to send

more blood to the vital organs. This 'fight or flight' mechanism is the main reason that the patients often complain of feeling cold, and even though they may be given a blanket, they still experience 'cold feet'.

With this in mind, our unit decided to provide a pair of clean, warm, fluffy socks for every patient that wishes them. The feeling of warmth and comfort that is generated by wearing these socks, is evident by the visual relaxation of the patient. Even those patients undergoing foot or leg surgery, are given the socks to wear during the anxiety producing period of 'waiting for their turn'. The socks are removed after they have gone to 'sleep' and placed with their dressing gown for putting on, if and when appropriate after surgery.

The physical touch of familiar clothing, or those that produce a feeling of comfort and safety, significantly contribute to the reduction of anxiety, and therefore create a positive memory of pre-operative phase.

Touch is one of the most powerful resources available in nursing. The power of touch is available in the broad sense not only through the nurses hands, but with the eyes, voice, body position and movements, apparel, and attitude. The comfort of the nurse's physical touch is a caring gesture that reassures patients that they are not alone and that any needed help is close and available (Burden, 1993 p. 111).

The area of 'touch' in the assurance of a quality experience for the patient, goes further than what has already been discussed. The anaesthetic nurses in our theatre are actively encouraged to not only perform the clinical skills necessary to assist with a safe anaesthetic, but to reassure the patient with an offer of a 'hand to hold', as the patient relinquishes control and drifts off to 'sleep'.

The recovery room staff also reassure the patient as they awaken from their anaesthetic, with a warm hand on their shoulder whilst quietly explaining to the patient where they are and that all is well.

The offer of a 5 min hand massage just before the patient is ready to go home is often received with delight, and gives the nurse the opportunity to begin the final discharge education process, during this pleasant interlude.

3. Taste

The area of taste was one that produced a considerable challenge as the patients are fasting, and 'nil by mouth' is an extremely important aspect of care in the management of the pre-operative surgical patient.

It is recognised that to successfully comply with the discharge criteria set in most day surgeries the patient must be able to take oral food or fluids before going home. Therefore it is important that the patients are asked at the admission interview if they have any special dietary requirements, either as a food preference or ethnic or religious restrictions. The food offered to the patients during the second stage of their recovery is usually a sandwich or a light meal with a drink of choice. This is prepared by the catering staff in an appetizing manner.

The timeliness of offering this nourishment is very important. If the patient has been nauseous, the nurse ensures that they have had an anti-emetic, as ordered, to control this unwanted outcome.

The offering of refreshments at this stage of the patients recovery is not a new initiative. It is important that the quality of this food is high, and the presentation attractive, as many patients see the eating of their first meal after surgery as a positive indication of their return to well-being.

As a consequence of dehydration due to fasting, compounded with the medications administered during anaesthesia, the patient often suffers from bad taste in the mouth, along with halitosis. This uncomfortable state has been recognised as an opportunity for quality improvement. The patients are now offered a disposable toothbrush and a single use toothpaste to use, to remedy this problem as they prepare to go home.

There is nothing like the feeling of freshly brushed teeth to help make one feel refreshed. This together with a face wash with a warm flannel and a comb through the hair ensures the patient feels prepared to leave the unit to continue their convalescence at home.

4. Sights

Over the last decade or so, it has become apparent that the healthcare industry, and hospitals in particular, have come to realise the enormous benefits of creating a pleasing visual environment with which patients and their families are faced at what can be a most distressing time. The benefits gained reach further than the organisation looking for ways to attract customers to their establishment.

It has been proven that a pleasant non-clinical environment contributes in a positive way to the levels of anxiety the patient and family feel when entering a hospital or day surgery.

the aim is to break down the barriers of the institution to make it a user friendly environment, to reduce stress and make patients more comfortable usually. The initial impact of the hospital when the person arrives sets the tone. They come in stressed and

anxious so if they come into a welcoming environment, the stress level is reduced (Bitomsky, 1996 p. 10).

Throughout the planning stages of our new day procedure unit the importance of the visual surroundings in creating positive outcomes in the recovery process were recognised.

Following the already proven recipe of creating a warm and non-threatening atmosphere to help in reducing the patient's fears, I have proposed to our administration the value of taking this concept past 'the closed doors' into the operating room. Through extensive research, it has been found that there are very few hospitals that have done anything to improve the cold clinical environment in which the surgical patient eventually finds themselves.

It can be argued that the main reason for this is that the preservation of a highly controlled aseptic environment is paramount. It is to the patients enormous benefit that this ethic is in no way compromised, and that strict infection control principles are adhered to.

However following the philosophy of continually looking for opportunities to 'do things better' and to improve the quality of care we give our patients, this initiative turned to lateral thinking to help solve the problem of the frightening atmosphere in the operating room.

The ceiling and walls are the last thing the patient sees as they drift off to sleep. It is these two areas that are to be changed in an effort to 'warm' the room. With infection control guidelines in mind, what ever is chosen to improve the visual appearance must be able to be washed in exactly the same manner that the existing surfaces are. It must also have a smooth finish so it does not provide a dust trap.

In making the decision, the people who work in the theatre are being currently consulted on what they would like to see, as a worker in the area, and to imagine what a patient might like. The feeling so far is that choosing warm, soft, muted colours which appear to work so well in a ward environment will help reduce the cold clinical perception of the theatre.

The space on the ceiling in most theatres is limited due to airconditioning vents, lights and sometimes ceiling mounted equipment. Ours is no exception. Therefore the area that we have to work with is the immediate circle surrounding the operating light. As circular friezes are not made and other than having a mural hand painted on the ceiling, (which we have had to dismiss due to a limited budget), we have decided to create a circular panel from wallpaper.

Once this washable wallpaper has been chosen, a matching frieze will be placed around the walls creating a pleasing first impression as the patient arrives in the theatre.

Another area which could be improved upon which contributes to the perception of coldness in the operating room, is the stainless steel trolleys and other furniture. It is acknowledged that the functionality of this equipment is its main feature. However I believe that with today's technology and the cooperation of the manufacturers, the appearance could be much improved. This an area of quality improvement that could be worked on in the future.

5. Sounds

Studies have proven that

the use of a combination of relaxation techniques and music therapy significant lower the anxiety in the pre and post operative patient (Good, 1992 p. 240).

The selection of music for relaxation is very individual. Two Walkmans and cassette tapes were purchased. The variety of music provides for a diverse group of people of all ages, sex and ethnic backgrounds.

The patient makes the choice from the tapes provided, when at the pre-admission interview or is encouraged to bring in their favourite tape from home. The personal Walkman provides the patient with the opportunity to play the music at a volume that they feel comfortable with, whilst not intruding on any other person near them. This music can be played as they wait their turn for surgery and is not only soothing but creates the illusion that the terrible period of waiting is not so long after all.

When the patient is escorted into theatre, they may wish to take their music along with them and have it on quietly as they drift off to 'sleep'. Once asleep, the tape player is then removed from the patient and taken to recovery, where it will be returned to them to have gently playing as they wake up. It has been proven that one of the first senses to return after an anaesthetic is hearing. By providing the music the patient has chosen, post operatively it will not only bring them back to the 'land of consciousness' in a pleasant and familiar way, but will also serve to reduce the inevitable clinical sounds of the recovery room.

Patients who listened to their choice of music before surgery in addition to receiving pre-operative instruction had significantly lower heart rate than patients in the control group who received only pre-operative instructions. Differences in experimental and control group patients' blood pressure measurements and respiratory rates approached significance. The authors suggest that perioperative nurses offer music as a viable option to reduce anxiety in ambulatory surgery patients who believe music is a method of relaxation (Augustin, 1996 p. 750).

6. Smells

'I hate the smell of hospitals.' How many times have I heard that, from patients, family, and friends? The sense of smell is one of the strongest senses the human being experiences, as it stirs up memories both pleasant and distressing in one tiny breath.

While working with a group of students at the University of Wisconsin, Professor Arch Minchin uncovered what he and other scientists believed was a significant breakthrough in the study of action olfaction-the sense of smell. He found that by exposing his students to different aromas found naturally occurring in nature, under controlled conditions, he could substantially influence their moods and energy levels. The professor documented his findings and termed this phenomenon 'scentual stimulation'. It was scientific validation for what aromatherapists and numerous other natural therapists have known for years-that our bodies react strongly and impressively to different fragrances (Day and White, 1995 p. v).

The plan for this stage of this quality initiative is to purchase two electric aromatherapy vaporizers. One will be placed in the pre-operative waiting room and the other in the second stage recovery area. The needs of these two areas are distinctly different. They require a different mixture of essential oils to create the outcome we are aiming for.

The pre-operative patient as we have already discussed will be stressed and anxious in varying degrees, and will benefit by being exposed to a calming aroma.

Stress is a force that can strain and deform or renew and empower. The essential oils can truly help us calm our emotions, clear our minds and focus more clearly on that we wish to achieve (Day and White, 1995 p. 171).

The essential oils suggested by the authors of the book referenced, to create the mood of calm would be, bergamot, cedarwood, lavender, camomile, neroli, orange, sandalwood or patchouli. The specific blends of two or three of these oils placed in the vaporise will create a gentle background smell that people should not immediately be aware of on arrival to the room. In addition to this, after discussion with the patient at the pre-operative interview, the patient will be offered a personal aromatherapy scent to be created for them. This can be easily done after the patient has made a choice, by putting the oil on a cotton wool ball and wrapping this in a tissue. This can be tucked into the collar of the patients dressing gown and later the operating theatre pillow.

