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Review article

Regional anaesthesia in ambulatory surgery

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Abstract

Regional anaesthesia provides many advantages and can be practised safely in ambulatory surgery. It provides better postoperative pain control, avoids many complications associated with general anaesthesia and shortens recovery time. However, extra time required, associated complications and acceptance of patients are the factors of concern in practising regional anaesthesia in an ambulatory setting. This review will discuss various regional anaesthesia techniques suitable for outpatients.

Keywords: Ambulatory surgery; Ambulatory anaesthesia; Regional anaesthesia

1. Overview

Given the changing patterns of health care delivery, considerable growth is occurring in ambulatory surgery worldwide. Regional anaesthesia has long been practiced in ambulatory surgery, but general anaesthesia is by far the commonest anaesthetic technique [1–3]. This article emphasizes the great potential for regional anaesthesia for outpatients, and the advantages and disadvantages for specific regional anaesthetic technique will be discussed.

2. Advantages and disadvantages

2.1. Advantages

Randomized studies comparing the morbidity of general versus regional anaesthesia are difficult to design and are frequently inconclusive. Some advantages of regional anaesthesia are discussed as follows (Table 1).

2.1.1. Avoidance of complications of general anaesthesia

Complications from general anaesthesia such as sore throat, nausea and vomiting, aspiration, airway trauma and muscle pain can be avoided or minimized. Although the risk of sore throat is minimized with the use of laryngeal mask airway for general anaesthesia, the incidence still ranges between 4 and 12% [4]. Nausea and vomiting is the commonest anaesthesia-related cause for unanticipated hospital admission following ambulatory surgery [2,5] whilst aspiration contributes 12% of hospital admissions in an ambulatory surgical centre [6]. With regional anaesthesia technique, the incidence of nausea and vomiting is significantly re-

Table 1
Advantages of regional anaesthesia compared to general anaesthesia

Avoid complications related to general anaesthesia (nausea and vomiting, airway trauma, aspiration pneumonia)
Smooth transition to postoperative pain control
Shorter recovery time
No loss of consciousness and 'control'

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duced [7–9] and the risk of aspiration and sore throat can be avoided.

2.1.2. Better postoperative pain control

Regional block, either alone or combined with general anaesthesia, facilitates a smooth transition to postoperative analgesia. It adds to the comfort and satisfaction of patients. In addition, the use of narcotics is reduced and thus the associated side effects can be minimized. When comparing different anaesthetic techniques for inguinal herniorrhaphies, those who had local infiltration or regional anaesthesia required less analgesia in the postoperative period [10]. Using three-in-one block for knee arthroscopy, postoperative pain control is better than general anaesthesia [11]. Similarly, suprascapular nerve block or femoral nerve block, when combined with general anaesthesia, have also been demonstrated to reduce postoperative pain following complicated arthroscopic surgery [12,13].

2.1.3. Faster recovery

Recovery from anaesthesia and duration of hospital stay can be reduced with regional anaesthesia. In two large-scale studies, regional anaesthesia was associated with shorter recovery time than general anaesthesia [1,2]. However, these studies were neither controlled nor randomized. Studies comparing recovery time of different anaesthetic techniques did show that recovery was faster with regional anaesthetic technique [7,11]. In a prospective, randomized study comparing different anaesthetic techniques in outpatient hand surgery, duration of stay in Post Anaesthesia Care Unit (PACU), time to ambulate and oral intake was much shorter with brachial plexus block compared with general anaesthesia [14].

2.1.4. No loss of consciousness and 'control'

Remaining conscious and feeling of 'in-control' are advantages offered by regional anaesthesia. Patients may remain wide awake intraoperatively, allowing the surgeons opportunity to demonstrate the disease process and the surgical repair. Morbid fear about general anaesthesia is not uncommon among patients receiving their first anaesthetic. In a comprehensive survey of 800 patients' attitude towards anaesthesia, the most common concern or fear expressed by patients was inability to emerge from anaesthetic [15]. Regional anaesthetic technique offers a welcome alternative.

2.2. Disadvantages

2.2.1. Time factor

Extra time is needed for a nerve block to be adequate for surgery. However, the delay caused by the increased anaesthetic time can be offset by the shortened recovery time of the patient [14,16].

To minimize the delay, the regional block can be performed in a separate induction room or a designated area in the PACU. Obviously, a skilled anaesthetist is required. Some authors suggest that ambulatory surgery should not be the place to learn regional blocks, especially for the junior resident [17,18]. However, this depends on the comfort level of the anaesthetist and the availability of the time resources. In our institution, we do not exclude the junior resident from learning regional blocks in the ambulatory surgery setting.

The onset time of the block can be shortened by proper choice of technique and drug or addition of adjuvant, e.g. bicarbonate to the local anaesthetics [19].

2.2.2. Acceptance factor

The majority of patients prefer general anaesthesia over regional anaesthesia if given the choice of anaesthetic [15,20]. The main reasons are that they preferred not to 'see or feel anything' or they believed 'spinal anaesthesia to be dangerous' [15]. In contrast, most practicing anaesthetists themselves prefer to receive regional to general anaesthesia for both emergency and elective peripheral surgery [21,22]. The difference in the preference of anaesthetic technique probably reflects the importance of knowledge on the influence of patients' attitude towards regional anaesthesia.

2.2.3. Nerve injury

The principle of regional anaesthesia is to deposit local anaesthetic to the vicinity of nerve plexus, nerve root or individual nerve to stop the transmission of nerve impulse. Nerve damage, albeit rare, is a potential complication in regional anaesthetic technique. Brachial plexus block via axillary approach is the commonest nerve block performed for the upper limb. Neurological complications ranged from 0–19% and were usually transient [23–28]. In a recent large series using transarterial technique in 996 patients, the risk of neurological complication is negligible [28].

Safety of intrathecal anaesthetic has been well established. Studies involving 20 000 patients receiving spinal anaesthesia showed that no major neurological sequela resulted [29,30]. However, the minor form of neurological complication transient radicular irritation (TRI) has aroused concern among those practicing anaesthetists recently [31,32]. Three prospective studies show that the incidence of TRI following the use of hyperbaric lidocaine ranged from 10–37% [33–35]. Various factors may contribute to the etiology of TRI but dose and concentration appeared to be the most important. With the use of dilute lidocaine solution (less than 1.5%), the risk of TRI may be minimized.

2.2.4. Associated complication of regional block

Backache is common after central neuroaxial blockade, ranging widely from 2–46% [8,36–39]. In the past, many believed that back pain occurred as frequently after general anaesthesia as after spinal anaesthesia [36,37]. Postoperative back pain appears to be related to the length of surgery and the position of the patient than the type of anaesthetic used. Recent studies found that the incidence of backache is higher following spinal/epidural than general anaesthesia [8,40]. Backache following the lumbar puncture is thought to result from direct needle trauma of ligamentous and periosteal structures.

Postdural puncture headache and urinary retention are infrequent but important complications following spinal anaesthesia and will be discussed in a later section.

3. Preparation and set-up

Options of regional anaesthetic technique should be suggested to the patients before arrival in the holding area where they are waiting anxiously for the surgery. This involves collaborative effort among the surgeons, nurses and the anaesthetists. It is very helpful if the option of regional anaesthesia is suggested to the patient in the surgeon's office. In the pre-admission clinic or pre-anaesthetic clinic, patients can be further screened and informed about the choice of regional techniques. This allows patients to think over the choice of anaesthetic and offers opportunities to clarify some of the concerns patients may have about regional anaesthesia. Information in the form of pamphlets or video cassette gives patients a better idea about the anticipated regional anaesthetic technique. If the regional anaesthetic technique requires the use of nerve stimulator or seeking of paresthesia, the patient should understand this to obtain maximal co-operation.

To minimize the time restraint, a designated area in which nerve block can take place is necessary. This can be a separate room beside the operation theater, the holding area or PACU. The area should be fully equipped with resuscitation equipment and monitors. A designated nurse can improve the efficiency of performing the regional anaesthesia. While the anaesthetist is still in the operating theater, the nurse can put monitors on the patient, start the intravenous access and explain the anticipated procedure.

Music is a very useful non-pharmacological sedative for patients receiving regional anaesthesia. Some institution has individual headsets in every operating theater and a control box to allow patients to set the volume and choose the type of music they desired. This helps the patients to relax and screen some of the unwanted noises inside the operating theater. Some institutions like ours offers patients a special goggle so that they can watch movies.

Table 2
Application of regional techniques to specific operation

Technique	Surgery
Central neural block (spinal/epidural/combined)	Lower abdominal surgery
	Laparoscopy (e.g. tubal ligation), hysteroscopy
	Perineal surgery (caudal or spinal)
	Lower extremity surgery
	Knee arthroscopic surgery
	Ankle open (e.g. fusion) or arthroscopic surgery
	Vascular procedure (e.g. varicose vein stripping)
Upper limb regional block	
IVRA[a], axillary block	Orthopedic or plastic surgery below elbow
Axillary, supraclavicular block	Surgery at elbow (e.g. transposition of ulna nerve)
Interscalene block	Shoulder surgery (open or arthroscopic surgery)
Lower limb regional block	
'3-in-1' Block	Knee arthroscopic surgery
Popliteal or ankle block, ?IVRA[a]	Bunion surgery, tarsal/metatarsal surgery, neuroma excision

[a] IVRA = intravenous regional anaesthesia.

4. Spinal anaesthesia

4.1. Advantages of spinal anaesthesia

Spinal anaesthesia provides an excellent and reliable anaesthetic technique for procedures of lower abdomen and extremity (Table 2). Its role in ambulatory surgery is still controversial. It is reliable, easy to perform, has a rapid onset of action, and provides good pain relief and muscle relaxation. Its ability to provide sacral anaesthesia makes it superior to epidural techniques [41]. In general, dose response is highly predictable and the small doses of local anaesthetic drug required for subarachnoid blockade eliminate the chance of systemic toxicity. Postoperative nausea and vomiting are less prevalent following spinal anaesthesia versus general anaesthesia [8,9].

Despite these advantages, there are two main concerns of using spinal anaesthesia in ambulatory setting: postdural puncture headache (PDPH) and urinary retention.

4.2. Postdural puncture headache

Postoperative headache is common even after general anaesthesia, ranging between 15 and 43% [8,42]. The incidence of true postdural puncture headache depends on various factors: age, sex, needle size, and design of needle bevel [43,44].

Since PDPH occurs only when patients assume upright position, one will suggest that it is more common in ambulatory settings. However, many studies has shown that the incidence of PDPH is not affected by the duration of bedrest [45–47].

Early experience of the use of spinal anaesthesia has been associated with a high incidence of PDPH. Flaaten noted a 37.2% incidence of PDPH in 51 young male outpatients given spinal anaesthesia through a 25G Quincke needle [48]. Those patients who developed headaches were off work for a significantly longer time than those who did not. Using small gauge needles in 658 ambulatory outpatients, Kang reported the incidence of PDPH was 9.6% and 1.5% for 26G and 27G respectively [49]. Only 12 of 31 (38.7%) patients in the 26G group and 1 of 5 (20%) in the 27G group required epidural blood patch. Failure rate with small needles is very low ($< 1\%$). Satisfaction and acceptance is higher in the 27G group. A total of 98.2% of patients in the 27G group wished to have spinal anaesthesia again in the future. With pencil-point needle (Sprotte), Pittoni achieved an incidence of PDPH 0.8% for 22G and 0% for 25G with very low failure rate (0.8%) [50]. The only patient in 22G group who had PDPH responded to conservative management without resorting to epidural blood patch. This patient underwent spinal anaesthesia 6 months later with the use of 25G Sprotte needle and no PDPH was recorded.

Where PDPH might be an acceptable complication for an inpatient who anticipates 3 to 4 days of hospitalization, this complication can be considered a serious setback for a young, healthy, active outpatient anticipating a rapid return to work or a resumption of other daily activities. Corbey reported an incidence of PDPH of 4.5 and 8% when 26G and 27G Quincke needle were used in outpatients under 45 years of age. Majority of them responded well to conservative treatment and none of them required epidural blood patch [51]. Hence, for younger patients who have a higher incidence of headache and who have an urgent need to return to full ambulatory function within 24 h after the surgical procedure, these patients are not the ideal candidates for spinal anaesthesia.

4.3. Urinary retention

Urinary retention is an uncommon complication following spinal anaesthesia. This adds to the patient's discomfort and may result in unanticipated admission for patients undergoing a simple procedure [50].

Urinary retention is due to complex effects on peripheral and central neurogenic mechanisms controlling the micturition reflex. This would include autonomic blockade, estimated to be three times longer than two segment regression [52]. Following spinal anaesthesia, autonomic function will have returned to baseline when motor function in the lower extremity, proprioception of the big toe, and sensory function in the perianal region have returned to normal [53].

Various factors may increase the risk of developing urinary retention following spinal or epidural anaesthesia: male gender, site of surgery, amount of intraoperative intravenous fluid and duration of blockade, the last one being the most important factor. A much higher incidence of urinary retention was reported with the use of longer-acting local anaesthetic than the short-acting one for either spinal or epidural anaesthesia [54,55]. A total of 25% of outpatients receiving spinal anaesthesia with heavy bupivacaine 0.5% requiring catheterization in the postoperative period to relieve urinary retention before discharge has been reported [39] and this can result in subsequent unanticipated admission [50].

Large amounts of perioperative intravenous administration may result in overdistention of bladder, but the correlation with urinary retention is unclear [56]. Urinary retention tended to occur more frequently in association with groin and perineal procedures [50,54]. Pain at the incision site associated with attempts to void may be a contributing factor.

Urinary retention almost always subsides with the complete recovery from anaesthesia and seldom necessitates bladder catheterization. Various methods are recommended to decrease this side effect: minimize use of a long-acting local anaesthetic, restriction of the infusion of fluids perioperatively, early mobilization, psychological encouragement, and delay of catheterization. However, if catheterization is indicated, patients may simply be catheterized once and discharged. Only in rare circumstances will a patient require an indwelling catheter overnight.

4.4. Modification of techniques recommended for ambulatory surgery

4.4.1. Choice of local anaesthetic

A short-acting local anaesthetic agent such as lidocaine is the drug of choice for spinal anaesthesia in the ambulatory setting. Longer-acting agents like bupivacaine and tetracaine should be avoided as they are associated not only with longer stay in recovery room but also higher incidence of urinary retention.

Lidocaine is commercially available in both hyperbaric (1.5 and 5%) and isobaric (2%) preparations (Table 3). The usual duration of action ranges from 30 to 90 min, shorter with the dilute concentration [57]. Lidocaine is ideal for lower abdominal surgery up to 60

Table 3
Local anaesthetics for spinal anaesthesia

Drug	Usual concentration (%)	Usual volume (ml)	Total dose (mg)	Baricity	Glucose concentration (%)	Usual duration (min)
Lidocaine	1.5, 5.0	1–2	30–100	Hyperbaric	7.5	30–90
Mepivacaine	4	1–2	40–80	Hyperbaric	9.0	30–90
Tetracaine	0.25–1.0	1–4	5–20	Hyperbaric Hypobaric Isobaric	5.0	75–150
Bupivacaine	0.5	3–4	15–20	Isobaric		75–150
	0.75	2–3	15–22.5	Hyperbaric	8.25	75–150

Adapted and modified from Strichartz, [57], with permission.

min and lower limb surgery requiring tourniquet up to 90 min. For surgery of longer duration, one can avoid using long-acting local anaesthetic by adding adjuvant. Fentanyl, a short-acting opioid, is the drug of choice. Addition of fentanyl 20 μg to plain lidocaine significantly increases the duration of anaesthesia to transcutaneous electrical stimulation, which is comparable to surgical stimulation [58], and tourniquet-induced pain without prolonging the motor block and time for voiding [59]. In contrast, addition of epinephrine 0.2 mg increases the duration of surgical anaesthesia and prolongs the time to void [60]. Hence, epinephrine should be avoided in an ambulatory setting as it results in an increase in time to spontaneous urination and discharge [61].

Recently, there is significant concern about the neurotoxicity of 5% hyperbaric lidocaine [31,32]. The incidence of transient radicular irritation following the use of hyperbaric 5% lidocaine ranged from 10–37% [33–35]. Although the symptoms usually resolve within 3 days, it can pose a significant problem for day surgery patients [62]. Even the manufacturer acknowledged the problem and recommended the dilution of 5% lidocaine with an equal volume of cerebrospinal fluid or preservative-free saline [32]. On the other hand, dilute concentrations of Lidocaine from 0.5 to 2%, either hypobaric or hyperbaric, have been shown to provide successful block for various surgery [63–66]. Recently, the minimum effective anaesthetic concentration has been defined and was shown to be 0.53 and 0.3% for a dose of 48 and 72 mg respectively [67]. Hence, it is prudent to use dilute lidocaine solution in ambulatory settings.

4.4.2. Choice of spinal needles

To minimize the risk of PDPH, the smallest spinal needle of pencil-point design should be used for ambulatory surgery [44]. With small Whitacre (26–27G) or Sprotte (24G) spinal needle, the incidence of PDPH can be reduced to 0.5% or lower [50,68]. Needle size less than 27G is not recommended as it increases the technical difficulty and thus associates with higher failure rate [69].

5. Epidural anaesthesia

Epidural anaesthesia is perhaps the most popular regional technique in the ambulatory setting for surgery of lower abdomen and lower extremity [17,70,71]. In a double-blind study, favorable discharge times for chloroprocaine or lidocaine epidural anaesthesia were found in outpatients [72]. When epidural anaesthesia was compared to general anaesthesia for ambulatory knee arthroscopy, shorter discharge times, decreased incidence of nausea and vomiting, and reduced postoperative pain were found [73].