The second stage recovery lounge is a different situation altogether. Here the outcome aimed for, is the gentle stimulation and anti-nausea properties that different essential oils possess. Some of the oils recommended are, basil, clary, sage, eucalyptus, fennel, peppermint, lemongrass, rosemary and tea tree. The vaporiser in this room would contain a selection of two or three of those oils suggested, and would create an atmosphere of clarity and balance. At this stage the lotion used for the hand massage already discussed in the touch section, ideally would have an uplifting scent, such as peppermint or tea tree.

7. Conclusion

Taken singularly, none of the topics discussed in this paper are either new or startling. It is the total package that I have presented, that will make a difference. By concentrating on all of the patient's senses this quality assurance initiative will be treating the whole person. Through 'doing things better' and continually looking for opportunities to improve our facilities and service to our patients, we will ensure the success of our unit. The monitoring and evaluation of this initiative will be on-going through patient feedback informally, as well as through the formal 'patient satisfaction' questionnaire, which will be modified to include questions relating to the five senses. For the purpose of this paper I have concentrated on the Day Surgery patient. I do believe that the surgical inpatient would also benefit enormously from the quality initiative proposed. With

the increasingly common practice of admitting patients for major surgery the morning of their scheduled operation, these patients have the same fears and anxieties as the day patient. The principles of quality nursing care are the same and should cross all boundaries of patient groups. When considering this quality assurance project the financing of the new initiatives recommended was an important factor. After presenting the ideas to our Chief Executive Officer and Director of Nursing, I estimated, the cost to implement them. I believe this cost of \$150, will be returned many times over through the positive 'word of mouth' advertising generated through our satisfied patients to their friends and families.

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Cost-effective anaesthesia for outpatient arthroscopic surgery: Desflurane versus propofol?

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Abstract

We compared desflurane to propofol as the main anaesthetic in a balanced anaesthetic technique during elective arthroscopic day-case procedures with special reference to cost-effectiveness. A total of 80 ASA classification I patients were studied in a prospective randomised fashion. Surgery and anaesthesia were uneventful in all cases. Time spent in the recovery room and time to discharge was equal between the two techniques, desflurane and propofol. The estimated cost for desflurane maintenance was 40.5 SEK as compared to 114 SEK for a propofol maintenance ($P < 0.01$). Desflurane was found to be a cost-effective alternative to propofol for day-case anaesthesia. © 1997 Elsevier Science B.V.

Keywords: Outpatient anaesthesia; Ambulatory surgery; Cost-effective; Desflurane; Propofol

1. Introduction

The constraints of day-case anaesthesia dictate a smooth induction, good perioperative conditions and a rapid and pleasant recovery to ascertain a safe discharge from the hospital. The patients should become home-ready in a minimum of time while limiting pain, nausea or drowsiness.

The introduction of propofol has made a major contribution to day-case anaesthesia by providing most of these characteristics. Desflurane (Suprane, Pharmacia) is a new fluorine halogenated methyl ether volatile anaesthetic agent. The blood gas solubility for desflurane is 0.42, which is similar to that of nitrous oxide. This allows for a fast equilibration and desflurane is therefore promoted as having rapid induction and emergence/recovery characteristics [1]. The properties of desflurane promote its use in day-case

practice. Most studies on new agents have focused on the clinical advantages of the drugs, but have ignored their cost. Cost considerations are of increasing importance when choosing anaesthetic techniques and drugs [2].

The aim of the present study is to compare a balanced anaesthetic technique based on propofol or desflurane as the main anaesthetic during a typical ambulatory surgical procedure, arthroscopy, looking at which regimen is most cost-effective.

2. Methods

The study protocol was approved by the local ethics committee. A total of 80 ASA classification I patients scheduled for elective arthroscopy on a day-case basis were randomly allocated to one of two anaesthetic techniques. Exclusion criteria were: Body weight above 95 kg, drug allergy, bleeding disorder and liver or kidney dysfunction.

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All patients refrained from eating and drinking from the evening prior to surgery until after the surgery was completed. If surgery was planned for the afternoon, at 11:00 h the patients were given a balanced sugar-electrolyte drip i.v.

Pre-medication in the form of 5 mg of midazolam was given intramuscularly on the general ward 40–90 min prior to anaesthesia.

Fentanyl 1–2 $\mu\text{g}/\text{kg}$ was given 2–3 min prior to induction with propofol. After induction, the patients were separated into two groups with differing methods of maintaining anaesthesia:

1. Propofol induction in accordance with the scheme by Roberts [3]. Breathing nitrous oxide in oxygen at a ratio of 2:1.
2. Desflurane anaesthesia, after induction the patients were breathing nitrous oxide in oxygen at a ration of 2:1 and desflurane was added in 1% increments every two to four breaths.

A fresh gas flow of 3 l/min was used. All the patients were breathing spontaneously through a face mask or laryngeal mask airway. A pharyngeal airway was used when found necessary during mask breathing. Breathing was assisted when necessary.

Depth of anaesthesia was adjusted according to clinical needs in accordance with Evans score [4]. Desflurane as well as propofol was adjusted throughout the procedure in order to maintain an adequate depth of anaesthesia, no fixed MAC equivalent or infusion rate was used. During surgery, all patients were given 30 mg of ketorolac i.v. At the end of the procedure, nitrous oxide was discontinued and the patients were breathing oxygen for 2–5 minutes at a fresh gas flow of 6 l/min. Propofol, as well as desflurane, was discontinued as the last stitch was completed.

All patients were cared for in the same postoperative room. The patients were transferred back to the general day-care ward when found awake with stable vital signs and without major pain or nausea. The patients were considered home-ready according to the routine of the department when able to stand, walk, drink and void and when any pain and/or nausea had subsided [5].

Pain was treated initially with peripheral acting analgesics (1 g paracetamol). If this was insufficient to mitigate pain, a small i.v. dose (2–3 mg) of ketobemidone was given. In cases with severe persistent nausea or vomiting, 1 mg of droperidol i.v. was given as an antiemetic. All spontaneous complaints of pain, nausea and vomiting, need for pain relief and anti emetics were recorded as well as time spent in the recovery room and time to discharge.

The cost for each technique was calculated from the amount of main anaesthetic agent required times the cost for desflurane and propofol in SEK. The official list price for desflurane (2.2 SEK/ml) and propofol (0.28 SEK/mg) was used.

Table 1
Patients characteristics and type of surgery

	Desflurane (<i>n</i> = 40)	Propofol (<i>n</i> = 40)
Sex (men/women)	24/16	17/23 ns
Age (years)	34 \pm 13	36 \pm 12 ns
Weight (kg)	72 \pm 11	70 \pm 12 ns
Therapeutic procedure	29	26 ns
Diagnostic procedure	11	14 ns

ANOVA and χ^2 -tests carried out. ns, not significant.

All values are given as mean + S.D. unless others stated. Continuous variables such as age and time spent in the recovery room was compared with Student's *t*-test and discrete variables with χ^2 test. A *P* < 0.05 was considered statistically significant.

3. Results

The two groups of patients were comparable in terms of demographic data and surgical procedures performed (Table 1). No major complications were observed during surgery or anaesthesia. Duration of surgery and anaesthesia was the same for both anaesthetic groups (Table 2). Mean endtidal desflurane concentration during surgery was 2.4%. Average time spent in the recovery room was 77 \pm 16 min without difference between the groups (Table 2). A total of 42 patients complained about pain (53%) and two experienced nausea during the time spent in the recovery room (Table 3). Mean time from end of anaesthesia until considered home-ready was 255 \pm 70 min and again there was no difference between desflurane and propofol anaesthesia (Table 2). The number of patients complaining of pain or emesis during the entire recovery period is shown in Table 4.

The calculated cost for desflurane was 40.5 \pm 18 SEK and for propofol 114.0 \pm 34 SEK (*P* < 0.01).

4. Discussion

The major finding of our study is that both techniques were found safe and effective and that time

Table 2
Perioperative observations

	Desflurane (<i>n</i> = 40)	Propofol (<i>n</i> = 40)
Duration of surgery (min)	23 \pm 9	25 \pm 9 ns
Duration of anaesthesia (min)	45 \pm 20	48 \pm 11 ns
Time in PACU (min)	78 \pm 15	77 \pm 18 ns
Time to discharge (min)	255 \pm 60	254 \pm 79 ns

ns, not significant.

Table 3
Number of patients experiencing pain or emesis in the recovery room

	Desflurane (n = 40)	Propofol (n = 40)
No pain	21	18 ns
Pain	19	22
No PONV	38	40 ns
Nausea	1	0
Vomiting	1	0

χ^2 Test carried out. ns, not significant.

spent in the recovery room as well as time to discharge was the same for the desflurane and propofol patients. In most previous studies it has been shown that desflurane creates an emergence comparable to propofol however the propofol anaesthetised patients have been discharged earlier [6]. The difference in result may be explained by a number of reasons.

Pain and emesis are factors well known to be of importance to discharge [7,8]. In most previous studies comparing propofol to desflurane PONV has been more frequently seen among the desflurane patients [9-12]. In the present study we chose patients having arthroscopic surgery. Patients having peripheral orthopaedic surgery in general are prone to have a low incidence of postoperative emetic sequelae [13].