Several advantages make epidural anaesthesia a favorable choice of anaesthetists. The risk of postdural puncture headache is extremely low. There is always a potential risk of unintentional dural puncture by either the needle or the catheter. A 0.5% incidence of accidental dural puncture during epidural needle placement was reported [74] and chance of having PDPH following this exceeded 50% in younger patients [75]. Onset of anaesthesia is slower and thus less threatening to patients. It can be 'titratable', i.e. the dose can be adjusted to the desired dermatome and the concentration can be varied depending on the motor block required.

The advantages of epidural anaesthesia must be weighed against several factors that compared negatively with spinal anaesthesia. Technically, it is more difficult especially in obese and elderly patients. The onset is slower than spinal technique and 15–20 min are usually required to attain adequate surgical anaesthesia. It is less reliable than spinal anaesthesia in providing a dense motor and sensory block, especially in the sacral area. Variation in dose response is wider and younger patients require significantly higher dose than elderly and obstetric patients [74]. The higher dose requirement also increase the risk of local anaesthetic toxicity. Backache is another problem. The risk of backache is higher and tends to last longer in young patients compared with spinal anaesthesia [76].

The technique for epidural anaesthesia for outpatient is basically the same as for inpatient. Lumbar epidural blockade is suitable for surgery of lower extremity,

Table 4
Local anaesthetics for epidural anaesthesia

Drug	Usual concentration (%)	Usual volume (ml)	Total dose (mg)	Usual duration (min)	
				Plain	With epi 1:200 000
Chloroprocaine	2–3	15–30	300–900	45–60	60–90
Lidocaine	1–2	15–30	150–300	80–120	120–180
Mepivacaine	1–2	15–30	150–500	90–140	140–200
Bupivacaine	0.25–0.5	15–30	37.5–150	165–225	180–240

Adapted and modified from Brown, [108], and Strichartz, [57], with permission.

laparoscopy, inguinal hernia repair and lithotripsy while caudal epidural approach is more appropriate for perianal procedure (Table 2). Short acting local anaesthetic agents should be the drug of choice; 2-chloroprocaine and lidocaine provide adequate anaesthesia for surgery up to 1 and 2 h, respectively (Table 4). For procedures with longer or unpredictable duration, one can add epinephrine to the local anaesthetic or repeat the dose through the epidural catheter rather than using longer acting drug. Although placement of catheter increases the risk of venous puncture from approximately 3 to 8%, this allows the anaesthetist to use a smaller dose without worrying about inadequate anaesthesia intraoperatively.

The use of 2-chloroprocaine deserves some discussion. Since it was made available in the US in 1952, there have been concerns about the neural toxicity following accidental intrathecal injection. Preservatives like sodium bisulphite was thought to be responsible [77]. In 1987, a new preparation using disodium EDTA was available in the market but it raised new concern about the high incidence of back pain associated with its use [78,79]. The back pain is deep aching burning in character and diffuse in the lumbar region, lasting at least 24 h [79]. This appears to be associated with larger doses of chloroprocaine (35 to 45 ml range). Hence, chloroprocaine should be restricted to very short outpatient procedure requiring small dose of local anaesthetic. In view of this, a new preparation of preservative-free chloroprocaine is now available.

6. Combined spinal epidural technique (CSE)

Since CSE was performed on a single spinal segment for lower limb surgery in 1982 [80], this regional technique has become increasingly popular during recent years. CSE anaesthesia offers advantages over the use of epidural or spinal alone. Compared to epidural anaesthesia, CSE has a faster onset and virtually no risk of clinically relevant intravascular injection. With an epidural catheter as backup for possible re-dosing, the anaesthetist can confidently administer a minimal intrathecal dose which can result in shorter duration of anaesthesia and recovery time. Furthermore, it offers increased flexibility because the anaesthetic duration can be extended using the epidural catheter.

However, this technique also combines the disadvantages of both the spinal and epidural technique. By combining the two techniques, it increases the complexity and the time for performing this procedure. With the puncture of the dura, the patient has the risk of postdural puncture headache. In this needle-through-needle technique, the risk of displacement of the spinal needle is high. The failure rate ranged from 4 to 16% [81,82]. Failure is also associated with inadequate length of spinal needle protruding through the Huber aperture of the epidural needle. By using a longer spinal needle with protrusion of its tip at least 12 mm beyond epidural needle, the failure rate can be decreased [82,83]. There is also concern about the migration of the epidural catheter into the same hole created during the dural puncture but a recent study showed that it was impossible to force a 16- or 18-gauge epidural catheter through the hole made with a 25- or 26-gauge spinal needle [84].

Most of the studies using CSE technique are in obstetric and inpatient population [85]. In 90 outpatients undergoing knee arthroscopy, CSE with 40 mg isobaric lidocaine resulted in very short favorable discharge times with few side effects [86]. About 10% of patients required epidural supplement intraoperatively. Without a backup of epidural catheter, one might use a higher dose for spinal anaesthesia which would prolong the discharge time. More studies are required to show the usefulness of CSE in the ambulatory setting.

7. Regional block for upper extremity

Regional anaesthesia offers many advantages for surgery of the upper limb. With anaesthesia confined to the upper limb, patients remain awake and can enjoy faster recovery and earlier discharge [24]. Complications such as nausea and vomiting are minimized and pain control is smoother, regional anaesthesia can reduce unanticipated admission in ambulatory setting [16,87] and result in cost-saving [14].

Table 5
Local anaesthetics for major nerve blocks

Drug w/epinephrine 1:200 000	Usual concentration (%)	Usual volume (ml)	Maximal dose (mg)	Usual onset (min)	Usual duration (min)
Lidocaine	1–1.5	30–50	500	10–20	120–240
Mepivacaine	1–1.5	30–50	500	10–20	180–300
Bupivacaine	0.25–0.5	30–50	225	15–30	360–720
Tetracaine	0.25–0.5	30–50	200	20–30	300–600

Adapted and modified from Strichartz, [57], with permission.

Time constraint is a major concern with this technique. This can be minimized by performing the block outside the operating room, either a regional block room or PACU. Actually, the extra time spent to perform the block can be offset by the rapid turnover and faster recovery of patient compared with general anaesthesia [16,87].

Different techniques can be used for major upper limb blockade: intravenous regional anaesthesia and brachial plexus block of different approach, i.e. interscalene, supraclavicular and axillary. Surgical procedures suitable for the particular regional technique are listed in Table 2.

Intravenous regional anaesthesia provides an extremely simple, safe and reliable form of regional technique for the surgery of hand and distal forearm. Onset is rapid and the surgeon can start prepping and draping once all the local anaesthetic is administered. Dilute (0.5%) prilocaine or lidocaine are the drug of choice. Disadvantages of this technique are tourniquet pain, possible toxic reaction following tourniquet release and rapid loss of analgesia in the immediate postoperative period.

The brachial plexus can be blocked with different approaches. Factors that determine the specific approaches are the site for surgery and the associated complications. Interscalene approach is most suitable for surgery involving the shoulder while axillary approach for surgery for the hand. The supraclavicular approach provides reliable, fast onset of anaesthesia with relatively small volume of anaesthetic, and is most likely to anaesthetize all the major branches of upper limb. The risk of pneumothorax, albeit rare, may result in unanticipated admission. This complication was addressed by Moorthy by using a lateral paravascular approach [88].

The axillary brachial plexus block is an accepted technique for the forearm and hand surgery. Three methods are used to localize the plexus: paresthesia seeking, transarterial and nerve stimulation. Although there was no significant difference in success rate among these three methods [89], transarterial technique has been gaining popularity because of the reports of increased success and decreased complication [26–28,90]. Standard paresthesia technique has been characterized by Mulroy [91] as probably the most common for the axillary block. However, in a recent editorial analyzing the controversy of complication associated with this technique, the author suggested that paresthesia technique may increase the likelihood of neuropathy [90]. Until there is large prospective study to confirm this argument, the practicing anaesthetist should choose the method they are comfortable with.

Interscalene brachial plexus block is the regional technique of choice for shoulder surgery. With recent advance in arthroscopic technique, there is an increasing popularity of shoulder surgery performed in the ambulatory surgery setting. Unfortunately, this type of surgery was associated with a 45% incidence of severe postoperative pain [92].

Interscalene blockade, either as the sole technique or combined with general anaesthesia, has been compared favorably to general anaesthesia in terms of pain control and better recovery [16,87,93]. The anaesthetist should be aware of the complications and limitations of this block as sole anaesthetic. Hemidiaphragmatic paresis following interscalene block has been reported to be 100% [94]. Although the consequent reduction of forced vital capacity (FVC) is not life-threatening in young healthy patients (27–34%) [94,95] it can cause the sensation of breathlessness and necessitate the conversion to general anaesthesia [87]. Hoarseness, as a result of blockade of recurrent laryngeal nerve, can increase the anxiety of an already nervous patient. Finally, activation of Bezold–Jarisch reflex in patients undergoing shoulder arthroscopy following interscalene block has been reported [96]. This reflex results in profound bradycardia and hypotension with the patient usually experiencing nausea and lightheadedness 60 min after the interscalene blockade. Therapy consists of atropine and/or ephedrine.

Lidocaine and mepivacaine are the drugs of choice for brachial plexus block (Table 5). For surgery less than 3 h duration, lidocaine 1.5% with epinephrine or mepivacaine 1.5% are ideal for this purpose. For surgery of shorter duration, plain lidocaine 1.5–2% is preferable. Bupivacaine with longer duration of anaesthesia may cause some concern in patients because of the slow return of normal function.

Recently, two new regional techniques are being used to improve pain control and recovery of patient undergoing outpatient shoulder arthroscopic surgery. When combined with general anaesthesia, suprascapular nerve block significantly improved pain control in the early postoperative period, reduced the consumption of analgesic and resulted in earlier discharge [12]. This method is applicable to arthroscopic rather than open shoulder surgery. The advantage of this block is the ease of performing compared to interscalene block. The other technique is modified interscalene block in which low volume (10 ml) and low concentration (0.125%) of bupivacaine is used in combination with general anaesthesia [97]. With this technique, the pain score was significantly reduced, 39% of patients did not require morphine during the hospital stay and patients reached discharge criteria significantly earlier. Advantages include less profound motor block (motor function almost fully recovered by 120 min) and smaller volume of injectate implying lower risk of systemic toxicity.

8. Regional anaesthesia for the lower limb

Peripheral nerve blockade for the lower limb is not as commonly practiced as in the upper limb. The main reason is that spinal or epidural technique offers an easy, quick and reliable technique for the anaesthesia of the lower limb. Anatomically, the nerve supplies to the lower limb, the lumbar and lumbosacral plexus, are not bundled together and easily accessible, making it technically more difficult and time-consuming to anaesthetize. The latter factor is particularly important in the ambulatory settings. Surgical procedures suitable for the particular regional technique are listed in Table 2.

Intra-articular instillation of local anaesthetic is the simplest form of anaesthesia for knee arthroscopy and is effective for diagnostic arthroscopy. When tourniquet and arthroscopic surgery is required, a more extensive anaesthetic is required. Anaesthetizing the lumbar plexus alone without blocking the sciatic nerve usually is enough for this purpose. The lumbar plexus can be blocked either through a posterior [98] or anterior approach, the latter is technically easier and is more commonly used in ambulatory surgery. In anterior approach, either separate injections to femoral nerve and lateral cutaneous nerve of thigh or one injection in '3-in-1' block described by Winnie can be used [99]. With '3-in-1' block of 20–30 ml volume of injectate, there is a high chance that the lateral cutaneous nerve of thigh or the obturator nerve are missed [11,98]. Patel described the satisfactory use of the '3-in-1' for outpatient knee arthroscopic surgery. It resulted in superior postoperative pain control, faster recovery and earlier discharge compared with general anaesthesia group [11]. Supplementation of '3-in-1' block with blockade of lateral cutaneous nerve of thigh was suggested to improve the success rate.

For foot surgery, three techniques (popliteal fossa block, ankle block and intravenous regional anaesthesia) can be used in ambulatory settings. Popliteal fossa block is a simple and effective procedure that is very useful for ambulatory surgery [100]. With the patient in prone position, a single injection of 30–40 ml of local anaesthetic is required to anaesthetize the sciatic nerve at this level. In experienced hands, this block can be finished within 15 min [100]. Supplementation with saphenous nerve block is needed if anaesthesia of the dorsum of foot or big toe is required.

Ankle block is also a very useful procedure for outpatient foot surgery like bunionectomy and neuroma excision [101]. Since there is only minimal disruption of ambulatory function, longer-acting local anaesthetic can be used and results in excellent postoperative pain control. However, at least three separate needle insertions are required to anaesthetize the five nerves, and additional time is required to wait for the block to work, making this a time-consuming procedure. Both the ankle block and popliteal fossa block do not provide adequate anaesthesia for the ischemic pain from the tourniquet placed on the thigh.

Intravenous regional anaesthesia (IVRA) for the lower limb is not as popular as its use in the upper limb. The major drawback is greater ischemic tourniquet pain when the tourniquet is applied at the thigh or calf level [102,103]. This can be minimized by placing the tourniquet in the ankle with good acceptance with patients receiving this anaesthetic [104]. Although the success rate of the latter technique was 80%, all procedures were successfully completed with additional local anaesthetic infiltration. The advantages of this technique are the simplicity and the rapid onset of the block.

9. Discharge considerations

Patients receiving regional anaesthesia require the same postoperative care as other ambulatory surgery patients. Central nervous system effects of local anaesthetics may prolong complete recovery after regional anaesthesia. It has been shown that patient postural stability was impaired 40 min after perivascular axillary block with mepivacaine [105]. For those patients who received peripheral nerve blockade, there is no need to delay their discharge until complete resolution of sensory and motor blockade. In fact, residual sensory block allows better pain control and is one of the advantages of regional anaesthesia technique. However, patients with residual block of an extremity should be well informed of the need to protect the extremity from any trauma due to the loss of sensation and reflex. A

sling is all that needed for a numb upper extremity while a bulky dressing is required to protect a numb lower extremity against injury. Crutches should be supplied to all patients with knee or foot surgery. Before discharge from the day surgery unit, patients should be instructed and supervised on the use of this walking aid.

When is it safe to permit patients to ambulate following spinal or epidural anaesthesia? Suitable criteria for ambulation after spinal anaesthesia include normal perianal (S4–S5) pinprick sensation, plantar flexion of the foot, and proprioception of the big toe [106]. No motor block should be present when a patient tries to stand or walk. To test the motor block, the clinician may ask the patient to touch both the right and left heel to the opposite big toe and to run each heel up and down the opposite leg to the knee [107]. A patient's ability to walk to the bathroom and urinate may be the best recovery tests after epidural or spinal anaesthesia because these abilities indicate the recovery of motor and sympathetic functions. Patients with spinal anaesthesia should be warned about the possibility of spinal headache.

Before discharge, patients should be given a phone number so that they can contact an anaesthetist or the regional anaesthesia program nurse in case of any concern about complication resulting from the regional nerve blockade. Patients should also be followed up in the postoperative day 1 to ensure complete return of neurological function.

10. Conclusions

Regional anaesthesia provides better postoperative pain control, avoids complications from general anaesthesia, such as nausea and vomiting, and results in faster recovery of patients. All these advantages are important in ambulatory surgery. However, there are several limitations with this technique. Extra time is required to initiate a nerve block. Therefore, the block procedure is preferably performed in a designated area outside the operating room. Regional anaesthesia is a technical specialty. Anaesthetists skillful in this area are required to ensure smooth running of the regional anaesthesia program and careful exact technique must be practiced in treating outpatients. Certain complications associated with regional anaesthetic technique, like postdural puncture headache, may not be acceptable to young and active ambulatory outpatients. Careful selection of candidates and technique is necessary.

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The use of drains for outpatient orthopaedic surgeries: Safety and efficacy

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Abstract

While drains have been routinely used in orthopaedic surgery for postoperative wound drainage following inpatient surgical procedures, there are no published reports on the safety or efficacy of drains for outpatient orthopaedic surgeries. This review reports our experience between July 1995 and January 1996 with the use of drains for 35 patients having outpatient orthopaedic surgery. Consequences of drain usage were determined by medical chart review and a follow-up telephone survey in which patients were asked a series of questions regarding the drains used for their operation. None of the patients had an infection or any other medical problem as a result of drain usage and there were no problems with wound healing. Patients were quite capable of managing and removing their own drains. We conclude that drains are effective and can be used safely for outpatient orthopaedic surgical procedures. © 1997 Elsevier Science B.V.

Keywords: Outpatient surgery; Drains

1. Introduction

Drains have been routinely used in orthopaedic surgery for postoperative wound drainage following certain inpatient surgical procedures [1–4]. Some surgeons have recently also started to use drains for selected outpatient surgical procedures. There are, however, no published reports on the safety or efficacy of drains for outpatient orthopaedic surgeries.

Much has been written about the advantages and disadvantages of postoperative wound drainage. Advantages of drain usage include improved apposition of tissue surfaces by removing excess blood, protection of the skin from irritating discharges, and for intraarticular drains, decreased joint swelling which facilitates early range of motion. Disadvantages of drain usage include foreign body effects, mechanical problems (such as entrapment by a misplaced suture), promotion of fluid and electrolyte losses, and the potential for an increased incidence of wound infection.

Despite the potential risks most orthopaedic surgeons use drains routinely in certain situations. We routinely use drains for patients having selected outpatient orthopaedic operations. Some of these patients stay overnight in our outpatient surgery center and have the drain removed by the surgical team in the morning before they are discharged, but others are sent home with the drain in place and are given instructions to remove it themselves the day after surgery. The purpose of this review is to report our experience with the use of drains in the ambulatory surgery setting.

2. Patients and methods

Between July 1995 and January 1996, 117 outpatient orthopaedic operations were performed by the senior author at the University of California at Los Angeles

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Outpatient Surgery Center. Thirty-five of these surgeries involved the placement of at least one polyvinylchloride (Snyder hemovac; Zimmer, Dover, OH) or silastic (Swanson; Wright Medical, Arlington, TN) drain in or around the surgical site. The group of patients who had these drains placed at surgery comprises the study group for this review. There were 28 males and seven females in the group. The average age of the patients was 31 years with a range from 16 to 59 years.

Twenty-six patients stayed overnight after their surgery at the surgery center. Twenty-one of these patients had their drain removed by a member of the orthopaedic surgery team on the morning after their surgery. Five of these patients were sent home with their drain in place and were given instructions about when and how to remove the drain themselves. Nine patients went home on the day of their surgery and they were also given instructions about drain removal. All 14 patients sent home with a drain in place received clear written and verbal instructions about when, how, and what to expect regarding the removal of the drain (Table 1).

Table 1
Written instructions to patients about drain removal at home

About your drain
1. In order to prevent excess accumulation of blood around the area of your surgery, a drain was placed under the skin to accumulate excess blood and body fluids from the surgery site.
2. Part of the drain is under your skin and part of it is outside of your body. We commonly use one of two types of drains for the type of surgery you had.
3. Your drain either looks like a small tube exiting from your dressing and attached to a suction bulb OR like a thin, flat piece of rubber underneath and draining directly into your dressing.

When to remove the drain
1. Before you leave the Surgery Center your doctor will tell you when to pull out your drain. Most patients who go home with drains in place are asked to remove them 24–48 h after their operation.

How to remove the drain
1. In order to remove your drain you must first loosen the dressings around it so that you can see where the drain exits your skin.
2. Next grab the exposed drain at a point close to where it exits your skin and pull the drain out gently but steadily.
3. After the drain is removed wrap it up and throw it away.

What to expect with drain removal
1. The drain should come out with little effort.
2. The drain site may sting for a few seconds after the drain is removed.
3. Sometimes there is a small clot of blood that comes out of the drain site after the drain is removed. This is normal and the drain site should simply be covered up with a gauze sponge or Band-Aid.

Don't hesitate to call your doctor if you have any problems or questions.

There is a wide variety of outpatient orthopaedic operations for which drains are useful. In this review there were 12 anterior cruciate ligament reconstructions, five open reductions of fractures or joint dislocations treated with internal fixation, four open Bankart repairs, three hardware or loose body removals, three minor bony resections, two lateral retinacular releases, two ulnar nerve transpositions, two extensive arthroscopic knee joint debridements, one lysis of adhesions between quadriceps muscle and femur fracture callous, and one elbow lateral epicondylar release.

A total of 44 drains (36 hemovacs and eight silastics) were used for the 35 procedures reviewed. Two drains were placed in nine of the operations and one drain was placed in the other 24 operations. One open reduction with internal fixation of a metatarsal, one hardware removal of tibial screws, two of the minor bony resections, one of the ulnar nerve transpositions, and the lateral epicondylar release were the only procedures for which we used a silastic drain. The rest of the operations involved the placement of a hemovac drain.

In order to assess the efficacy of the drains used for these outpatient surgeries we conducted a follow-up survey by telephoning each patient after their last postoperative visit to ask them questions regarding the drain used for their operation. Specifically, we asked each patient what the elapsed time was between their surgery and drain removal, if they had any problems or medical complications as a result of the drain and, finally, we asked if our instructions about drain management were clear and easy to follow or if they needed to call the office about any drain related questions.

3. Results

None of the 35 patients in this review had an infection or any other medical problem as a result of drain usage and none had any problem with primary wound healing. Additionally, none of the 14 patients who removed the drain on their own reported any significant pain with drain removal, whereas two of the 21 patients who had their drain removed by a member of the orthopaedic team reported severe pain with drain removal.

The average time elapsed between surgery and drain removal was 21 h (range from 8 h to 30 h) for patients who had their drain removed at the surgery center before going home and was 46 h (range 6 h to 7 days) for patients who went home with their drain in place and removed it themselves.

Two patients who were sent home with their drain in place had unplanned drain removals. In one patient the drain was inadvertently removed after 6 h when the patient rolled over in bed on the evening after surgery. The other patient did not understand the instructions

and left the drain in until the first postoperative visit at seven days. This patient was the only one in the review that either was not given or did not understand our instructions regarding the care and removal of the drain. All the rest of the patients felt that our instructions were clear and easy to follow and none needed to call the office with any drain related questions.

4. Discussion

Drainage of orthopaedic wounds has been strongly advocated for many years. In one of the first studies on the role of drains for orthopaedic surgeries, Waugh and Stinchfield [5] compared the postoperative complications of 100 various orthopaedic operations using drains with a similar number of undrained matched controls. They reported a 1% infection rate for drained wounds compared to a 3% infection rate for undrained wounds and concluded that all wounds involving medullary bone as well as all wounds involving a potential dead space should be drained 'to promote a more benign and uncomplicated postoperative course'. This research supports the surgical principle that minimizing postoperative hematoma will minimize postoperative infection [6,7].

Not all research, however, has supported the use of drains. Stevens [8] initiated concerns about drain usage when he reported an increased infection rate for orthopaedic surgeries using drains. More recently, several studies have suggested either no benefit or even an increased risk from the use of drains for orthopaedic surgeries. Cobb [9], in a prospective randomized study on the use of drains after surgery for femoral neck fractures, concluded that drains did not seem to improve overall wound healing. Other studies on the role of drains in total joint arthroplasty surgery have come to the conclusion that the potential risk of increased infection may not be worth any advantages that may be afforded by drain usage.

All previous reports on the use of drains for orthopaedic surgeries have reviewed inpatient procedures. This report is unique in that it is the first to review the use of drains for outpatient orthopaedic surgeries. It is significant that there were no infections or medical complications as a result of the drain for any of the patients in our review. Perhaps the relatively short time for which a drain is needed after an outpatient surgery helps to minimize the potential increased risk of infection that drains may cause. Also, it may be that the drains themselves were the reason for the lack of infections in that they were effective in evacuating wound hematomas which have long been known to be a fertile source of infections.

We believe that surgeons should feel confident that patients can safely manage their own drain care should they need to be sent home with a drain in place. Only one of our patients who was sent home with a drain in place had any problem in following our verbal instructions about when to take the drain out and even then no untoward outcome occurred.

This study does not address the issue of whether or not drains should be used for particular surgical procedures. That is a question that has not been clearly answered by the current orthopaedic literature, and as such, is subject to the beliefs and experiences of individual orthopaedic surgeons. The current medical climate requires that more and more orthopaedic procedures be done in the outpatient setting. This study asks the simple question of whether or not drains can be used safely and effectively in the ambulatory setting. Our patients had the benefits of surgical wound drainage and there were no complications. It would seem that surgical drains can be used in outpatient orthopaedic procedures when the surgeon feels it is warranted. As long as the patient has clear written and verbal instructions, we feel that the use of drains is a safe and effective adjunct for outpatient orthopaedic surgical procedures.

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Ambulatory Surgery

Ambulatory surgery for PTFE grafts for dialysis

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Abstract

All prosthetic vascular accesses for hemodialysis performed in an ambulatory surgical setting between January 1992 and December 1996 were reviewed retrospectively. During this period, 400 out of the 450 vascular accesses with PTFE grafts (88.9%) were performed as outpatient cases. All operations were under local aesthesia without premedication. There were no postoperative deaths. Early complications were as follows: mild postoperative bleeding (readily controlled by local pressure): three (0.75%); surgical site infection: three (0.75%); early thrombosis (successfully treated with rescue surgery within the first 48 h, also in an ambulatory setting): four (1%). Four patients needed hospital admission (1%), one due to threatening arrhythmia, another because of anaphylactic reaction to cephazoline and two because of severe metabolic disorders. There was no increase in morbidity when the patients travelled long distances from the hospital to their homes immediately after the operation. These results show that prosthetic vascular accesses can be constructed and repaired in patients under local aesthesia and in an ambulatory surgical setting without an increase in morbidity. Delays due to waiting lists can be avoided, less resources are required, and complications associated with the prolonged use of central vein catheters for temporary hemodialysis can be reduced. © 1997 Published by Elsevier Science B.V.

Keywords: Vascular access; PTFE grafts for dialysis; Ambulatory surgery

1. Introduction

Patients with end-stage renal failure needing vascular access for future hemodialysis, as well as those being currently dialyzed who suffer any complication from their angioaccess, require prompt surgical intervention in order to avoid the deletereous complications derived from central venous catheters for hemodialysis [1]. Performance of vascular access procedures in an ambulatory setting would avoid unnecessary delays of surgery. Published experience on ambulatory vascular surgery is restricted to the treatment of varicose veins [2] and the creation of vascular access for hemodialysis [3]. Our group's experience on vascular access in an ambulatory settings up to 1992 has been previously published [4].

The purpose of this study is the retrospective analysis of a 5 year experience of inserting polytetrafluoroethylene (PTFE) prostheses for hemodialysis in an ambulatory surgical setting.

2. Material and methods

2.1. Patients

From January 1992 to December 1996, 450 vascular accesses for hemodialysis using PTFE prostheses were undertaken in the Hospital Gregorio Marañón, Madrid, Spain. Patients came from hemodialysis units in Madrid and other cities located 100–300 km around. The only limitation for day-surgery vascular access during this period was the patient's need of hospital admission for other causes. Depending on their own preferences, patients came to the hospital either by ambulance, taxi, or their own means. Some patients living in Madrid used public transport to return home

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after their operation. The patients were previously informed that they were allowed to have breakfast and take their usual medication on the morning of operation. When the patient was currently included in a hemodialysis program through a temporary catheter, a dialysis session was held the day prior to surgery.

2.2. Surgical strategy

Patient's monitoring included continuous electrocardiogram, pulse oxymetry and noninvasive blood pressure monitoring. Glucose solution (5%) was infused through a peripheral vein. As antibiotic prophylaxis, 2 g of cefazline was given intravenously (500 mg of vancomycin in cases of allergy to penicillin). Heparin was not administered during vessel clamping.

All surgical procedures were carried out under local aesthesia using alkalinized 0.25% bupivacaine solution (maximum dose 300 mg). Anesthesia was injected in all layers of the surgical field (dermal, subcutaneous, subfascial and perineurial) and along the path of the subcutaneous tunnel. No sedative premedication was used but pre and intraoperative psychological support was given.

The subcutaneous tunnel for the prosthesis was formed using a curved tunneller (Gore-tunneller, WL Gore and Associated, Flagstadt AZ). Stretch wall PTFE prosthesis (WL Gore and Associated, Flagstadt, AZ), 6 or 8 mm in diameter was used and anastomosed to the vessels using PTFE or polypropylene sutures. Only the skin was closed, leaving the subcutaneous layers unsutured. Postoperatively patients returned to their homes and were reviewed the following day at their dialysis units. Non-steroidal anti-inflammatory drugs were used for postoperative analgesia. Early and late complications were treated on an ambulatory surgical basis.

3. Results

Of the 450 vascular accesses for hemodialysis, 400 were carried out in an ambulatory surgical setting (substitution index: 88.9%) [5]. The mean age of the patients was 57.6 years and 27% of them were ASA III. The kinds of vascular access are depicted in Table 1. There was no perioperative mortality among patients undergoing ambulatory surgery. Early complications observed within the first 48 hours, are depicted in Table 2. Haemorrhages were self-limited and did not require admission. They only required observation at the center of reference for a few hours. Early thromboses were successfully treated in an ambulatory setting within 48 h of surgery.

Four patients (1%) needed hospital admission from the operating room, one due to cardiac arrythmia, another because of anaphylactic reaction to cefazoline and the remaining two because of several metabolic complications. There were no complications associated with patients travelling home postoperatively, regardless of the distance they had to cover.

Cumulative patency rates are shown in Fig. 1. There were no statistical differences between patency rates of ambulatory and inpatient grafts ($P = 0.6732$).

Table 1
PTFE grafts performed between January 1992 and April 1995

	Total	Amb surg[a]	% Amb surg
Forearm	88	78	88.6
Upper-arm	335	302	90.1
Brachial-jugular	20	16	80
Femoro-femoral	6	4	66.7
Total	450	400	88.9

[a] Amb surg, ambulatory surgical cases.
% Amb surg, substitution index.

Table 2
Early complications observed in 400 PTFE grafts for displays performed in an ambulatory surgical setting

Complication	No.	%
Mild postop. bleeding	3	0.75
Surgical site infection	3	0.75
Early thrombosis	4	1
Hospitalization	4	1
Total	14	3.5

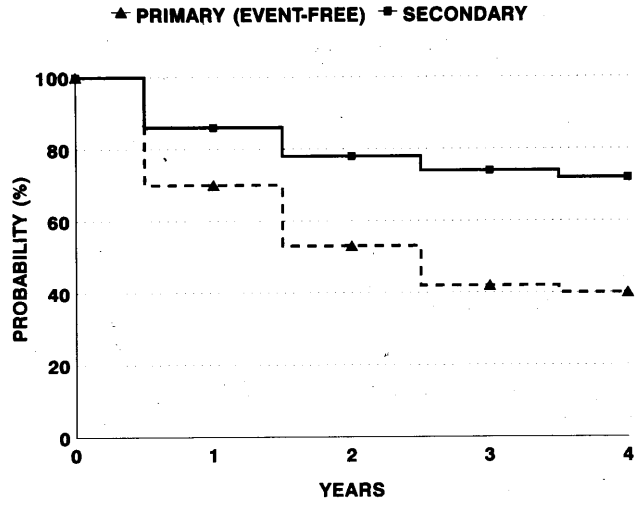

Fig. 1. Cumulative patency rates of 450 PTFE grafts for dialysis. Primary (P) event-free patency. Secondary (S) overall patency. There were no statistical differences between primary curves of inpatients (No = 50) and outpatients grafts (No = 400). $P = 0.6732$.

4. Discussion

Several factors affect the increasing population of patients undergoing hemodialysis: greater survival rates of these patients, lack of an age limit among the criteria for patient selection, small number of kidneys available for transplantation, loss of transplanted kidneys due to rejection, etc. All these factors lead to an increasing number of patients requiring vascular access. Moreover, the complication rate of vascular accesses is directly proportional to the number of patients and the time they have been in a dialysis program. For these reasons, the number of surgical interventions needed for the construction or repair of vascular accesses is also rising.

Due to large number of patients on waiting lists, inpatient surgery may be delayed, leading to undesirable complications from the use of temporary venous catheters for hemodialysis. Ambulatory surgery, must be considered as an effective alternative that avoids this problem.

It has been shown in this and other studies [3,4] that vascular accesses, either autologous or prosthetic, can be created and repaired ambulantly, without increasing complication rates. Our experience of 1482 vascular accesses for hemodialysis up to 1992 yielded a substitution index of 78%. Limitations for ambulatory surgery during this period included: patients hospitalized for other causes, periprosthetic infection, grafts placed in lower limbs, attitude of patients or their nephrologists and night emergencies with temporary admission until the next morning [4]. Since 1992 the only limitation has been hospital admission for other causes while the patient was waiting for access construction. We believe that the main factors favouring ambulatory surgery are: local aesthesia, avoidance of preoperative fasting, the patients ability to take their usual medication before the operation, no need for sedative premedication and no use of perioperative heparin.

Some authors have stated that general or regional anesthesia are the preferred choice for vascular accesses in which the anastomosis of the basilic or humeral veins is located above the middle third of the arm, in forearms previously operated on and when a prosthesis is placed in a lower limb [3]. Our experience is that any location of the prosthesis, including upper-arm grafts [6] brachial-jugular grafts [7] and femoro-femoral grafts, can be achieved using local aesthesia. The use of 0.25% alkalinized bupivacaine, which allows the use of up to 120 ml, aids broad surgical field procedures.

Travelling long distances after surgery does not increase postoperative morbidity, as has already been stated by other authors [8]. Thus, a vehicle with medical support is not essential for this kind of surgery with the exception of patients with femoro-femoral grafts where we currently advise 24 h of bed rest postoperatively. These patients should be sent home by ambulance from the recovery room after 4 h of observation.

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Ambulatory Surgery

Prevention of postoperative nausea and vomiting with metoclopramide, droperidol and ondansetron: a randomized, double-blind comparison with placebo in ambulatory surgery[1]

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Abstract

In order to compare the efficacy of metoclopramide, droperidol and two different doses of ondansetron in the prevention of postoperative nausea and vomiting (PONV) after ambulatory surgery, a prospective, randomized, double-blind, placebo-controlled study was performed in 264 patients. The incidence of PONV was 6% and no antiemetic was more effective than placebo in preventing this complication during the 24 h after surgery. © 1997 Elsevier Science B.V.

Keywords: Anaesthesia; Outpatient; Ambulatory; Nausea; Vomiting; Postoperative complications; Antiemetic; Metoclopramide; Droperidol; Ondansetron

1. Introduction

The number of surgical procedures performed on an outpatient basis has increased in the last years, accounting for ≈15 to 30% surgical procedures performed in Europe and up to 50–60% in the USA [1]. Hospital admissions following ambulatory surgery are an important index of outcome and in economic terms a major contributor to direct and indirect costs for both the hospital and patients [2]. Reports of admissions range from 0.09% to 16% [3]. By categorizing them as either avoidable or unavoidable, corrective measures can be taken to reduce the avoidable category. In this regard, the most frequent avoidable anaesthetic reason of unexpected hospital admission is intractable postoperative nausea and vomiting (PONV) [7% of total causes] [3].