We found no significant difference in respect to PONV. Propofol was used for induction in all patients. The low frequency of PONV associated with propofol anaesthesia is well recognised [14]. Some have even stated an antiemetic effect of propofol [15]. Although an induction dose of propofol is hardly effective to completely alleviate the emetic action of inhalation anaesthetics and surgery per se it may indeed reduce the intensity and frequency of the emetic symptoms [8].

In the present study a balanced anaesthetic technique was used. All patients had a loading dose of fentanyl immediately prior to induction in order to reduce intraoperative pain. Both groups of patients were also given 30 mg of ketorolac during surgery in order to reduce postoperative pains, there are studies using bolus doses of up to 60 mg of ketorolac i.v. [16]. A 30 mg dose of ketorolac has been found to have a significant opioid sparing effect in a previous study in our institution [17]. This prophylactic treatment may have reduced the need

Table 4
Total number of patients experiencing pain or emesis until discharged

	Desflurane (n = 40)	Propofol (n = 40)
No pain	13	17 ns
Pain	27	23
No PONV	33	38 ns
Nausea	4	2
Vomiting	3	0

χ^2 Test carried out. ns, not significant.

for further opiates during the recovery period. The intricate interaction between pain, opiates and emesis is well known as are the importance of these factors for delaying discharge [18,19]. Standardised discharge criteria were used and the number of patients should be sufficient to detect a clinical significant difference regards recovery.

Apart from the main anaesthetic all drugs used were the same for both groups of patients. Propofol and desflurane was found equally safe and effective as main anaesthetics. We did not see any sparing effect of using propofol for time spent in recovery room or in the step down unit. The main determinant for cost-effectiveness is therefore the cost associated to the main anaesthetic. We found desflurane maintenance to be considerably less expensive than the propofol based technique. This is a finding in agreement with Rosenberg et al. [20].

To summarise, we did find desflurane to be an interesting alternative as maintenance in a balanced anaesthetic technique for day-case arthroscopic procedures, creating a cost less than half that for a propofol based technique.

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Does day surgery embarrass the primary health care team? An audit of complications and consultations

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Abstract

In order to assess the impact of day surgery on primary care in this district, a prospective study of 297 consecutive patients, being treated in the local day surgery unit, was undertaken to ascertain patient satisfaction and to assess what post-operative problems patients are having requiring primary care services. The results suggest that overall satisfaction with the service is high. After surgical interventions, 43% of patients required one or more primary care consultations. Unplanned GP visits were made by 13% of patients for reasons such as post-operative infection or pain. It was concluded that the majority of the primary care workload was anticipated and pre-arranged; it could possibly be reduced further by arranging better pain relief for patients on discharge and providing more information on what patients might expect after their surgery. © 1997 Elsevier Science B.V.

Keywords: Audit; Day surgery; Complications; GP consultations

1. Introduction

There has been a significant increase in the level of day surgery performed in the UK in recent years [1]. Although reducing hospital costs per patient treated, day surgery may have repercussions for community services. Opinions vary as to the magnitude of this effect and the impact that this shift in hospital activity has already had on general practitioners and other community health professionals [2–4].

Despite the debate about the economics and workload, the concept of day surgery increases in popularity with patients and general practitioners

alike [2,5,6]. Advantages to the patients include shorter waiting times for surgery, less chance of operations being cancelled [7] and less time away from home or work. General practitioners appreciate the quicker service to their patients and a significant number enjoy the greater participation in their patients' surgical care [6].

The first objective of this study was to ascertain patient satisfaction with day surgery services in this district. Thus completing the audit cycle, started in 1993, which recommended reviewing the quantity and quality of information, both written and verbal, for patients before and during day surgical admission. The second objective was to assess what problems patients are experiencing after discharge, to assess what community services are being used and therefore determine to what extent their workload may change with the anticipated expansion of day surgery.

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2. Methodology

The study was carried out in the Massereene Hospital, Antrim day surgery unit, during the period of January–March 1996. The unit has 12 designated beds. There were no restrictions regarding type of procedure being performed. Ethical approval was given by the Regional Ethical Committee.

Consecutive day surgery patients passing through the unit were approached regarding the study and given an information sheet explaining its nature and purpose. The patient's details and clinical information were recorded on a standardised questionnaire. The patients were subsequently surveyed using a postal questionnaire sent out 2 weeks after discharge. One reminder was sent if no response was received 3 weeks later. If the patient indicated on the questionnaire that they had required a community service, the health professional concerned was contacted for further details.

A pilot study of 20 patients was initially carried out and, as there were no major problems identified, these patients were included in the final analysis. For children undergoing surgery, a parent or guardian completed the questionnaire on their behalf.

The data was analysed using the Statistical Package for Social Sciences (SPSS), using descriptive and inferential analyses. Differences for proportions were calculated by using the χ^2 -statistic for contingency tables.

3. Results

In total, 297 patients were given information sheets and sent a questionnaire. A response was received from 82%, (244 patients).

Thirty different types of surgical procedure were performed. Table 1 illustrates the case mix of proce-

Table 1
Procedures performed

Operation	% All operations 1993	% All operations 1996
Removal of skin growth	20	18
Gastrosocopy	14	0
Vasectomy	13	24
Sigmoidoscopy	9	1
Cystoscopy	7	3
Varicose vein surgery	6	7
Breast lump biopsy	4	11
Removal ganglion	4	4
Haemorrhoid surgery	4	1
Hernia repair	2	5
Carpal tunnel release	2	3
Other	15	23

Table 2
Information received by patients

	1993 (%)	1996 (%)
Information about right or more than wanted	89	86
Received written information on treatment pre-op	73	67
Treatment explained during admission	94	91

dures during the two study periods, in 1993 and 1996. Toe nail surgery, removal of lumps from various sites and removal of foreign bodies account for 12% of the 'other' group in 1996. Due to the amalgamation of two hospitals, the majority of endoscopic surgery is now carried out elsewhere.

Of those who responded, 64% were male. The age range of respondents was 2–85 years, mean 38 years. There was a high number of vasectomies performed, accounting for the excess in males in the group and the peak in age group 31–45 years. There was no significant difference in the age or sex distribution of responders and non-responders.

The results suggest that overall satisfaction with the service is high, with 79% stating that they would recommend day surgery for the same procedure to a friend. However, this figure has fallen from 89% in 1993.

Table 2 compares the information given to patients about their treatment in 1993 and in 1996. This shows a slight overall fall in the amount given to patients and an increase in the proportion of patients who would have liked more information.

As might be expected, there was a significant correlation between those receiving written information about their treatment pre-operatively and those satisfied with the amount of information given overall, ($\chi^2 = 13.7$, $df = 2$, $P = 0.001$). There were also highly significant associations between receiving explanations about treatment before and during admission and recommending day surgery for the same procedure to a friend ($\chi^2 = 11$, $df = 2$, $P = 0.004$ and $\chi^2 = 24.1$, $df = 2$, $P = 0.0001$ respectively).

In the first 24 h after surgery, 30% of patients experienced 'a fair amount of pain', and 9% 'a great deal of pain'. Analgesia was required by 64% of all patients with an average of ten tablets being taken by each of these patients. The type of pain relief was recorded by 58% of patients. Simple analgesia, such as paracetamol, was taken by 54% with 4% requiring stronger medication, such as diclofenic voltarol or injectable pain relief.

Twelve percent of patients required 'quite a lot of extra help' and 9% required a 'great deal of help' after discharge. One in ten carers had to take time off work, on average 3 days, and 7% of the carers indicated a loss of earnings.

Follow-up was arranged by the day surgical unit for 37% of patients. This follow-up was at the patient's own health centre in 30% of cases and at surgical outpatients in 9%, (2% had arrangements made for both).

There were 157 primary health care consultations in the month following on from the study patients' day surgery. The number of visits is elevated by one individual patient accounting for 10% of the total, as a pre-arranged visit revealed infection which required 18 further attendances to resolve (Fig. 1).

In total 106 (43%) patients required one or more primary health care services with 27% (66 patients) consulting their GP. Seventy-eight percent of the total number of visits were pre-arranged or represented follow-up to a pre-arranged visit and 22% were unpredicted episodes with their follow-up. The majority of patients attending by prior arrangement did so for suture removal (17%), change of dressing (8%) or to obtain a medical certificate for absence from work (5%).

Unplanned visits to their GP were made by 13% (32 patients) for reasons such as suspected post-operative infection (confirmed in 5%, unconfirmed in 2% as there was no record available in the patients' notes), post-operative pain (3%) and reassurance that the wound was satisfactory (3%). Of these consultations 1% (three visits) were made to the patients' own home. An accident and emergency attendance was recorded by 1% of patients, all for pain relief. An unpredicted visit to the chemist was required by 3% of patients, for items such as analgesia and dressings.

Immediate post-operative admission was required for 10% of patients, for reasons such as wound drains being in situ, anaesthetic problems and for post-operative pain relief. One percent of patients required re-admission for the management of wound sepsis. Two percent required a further admission for additional breast surgery when the initial biopsy pathology was known.