Reported incidences of PONV in the ambulatory setting range from 20% to 40% in adult patients [4] and up to 73% in paediatric patients [5], depending on several factors such as the patient's age and sex [6], type and length of surgery [4], anaesthetic technique [7], the patient's ambulatory status, previous history, anxiety, pain [8], and time of the menstrual cycle [9]. Different agents such as antihistamines (e.g., hydroxyzine, promethazine), anticholinergics (e.g., scopolamine, hyoscine), dopamine-receptor antagonists (e.g., metoclopramide), butyrophenones (e.g., droperidol), seretonin-receptor antagonists (e.g., ondansetron, granisetron, tropisetron), and more recently sympathomimetics (e.g., ephedrine) are currently being used to prevent PONV. Many studies demonstrate the prophylactic antiemetic efficacy and safety of these drugs in placebo-controlled studies [10–16]. However, the optimal regimen in the prevention of PONV is still not known, due to the lack of comparative trials between drugs currently being used [17].

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Table 1
Demographic data, ASA physical status of the patients, type of anaesthesia, and type of surgery in each treatment group

Characteristics	Metoclopramide (%)	Droperidol (%)	Ondansetron (%)		Placebo (%)	*P*
			2 mg	4 mg		
Patients	20.2	19.3	21	21	18.5	
Sex						
Male	48.1	45.3	47.7	43.1	42.9	
Female	51.9	54.7	52.3	56.9	57.1	0.606
ASA						
I	86.7	88.6	85.1	85.2	86	
II	13.3	11.4	14.9	14.8	14	0.928
Type of anesthesia						
General	68.1	73.3	79.6	73.5	75.3	
Spinal	31.9	26.7	20.4	26.5	24.7	0.179
Type of surgery						
ENT	42.5	46.7	49	42.8	62.8	
General surgery	42.5	35.5	31	38.8	25.6	
Gynaecology	12.8	15.6	20	16.3	11.6	
Orthopaedics	2.2	2.2	0	2.1	0	0.775
Mean ± SD						
Age (years)	29.1 ± 20.6	27.2 ± 22.9	28.6 ± 22.21	34.1 ± 22.2	28.4 ± 18.3	0.608
Age (<14 years)	6.4 ± 2.2	5.1 ± 1.3	6.3 ± 2.7	6.6 ± 7.8	6.6 ± 2.4	0.216
Weight (kg)	56.1 ± 24.1	52.5 ± 24.9	51.7 ± 21.4	60.4 ± 22.3	59.7 ± 24.9	0.282
Height (cm)	151.7 ± 22.7	149.3 ± 24.9	149.2 ± 22.4	155.4 ± 21.2	155.9 ± 23.1	0.506
Body mass index	22.7 ± 5.5	21.8 ± 5.1	21.8 ± 5.7	23.9 ± 4.9	23.1 ± 5.5	0.281

The purpose of this study was to compare the efficacy of metoclopramide, droperidol and two different doses of ondansetron in the prevention of postoperative nausea and vomiting after ambulatory surgery.

2. Patients and methods

This study was prospective, randomized, double-blind, and placebo-controlled. Approval of the hospital's Investigational Review Board and written informed consent from all patients were obtained.

2.1. Selection criteria

Patients scheduled to undergo elective, outpatient surgery were included. Patients considered to be appropriate candidates were those of physical status 1 (healthy patient), 2 (patient with mild systemic disease), and 3 (stable patients with severe systemic disease that is not incapacitating) of the American Society of Anesthesiologists (ASA) classification. Patients were excluded from the study if they were pregnant, had nausea or vomiting 24 h before surgery, had received any prophylactic antiemetic preceding surgery, had gastric suction during or after the operation, were more than 75% over their ideal body weight, had abnormalities in clinical laboratory tests of liver function, were under therapy with digoxin, levodopa or xanthines, or needed aggressive ventilation via face mask during anaesthesia. Age itself was not part of the selection criteria, except that the lower limit was 3 years.

2.2. Antiemetic protocol

Patients were randomly allocated into five groups: 0,9% saline (as control), metoclopramide 10 mg (0,1 mg/kg in paediatric patients), droperidol 1.25 mg (0.025 mg/kg in paediatric patients), ondansetron 4 mg (2 mg in paediatric patients), and ondansetron 2 mg (1 mg in paediatric patients). The appropriate volume of antiemetic was admixed with 0.9% sodium chloride solution to a final volume of 100 ml (50 ml in paediatric patients), and administered intravenously in a double-blind fashion over 15 min immediately before the induction of anaesthesia.

2.3. Anaesthetic technique

Premedication was not used. A standard anaesthetic technique was used for all patients.

In the case of general anaesthesia atropine 0.01 mg/kg was administered prior to induction. Anaesthesia was induced with propofol 2 mg/kg and the trachea was intubated with a tube with cuff after intravenous administration of vecuronium 0.1 mg Kg^{-1}. Anaesthesia was maintained with a propofol infusion at 10 mg Kg^{-1} h^{-1} and air in 40% oxygen. End-tidal carbon dioxide was maintained at 35–45 mmHg. Alfentanil was used for analgesia at a dose of 10–15 μg Kg^{-1}.

Table 2
Surgical procedures performed in each group

	Metoclopramide	Droperidol	Ondansetron		Placebo
	n (%)	*n* (%)	2 mg *n* (%)	4 mg *n* (%)	*n* (%)
Otorhinolaryngology					
Tonsillectomy	16 (21)	18 (23.7)	13 (17.1)	12 (15.8)	17 (22.4)
Septal surgery	1 (9.1)	0 (0)	6 (54.5)	1 (9.1)	3 (27.3)
Myringotomy	1 (9.1)	1 (9.1)	4 (36.3)	2 (18.2)	3 (27.3)
Microlaryngeal surgery	2 (13.3)	2 (13.3)	1 (6.7)	6 (40)	4 (26.7)
General surgery					
Varicose vein surgery	3 (27.3)	2 (18.2)	1 (9.1)	4 (36.3)	1 (9. 1)
Cystis pilonidalis resection	5 (29.4)	3 (17.6)	2 (11.8)	4 (23.5)	3 (17.7)
Cervical adenopathy biopsy	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)
Esophagus endoscopy	3 (27.3)	2 (18.2)	1 (9.1)	4 (36.3)	1 (9.1)
Anal fistula excision	1 (33.3)	0 (0)	1 (33.3)	1 (33.3)	0 (0)
Herniorrhaphy	8 (22.2)	8 (22.2)	8 (22.2)	6 (16.7)	6 (16.7)
Abscess incision and drainage	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)
Orthopaedics					
Arthroscopy	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)
Muscular biopsy	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Bone biopsy	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)
Gynaecology					
Dilatation and curettage	5 (15.6)	6 (18.8)	8 (25)	8 (25)	5 (15.6)
Conization	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Polypectomy	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Breast biopsy	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)

Arterial pressure and heart rate were kept within 20% of preanaesthetic values. Before extubation of the trachea neuromuscular blockade was antagonized with neostigmine 0.05 mg Kg^{-1} and atropine 0.01 mg Kg^{-1}. Postoperative pain was treated with metamizol 2 g iv. Tramadol 1 mg Kg^{-1} iv was used in patients who could not tolerate metamizol, or where analgesia was insufficient.

Spinal anaesthesia was performed with the patient in the lateral decubitus position. A 25-gauge Whitacre spinal needle was inserted via the introducer at the L3-4 interspace using the midline approach. Hyperbaric 5% lignocaine (1 mg/kg) was administered in all cases.

2.4. Data collection

All patients were transferred postoperatively to the recovery room, and afterwards to the day hospital before discharge home. The same trained nurses monitored all patients and also registered the vital signs, and any adverse events.

For the purpose of data collection, no distinction was made between vomiting and retching. The occurrence of emetic episodes (defined as a vomiting or retching event, or any combination of them that occurred within a minute) and the presence of nausea were recorded prior to the study drug infusion, and during the following time intervals: 0–0.5, 0.5–1, 1–1.5, 1.5–2 h after the end of anaesthesia, between discharge home and the first 12 h after the operation, and between 12 and 24 h after the operation (by a telephone interview).

Rescue therapy (ondansetron 4 mg, 2 mg in paediatric patients) was given at any time upon patient request, after more than 3 emetic episodes, or after nausea lasting more than 15 min. The administration of postoperative rescue therapy was considered as treatment failure.

2.5. Statistical analysis

Patients were randomized using a computer-generated randomization. Analysis was made by intention to treat using the BMDP statistical package® (Dynamic version) [18]. Chi square test was used to compare qualitative variables between the five groups (sex, ASA, type of anaesthesia and type of surgery). For continuous variables analysis of the variance test and the Kruskal-Wallis test (for non-parametric variables) were used. Relative risk (RR) and its 95% confidence intervals (95% CI) were calculated using the StatCalc option of the Epi Info® 6.0 version [19]. A P-value of 0.05 was considered significant. Data are reported as mean $\pm$ standard deviation (SD). All statistical comparisons were placebo versus each group, and between groups, with regard to the proportion of patients free of emetic episodes over the 24 h study (principal variable), the proportion of patients reporting no nausea over the 24 h study, and time of onset of nausea and/or emetic episodes (secondary variables).

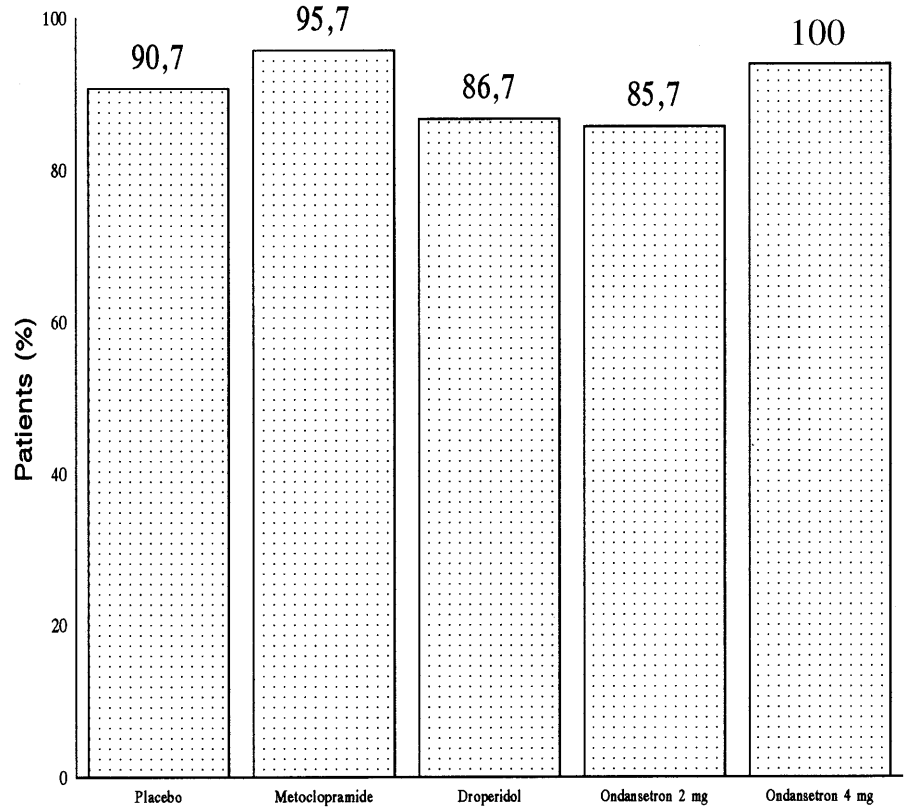

Fig. 1. Percentage of patients free of emetic episodes in each group ($P > 0.05$).

3. Results

3.1. Patient characteristics

Following the previous criteria 264 caucasian patients were included in the study. Thirty one of them were excluded because the procedure was finally scheduled for local anaesthesia ($n = 6$) or because lack of information during data collection ($n = 25$). No patient had a nasogastric tube inserted during the study period. Rescue therapy was administered in two patients. Detailed demographic data, ASA physical status of the patients, type of anaesthesia, and type of surgery in each treatment group are shown in Table 1. There were no significant epidemiologic differences between the groups ($P > 0.05$). The groups were well matched for types of operation and anaesthesia performed. All the surgical procedures performed are shown in Table 2.

3.2. Efficacy

The combined overall incidence of emetic epidodes and/or nausea during the first 24 h after anaesthesia was 6%. Symptomatic patients consistently were male (71.4%) with a mean age of 9 ± 11 years (range: 6–48 years), undergoing ENT surgery (9.6% of emetic episodes and 4.3% of nausea). The incidence of PONV was 7% after general anaesthesia and 2.1% after spinal anaesthesia ($P = 0.223$).

No antiemetic was more effective than placebo in preventing emetic episodes during the 24 h after surgery. The percentage of patients with no emetic episodes was above 80% in all groups (Fig. 1). One hundred percent of the patients in the ondansetron 4 mg group were free of emetic episodes. The same results were found when calculated for the type of anaesthesia (Fig. 2) and the type of surgery (Fig. 3).

Nausea scores were also not significantly different between the five groups. The number of patients free of nausea ranged from 100% for metoclopramide, to 93.9% for ondansetron 4 mg ($P > 0.05$).

The incidence of nausea or emetic episodes versus time was maximum at the first hour (1.7%) and between 12 and 24 h (2.1%).

When the relative risks of experiencing nausea and vomiting were calculated (Table 3), patients receiving ondansetron 4 mg were found to be more likely to experience these symptoms when compared to placebo (risk ratio = 1.8 and 95% confidence interval = 0.5–6.6), although there were no significant differences.

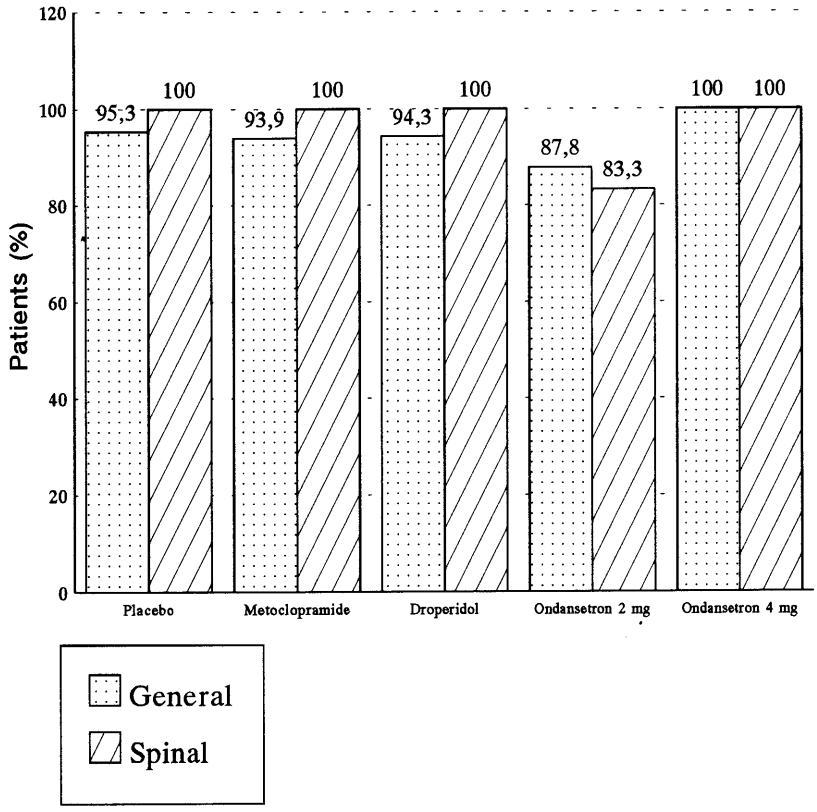

Fig. 2. Percentage of patients free of emetic episodes depending on the type of anaesthesia ($P > 0.05$).

4. Discussion

Postoperative nausea and vomiting are common and unpleasant sequelae of anaesthesia and surgery, they are often painful, may contribute to patient and parental anxiety, require extra nursing time, and influence postanaesthesia care unit stay [20]. They are considered to be the most frequent cause of anaesthesia-related hospital admissions following ambulatory surgery [3,21]. Commonly used antiemetics are generally effective in preventing PONV [10–16], although they have variable degrees of success and sometimes are associated with unacceptable side effects, such as sedation and extrapiramidal movements [22,23]. Moreover, patients have a variable risk for PONV depending on influencing factors: age, sex, weight, anxiety, preoperative medications, type of anaesthesia, type and duration of surgery, previous history of nausea and vomiting, etc [4]. Based on this evidence, should routine preoperative antiemetic prophylaxis be used? The existing comparative trials make it is possible to assess the relative merits of any agent with regard to anything but drug cost [17].

In this study, no significative differences were found in the frequency of PONV during the first 24 h after anaesthesia in patients receiving prophylactic antiemetic treatment with metoclopramide, droperidol and two different doses of ondansetron when compared to placebo ($P > 0.05$). The treatment groups were similar for patient characteristics, surgical procedures, type of anaesthesia administered and analgesics used postoperatively. Therefore, the differences in the frequency of PONV among the groups can be attributed to the differences in the drugs tested. There were no laparoscopic procedures performed in the study and the percentage of paediatric procedures was not high in any group. This may support the low nausea and vomiting scores reported. As propofol has a lower incidence of PONV associated with its use (0–23%), it is possible that this may have influenced the overall incidence observed [24–27]. Nevertheless, our results show a global rate of PONV comparable to previous reports [28]. The results of this study do not support the routine preoperative administration of a prophylactic antiemetic, at least in the type of ambulatory procedures tested when propofol is used as the induction and maintenance agent. In our study all antiemetics were administered immediately before surgery, but some authors suggest that efficacy of droperidol could be improved if it is administered towards the end of surgery [29].

Our hospital pharmacy pays 2014 pesetas for ondansetron 4 mg, 1007 pesetas for ondansetron 2 mg, 36 pesetas for metoclopramide 10 mg (one ampoule) and

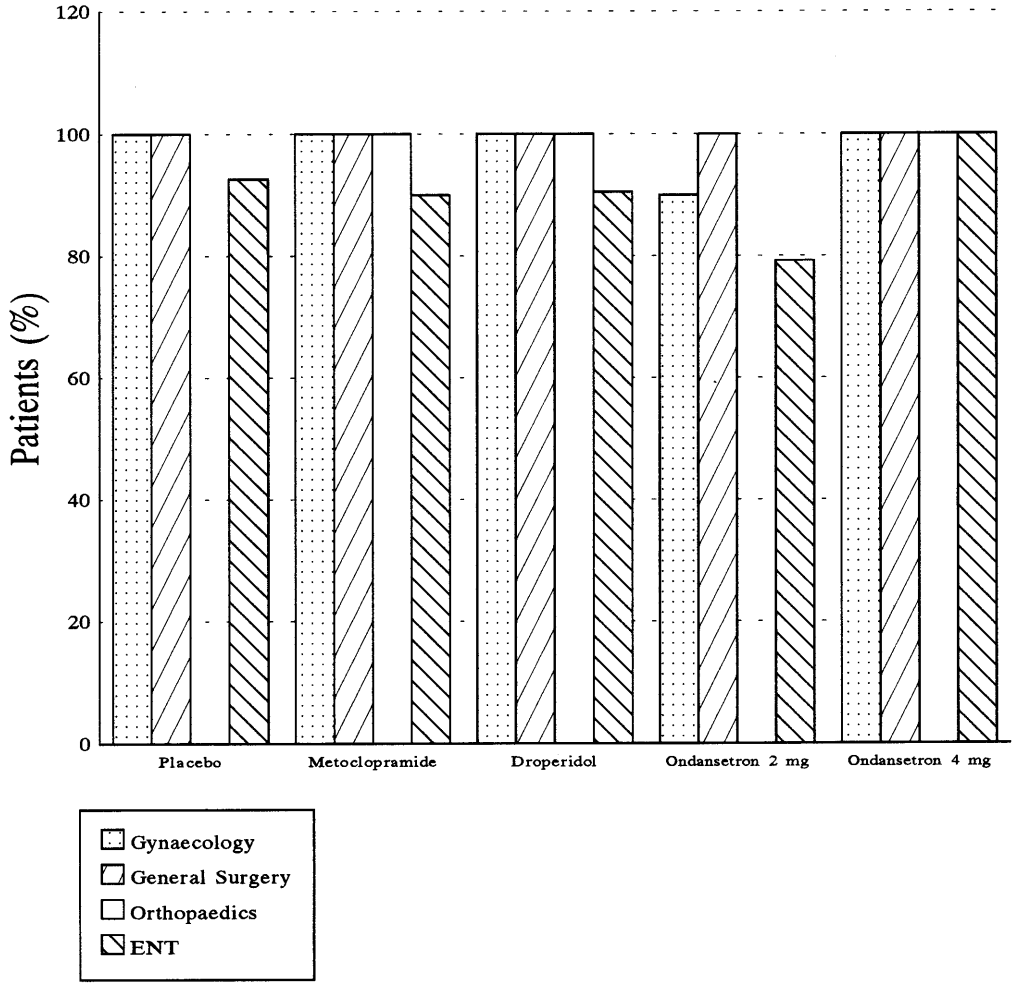

Fig. 3. Percentage of patients free of emetic episodes in each group by type of surgery ($P > 0.05$).

52 pesetas for droperidol 7.5 mg (one ampoule). A rational therapeutic selection must ensure clinical efficacy, low complications, shorter length of time in the recovery room or in the hospital, less readmissions in outpatient surgery, and minimal cost. It is time to perform clinical trials comparing the antiemetics currently being used for this indication. The combination of two antiemetic medications with different site of action could be more effective than one drug alone [30], and should be included for study in the high risk population. Cost-effective rational selection should drive the decision when clinical efficacies are equal [31]. On the basis of our results, we abandoned the routine use of drugs for the prophylaxis of PONV in the type of surgery studied when propofol was used, except in high risk patients.

In conclusion, this study suggest that preoperative administration of metoclopramide, droperidol and two different doses of ondansetron are not superior to placebo for preventing PONV. Until more information becomes available, the key to judicious use of a prophy

Table 3
Incidence and relative risk of postoperative nausea, emetic episode or both for each group

	Total	Cases	RR	95% CI
Nausea				
Placebo	43	1	1[a]	
Metoclopramide	47	0	–	
Droperidol	45	1	1.0	0.1–14.8
Ondansetron 2 mg	49	3	2.6	0.3–24.4
Ondansetron 4 mg	49	1	0.9	0.1–13.6
Emetic episodes				
Placebo	43	2	1[a]	
Metoclopramide	47	2	0.9	0.1–6.2
Droperidol	45	2	1.0	0.1–6.5
Ondansetron 2 mg	49	6	2.6	0.6–12.4
Ondansetron 4 mg	49	0	–	
Nausea or emetic episodes				
Placebo	43	3	1[a]	
Metoclopramide	47	2	0.6	0.1–3.5
Droperidol	45	2	0.6	0.1–3.6
Ondansetron 2 mg	49	6	1.8	0.5–6.6
Ondansetron 4 mg	49	1	0.3	0.0–2.7

[a]Reference group; RR: risk ratio; 95% CI: 95% confidence interval.

lactic antiemetic should be the preoperative identification of patients who are at high risk of PONV.

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Ambulatory Surgery

Ingrowing toenails: a treatment algorithm

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Abstract

Ingrowing toenails (IT) are a common disorder in which the the nail penetrates into the surrounding tissues, causing inflammatory reaction, pain and interference with daily activities. The aim of the study is to provide an algorithm treatment. Patients were divided into three groups according to the stage of IT at presentation. A total of 161 patients with 173 IT's were treated conservatively initially and then surgically if no recovery was documented. The surgical treatment included removal of the nail with the spicules which penetrate the soft tissues, excision of the nail wall, and curettage of the granulation and inflamed tissues. Ablation of the germinal matrix using phenol solution was performed only in recurrent IT's. Using our algorithm recurrent IT's were noticed in 13% and 19.4% of the patients who had stage II and III respectively. For optimal results IT should be staged and treatment tailored according to the algorithm. © 1997 Elsevier Science B.V.

Keywords: Ingrowing toenail; Treatment; Algorithm

1. Introduction

Ingrowing toenails (IT) are a common disorder in which the distal corner of the nail penetrates the surrounding tissues, causing inflammatory reaction and infection. It affects mainly the lateral side of the first toe and is most common in young males [1]. IT can cause considerable debilitating pain and discomfort, and be accompanied by signs of local infection [2]. Many patients, especially blue collar workers, are temporarily incapacitated in performing their daily activities leading to IT's becoming a significant socio-economic burden.

Several modalities have been used to treat IT, ranging from conservative therapy to radical excision of the nail and ablation of its germinal matrix [3,4]. Results are extremely variable and failure rates high [1] Because not all treatment options were administrated in a methodical fashion failure rates vary in the various reports and it is difficult to compare results. Therefore a well-organized approach is recomended and an algorithm of treatment options based on the stage of the IT is needed in order to achieve optimal results.

We describe an algorithm for the management of IT. The algorithm is based on our staging of IT and the treatment of 173 IT's.

2. Patients and methods

Patients were referred to our clinic by their general practitioners, and were all treated by both authors. Only patients with ingrowing toenails were recruited. Individuals with onychogryposis, onychomycosis and traumatic nail injuries were excluded. Patients were divided into three groups according to the stage of IT at presentation [1,5]. Patients in Stage I suffered mostly

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from pain and there were only minimal signs of infection, patients in Stage II had swelling, erythema and granulation tissue around the nail, and in Stage III these features were more marked, with suppuration, discharge and notable hypertrophy of the granulation tissue.

2.1. Conservative treatment

The initial treatment for all patients included soaking the affected foot in warm diluted povidone solution twice a day and elevating the affected corner of the nail when possible. The patients were instructed to avoid trimming the nail or digging into the inflamed surrounding tissues. The use of sandals or loose shoes was recommended. Systemic antibiotics (Cephalexin, 0.5 g. t.i.d) were administered to patients with IT in stage III. The stage III patients were examined within 48 h following the initiation of the treatment. All patients were re-examined after 7–10 days. Surgery was recommended for patients with either persistence of significant pain interfering with their daily activities or the presence of active infection.

2.2. Surgical treatment

All operations were performed on an outpatient basis with digital block anesthesia. Two injections (2 ml each) of 1% lidocaine (Xylocaine) without epinephrine were given on both sides at the base of the affected toe. When only one side of the toe was affected, a narrow wedge (around 1/4) of the nail was cut longitudinally as proximal as possible and removed. The nail wall was cut with scissors, and the granulation tissues and nail spicules were removed with a curette up to the periosteum. Thus, a wide open groove between the cut edge of the nail and the lowered nail wall was created (Fig. 1). Hemostasis with diathermy was used rarely. When both sides of the nail were affected, the whole nail was removed and the nail wall on both sides was cut. Ablation of the germinal matrix was recommended only to patients who suffered from recurrent ingrowing toenails. In these patients, after the nail was removed, the surrounding skin was protected by petroleum jelly, and liquefied phenol (70%) was applied with cotton buds beneath the cuticle for 3 min and then washed with alcohol solution. The toe was dressed with povidone ointment and Vaseline ganze, and the wound was observed for 30 min for signs of bleeding. The patients were instructed to rest for 24 h with the foot elevated. The dressing was changed once daily by a nurse. Patients resumed their regular activities within 48–72 h.

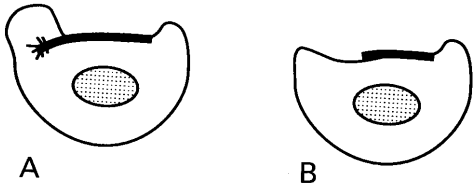

Fig. 1. Cross-section view of the distal toe phalanx. (A) Ingrowing toenail with nail spicules, and inflamed edematous nail fold with abundant granulation tissue; (B) after wedge resection.

2.3. Follow-up

Patients were reexamined in the clinic 1 and 3 weeks postoperatively. When the nail started to grow back, they were instructed how to cut the nail properly. Follow-up examinations were carried out monthly for any signs of recurrence. The patients were discharged if there was satisfactory healing for 6 months after the operation. The patients who were not examined at the clinic for more than 3 months were contacted by telephone at the time this survey was performed and were asked to attend the clinic for follow-up examinations. Patients who declined to do so were interviewed via the telephone.

3. Results

Between January 1, 1994 and December 31, 1996, 161 patients were treated for IT. Their age range was 11–56 years (average 22.4), 87 (54%) were males and 74 (46%) were females. In 76 patients (47.2%) the right foot was affected, 73 (45.3%) had left IT, and 12 (7.5%) patients presented with bilateral IT, leaving a total number of 173 nail sides treated for IT.

There were 42 (24.3%) stage I IT, 86 (49.7%) stage II IT, and 45 (26.0%) stage III IT. The results of treatment are presented in Table 1.

3.1. Conservative treatment

Of the 42 stage I ITs, 37 were treated conservatively. Follow-up data were available in 30 of them: 26 (86.7%) are symptom free.

Of the 86 stage II ITs, 33 were treated conservatively. Follow-up data were available in 29 of them: 21 (72.4%) are symptom free.

Of the 45 stage III ITs, only six were treated conservatively. Follow-up data were available for four of them: two (50%) are symptom free.

3.2. Surgical treatment

Five (11.9%) of the 42 stage I ITs were treated by surgery. All these operations were wedge resections.

Fifty three (61.6%) of the 86 stage II ITs were treated by surgery; 39 (73.6%) procedures were wedge resections, and 14 (26.4%) involved removal of the whole nail.

Table 1
Treatment results of ingrowing toenails

Stage	Number of IT	Conservative treatment	Surgical treatment	Number of ITs (follow-up after surgery)	Recurrence
I	42 (24.3%)	37 (88.1%)	5 (11 9%)[a]	4	0
II	86 (49.7%)	33 (38 4%)	53 (61.6%) 39 (73.6%)[a] 14 (26.4%)[b]	46	6 (13%)
III	45 (26%)	6 (13.3%)	39 (86.7%) 24 (61.5%)[a] 15 (38.5%)[b]	36	7 (19.4%)

[a] Wedge nail resection.
[b] Removal of the whole nail.

Thirty-nine (86.7%) ofthe 45 stage III ITs were treated by surgery. Twenty-four (61.5%) procedures were wedge resections, and 15 (38.5%) involved removal of the whole nail.

3.3. Short-term results

Of the total 97 ITs which were surgically treated, 91 (93.8%) reported a striking improvement in symptoms after 1 or 2 days. The six remaining patients had either painful hematoma (two patients) or persistent infection and discharge (four patients). Analgesics were seldom used, and almost all patients resumed their work and daily activities within 2–3 days.

3.4. Long term follow-up

The follow-up period was 4–40 months and 139 (86.3%) patients with ITs either remained to the end of this period or updated data on them are available. Therefore of the 173 treated IT's follow-up information was available on 149 (86%)

3.5. Long term results

Four of the five patients with stage I ITs treated by surgery were available for long-term follow up, and there was no recurrence in any of them. Among the 53 patients with stage II ITs, 46 had long-term follow-up during which IT recurred in six of them (13.0%). In patients with stage III ITs, follow-up data were available on 36 out ofthe 45 ITs which were treated by surgery: it recurred in seven cases (19.4%).

The overall recurrent IT rate was 15.1%, and the time of recurrence was 2–10 months. It is noteworthy that all the patients who did not have a recurrent IT were symptom free. Patients who suffered from recurrent IT were recommended to undergo surgery again, with ablation of the germinal matrix, and ten patients underwent this procedure. Six patients underwent wedge resection, and four patients underwent removal of the whole nail, with phenol application. There were no recurrences following the second operations. Three patients refused a second operation.

4. Discussion

Although IT may appear to be a trivial health problem, it can be very troublesome and painful, and invariably interferes with the patient's daily activities. Treatment should be prompt upon diagnosis since, as we have shown, conservative treatment often suffices when the condition is mild in degree.

Several factors are associated with the developments of IT. There may be an inherent congenital tendency, as it is often associated with a specific shape of the tip of the toe and the nail [6], in which the nail is situated deeply below high nail folds. In these patients there is often a family history of IT. Among the acquired factors, the most important are improper trimming of the nails and pressure from shoes, especially among adolescents whose feet grow rapidly [5].

Numerous conservative and surgical therapeutic methods for IT have been suggested. The latter includes: (1) nail and nail fold excision with thorough removal of the granulation tissue; and (2) the addition of ablation of the germinal matrix together with nail removal. The second technique prevents regrowth of the nail, but may lead to deformity and a poor cosmetic result, an outcome which may be problematic especially in adolescents.

Reijnen [1] used silver nitrate to treat the granulation tissue, with 60% alcohol-soaked cotton packed under the nail as a conservative measure. This method is time consuming and expensive, and a high recurrence rate (62%) was noted in patients with stage III IT. Some surgeons prefer a combination of wedge resection of the nail with application of Phenol [7]. Simple avulsion of the toenail is quick but has a recurrence rate as high as 70% [8]. Excision of the lateral sulcus and removal of the entire nail bed may disable the patient for longer periods than using a less aggressive approach [8]. Laser matricectomy never gained popularity due to a reported

high failure rate (50% for total matricectomy) and the need for special equipment [9]. Repeated nail abrasion was proposed by Maeda et al. with rapid relief from pain in all patients, but only 23% of their patients remained problem free for more than 1 year [10]. Cryotherapy with liquid nitrogen spray was proposed by Sonnex as being a quick, simple, inexpensive outpatient procedure [2]. Their reported rate of success was comparable with that of other nail-sparing techniques. Fishman reported on his experience with the use of iodine tincture into the affected sulcus and application of silver nitrite on the granulation tissue, stating that this technique worked effectively on about 80% of ITs [11].

The multiplicity of the surgical approaches to this problem which appear in the medical literature is a testimony that there is no ideal one and, indeed, recurrence rates are significant in all reports. Thus, the treatment of ingrowing toenails should not be dogmatic and similar in all patients. Indeed, the surgical option is not always the preferred one. We present here an algorithm that individualized the treatment according to the stage of the IT upon presentation.