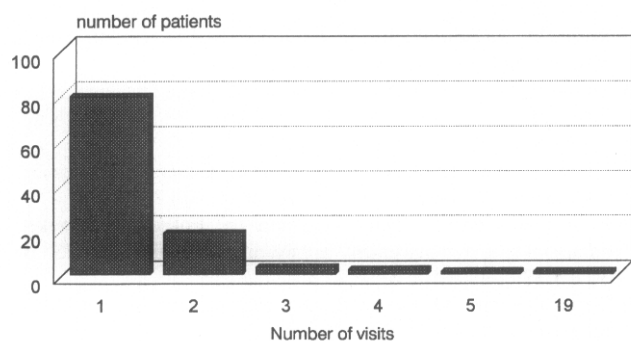


Fig. 1. Post-operative primary care visits.

4. Discussion

Continued expansion of day surgery is widely advocated by the Royal College of Surgeons and the Audit Commission, among others. It is recognised that the evidence for increased primary care workload as a result of this trend is tenuous [8]. They advocate gathering further evidence on this subject in conjunction with the continued planning and development of the service. The present study attempts to address this problem with a view to improving patient management and care.

The study population and types of procedure in the study group are typical of many day surgery units in the UK and therefore the results are thought to be representative of the average workload experienced by many general practitioners.

The authors' original objectives included reascertaining patient satisfaction with day surgery thereby closing the audit loop. The results concur with other studies in finding a high level of patient satisfaction. Although the differences are small, the re-audit component to this study indicated a slight decrease in satisfaction over the three year period. One of the purposes of audit is to identify ways of improving a service and what has been highlighted in this study is the importance of completing the audit cycle to see if previous recommendations have been implemented and, if they have, had the desired effect. In this case, follow-up on the need for improved patient information both before surgery and during admission has not been ideal and needs to be addressed again. However, the present figures remain equal to, or higher than those compiled by the Audit Commission [9,10].

The second objective was to assess what problems patients were experiencing after discharge, to assess what community services were being used and therefore to what extent the primary care workload would change with the continued expansion of day surgery. This latter question is a forum for much debate in the literature. In Burn's opinion, day surgery rarely places demands on these services [4], whereas Russell et al. [11] found that the average day patient received 0.5 more family doctor consultations and 4.2 more district nurse visits than their in-patient equivalents. Although Russell's work is widely quoted, the fact that it was carried out in the 1970s should be taken into account. Improvements since then have resulted in a decrease in requirements for nursing care and medical services, for example as a result of changes in surgical techniques, suture materials and pre-operative preparation of patients.

In contrast to Russell's findings, only a small number of the present study group required the services of a district nurse. The bulk of the primary care workload was in the form of a visit to the GP or a treatment room nurse. As sutures, and some dressings, are gener-

ally removed five to ten days after surgery, these visits would be carried out in primary care even if the patients had several nights in hospital. Similarly attending for a sickness certificate would also take place regardless of length of stay.

Several measures have been used to assess clinical outcome, including post-operative complication rates, re-admission rates and also patient satisfaction. A review of the literature, by Morgan et al. [12], concluded that in general short stay policies and day case surgery for selected procedures have little impact on clinical outcomes, although in some cases the presence of higher rates of minor short term complications was noted.

The findings from this study compare favourably with other studies in relation to numbers of planned day surgery patients requiring overnight stay, the range recorded in the literature being from 2.5–16% [12]. Similarly the re-admission rates in the present study (1%) are comparable to, or slightly lower than, those reported elsewhere [10,13].

Post-operative pain is reported to be a common reason for contacting the GP after day surgery. In one survey of GPs [2], 75% reported that inadequate analgesia was a common reason for patients requiring to be seen post-operatively. In the present study post-operative pain was a problem for 39% of patients but only precipitated a GP consultation in 3% of patients. The GP survey also reported that post-operative infection was the commonest reason for self referral [2]. This is in keeping with the authors' findings of wound infection, or patient concern about the wound, being the cause of 10% of the self referral GP consultations.

Efforts to decrease the primary care workload might usefully focus on post-operative pain relief. The Massereene unit has a 24 h advice line for patients so that if they meet an unexpected situation their worries can be allayed by a phone call to someone familiar with their background, thereby alleviating the need for a primary care consultation but it could perhaps be promoted and used more widely.

Since the response rate was high (82%) the authors felt that non-response bias is unlikely to be significant, as patients dissatisfied with the service or who had experienced problems and complications would be more, rather than less, likely to respond. Attempts were made to minimise recall bias by sending out the questionnaires soon after the procedure and following up non-responders quickly.

To give a definitive answer to the original questions posed, a study of patients undergoing procedures suitable for day surgery would be required, where patients were randomly allocated to either inpatient or day case treatment and their post-operative course followed prospectively by investigators blinded to the

patients treatment group. Such studies were conducted in the 1970's [6,11]. However, management has changed so radically since then that the applicability of the results has been questioned. Indeed many patients now prefer to be treated on a day case basis, and so maximising participation in such a trial might prove a challenge.

5. Conclusion

The majority of patients were satisfied with their experience of day surgery. Improvements could still be made regarding the amount of information patients receive both before and during their admission. The majority of the primary care workload was anticipated and pre-arranged. The impact on primary care could possibly be reduced further by better pain relief being provided for patients on discharge and by giving more written and verbal information on what to expect post-operatively. More emphasis could be given on the facility of telephone advice for patients after discharge from the day surgery unit.

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Reconstruction of the anterior cruciate ligament as day surgery

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Abstract

Rupture of the anterior cruciate ligament (ACL) can be a disabling injury with regards to work and sport. The surgical treatment of this injury has been revolutionalized in recent years most noticeably with increased utilization of arthroscopy. Surgical technical advances and more aggressive rehabilitation has enabled us to perform this procedure as day surgery between 60-93% of the time. © 1997 Elsevier Science B.V.

Keywords: Anterior cruciate ligament reconstruction; Day surgery; Hamstring tendons

1. Introduction

The evolution of treatment in anterior cruciate ligament (ACL) rupture has enabled patients to recover fully from this serious knee injury and allows them to return to previous levels of function. The surgical reconstruction procedure itself has been revolutionized over the past 10-15 years and these advancements in technique have enabled patients to return to activities of daily living earlier and with less restrictions. This has led to less time away from work and sport and return to normal or near normal function.

The complex anatomic nature of the ACL initially lead to attempts at repairing the ruptured ligament with the intention to re-establish the complex nature of the ligament. The tenuous nature of the repaired injured fibers required prolonged protection, including bracing or casting of the knee postoperatively, which resulted in prolonged immobility. Despite various attempts, the end result of ligament repair was poor as there was a high failure rate with recurrent instability and poor function [1-3].

Extra-articular knee reconstruction was attempted but this has also fallen into disfavor. Most of these surgical procedures resulted in an anterolateral tenodesis requiring more extensive surgical dissection but did not consistently prevent anterior subluxation of the lateral tibial plateau [4]. This was not surprising as it is extremely difficult for a peripheral tenodesis to adequately perform the complex function of a centrally placed ACL. These reconstructions also tend to stretch out over time [5,6]. Another detraction from extra-articular reconstruction has been the increased use of intra-articular grafting. Once intra-articular grafting became more reliable and commonplace, any positive effects of extra-articular grafting were negated. These extra-articular procedures are still occasionally used by some surgeons to augment intra-articular reconstruction but without improved results over intra-articular grafting [7-10].

Artificial ligaments have been used to aid in the repair and reconstruction of ACL ruptures. Use of synthetic ligaments in Europe and North America has not led to improved clinical results [11,12]. This lack of improvement combined with increased complications [13,14] has led to the virtual cessation of the use of synthetic grafts.

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With increased use of arthroscopy there was a natural opportunity to refine the surgical technique for ligament reconstruction in the knee. Arthroscopic surgery allowed less surgical dissection and trauma to the knee while permitting more accurate graft placement. These factors allowed greater range of motion (ROM) immediately postoperatively as a result of less surgical trauma to the knee joint while ensuring that extremes of ROM would not place undue stress on the newly inserted graft.

Through increasingly accurate graft placement and aggressive rehabilitation it was noted that there was a significantly lower incidence of loss of ROM with the intra-articular reconstruction [15,16]. This in turn led to more aggressive postoperative rehabilitation in contrast to previous regimes of casting or bracing in a fixed position to 'protect' the graft until it had healed. It is likely more damage than good was achieved with prolonged immobilization as ligaments heal more quickly and strongly when moderately stressed. With arthroscopic verification of graft placement and direct observation of graft movement to document appropriate graft tension through a full ROM, a quicker rehabilitation protocol was introduced.

The typical advanced rehabilitation included regaining immediate full ROM although some surgeons initially restrict ROM from 30–90°, once again to prevent excessive tensioning of the graft as the knee reaches full extension or flexion. Further research [17–19] including testing on cadaveric knee models and clinical evaluation demonstrated that grafts were not under undue tension at full extension and now most rehabilitation protocols allow for full ROM and weight bearing as tolerated immediately postoperatively.

2. Technique

ACL reconstructions initially began as large procedures requiring extensive hospital stays with prolonged immobilization. Hospital stays up to 7–10 days were not uncommon. As the procedure became more refined the stays shortened to 4–6 days. Introduction of arthroscopy and intra-articular reconstruction also shortened the hospital stay and most currently, in Australia, the hospital stays range from 2–4 days.

A continuation of this aggressive trend has led to the current protocol that we use. The once prolonged hospital stay has now been shortened to a day surgery procedure in most cases in our hospitals. Once the diagnosis has been made and surgical treatment has been decided as the treatment of choice, patient education begins. The surgical procedure as well as the rehabilitation expectations are described to the patient. The patient is referred to a physical therapist for instructions on quadriceps rehabilitation preoperative as well as immediate postoperatively.

Patients are admitted to hospital on the morning of the surgical procedure after having been NPO for a minimum of 8 h prior to the procedure. They are seen by nursing staff, anesthetist, and pre-operatively by the surgeon. Under general anaesthetic a full examination of the affected knee is performed with comparison to the unaffected side. A tourniquet is applied to the affected leg which is exsanguinated prior to tourniquet inflation. The leg is prepped and draped and the surgical procedure commenced.

A preliminary arthroscopy is performed through inferolateral and inferomedial portals and any meniscal pathology is dealt with, including meniscal repairs, at this time. ACL disruption is documented and the intercondylar notch is cleared out along with debridement of remaining ACL stump. The arthroscope is removed temporarily and graft harvest is performed.

A 2–3 cm incision just medial to tibial tubercle is made followed by incision of the superior border of pes anserine to expose the hamstring tendons. Semitendinosus and gracilis tendons are harvested up to muscle belly utilizing a specialized tendon harvester to ensure adequate graft length of 22 cm. The tendons are folded over (making four tendons in cross-section) and sutured together. The graft is measured with a sizing block. Anatomic placement of drill holes is performed on the femur and tibia using arthroscopic guidance. The graft is passed through the tibial drill hole (drilled to graft diameter) into the femoral drill hole which is pre-drilled to graft diameter for a 30 mm depth. The graft is locked into the bony canals using 7 mm soft threaded cannulated screws (RCI-Smith and Nephew Endoscopy, Andover, USA) for stable interference fixation. Ligament stability is tested as well as knee ROM and closure is performed.

No drain is inserted as all exposed vessels are cauterized prior to closure. 2-0 Vicryl (polyfilament absorbable) subcutaneous sutures are inserted to close the deep space and 3-0 Maxon (monofilament absorbable) is placed subcutaneously and cut at the level of the skin after steri-strips are applied. Local anaesthetic (Marcaine 0.5% with Adrenalin—20 ml) and morphine (10 mg) are inserted into the portals and incision site as well as intra-articularly. The wound is dressed with Melolin and Velband with a crepe bandage applying mild compression. A cryopac is applied over the knee.

The patient is taken to the recovery room and observed until awake. Once meeting the discharge requirements of being alert and orientated, having no nausea or vomiting, able to take oral fluids, and able to ambulate, the patient is discharged. Physiotherapy instructions are given prior to discharge to begin moving the knee within limits of pain tolerance. The patient is reviewed in 7–10 days for wound healing. Physiotherapy is continued during this time to regain knee ROM and obtain control of the extensor mechanism.

3. Experience

This surgical procedure is now performed as day surgery in the majority of our patients. Over approximately a 1 year period from mid-95 to mid-96, 370 ACL reconstructions were performed by a single surgeon (LAP) at the Castlecrag Private Hospital in Sydney. Of these patients 60% were discharged on the day of surgery while 40% remained in hospital overnight. Of the 40% requiring overnight stay, 18% were for geographical reasons, 21% were for pain and/or nausea, while 1% was per the doctor's request. During approximately the same period 130 ACL reconstructions were performed by the same surgeon at Mater Misericordiae Hospital in Sydney. Of these, 93% were discharged on the day of surgery and only 7% required an overnight stay which was due to geographic reasons in 5% and social reasons in 2%.

In most hospitals this procedure still has a 2–4 day hospital stay. There are many factors which can be manipulated to shorten this period. Surgical factors are important. The operative procedure must be quick and precise to minimize operative time and decrease surgical trauma and postoperative pain. The surgeon should be performing this procedure frequently and regularly for the best reproducible results and safety. Anaesthetic should include minimal premedication, induction by early recovery agent such as propofol, and no paralysis during the case. Postoperative pain management consists mainly of long acting local anaesthetic (Marcaine) and morphine subcutaneously and intra-articularly. Expectation of same day discharge by all hospital staff including nurses and physiotherapists should be maintained to aid in rapid recovery. These preparations enable the patient to commence ambulation with crutches and quadriceps rehabilitation immediately in the postoperative period with discharge in the early afternoon. With the appropriate education of all people involved, a day surgical environment can be created to safely perform ACL reconstruction as day surgery.

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Day-case circumcision in an African rural hospital¹

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Abstract

A prospective study of 82 circumcisions performed as a day-case over 1 year at Sololo General Hospital (Northern Kenya) was carried out in order to evaluate the results of our day-case policy. The mean age of the patients was 14.5 years (S.D. \pm 5.8). No complications were observed during surgery and all the patients were discharged home immediately after their operation. Of the 82 patients operated on, 76 (92.7%, 95% C.I., 84.8–97.3%) came for the follow-up after 7 days and only two patients presented with a wound infection (2.6%, 95% C.I., 0.3–9.2%). This study shows that day-case circumcision with a low and acceptable complication rate can be performed even in a rural hospital in a low income country, despite a setting with poor hygienic conditions. © 1997 Elsevier Science B.V.

Keywords: Circumcision; Day-case surgery; Africa

1. Introduction

Circumcision is performed in the absence of medical indications but on religious and traditional grounds, in many diverse cultures such as Judaism, Islam, Aboriginal Australian, tribal African and Christian US [1]. Some complications, such as bleeding, sepsis, urethrocutaneous fistula and meatal stenosis, are well known even where circumcision is performed by qualified medical personnel [2]. The complication rate of this common operation becomes higher when it is carried out by traditional practitioners [3–10]. Sololo General Hospital is placed in Northern Kenya, in a region inhabited by Borana people. All Borana males are submitted to ritual circumcision (called ‘qabanqaba’) usually during adolescence. With the aim of offering circumcision under anaesthesia and in aseptic conditions, the operation has been performed, as a day-case for 10 years, at

Sololo General Hospital even when this has been for ritual purposes. In order to evaluate the results of our day-case policy, we carried out a prospective study of the circumcisions performed in a 1 year period.

2. Patients and methods

The criteria for circumcision were as follows: simple request of the patient (or the parents/caretakers, in case of under-age patient) or presence of symptoms related to the foreskin with evidence of phimosis or paraphimosis.

All the patients (or their parents) were given a date and time for their operation (usually at 8:00). They were starved from midnight the night before. On arrival at the hospital, the patients took off their own clothes and changed into a clean uniform. The patients were not premedicated and, after the usual cleaning of the skin of the penis, anaesthesia was administered by the surgeon. The technique chosen for anaesthesia was a ring block of the penis as described by King et al. [11], using 5–10 ml of 0.5% lignocaine without adrenaline. A subcutaneous skin wheal is made at the ten o'clock

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position at the basis of the penis. Then the needle is advanced subcutaneously across the patient's penis to reach the two o'clock position. After aspiration to make sure to have not entered the corpora cavernosa, one fifth of the anaesthetic solution was injected to perform the left dorsal penile block. Without removing the needle the eight o'clock position was reached and another fifth of lignocaine is injected. The same thing was done controlaterally. As a modification of this technique, the last fifth of the total amount of the anaesthetic solution was injected subcutaneously around the frenulum, in order to anaesthetise the ventral branches of the dorsal nerves, that are given off early in the subpubic space and supply the ventral surface of the penis including the frenulum [12,13]. Analgesia was checked at approximately 3 min after injection by gentle pinching the skin of the penis with a toothed forceps. Patients were asked to report any kind of sensation or pain during the operation. The same surgical technique was used in all cases. The prepuce was retracted until the tip of the glans came into view. Three fine untoothed haemostats were applied to the edges of the prepuce, one in mid-line ventrally and two on either side of the mid-line dorsally. The under-surface of the prepuce having been completely separated from the glans and the corona, the layers of each flap were excised. Electrocautery was not used to coagulate blood vessels. After circumcision four interrupted mattress sutures with 4/0 chromic catgut were placed at 90 degrees (at 3, 6, 9 and 12 o'clock positions) and left with a long tail. The skin between these was approximated by four interrupted mattress sutures. The frenal artery was ligated with a mattress suture. A ribbon dressing was fashioned from paraffin gauze and the four long tailed sutures tied over this [14,15].

Patients were discharged from hospital after a 1 h period of observation. Paracetamol was provided for analgesia in the postoperative period at home. Patients (or their parents/caretakers) were instructed by nursing staff to leave the dressing in place unless it fell off spontaneously. Instructions were given to come back to the hospital if they were in any way concerned and for the follow-up after 7 days.

The patients who came for the follow-up after 7 days were evaluated. The dressing, if it had not already fallen off spontaneously, was removed by cutting the retention sutures. The presence of any wound infection, defined by the discharge of purulent exudate, was recorded. Wound healing assessment was performed according to the following Grading Score (modified from D.C.S. Gough and N. Lawton, 1990 [16]): Grade 0 = raw moist areas on wound or glans; Grade 1 = healed, scabs on wound edge; Grade 2 = healed, no scabbing or crusting. All the data collected were recorded in a database and statistical analysis was carried out using Epi Info, Version 6.02 software pack-

Table 1
Indications in 82 circumcisions

Indication	n	%	C.I.*
Phimosis	2	2.4	0.3–8.5
Paraphimosis	1	1.2	0.0–6.6
Traditional purpose	79	96.3	89.7–99.2
Total	82	100	

* C.I. = 95% Confidence intervals.

age (Centers for Disease Control and Prevention, Atlanta, Georgia, US, 1994).