In order to customize treatment according to our proposed algorithm (Fig. 2) several features of our surgical technique are worth highlighting. It is our opinion that the main objectives in the surgical treatment of ingrowing toenails are to remove both the spicules of nails which penetrate the soft tissues in the nail walls and the abundant granulation tissue which accumulates around the embedded nail and prevents adequate healing. In order to achieve these goals, it is imperative to excise the nail wall and lay open the groove between the nail and the nail walk and to remove all the granulation and chronically inflamed tissues by curettage (Fig. 1). The granulation tissue is characterized by abundant small blood vessels and tends to bleed easily. Nevertheless, we found that after its removal bleeding was minimal and tourniquets were not required, thus eliminating the hazards of ischemic damage and necrosis to the affected toe. It is also vital to use minimal diathermy in order to reduce the amount of necrotic tissue. We prefer phenol cauterization of the germinal matrix, because its efficacy is comparable to surgical excision of the germinal matrix with lower morbidity. Postoperative management is no less important than the surgery itself. Regular check-ups in the clinic for removal of any crusts, new granulation tissue and follow-up of the regrowth of the nail are mandatory in the first few postoperative weeks. In stage I and even stage II IT, conservative treatment is often curative in that growth of the nail out of the nail fold and thereafter clearing the inflammatory process may be successfully achieved. Meticulous hygiene and daily baths with antiseptic solution, administration of antibiotics and refraining from cutting or digging around the nails should be the initial treatment for IT of all stages. In patients with severe infectious signs (stage III), such as purulent discharge, marked erythema of the skin of the toe swelling of the entire toe or septic foot, systemic antibiotic administration is indicated and surgery should be postponed if possible until these signs subside. If marked improvement is noted, conservative treatment should be continued. Surgery is indicated when conservative measures fail and the pain and discomfort lead to interference with the patient's regular daily activities. The essential element of the surgical treatment of IT is the radical removal of all the granulation and chronic inflammatory tissues which accumulate between the nail and the nail wall together with the nail spicules.

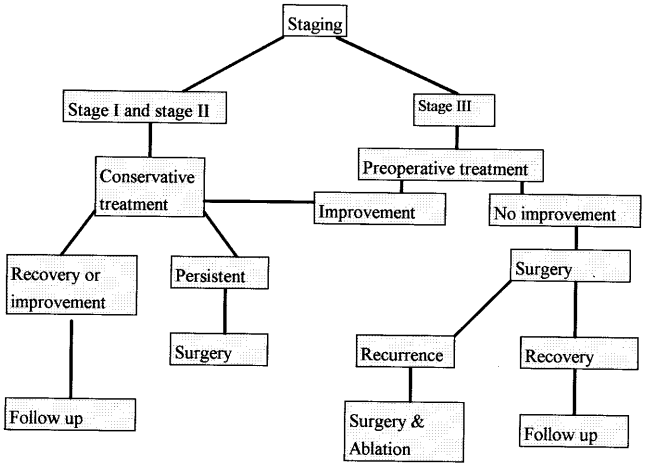

Fig. 2. A treatment algorithm for ingrowing toenails

During the follow-up period the importance of preventing ingrowing of the toenails by proper trimming needs to be emphasized, and all patients in all stages are instructed in the proper techniques of nail trimming.

In conclusion, treatment of ingrowing toenails should be individualized. Based on our experience, we recommend that the initial step of the treatment is to stage the condition at the first visit to the clinic. In cases in which no surgery had been performed, the conservative approach is to be preferred. Radical excision with destruction of the germinal matrix is relatively contraindicated because of the consequent unfavorable cosmetic outcome. However, should the lesion recur, and especially when the shape of the toe with 'deep' nail and 'high' nail wall predisposes to an ingrowing toenail, a more aggressive approach is justified. Our algorithm (Fig. 2) is a structural approach to the treatment of IT with good results.

Since the early and milder stages of this condition are amenable to resolution by conservative treatment, primary care physicians and nurses should include examination of the toes in a patient's regular check-up. We

recommend that adolescents should be instructed how to properly trim their toenails in order to prevent this condition.

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Ambulatory Surgery

Minor operations performed under local anaesthetic in a day surgery unit

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Abstract

Minor 'lumps and bumps' requiring operation under local anaesthetic constitute a significant number of referrals each month to general surgical clinics. These patients have often remained on hospital waiting lists for more than 1 year. A new system for managing these cases is presented whereby: (i) a large throughput of 'clinical material' is available for supervised teaching of both medical students and junior trainees; (ii) patients are operated upon safely and efficiently; (iii) the waiting list time can be significantly reduced; and (iv) the patient has an overall satisfactory hospital 'experience'. © 1997 Elsevier Science B.V.

Keywords: Minor surgery; Local anaesthetic; Day surgery; Ambulatory surgery

1. Introduction

Previously, in many general surgical 'out-patient' clinics, minor 'lumps and bumps' requiring operation under local anaesthetic would be assessed, taught upon and then have their surgery performed during the course of that same clinic. Today, there are two main reasons why this facility is often withdrawn: (i) a reduction in the number and availability of 'out-patient' nursing staff; and (ii) an increasing realisation that leaving the most inexperienced member of the surgical team to 'cut their teeth' on what can prove to be challenging procedures may not be ideal for the patient. Presently, patients requiring minor surgery could possibly be seen as a slightly awkward group to manage. They are still referred in significant numbers, cannot have their procedure the same day in the clinic and must be placed on a waiting list. Their teaching benefit is reduced and they now take up the time of both a senior member and a junior trainee of the surgical team. It is possible to understand why patients awaiting minor surgery under local anaesthetic can gravitate and remain towards the bottom of surgical waiting lists.

This study details a new approach for undertaking minor surgical procedures (under local anaesthetic), allowing a prompt, safe throughput of patients, combined with an excellent opportunity for teaching at both medical student and junior surgeon levels.

2. Methods

Agreement was obtained that all letters addressed to any consultant surgeon from a general practitioner referring a patient for a minor operative procedure, would be re-directed to a file held within the Day Surgery Unit. At regular intervals a senior registrar would read each letter and construct proposed operating lists of up to 30 patients. Letters that did not seem straightforward were returned to the appropriate consultant's main surgical 'out-patients' clinic. Referrals that had already been seen in the main 'out-patients' department were added directly onto the operating lists.

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An administrative clerk in the Day Surgery Unit obtained any necessary medical records and informed the patients by letter of their surgery date. To minimise non-attendance, 2 weeks prior to their surgery date patients were given a confirmatory telephone call.

The surgical procedures were all performed by a senior registrar and registrar team, with house officers and medical students expected to attend and actively participate. One ten-bedded/chaired area of the Day Surgery Unit staffed by two nurses was set aside for each list. Up to 30 patients per list were treated. Groups of ten were given appointments to arrive (en bloc) every 60 min (for a planned operating session of approximately 4 h). On arrival, each patient had a name bracelet attached, was given their notes/referral letter to hold and was directed towards a bed or chair. The senior registrar, accompanied by a house officer and attendant medical students, reviewed each patient, taught, explained the procedure, marked the operative site, consented the patient and gave the local anaesthetic. Ten sets of local anaesthetic for each of the three, hourly groups had previously been drawn up, checked and placed onto cardboard trays together with sterile needles, cleaning swabs and gauze swabs.

In the Day Surgery Unit operating theatre, another two nursing staff had previously prepared ten minor operation sets, consisting of a scalpel, small dissecting scissors, toothed forceps, non-toothed forceps and stitch cutting scissors. Other potentially necessary equipment was available nearby, but kept wrapped until needed. Between cases, sets were re-sterilised using a 'Little Sister' automatic autoclave unit. In the adjacent anaesthetic room, a waiting area for the next patient to be operated upon was fashioned with an armchair, radio and magazines.

The registrar present undertook the first five or so operations whilst the senior registrar house officer and medical students continued to review patients on the ward. At the end of each procedure, the notes were written with a copy given to the patient to hand to his/her general practitioner, together with instructions for any sutures to be removed and whom to contact if any tissue sample had been sent for histology. Oral analgesics for 2 days were provided where necessary. The senior registrar, house officer and medical students, once the initial group of ten patients had been reviewed, changed places with the registrar in the operating theatre, who was then ready to review the second group of ten patients on the ward.

After the operation, each patient was given a hot drink and snack and checked to make sure that the wound site was satisfactory. They were given an information sheet detailing the persons to contact in the event of a complication including the mobile telephone number of a 24 h general advice service provided by one of the senior nursing sisters from the Day Surgery Unit. No follow-up appointments were made.

3. Results

Of the 215 referral letters read by the senior registrar in the Day Surgery Unit, only five were re-directed towards the main surgical 'outpatient' clinics.

With a catchment population of approximately 260 000, between 25 and 35 letters per month were sent for minor procedures to be performed under local anaesthetic block. Previously, such cases had been added to an individual consultant's Day Surgery Unit waiting list (which in 1994 averaged over 12 months). Following the introduction of the new system, the waiting list time for general surgery under local anaesthesia was reduced to a maximum of 2 months.

Of seven lists of 30 patients (total 210) who confirmed for attendance, 187 (89%) actually attended. Of the 23 (11%) who did not attend, only two (1%) responded to attend on another date and 21 (10%) were removed from the waiting list.

The average length of time taken per case was 8 min (range 3–27 min). Only one complication was recorded (0.5%) — persistent bleeding from a scalp wound following excision of a sebaceous cyst.

4. Discussion

Patients requiring surgery under local anaesthetic block constitute a significant number of referrals each month to general surgical out-patient clinics (for us 10–14 per 100 000 population). In the past, in many hospitals, these patients would have been reviewed, taught upon and subsequently operated upon in an area set aside in the out-patient clinic often during the same visit. Now, more usually, they are placed on a waiting list to have day surgery at some stage in the future (for us, frequently after a wait of a year or more). The percentage of day surgery is increasing with a level of 40%–60% of surgical throughput being achieved [1–3]. Thus there is often a second prioritisation step within day units, such that hernia repairs and varicose veins, for example, take precedence over more minor local anaesthetic procedures. Given the current referral rates experienced, it is not difficult to see why such patients may languish at the bottom of the surgical waiting list. When a patient is finally asked to attend for surgery it is no longer acceptable to have a very junior trainee operating alone and only calling for help when a supposedly easy procedure becomes unexpectedly awkward [3].

In this study, which describes a possible management plan for this type of surgery, we do appreciate that minor operations can form a 'nursery' for surgical training. We wanted to use the opportunity given by the Day Surgery Unit setting to improve the education of medical students and the training of house officers

(and senior house officers) in a more supervised atmosphere, where they could become increasingly familiar with common lesions and how to operate upon them, accompanied by more experienced registrars. The management plan also allows for a safe, efficient method of processing relatively large numbers of patients quickly, keeping waiting list times to a minimum. In our case, patients for minor surgery under local anaesthetic had to wait for 12 months or more, but now can be referred, seen and treated within a maximum of 2 months.

Increasingly, as the system became more streamlined, a significantly greater proportion of time became available for teaching both medical students and house officers. With fewer in-patients to teach upon regularly, the ability to instruct quickly and repetitively on 25–30 'lumps and bumps' at one sitting becomes invaluable.

Of all patients (210) who confirmed their attendance, 89% (187) actually had their operation. We consider the one in ten non-attendance rate acceptably low and ascribe this to the letter sent to the patient giving the date of operation backed by the telephone call from the administrative clerk 2 weeks prior to surgery. We felt it reasonable to remove a patient from the waiting list if they still did not attend after a second, mutually agreeable date had been arranged.

The senior registrar/registrar combination is an efficient one. Both are competent to assess each individual patient, explain the procedure, accurately mark the operative site, obtain consent and give the local anaesthetic block. Working in tandem as described, the average procedural time was only 8 min. The presence of two surgeons allowed one of them to teach medical students and house officers, take a coffee break, be called upon for occasional assistance, or to write up notes, take-away drugs and histology forms whilst the other surgeon completed any given operation. The complication rate (0.5%) was low [4–6].

From the patient's perspective, it could be envisaged that they were being treated on a conveyor belt. We tried to overcome this by breaking the group of 30 into smaller groups of ten, with three different admission times. Each patient was welcomed by a nurse and promptly seen by one of the two surgeons. In the waiting area, a comfortable armchair, radio and magazines were provided. Post-operatively, all were given a hot drink and snack. These simple pleasantries seemed to do more to raise the patients sense of gratitude towards the NHS than the whole drive to keep them off a prolonged waiting list!

Prior to leaving, each patient was given information as to whom to contact in the event of a complication or concern about the surgery. In addition, our Day Surgery Unit gives each patient a 24 h mobile telephone number. The mobile phone is held by a senior nurse from the unit who can give advice directly or arrange further help for the patient if needed. We feel that this gives further reassurance to the patients and is better than giving a printed advice sheet alone.

In conclusion, with the current changes that seem to be affecting the way in which minor surgical procedures are being undertaken, we feel that there are many benefits to be gained from the system described. Minor operations performed under local anaesthetic can be safely and efficiently dealt with. The rapid throughput would appear to pay dividends both in the lowering of waiting list times and in the opportunities available for supervised teaching.

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Ambulatory Surgery

The South Tyneside FASTRAK service: evaluation of a new model for day surgery

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Abstract

Objective: To evaluate a service (FASTRAK) offering general practitioners direct access to day surgery operative waiting lists, based on explicit guidelines regarding patient suitability for surgery and anaesthesia. Design: Notes abstraction for a cohort of patients referred via FASTRAK and a cohort referred via conventional day surgery routes; postal questionnaire survey of patient satisfaction amongst FASTRAK patients and matched controls referred via conventional routes; postal survey of professional satisfaction. Setting: One district general hospital in the north east of England, and all general practices in that district. Subjects: 1278 patients (1100 conventional day case patients; 178 FASTRAK patients) for notes abstraction; 70 patients for patient satisfaction survey 83 general practitioners for professional satisfaction survey. Main outcome measures: interval from referral to operation, and appropriateness of referral; patient experience and satisfaction with hospital and post-discharge care, especially with respect to information provision, for patient survey; overall rating of service, perceived benefits and disadvantages and future intentions for professional satisfaction survey. Results: The interval from referral to operation was significantly shorter for FASTRAK patients by a median of 91 days. Out of a total of 178 FASTRAK referrals, only seven (4%) were inappropriate whilst diagnosis was wrong in three (2%) cases. Patients referred via FASTRAK were much more likely to have received written information prior to admission (83 vs. 37%: $\chi^2 = 12.25$. $P = 0.0019$). General practitioners (GPs) had positive views of the service; 94% rated it as 'fair' to 'very good'. GPs, 90%, perceived the main benefit to patients to be a shorter waiting time for operation; 40% felt that the availability of clear information for patients benefited doctors. Increased general practitioner workload was recognised as a disadvantage (61%) and the main barrier to use of the service was lack of eligible patients under the current guidelines (69%). Conclusions: When diagnosis, indication for surgery and fitness for anaesthesia are not in doubt, general practitioners, given appropriate guidance, are able to provide all the necessary pre-operative services that are usually provided in the general surgical outpatient clinic, without prejudicing the quality of care or decreasing patient satisfaction. © 1997 Elsevier Science B.V.

Keywords: Day surgery; FASTRAK; Patients

1. Introduction

Day surgery is now widely recognised as a cost-effective method for the delivery of certain specified surgical procedures and, as such, has been targeted as an area for expansion and development by the Royal College of Surgeons and the Audit Commission [1,2]. It has been seen as a means of reducing expenditure by reducing bed occupancy, whilst providing a service for patients which reduces disruption to domestic and working life, and provides a high level of satisfaction [3].

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South Tyneside has been identified as a high-performance day surgery district. Despite the fact that the district performs neither ENT nor ophthalmic surgery (the two disciplines most often associated with high levels of day case work), 51% of elective surgery is performed as day cases [2]. Nonetheless, both clinicians and management in South Tyneside were looking for ways of further improving the day surgery service. The FASTRAK service developed from this liaison. The development of the FASTRAK service is described in detail elsewhere [4]. It provides all general practitioners in the South Tyneside district with the means to refer suitable patients directly to day case operative waiting lists, using agreed criteria for diagnosis, referral and assessment of suitability for surgery and anaesthesia. This universal availability is in contrast to the only other reported study of direct referral to day case surgery [5], where access was confined to four selected practices.

The underlying rationale for the FASTRAK service is the recognition that, within South Tyneside, young, fit patients with certain clear diagnoses are almost invariably operated on as day cases. Under these circumstances, the surgeon is acting as little more than an operative technician, providing specialist surgical services that the general practitioner (GP) is unable to perform. GPs however, are usually able to recognise straightforward presentations amenable to day surgery correction. Additionally, although most have no formal training in pre-operative assessment, their detailed knowledge of patients' past medical and family history should allow them to make accurate decisions about suitability for day case surgery, given explicit and unambiguous guidelines. If these premises hold true, there are potential benefits for patients. By eliminating the wait for an outpatient appointment (the traditional route to surgery), the interval from referral to operation should be reduced, thereby decreasing the period of suffering and disruption to domestic and working life. Reducing the number of new patients requiring an outpatient appointment might also free up surgeons' time for pre-operative assessments or post-operative follow-up. As Smith and Gwynn suggest [5], this could allow more time for the assessment of more complex cases. It could also reduce waiting times for conventional day case patients.

A multi-disciplinary group of surgeons, GPs, anaesthetists, day ward nursing and administrative staff, and health services researchers led the development of the FASTRAK service [4]. Eligible conditions were identified and defined (Table 1); condition-specific and general criteria for FASTRAK suitability were drawn up (Table 2); documentation for assessment and referral were prepared and patient information materials developed. Finally, the system was publicised to potential users. Each practice in the district was visited and a FASTRAK manual [6] was provided for every GP. These initiatives were backed up by a series of educational meetings. In this paper we describe the results of the service for the first 3 years (August 1993–July 1996) including a more detailed evaluation of the pilot scheme which took place during the first year of the project.