3. Results

In the year from July 1995–June 1996, 82 circumcisions were performed. The mean age of the patients was 14.5 years (S.D. \pm 5.8). The youngest patient was 1 year and the eldest 36 years. The indications for circumcision are shown in Table 1. No complications occurred during surgery. None of the patients complained of discomfort or pain and no supplemental analgesia was needed. All the patients were discharged home immediately after the operation. Of the 82 patients operated on 76 (92.7%, 85% C.I., 84.8–97.3%) came for the planned follow-up after 7 days. One returned after 2 days complaining of slight oedema of the glans. He was reassured and sent back home.

By the seventh post-operative day in 46 out of the 76 patients the dressing had already fallen off (60.5%, 95% C.I., 48.6–71.6%) and two patients presented with wound infection (2.6%, 95% C.I., 0.3–9.2%). The results of the grading of wound healing are shown in Table 2.

4. Discussion

According to several workers, absence of male circumcision increases the risk of urinary tract infection [17], balanitis [18], penile cancer [19–21] and the probability of transmission of syphilis [22], gonorrhoea, chancroid and genital herpes [23]. Although the results

Table 2
Results of grading wound healing at 1 week control

Grade	n	%	% C.I.
0	14	18.4	10.5–29.0
1	34	44.7	33.3–56.6
2	28	36.8	26.1–48.7
Total	76	100	

* C.I. = 95% Confidence intervals.

require cautious interpretation, the lack of circumcision has been even identified as a risk factor for HIV infection in several epidemiological and clinical studies [24–30].

Even though these results cannot justify widespread mass circumcision as a preventive medical intervention [28,31] and despite the fact that some authors consider circumcision without medical reasons as a senseless mutilation [32–34], we think that circumcision undertaken in a hospital should be maintained wherever it already exists, for its potential impact as an interventional strategy to reduce transmission of the above mentioned diseases [5,23].

Consideration also has to be given to circumcision performed by unqualified people in the community. Apart from being burdened by an unacceptable high rate of surgical complications, it can contribute to the spread of blood borne diseases such as hepatitis B and AIDS [35] and tetanus [36]. Hospital circumcision performed under conditions of sterility avoids these risks.

It has already been shown in developed countries that circumcision can be performed in day-case centers with significant financial saving and patient satisfaction [37–41]. In our setting hospital day-case circumcision helps reduce medicalization thus increasing acceptability in the local community and partly avoiding the appearance that it is a Western intrusion into this important custom [4,5].

In conclusion our prospective study shows that day-case circumcision can be performed in a rural hospital of a low income country with a low and acceptable complication rate.

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The safety, efficacy and recovery characteristics of desflurane versus propofol for anaesthesia in an older day surgery population

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Abstract

Desflurane is one of a new generation of volatile anaesthetic agents with a low blood gas solubility coefficient of 0.42 (cf. Isoflurane 1.40 and nitrous oxide 0.46) and the potential for rapid recovery and minimal post-operative hangover. This could have advantages for day surgery particularly in an older day surgical population. This study compared the maintenance of anaesthesia with desflurane or propofol in a randomised, comparative, controlled and open labelled trial. A variety of tests of or indices of recovery were studied including psychometric testing and the recovery from similar depths of anaesthesia as assessed by the coherent frequency analysis of auditory evoked potentials in the electroencephalogram (EEG). © 1997 Elsevier Science B.V.

Keywords: Desflurane; Propofol; Older day surgery population

1. Introduction

The Royal College of Surgeons of England defines day surgery as the admission of a patient on a planned non-resident basis for an operation or investigation who nonetheless requires facilities for recovery. It has advantages including a high patient throughput with a resulting reduction in costs and waiting times as well as offering convenience and a low morbidity for the patient. However preoperative preparation must be good, minor sequelae still occur and there is resistance to its use due to fears of an increase in community workload or medicolegal complications. One of the keys to successful day surgery is good quality anaesthetic recovery to facilitate the patient returning home. However the ideal anaesthetic technique has not been established and this study hopes to examine the differences in recovery between two different techniques of anaesthetic maintenance in the older day surgical population.

2. Methods

The study was approved by the Local Research and Ethics Committee and all the patients gave written informed consent. Forty patients aged 50 years or older, male and female, ASA status I-III, undergoing elective day case surgical procedures were entered into the study. The study was randomised, comparative, controlled and open labelled.

Patients were excluded from the trial if they had a history of clinically significant cardiovascular, respiratory, hepatic or renal disease. Patients with a history of alcohol or drug abuse or of allergy to any of the drugs used in the trial were also excluded. Other exclusions included any patients having received general anaesthesia within the past 7 days and participation in another study within the preceding month.

Patients were randomly allocated into two groups and received either desflurane or propofol for anaesthetic maintenance. Blood was taken prior to induction

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Table 1
Patient characteristics

	Desflurane				Propofol			
	<i>n</i>	Mean	S.D.	Range	<i>n</i>	Mean	S.D.	Range
Male								
Age (years)	13	56.7	3.9	51–63	12	62.2	7.5	50–71
Weight (kg)	13	74.7	8.5	65–94	12	75.8	15.4	54–114
Height (cm)	13	172	4.8	165–179	12	173	10.1	152–190
Female								
Age (years)	7	55.6	4.3	50–63	8	56.5	4.1	50–60
Weight (kg)	7	65.7	10.4	51–79	8	69.7	10.1	58–86
Height (cm)	7	165	8.1	158–180	8	167	9.3	148–178

of anaesthesia and in the postoperative period to examine serum Creatinine, bilirubin, Alanine-amino transferase (ALT), Alkaline phosphatase (ALP) and Aspartate-amino transferase (AST).

2.1. Anaesthesia

All patients were unpremedicated and taken into the operating theatre where routine monitors were positioned. Heart rate, arterial blood pressure and pulse oximetry were recorded at 2 min intervals until the incision, at 1 min intervals for 5 min after incision and every 5 min thereafter. The inspired oxygen and end-tidal carbon dioxide, nitrous oxide and desflurane concentrations where appropriate were continuously measured with a Datex[®] monitor calibrated for the study and the values were recorded at the same time as the haemodynamic variables. The desflurane was administered by an Ohmeda TEC 6[™] vaporiser and a propofol infusion was delivered with a Graseby 3100[®] pump. All doses of anaesthetic administered were noted.

Induction of anaesthesia commenced with intravenous (i.v.) alfentanil 7–15 mg/kg given over 1–2 min followed by propofol 1.5–2.5 mg/kg until the loss of verbal contact and loss of eyelash reflex. The airway was maintained with a laryngeal mask airway (LMA) and maintenance of anaesthesia was provided by either desflurane or propofol infusion (6–15 mg/kg per h) together with an oxygen/nitrous oxide mixture achieving an inspired oxygen concentration of between 30–50%. The concentrations of propofol or desflurane were adjusted to the patients needs as clinically indicated with the object of maintaining the heart rate and blood pressure within 20% of the baseline values. Light anaesthesia demonstrated by an increasing respiratory rate, pupillary dilatation, lacrimation or movement were treated with further boluses of alfentanil 5 mg/kg. Clinically significant bradycardia was treated with atropine 0.3–0.6 mg as required.

Anaesthesia was terminated at the application of the dressings and following this the immediate recovery criteria were then monitored.

2.2. Recovery testing

The anaesthesia emergence observations consisted of time to opening eyes, obeying commands and the ability to vocalise birth date. Visual analogue scores measuring pain, sore throat, nausea, dizziness, drowsiness and headache were noted preoperatively and then 30 and 90 min after achieving a Steward's score of 6. At the same time intervals psychological tests including simple reaction times, grooved peg board and word retention tests, logical reasoning, speed of comprehension, visual acuity and contrast sensitivity were also performed. Finally the coherent frequency analysis of the auditory evoked potentials in the EEG was carried out preoperatively, 5 min after surgical incision and 1 h after awakening.

Any adverse events during the anaesthetic or in recovery were noted. Pain and nausea were treated in the recovery room with a combination of oral or rectal diclofenac 50–100 mg, codydramol 2 tablets and metoclopramide 10 mg i.v. Patients were followed up for 14–21 days after surgery to assess the occurrence of any problems or adverse events.

Table 2
Surgical procedures

Surgical Procedure	No. of Patients	
	Desflurane	Propofol
Varicose veins ligation and strip	8	6
Inguinal hernia repair	10	11
Arthroscopy of knee	1	1
Minor orthopaedics	1	2

Table 3
Duration of anaesthesia

	Desflurane				Propofol			
	n	Mean	S.D.	Range	n	Mean	S.D.	Range
Duration (min)	20	42.0	18.0	12.0-73.0	20	41.6	17.9	17.0-86.0
End-tidal cone (%):								
Mean during surgery	20	3.31	0.56	2.32-4.20	---	---	---	---
Peak during surgery	20	4.14	0.79	2.70-5.70	---	---	---	---
End of surgery	20	2.75	0.72	1.60-4.20	---	---	---	---
Infusion rate (mg/kg per h)								
Mean during surgery	---	---	---	---	20	8.29	2.56	4.38-13.9
Peak during surgery	---	---	---	---	20	9.51	2.19	6.00-15.0
End of surgery	---	---	---	---	20	6.810	2.96	2.901-12.0
Total amount (mg)	---	---	---	---	20	392	168	150-850

Table 4
Number (%) of patients given additional medication for blood pressure/heart rate control

Additional medication during anaesthesia	Reason	No. of patients (%)	
		Desflurane	Propofol
Haemocel + atropine	Hypotension	1 (5%)	---
Atropine	Bradycardia	4 (20%)	1(5%)
Glycopyrrolate	Bradycardia	1 (5%)	---
Ephedrine	Hypotension	---	1(5%)

Table 5
Number (%) of patients needing additional medication for light anaesthesia/intra-operative pain

Additional medication during anaesthesia	Reason	No. of patients (%)	
		Desflurane	Propofol
Alfentanil	Intra-operative pain	17 (85%)	14 (70%)
Bupivacaine	Intra-operative pain	1 (5%)	2 (15%)
Propofol	Light anaesthesia	---	2 (10%) ^a

^a Those patients also received alfentanil for intra-operative pain.