Table 1
Conditions eligible for FASTRAK referral

Hernia simple and unilateral
Inguinal
Femoral
Epigastric
Anal fissure
Circumcision
Varicose veins
Epididymal cyst
Varicocoele
Hydrocoele
Skin lesions, requiring general anaesthetic for excision
Lymph nodes requiring biopsy
Ganglion

2. Methods

To evaluate the initiative, data were collected from hospital records, from patients' themselves and from

Table 2
General criterial for FASTRAK suitability

Patients must:
1. Have a condition causing problems they are prepared to have an operation for
2. Be able to be driven home in a car by someone
3. Have easy access to a telephone
4. Have easy access to a toilet
5. Not be pregnant

Patients must have none of the following:
1. Uncontrolled hypertension
2. Ischaemic heart disease
3. Asthma/bronchitis
4. Heat murmur
5. Other heart disease
6. Other significant lung disease
7. Breathlessness or chest pain on exertion
8. Previous stroke/transient ischaemic attack
9. Previous deep vein thrombosis
10. Diabetes
11. Rheumatoid arthritis or significant cervical spondylosis

Patients must have normal:
1. Blood pressure
2. Heart sounds
3. Pulse rate
4. Chest examination
5. Acceptable body mass index

the GPs in the distinct. During the pilot year we examined case-mix, referral and attendance rates for conventional day case and FASTRAK surgery, the ability of GPs to refer appropriately, the effect of FASTRAK on waiting times, and patient and professional views of the service. In the subsequent 2 years we examined referral and attendance rates for FASTRAK surgery and the ability of GPs to refer appropriately.

Structured pro-formal were developed to abstract information from conventional referral letters, FASTRAK referral forms, and from ward and theatre records of patients both in the FASTRAK system and those referred via conventional day case routes. The information sought included the dates of referral by GP, of first outpatient appointment (conventional day case patients only) and of the operative procedure. Information on both GP's and surgeon's diagnosis of the presenting problem, the surgical procedure carried out, and patient characteristics were also sought, along with details of the referring GP. To test whether the FASTRAK service had any impact on waiting times for conventional day case patients, data for this patient group were collected for patients operated on during the 6 months prior to the launch of the service (August 1993) as well as during the pilot year.

During the pilot year, patients' views were sought using a previously validated questionnaire on satisfaction with day case surgery [3,7]. FASTRAK patients, 34, were surveyed, along with a sample of conventional day-case patients matched for age, gender and date of operation. The FASTRAK service was confined to a sub-set of diagnoses and day case surgical procedures (Table 1) and within these procedures to certain age-groups. For this reason, it was not possible to match by presenting problem or operative procedure. Two reminders, the second enclosing a duplicate copy of the questionnaire, were sent to nonrespondents at 3 and 5 weeks, respectively.

A structured self-completion questionnaire, seeking professional views of the FASTRAK service was developed and sent to all 83 GPs in the South Tyneside district at the end of the pilot year. Two reminders, the second enclosing a duplicate copy of the questionnaire, were sent to non-respondents at 3 and 5 weeks, respectively. The views of the surgeons, anaesthetists, day ward staff and management were sought in unstructured interviews.

Data were analysed using the SPSSX package [8]. Because of the skewed distribution of waiting times, the Mann-Whitney test [9] was used in this analysis. Comparison of the experiences and satisfaction of conventional day case and FASTRAK patients was carried out using the χ^2 test [10].

3. Results

Because of the scope and complexity of results we have presented them as a series of answers to pertinent questions. The main results on casemix and what happened to patients are presented as a flow diagram also (Table 3).

3.1. How many patients were suitable?

A total of 178 FASTRAK patients were referred between August 1993 and July 1996 of whom seven (4%) were inappropriate referrals. Four were referred to a consultant not participating in FASTRAK, two were for conditions not covered by the protocol and the seventh was an administrative error. For FASTRAK patients, there was complete agreement between GPs and anaesthetists regarding their fitness for anaesthetic. Of the 171 suitable from the referral letter only two (1%) were found to have a wrong diagnosis on the day of the procedure when checked by the consultant in the day-ward (no varicocele, no hernia) and another error was identified when the patient was admitted urgently (when an anal fissure was found to be a carcinoma of rectum). In the case of a saphena varix both the GP and consultant surgeon made the same wrong diagnosis of femoral hernia prior to operation.

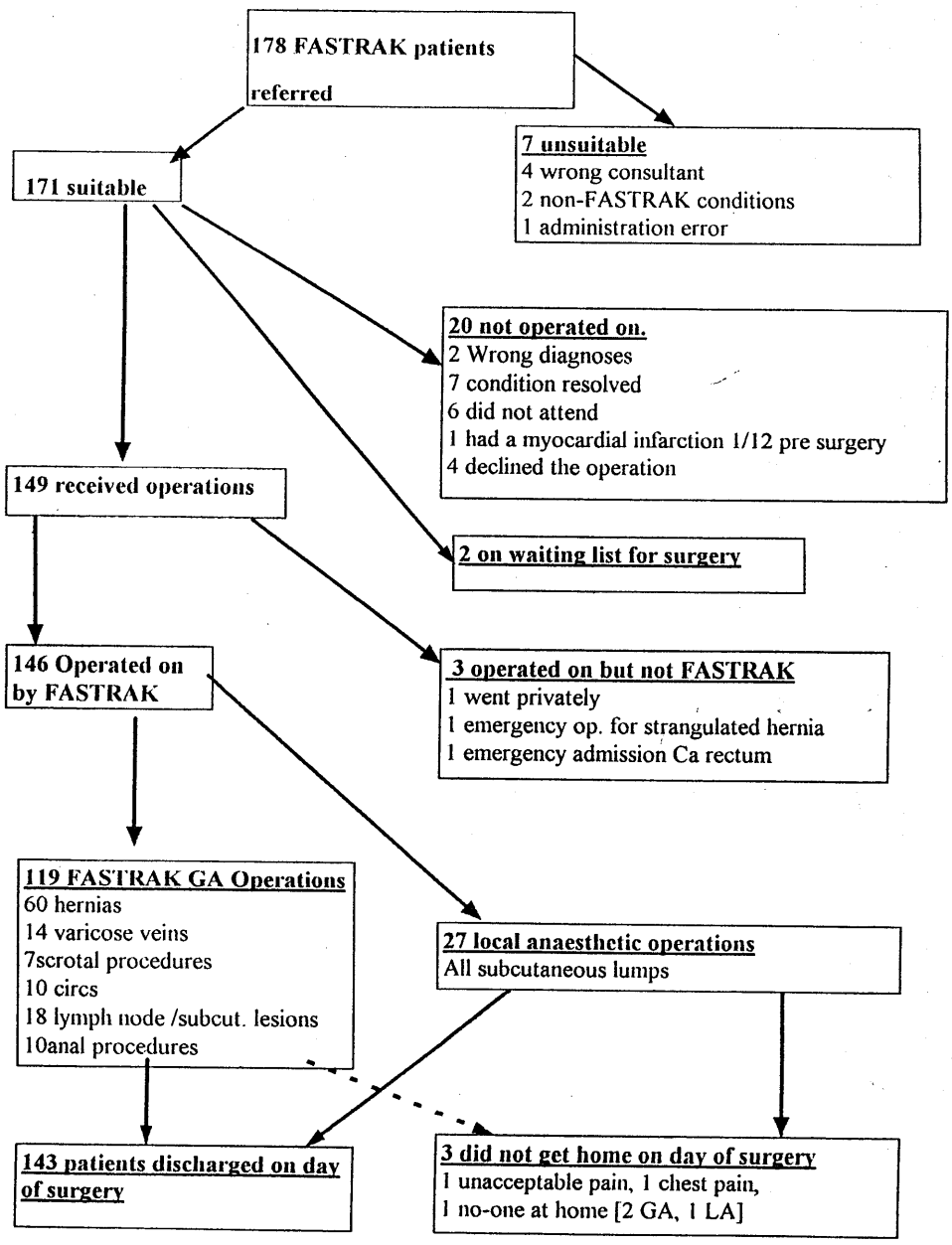
3.2. What was the casemix?

Amongst the eligible referrals, the most common presenting problem amongst FASTRAK patients was inguinal hernia (37%), followed by a need for lump excision (36%), varicose veins (8%) and anal procedures (7%). By contrast, the most common problem in conventional day case patients was varicose veins (16%), followed by vasectomy (13%), a procedure not available under FASTRAK as it is routinely performed under local anaesthetic in this district, with inguinal hernia in third place (11%).

3.3. Did all the suitable cases get an operation?

Of the 171 'suitable' from the referral letter 146 patients received an operation of which 27 (16%) had an operation requiring only local anaesthetic (initially outside the rules for FASTRAK). Of the 25 'suitable' patients not operated on by FASTRAK, two were waiting for an operation at the time of finishing data collection, six (3%) did not attend, in seven (4%) the condition had resolved (two ganglion, two sebaceous cysts, one perianal wart, neck nodes and a hydrocele, which was aspirated), the diagnosis was wrong in two cases, one went privately and two were operated on as emergencies, one had a myocardial infarction one month prior to the operation whilst four (2%) were

Table 3
What happened to the patients?



cancelled prior to admission as the patient declined surgery. (see Table 3 for summary).

3.4. Were there any other problems?

Three patients (2%) did not get home the same day, one because of unacceptable postoperative pain after a hernia repair, one developed chest pain after a ganglion removal and one lived alone (although this was not stated by the patient at the time of referral by the GP). Two patients were deferred because of upper respiratory tract infections but both were successfully operated on 3 weeks later. Two cases proved to have malignancies; a non-Hodgkin's Lymphoma where the GP suspected the diagnosis and discussed the case in advance with the surgeon involved, and a carcinoma of rectum where the original diagnosis was anal fissure. The diagnosis was not inappropriately delayed in either case. There were several minor violations of protocol, which were all accommodated within the study. For example, patients with bilateral varicose veins, recurrent hernias or those just outside the agreed age range were referred.

3.5. What was the effect on waiting times?

Because of variation in case-mix, and because waiting times varied with condition, it was necessary to control for surgical procedure in comparisons of waiting times between FASTRAK and conventional day case patients. During the pilot phase, when data on conventional day-cases was also collected, only inguinal hernia repair had sufficient numbers of patients in the FASTRAK group to allow statistical analysis. A total of 147 patients underwent this procedure, 123 as conventional day cases and 24 as FASTRAK patients. There was a significant difference between conventional and FASTRAK patients in the time taken to surgery (Mann-Whitney $W = 329.0$, $P < 0.0001$) with a median wait of 91 days less for those patients undergoing day-surgery via the FASTRAK service. The introduction of the FASTRAK service led to a small decrease in waiting times for conventional day surgery patients (Mann-Whitney $W = 1472.0$, $P = 0.038$). with a median decrease of 10 days after the introduction of FASTRAK.

3.6. What did patients think of it?

Patients, 55, satisfaction questionnaires were returned, 29 from FASTRAK and 26 from conventional day surgery patients, an overall response rate of 79%. General levels of satisfaction were high, no matter whether patients were referred as FASTRAK or conventional day cases. Regardless of type of operation, FASTRAK patients were more likely (83%) to have received written information prior to hospital admission than conventional day cases (37%; $\chi^2 = 12.25$, $P = 0.0019$). Controlling for case-mix, there were no other significant differences in the experiences of the two groups of patients, either in hospital or post-discharge.

3.7. How many GPs used it and what did they think of it?

During the pilot phase, appropriate referrals were received from 31 of the 83 general practitioners (37%) in post at the time, and from 17 (52%) of the practices. The maximum number of patients referred by a single doctor during this phase was four, most referred just one patient.

GP's, 52, satisfaction questionnaires were returned, a response rate of 63%. Overall, general practitioners were positively inclined towards the FASTRAK service; 53% rated it as 'good' or 'very good' and a further 40% as 'fair'. Over one third (37%) felt it should be continued in its current form and 60% felt it should be extended to other specialities, Only one respondent (who had negative views of all forms of day surgery and had not referred any patients via FASTRAK) would not consider using the service in the future. Only two respondents felt that FASTRAK offered no advantages to patients. The main advantage was seen to be a shorter waiting time for operation (90%), but ease of access to the GP surgery (35%) and receipt of consistent advice and information (31%) were also cited. Respondents were more likely (33%) to feel that the service did not offer any benefits to themselves as general practitioners, but over 40% saw the provision of clear and concise information for use with patients as a positive feature, and almost 20% cited improved doctor-patient relations as a benefit. However, 80% of respondents also recognised some disadvantages to referring patients via the FASTRAK service. Chief amongst these was increased workload (61%); 27% also expressed worries about making decisions. When asked which factors affected their ability or decision to use FASTRAK, almost 70% said they saw no or few suitable patients under the current guidelines, 38% forgot about the existence of the service when seeing patients who might have been suitable; being too busy and the risk of misdiagnosis were each mentioned by roughly 20% of respondents.

3.8. What did hospital staff think of the service?

From the unstructured interviews, it was apparent that the two general surgeons treating FASTRAK patients felt that the general practitioners had carried out the pre-operative work-ups successfully. There were relatively few inappropriate referrals to FASTRAK; those that were seen were regarded as genuine mistakes rather than an attempt to 'play the system'. Nor were patients who would have been eligible for FASTRAK referred as conventional day case patients. The surgeons did not see any advantages to themselves, but felt that patients would gain from 'one stop surgery'. The anaesthetists also felt comfortable with the ability of general practitioners to assess patients for anaesthesia and perceived that FASTRAK patients took less time to assess on the day of surgery, mainly because, by definition, they were fit and did not have serious underlying medical problems. The day unit ward sister felt that FASTRAK patients were better informed and prepared for what was going to happen to them, because they had received information leaflets prior to admission.

4. Discussion

Our findings suggest that, when diagnosis, indication for surgery and fitness for anaesthesia are not in doubt, general practitioners, given appropriate guidance, are able to provide all the necessary pre-operative services

usually provided in the general surgical outpatient clinic, without prejudicing the quality of care or decreasing patient satisfaction. There were few inappropriate referrals and the surgeons and anaesthetist were confident about general practitioners' capabilities. One of the surgeons felt that FASTRAK had initially engendered more stress in his daily routine as he had felt obliged to clerk all patients prior to operating to ensure that all was as stated by the referring general practitioner. However, as his confidence in the system increased both the stress and pre-operative clerking reduced so that now they are treated no differently to routine day-cases. The non-attendance rate and failure to go home rate, both critical to the running of a day unit, were no different to those for conventional day patients. The FASTRAK service was perceived by health professionals to offer benefits for patients in terms of decreased waiting times and more consistent information; patients may also find it more convenient to visit their local general practitioner for pre-operative assessment rather than to travel to hospital for an outpatient appointment. However, the validated patient satisfaction questionnaire we chose [3,7] did not address these issues explicitly, as it was designed for general application to all day case patients. Further research into patients' perceptions of the advantages and disadvantages of the FASTRAK service is indicated. The findings from the patient satisfaction survey do, nonetheless, suggest that establishing a relationship between surgeon and patient prior to the operation is not a pre-requisite for patient satisfaction, if some other means of information provision is employed.

Despite these positive findings, the number of patients referred to the FASTRAK service was disappointingly low, especially in view of the effort put into publicising the service to general practitioners. A lack of suitable patients, given the current stringent guidelines, was perceived to be the main barrier to referral. If the service was to be open only to those general practitioners in whom surgeons had a high level of confidence, criteria for patient eligibility could have been relaxed. But such a service could be open to criticisms of inequity. The developers of the service felt that access should be available to all general practitioners in the district and that tighter guidelines were therefore required. If criteria were to be relaxed in the future, there would be an increased risk of inappropriate referrals, possibly leading to postponement of operations and waste of resources.

At the start of the project, some concern was expressed that important conditions may be misdiagnosed and delayed by this service. This was not the case with the two malignancies encountered. With the first, a non-Hodgkin's lymphoma, the diagnosis was suspected and confirmed without delay by an appropriate node biopsy. In the second, a carcinoma of the rectum, misdiagnosed as an anal fissure, the patient would not have been seen any quicker had they been referred by a conventional route, as it is not the practice of the surgeons to see each suspected anal fissure urgently. It is impossible to envisage any system of referral that will never miss an important diagnosis but we do not believe that FASTRAK introduces any further delay into the referral process.

General practitioners also identified a number of disadvantages to themselves in referring patients to the FASTRAK service. Most importantly, they cited increased workload. There is a time cost to general practitioners in carrying out pre-operative assessments. A careful economic evaluation, examining and quantifying the costs and benefits accruing to the hospital staff, primary care team and patients will be required before firm conclusions can be drawn about whether direct referral is a cost-effective option in delivering day surgery services.

In general, there was support amongst all health care professionals involved for continuing the FASTRAK service and extending it to other conditions. The surgeons and anaesthetists recognised the need for a careful review of eligible conditions and the anaesthetist stressed the desirability of adhering to existing criteria for anaesthetic suitability.

We have shown that, given well defined guidelines and criteria, it is possible to offer universal access to direct referral for day case surgery, with significant benefits to patients. Rates of inappropriate referral are acceptable, though somewhat higher than in the Stafford study [5]. In Stafford access was confined to doctors from four practices, whom the authors acknowledge may have been particularly well-motivated. Whether the system can be transferred to other districts is less clear. General practitioners in South Tyneside are probably no more innovative than their colleagues elsewhere; indeed, the proportions of fund-holding and vocational training practices are below the regional average. However, they undoubtedly enjoy a good working relationship with local surgeons; the district is nationally recognised as being at the forefront in day surgery and is the demonstration site for a regional initiative on audit at the primary-secondary care interface. Because of these established relationships, there is considerable trust between primary and secondary care practitioners, which was crucial to the success of the FASTRAK initiative. Elsewhere, more time and effort may need to be expended in developing mutual trust and confidence. We see no major barriers to extending direct access to day surgery to other districts and other surgical disciplines.