2.3. Statistics

Treatment groups were compared with respect to the efficacy variables using the Students *t*-test. If the assumption of normality was seriously broken, corresponding non parametric tests were used (Wilcoxon rank sum tests).

3. Results

Tables 1 and 2 show that the two treatment groups were similar with regard to patient characteristics, diagnosis and surgical procedures.

Table 3 indicates that the mean value of duration of anaesthesia was 42 min for both treatment groups. The

mean end-tidal concentration of desflurane during surgery was 3.3% and the mean propofol infusion rate during surgery was 8.3 mg/kg per h.

Tables 4 and 5 record that the desflurane group six patients (30%) received additional medication for heart rate/blood pressure control compared to two patients in the propofol group. In addition, 18 patients (90%) in the desflurane group and 17 patients (85%) in the propofol group received additional medication for intra-operative analgesia/light anaesthesia during surgery.

3.1. Haemodynamic response

At baseline, and in the induction, surgery and recovery periods the mean values of heart rate and blood pressure were similar for the two treatment groups. The

Table 6

Times to eye-opening, 'squeeze my fingers', 'date of birth' and fit for discharge from recovery room (minutes from the end of anaesthesia)

	Desflurane				Propofol				P-value
	n	Mean	S.D.	Range	n	Mean	S.D.	Range	
Eye-opening	20	6.7	4.8	2-24	20	8.7	4.2	2-16	0.052
Squeeze my fingers	20	7.3	4.6	2-24	20	9.7	4.6	2-19	—
Date of birth	20	8.5	5.0	3-26	20	10.8	4.9	3-19	—
Fit for discharge	20	92.7	106.7	7-295	20	111.9	121.8	8-382	0.16

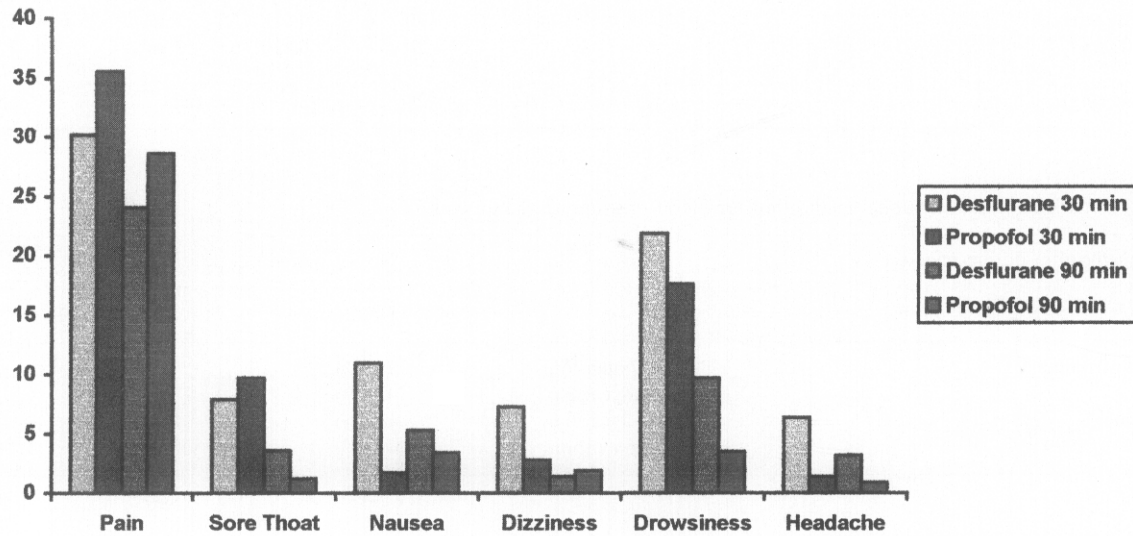


Fig. 1. Visual analogue scores in mm from 0-100 mm scale (pain, sore throat, nausea, dizziness, drowsiness and headache).

mean values at baseline, and the mean maximum and minimum values during surgery, of heart rate and blood pressure were:

	Desflurane- baseline/min/max	Propofol- baseline/min/max
Heart rate (bpm)	77/52/84	73/59/85
Systolic BP (mmHg)	147/97/154	142/92/150
Diastolic (mmHg)	87/58/92	83/55/89

In the desflurane group eight patients (40%) had adverse events during surgery. Seventy percent of these effects were haemodynamic problems including hypotension and bradycardia. Two of the patients had hypoxaemia for 1-2 min and one patient had laryngospasm. In the propofol group four patients (20%) had adverse haemodynamic events includ-

ing two separate episodes of both hypotension and bradycardia.

3.2. Emergence variables

No statistically significant difference between the treatment groups was recorded for the primary efficacy variable 'time to eye opening' ($P = 0.052$) nor for the secondary efficacy variable 'time judged fit for discharge from the recovery room' ($P = 0.16$). The mean values (min) for the emergence variables were:

Time to:	Desflurane	Propofol	P-value
Eye-opening	7 min	9 min	0.052
'Squeeze my fingers'	7 min	10 min	—
'Date of birth'	9 min	11 min	—
Fit for discharge from the re- covery room	93 min	112 min	0.16

See Table 6.

Table 7
Recovery tests (simple reaction time, grooved pegboard)

	30 min Before anaesthesia	30 min After Stewards score 6	90 min After Stewards score 6
Mean simple reaction time (1/1000 th s)			
Desflurane	250	274	254
Propofol	258	288	259
Mean grooved peg board time (s)			
Desflurane	77	90	75
Propofol	73	92	76

3.3. Psychometric tests

The following psychometric tests were performed during the study: Visual Analogue Score (for pain, sore throat, nausea, dizziness, drowsiness and headache); Recovery tests (simple reaction time, coherent frequency values of the auditory evoked potentials, grooved pegboard); and Psychological tests (word retention, logical reasoning, speed of comprehension, visual acuity and contrast sensitivity). Apart from a higher median score in the VAS assessment of drowsiness in the desflurane group 30 min after a Stewards score of 6 (16.5 vs 3.5), the values in the psychometric tests were similar for the two treatment groups (see Fig. 1 Tables 7 and 8). The results shown in Fig. 2 demonstrate that both groups of patients were subject to similar reduction and subsequent return of the coherent frequency measured auditory evoked responses during anaesthesia and recovery.

3.4. Pain and PONV

In the desflurane group six patients, of whom one received post-operative opioids before the event, and one patient in the propofol group experienced nausea and/or vomiting after surgery. Two patients in the desflurane group (10%) and one patient (5%) in the propofol group needed opioids during recovery (see Tables 9 and 10).

3.5. Biochemistry results

No significant changes in the laboratory values were observed after surgery.

During the follow up from the end of surgery to 21 days post surgery 15 adverse events were reported for eight patients in the desflurane group, two-thirds of these were for post-operative nausea or vomiting. One of the patients stayed in hospital overnight due to nausea and an episode of syncope. In the propofol group two adverse events were reported for two patients. One of the events was thrombophlebitis suffered after propofol administration and the other event was

nausea in the recovery room. No patients reported intra-operative recall in either group.

4. Discussion

Inhalational induction of anaesthesia with either desflurane or a combination of desflurane and nitrous oxide (N₂O) is rapid with typical induction times of 142 s with N₂O and 188 s without N₂O (Rapp et al. [1]). However several reports have found a high incidence of excitatory phenomena and airway complications including laryngospasm, breath-holding and coughing [2]. Observers have then smoothed the induction of desflurane anaesthesia with opioids to obtund the airway reflexes and even the addition of carbon dioxide may help [3]. In this study it was observed that the smooth, rapid induction characteristics of propofol made it the induction agent of choice for both anaesthetic groups. Pain on injection of propofol was common [4,5] and increased if injected into a small, distal vein [6]. This problem may be largely overcome if lignocaine (2 ml of 1% plain solution) is added to the propofol before injection [7].

The intraoperative haemodynamic stability was relatively stable for both groups despite the initial concern for an increase in hypotension in an older patient population. The four episodes of bradycardia noted in the desflurane group were all successfully treated with atropine or glycopyrrolate and no evidence of the sympathomimetic stimulation with associated tachycardias from rapid changes in anaesthetic depth reported in desflurane was noted [8,9].

Both anaesthetic agents provided rapid control of the depth of anaesthesia. Rampil et al. reported an MAC of 4.0% in younger (age 18-30 years) and 2.8% in older patients (age 31-65 years) for desflurane in 60% N₂O in oxygen [10-12]. In this study the mean end-tidal concentration of desflurane during surgery was 3.3% with the depth of anaesthesia being judged on clinical signs such as changes in the haemodynamic variables and evidence of light anaesthesia (lacrimation, sweating, pupillary signs). In addition this study provided an

Table 8
Psychological tests

	30 min Before anaesthesia	30 min After Stewards score 6	90 min After Stewards score 6
Word retention-words recognised (mean)			
Desflurane	22.0	15.6	20.7
Propofol	21.3	14.0	20.1
Logical reasoning-mean % correct out of total			
Desflurane	37.7	37.5	39.4
Propofol	34.9	43.6	48.0
Speed of comprehension-mean numbers completed			
Desflurane	67.4	65.2	70.5
Propofol	62.9	59.2	70.8
Visual acuity quotient (mean)			
Desflurane	88.5	83.1	84.6
Propofol	85.7	88.0	86.0
Contrast sensitivity (mean)			
Desflurane	1.71	1.67	1.71
Propofol	1.58	1.61	1.59

assessment of the depth of anaesthesia using the coherent frequency analysis of the auditory evoked potentials. In the EEG the auditory evoked potentials are obtained by recording the electrical activity from the brain after auditory click stimulation via headphones over a range of frequencies between 5–50 Hz. After signal averaging and then applying a Fourier analysis a value called the 'coherent frequency' is derived. The coherent frequency is typically about 40 Hz in the awake patient and decreases with increased depth of anaesthesia [13]. This allowed the confirmation of equal depths of anaesthesia in both groups thus allowing anaesthetic recovery to be studied from equal points of coherent frequency.

Both treatment groups produced similar scores of cognitive function as assessed by the recovery tests (simple reaction time, coherent frequency values of the auditory evoked potentials, grooved pegboard) and the psychological tests (word retention, logical reasoning, speed of comprehension, visual acuity and contrast sensitivity). Again analysis of the Visual Analogue Score for pain, sore throat, nausea, dizziness, drowsi-

ness and headache were all similar apart from a higher median score in the VAS assessment of drowsiness in the desflurane group 30 min after a Stewards score of 6 (16.5 vs 3.5). Previous work has also supported these findings [14] showing no difference in cognitive function after 60 min with either agent. However some workers suggested a delayed recovery of cognitive function with propofol [15].

Thus in contrast to work by several authors showing a more rapid emergence with desflurane anaesthesia compared to propofol anaesthesia, rapid recovery in patients receiving desflurane was not a feature of our study [16]. Even differences reported by Apfelbaum et al. of 18 min for emergence from propofol anaesthesia versus 10 min from desflurane anaesthesia may be of doubtful clinical significance [17]. Indeed many papers support the conclusion that desflurane and propofol have similar emergence times [18]. Many factors such as intraoperative opioid administration are known to prolong emergence times [19].

The analgesic requirements were similar for both groups but the incidence of nausea and/or vomiting was higher in the desflurane group. This finding was present despite the use of nitrous oxide [20,21] and it remains unclear whether the large variations in PONV were the result of an inherent propofol antiemetic effect or whether it was due to the absence of volatile anaesthetic

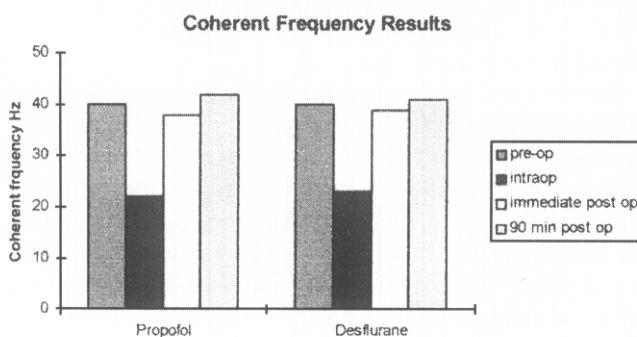


Fig. 2. The coherent frequency results of the study.

Table 9
Number of patients suffering from nausea and/or vomiting

	Desflurane	Propofol
Nausea and/or vomiting	6 (30%) ^a	1 (5%)

^a One of these patients had received opioids prior to this reported episode.

Table 10
Number of patients who needed post-operative opioids

	Desflurane	Propofol
Opioids	2 (10%)	1 (5%)

agents [22-24]. Many other factors such as age, gender, type of surgery and the use of narcotic analgesia are known to affect the degree of PONV [25].

In conclusion, both techniques provided a safe, effective anaesthetic with a rapid recovery profile as assessed by simple recovery tests and by selective, quantitative psychometric tests. The major questions for the choice of an anaesthetic technique for modern day surgery revolve around the ease of use for the anaesthetist, the cost of the technique and the quality of the recovery for the patient. Although authors have quoted potential cost savings from the use of desflurane in low flow circle systems [26] the rapid turnover in day surgery operating theatres may not allow enough time for these low flows to be achieved. There is no doubt that although desflurane may be potentially expensive compared to other agents such as isoflurane or enflurane it is cheaper than using propofol [27]. Desflurane has other advantages over other volatile anaesthetic agents in that it has a low rate of metabolism with a potentially lower incidence of hepatic complications, a low rate of fluoride production and safe, easy use in circle systems. Its low blood gas solubility coefficient of 0.42 allows rapid changes in anaesthetic depth without the need for nitrous oxide- an agent capable of producing PONV and atmospheric pollution. Propofol has its own drawbacks including the cost issue, fears of awareness in paralysed patients, the potential for epileptiform activity, accumulation and a high incidence of movement during surgery [25]. In summary therefore the basic question is a quality issue. PONV may be used as a quality indicator of anaesthetic care and due account for substantial day surgery overnight admissions [28]. All anaesthetists will have to address these issues and consider how much they and their anaesthetic departments will be prepared to pay for subjectively higher quality anaesthesia. At present there is no easy solution.

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A mechanism for reducing patient non-attendance rates for day surgery

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Abstract

This audit-based study was designed to assess the effect of a new administrative policy on the 'Did Not Attend' (DNA) rate for patients attending the Day Surgery Unit (DSU). Two study periods of 5 consecutive months, with over 4000 procedures booked, were audited. DNA rates fell from 5.8 to 2.4% ($\chi^2 = 16.29$, 1 df, $P < 0.001$) after the change in policy, clearly demonstrating how a simple administrative alteration can produce highly significant effects with consequent implications for work and cost efficiency. © 1997 Elsevier Science B.V.

Keywords: Audit; Day surgery; Attendance

1. Introduction

There is increasing pressure within medicine to see and treat larger numbers of patients, without a corresponding growth in access to facilities such as time in the operating theatre. It is therefore imperative that such time is used as productively as possible. Failure of patients to attend for surgery, especially when there is insufficient time to call in a replacement, can greatly impair efficiency. This problem is seen in the Day Surgery Unit (DSU), where patients present on the morning of surgery. The aim of this audit is to compare 'Did Not Attend' (DNA) rates in the DSU before and after the introduction of a new pre-admission administrative policy.

2. Methods

Patient DNA rates were measured over the months

from March to July in 1994 (Period A), and the same 5 months in 1996 (Period B), after introduction of the new policy.

The new policy was based around a nurse-led pre-admission clinic, occurring approximately 2 weeks prior to the proposed date of surgery. This involved the filling out of a standard proforma and the performance of pre-operative investigations where indicated. After 1994, patients were given very clear verbal and written information that failure to attend for this would result in their operation being cancelled. A replacement case could then be added to the list, with a 2 week period in which to arrange this. Attempts were then made to contact the cancelled patient and a new date offered if this was deemed appropriate.

The pre-admission clinic is only used for patients having surgery under a general anaesthetic (GA). Those undergoing local anaesthetic (LA) procedures were not invited to the pre-admission clinic, and acted as a control group. The DNA rates were compared for GA and LA patients for the two study periods. Results were subjected to statistical analysis using the χ^2 -test.

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Table 1

	DNA rate (LA cases)	DNA rate (GA cases)
Period A	13.0%	5.8 %
Period B	12.1%	2.4%

LA cases: no significant difference. GA cases: $\chi^2 = 16.29(1 \text{ df}) P < 0.001$.

3. Results

A total of 1933 operations were performed in Period A, 1058 under GA and 875 under LA. In Period B there were 2616 operations, 1266 GA and 1350 LA. Case mixes were comparable. DNA rates are shown in Table 1.

These results show a highly significant improvement in DNA rates in the GA study group after implementation of the new procedures, with no significant change in the LA control group.

4. Discussion

The long interval between the two study periods in our audit was caused by the variability in waiting list lengths, so that the new policy took more than a year to be universally implemented. The periods incorporated the same months of the year to avoid any seasonal bias.

Failure of patients to attend for surgery is a well recognized cause of inefficient use of operating theatre time, with rates of up to 30% described [1]. Previous studies have created a profile of a typical 'non-attender' [2], with young age being among the strongest correlates (i.e. a likely candidate for the DSU). In the 'In-Patient' setting, the use of doctor-led pre-admission clinics has been shown to significantly reduce the problem [1,3,4], showing levels of success similar to our own with greater than 50% reduction in DNAs.

The changes in policy we introduced, within a pre-existing nurse-led service, have produced marked results without any significant additional expenditure. We are now looking at ways to make similar improvements in our local anaesthetic service, with a postal confirmation of willingness to attend prior to placement on the list.

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