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The preoperative evaluation of pain management—a new approach!

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Abstract

Pain is inadequately managed on the day surgery unit, analgesia being mostly prescribed on the basis of the procedure to be performed. We have recently reported the first attempt to quantify an individuals response to a standard pain by measuring their pain response parameters (pain threshold, pain tolerance and pain sensitivity range) using pressure algometer and cold pressor tests, and then analysing their pain with the short form McGill pain questionnaire (SFMPQ) [5]. We report here that the SFMPQ does provide additional information about an individuals pain response in comparison to just measuring pain response parameters alone. Together with the pressure algometer test the SFMPQ provides a quick and practical method of assessing pain sensitivity preoperatively. © 1997 Elsevier Science B.V.

Keywords: Pain management; Pressure algometer; Cold pressor; Short form; McGill pain questionnaire

1. Introduction

The management of postoperative pain in the day unit has been shown to be a significant problem by several authors. The introduction of local anaesthesia and sedation/local anaesthesia techniques has made the subject of peroperative pain management of paramount significance. In this paper we discuss the use of preoperative pain assessment techniques and their relevance to the day surgery unit.

Pain represents a category of experiences signifying a multitude of different unique experiences having different causes and characterised by different qualities, varying along a number of sensory, affective and evaluative dimensions [1].

In everyday clinical practice pain is not quantitatively measured, a subjective report with an objective opinion is most often used. Eysenck [2] has shown that introverts have a lower pain threshold than extroverts but complain less, and Libman [3] was among the first of many to show that individuals feel differing amounts of pain when a standard stimulus is applied.

Pain can be measured physiologically by any of several standard pain tests [4], which for example are used to assess the efficacy of new analgesics. Pain response parameters, namely:

Pain threshold (P.Th)—the point at which pain is just perceived during an ascending series of stimuli.

Pain tolerance (P.Tol)—the point at which a subject will terminate or withdraw from noxious stimulation.

Pain sensitivity range (PSR)—the arithmetical difference between pain tolerance and pain threshold.

provide a measure of an individuals pain reaction.

We have recently reported the use of two standard pain tests, cold pressor and pressure algometer in the population attending the Whittington hospital [5]. For the general population the pain response parameters measured, for both pressure and cold pain tests correlated significantly. Following each pain test a short form McGill pain questionnaire (SFMPQ) was completed [6]. This takes a couple of minutes to administer and provides qualitative information on sensory and affective aspects of pain, SFMPQ scores for both pain tests correlated significantly.

The above would suggest that only one of these tests need be used. The pressure algometer is quick, causes

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less discomfort to patients than the cold pressor test and is more practical in its administration. However the question of whether the SFMPQ provides any more information about an individuals pain response, in comparison to the pain response parameters alone, has not been reported for these standard pain tests. The aim of this paper was therefore to assess these two aspects of pain measurement to show whether or not in routine testing in a hospital taking a SFMPQ is helpful.

2. Method

People, 240 (129 males, 111 females) attending the Whittington hospital as inpatients, outpatients, day surgery unit patients, visitors and staff were invited to participate in the study, by simple randomisation. A health questionnaire was then completed by the researcher (AY), recording details of age, sex, ethnic origin and chronic pain status (defined as pain most days of the week, most weeks of the year, for at least 1 year). Following an explanation of the study, the two pain tests were then performed:

2.1. Pressure algometer test

The electronic pressure algometer (Fig. 1, Force Five Multi-Capacity Force Gage, model FDV 30, Wagner Instruments, P.O. Box 1217, Greenwich, CT 06836) was applied to the anteriomedial shaft of the right tibia 5–8 cm below the tibial tubercle. The subjects were asked to tell the examiner to stop when they felt the first sensation of pain or discomfort (P.Th) and were then asked to put up with the pain until they could bear it no more (P.Tol). Two practice tests were performed on the left shin first to familiarise the subjects with the feelings. Three P.Th and P.Tol readings were taken at different sites in the measured region, and the average of these taken. The test was stopped if the subject tolerated a pressure of greater than 150 N.

Fig. 1. The new electronic pressure algometer. Model FDV 30, Wagner Instruments.

Table 1
Linear regression, stepwise method for the pressure and cold pain descriptors, with pressure/cold tolerance as the dependent variable

	Pressure/cold tolerance		
	B	95% Confidence interval	*P* value
Pressure descriptor total	−0.827	−0.063--−1.591	0.0350
Pressure VAS	−3.647	−1.602--−5.694	0.0006
Cold VAS	−5.112	−2.825--−7.399	<0.0001

B, slope of the regression; VAS, visual analogue score.

2.2. Cold pressor test

A variation of the standard technique described by Wolff [7] was used. Subjects immersed their hand to the wrist in a luke warm water bath for 2 min (to serve as a common baseline) and then transferred their hand to an ice/water bath at 0°C, when the timer was started. The subject pushed a hand held button when they first identified the feeling of pain/discomfort (P.Th) and removed their hand when they could bear it no more (P.Tol). A maximum safety limit of 3 min was allowed in the cold water bath. (See [5] for a detailed methodology).

A SFMPQ was then completed to describe the pain at the subjects pain tolerance level. It consists of 15 descriptor's (11 sensory and 4 affective), a visual analogue scale (VAS) and a present pain index (rating no pain as 0 and excruciating pain as 5). Each descriptor can score 0 indicating no pain, 1 - indicating mild pain, 2 -indicating moderate pain, 3 - indicating severe pain. Hence the three descriptive sections, sensory, affective and total, score 0–12, 0–33 and 045 respectively. The VAS scores 0–10.

2.3. Statistics

The statistics package used was in windows 3.1 SPSS 6.0, using linear regression with the stepwise method to analyze the results. Sex, age, ethnic origin, chronic pain status as well as the pressure or cold pain descriptor's were considered as possible variables in the regression.

3. Results

3.1. Pressure algometer test

Pressure pain tolerance was only related to the total descriptor score and the VAS score (Table 1) i.e. those with a high pain tolerance had a low total descriptor score and a low VAS score—they reported less pain despite putting up with more than those with a low

pain tolerance. The variables for the affective score, sensory score, ethnic origin and chronic pain status were not significantly related to the pressure tolerance. Sex and age were significantly related to pressure tolerance, this has been previously reported [5].

3.2. Cold pressor test

As cold pain tolerance increased, the VAS score decreased (Table 1). Hence those with a high pain tolerance reported less pain on the VAS, despite experiencing more. Variables for the verbal descriptors, age and ethnic origin were not significantly related to the pressure tolerance. Sex and chronic pain status were significantly related to cold tolerance, this has been previously reported [5].

4. Discussion

These results show that measuring an individuals pain tolerance would allow one to predict some aspects of the SFMPQ, however for both pain tests sensory and affective components cannot be predicted, i.e. it is possible to glean additional information about an individuals pain response with the questionnaire.

The more information one has about an individuals pain response preoperatively the better the chance of achieving satisfactory pre and postoperative pain management. Nurses measure temperature, BP, pulse and weight when a patient is admitted to hospital. No attempt has been made to quantify an individuals response to pain in this setting. The pressure algometer test takes about 3 min in total to complete, and could form part of a nursing assessment programme. Together with a SFMPQ, this could identify individuals requiring greater amounts of analgesia, sedation and reassurance.

Sex is a highly significant factor in pain response [5]. It should be noted that pain response parameters in females are lower than in males [5]. It has recently been shown that sex differences exist in analgesic response [8]. These differences must be taken into account by clinicians.

We are currently constructing nomogram tables which will be used to plot the patients pain response numerically and determine mathematically significant figures to indicate a comparison of the patient with a control population. This would allow the pain management of an individual to be tailored to their needs more appropriately.

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Unanticipated admissions following ambulatory surgery

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Abstract

The principal causes of unanticipated admission to the ambulatory surgery unit at Viladecans Hospital between October 1990 and January 1997 were analyzed. Of 7006 patients who underwent outpatient surgery in our facility, 108 were admitted (1.54%). The mean age was 38 years and 93.5% were American Society of Anesthesiologists' (ASA) physical status classification I and II. The principal reasons for admission were surgical complications 42.5% (46); anaesthetic complications 15.7% (17); uncontrollable pain 13% (14); infections 8.3% (9); protracted vomiting 7.4% (8); and coexisting medical problems 6.4% (7). The percentage of admissions in our facility is comparable to that of other ambulatory surgery units. Haemorrhage and pain were the principal causes of admission, vomiting was not common, and we address the role of infection, which has been overlooked as a reason for admission in other published series, perhaps due to the fact that it occurs after discharge. © 1997 Elsevier Science B.V.

Keywords: Ambulatory surgery; Unanticipated admissions; Perioperative complications

1. Introduction

Unexpected hospital admission following outpatient surgery is a significant measure of the outcome in ambulatory surgical care, reflecting as it does both an unanticipated patient morbidity and a disturbance to the satisfactory practice of ambulatory surgery.

In the ambulatory surgery facility of Viladecans Hospital 7006 patients underwent outpatient surgery. There were 108 unexpected admissions, in 104 patients.

It is necessary to identify the factors associated with a higher incidence of hospital admission, in order to decrease this percentage and to manage a wider range of patients and surgical procedures.

We recorded patients' demographic characteristics, medical history data, American Society of Anesthesiologists' physical status (ASA), type and duration of surgical procedure, type of anaesthetic technique, perioperative complications and causes of hospital admissions during the period October 1990–January 1997.

2. Patients and methods

We retrospectively reviewed all patients who underwent ambulatory surgery in Viladecans Hospital from October 1990 to January 1997 ($N = 7006$), using data taken from the surgical activity forms, which is processed and published in the hospital's annual reports. This source revealed the total number of interventions and the percentages of types of surgery and anaesthesia, and these were grouped according to years.

The admissions were identified from the hospital admissions list. Data on all the patients who were admitted either immediately or after discharge ($N = 108$) were individually checked and reviewed using the clinical histories and the forms for surgical activity, telephone follow-up and postoperative homecare. Admissions were grouped according to their demographic

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characteristics, surgery data, clinical data, homecare premedication, evaluation before surgery, ASA physical status, type of surgery, type of anaesthesia, duration of surgery and anaesthesia.

Admissions were analyzed according to diagnosis and discharge check-up, and were grouped according to surgical or anaesthetic cause, pain, vomiting and coexisting medical problems. Each group was divided into subgroups.

Admissions for infections were analyzed in a separate group which collated age, ASA physical status, surgical procedure, symptoms, culture, time lapse between discharge and admission and the length of hospital stay in days.

The ASA physical status was assigned during the preoperative consultation, in accordance with the classification of the American Society of Anesthesiologists, which is divided into five levels: ASA physical status I is a healthy patient; ASA physical status II is the equivalent of mild underlying disease without functional impairment; ASA physical status III represents severe systemic disease that interferes with daily function; ASA physical status IV is severe life-threatening disease; and ASA physical status V is the patient unlikely to survive 24 h, with or without surgical intervention. Only patients in ASA physical status I, II and III were candidates for ambulatory surgery. The type of surgery was classified under related diagnosis groups.

The anaesthetic technique was divided into six categories: general anaesthesia, spinal, epidural, retrobulbar (RTB) and brachial plexus blocks, local anaesthesia supplemented by sedation. Surgery time was divided into three categories: (1) 20 min or less; (2) 21–40 min; and (3) over 40 min.

3. Results

In the Ambulatory Surgery Unit of Viladecans Hospital in Barcelona 7006 patients underwent day-care surgery between October 1990 and January 1997. There were 108 hospital admissions in 104 patients (1.54%), four patients being admitted twice, once immediately and once after discharge.

The mean age in years ($\pm$S.D.) of the patients admitted was 38.36 ± 18.68, ranging from 3 to 93, with a mode of 32; 49.1% were male and 50.9% female.

Some days before the operation 88.9% of the patients were assessed by the anaesthesiologist, and 77.4% received premedication at home. As regards ASA physical status, 36.1% were ASA class I, 57.4% were ASA class II and 6.5% were ASA class III.

We evaluated the relationship between the need for admission and the type of surgical procedure used. The percentage of admissions for each procedure are described in Table 1.

Table 1
Admissions according to surgical procedure

Surgery type	Admissions/total number	Percent
Haemorrhoids	6/19	31.5
Inguinal hernias	26/364	7.1
Anal surgery	5/77	6.4
Adenotonsillectomy	5/89	5.6
Strabismus	1/20	5.0
Gynaecological laporoscopy	18/418	4.3
Extraction osteosynthesis material	3/82	3.6
Gynaecolgical:	9/302	2.9
Curettage	1	
Conization	4	
Voluntary interruption pregnancy	2	
Bartholin's cyst	2	
Septoplasty	2/82	2.4
Phimosis	3/143	2.0
Pilonidal cyst	7/354	1.9
Arthroscopy of knee	4/233	1.7
Colonoscopy	1/90	1.1
Superficial tissues	3/292	1.0
Epidydimus	1/91	1.0
Cataracts	13/2015	0.64
Carpal tunnel syndrome	1/315	0.3

The surgical procedures with more frequent admissions were haemorrhoids, inguinal hernias and anal surgery.

The mean surgery time of patients admitted ($\pm$S.D.) was 44.31 ± 25.74 min, ranging from 5 to 135 min, with a mode of 30 min. In 41.7% of admissions, the intervention lasted over 40 min, in 44.4% it lasted 21–40 min, and in 13.9% it lasted 20 min or less.

General anaesthesia was applied in 39.7% of cases admitted (26.8% total intravenous anaesthesia and 12.9% inhaled), epidural anaesthesia in 18.5%, spinal in 15.8%, local anaesthesia supplemented sedation in 15.7% and retrobulbar in 10.1%. In Table 2 we can see the admissions according to type of anaesthesia, with percentages of total numbers for each type of anaesthesia. Intubations were performed in 40.7% of the admissions and narcotics were administered to 48.8%.

There were surgical complications in 42.5% of the admissions: 17.5% presented with haemorrhage, and in 13% pain which could not be controlled by non-narcotic analgesics.

Table 2
Admissions according to type of anaesthesia

Type of anaethesia	Admission/total	Percent
Local + sedation	17/2445	0.7%
General	42/1481	2.8%
Spinal	18/366	4.9%
Epidural	20/397	5.0%
Retrobulbar	11/2015	0.5%

Table 3
Admissions due to infections

Age	Year	ASA	Surgical procedure	Admission (days) after discharge	Days spent in hospital
40	1991	I	Haemorrhoids	8	3
50	1991	III	Perianal tumor	3	3
53	1992	I	Inguinal hernia	3	22
47	1992	II	Infraumbilical mesh rejection	2	5
29	1994	II	Inguinal hernia	2	9
27	1995	II	Menisectomy artroscopy	5	25
79	1995	II	Cataract	3	15
22	1996	I	Pilonidal	6	2
49	1996	I	Haemorrhoids	1	10

Infections were observed in 8.3% of the patients (Table 3). Finally, 7.4% of admissions had emetic symtoms which were not controlled by treatment; general anaesthesia had been administered to 70% of this patient group.

The length of hospital stay in those patients admitted immediately after ambulatory surgery ranged from 1 to 9 days, with a mean of 1.54 days. In those admitted after discharge, the period between discharge and admission ranged from 1 h (through haemorrhage) to 3 months (cataract with dislodged retina), with a mean of 6.9 days. The mean stay in these cases was 5.28 days, ranging from 1 to 24 days.

There were no perioperative deaths in any of the patients studied. The causes of hospital admission are noted in Table 4. The number of admissions due to surgical causes divided among seven surgical departments, are seen in Table 5. The admissions for anaesthetic reasons in patients who underwent spinal anaesthesia are described in Table 6; admissions with a delay in anaesthetic emergence under general anaesthesia (Table 7); admissions due to pain, with the type of surgery and anaesthesia are shown in Table 8.

Table 4
Causes of hospital admissions (1990–1997)

Causes of admissions	No.
Surgical complications	(46)
Haemorrage	19
Surgical infection (1 stafilococcic sepsis)	8
Surgical extensión, greater complexity	7
Additional surgery	3
Suspected intestinal loop perforation	4
Feverish syndrome related to surgery	2
Postsurgical uveitis	1
Detached retina	1
Deep venous thrombosis + articular effusion	1
Anaesthetic complications	(17)
Accidental spinal anaesthesia in RTB[a]	3
Dural puncture in epidural anaesthesia	3
Anaesthetic emergence delay in general anaesthesia	4
Delay in spontaneus micturiction in spinal anaesthesia	4
Urinary retention in spinal anaesthesia	2
Prolonged motor and sensory weakness in spinal anaesthesia	1
Pain	(14)
Non-compliance with facility protocol	(12)
Selection	5
Schedule	7
Vomiting	(8)
Coexisting illnesses	(7)
Hypertension	3
Lipothymia	3
Hyperglycaemia	1
Feverish syndrome unrelated to surgery	(4)
Urinary origin sepsis through *E. coli* after vesical probing	1
Urinary infection unrelated to surgery	1
Common cold	2

[a] RTB Retrobulbar anaesthesia.

4. Discussion

Unanticipated hospital admission following ambulatory surgery has long been recognised as a valuable measure of morbidity and quality.

The success of an ambulatory surgery unit may be equated to its number of unanticipated hospital admissions.

The percentage of admissions varies from one unit to the other, but the highest percentages (by up to 10-fold) are found in Hospital-affiliated centres [1,2]

Table 5
Admissions due to surgical complications according to specialities

Sevices	Admissions (*n*)	Operations (*n*)	Percent
Digestive	1	44	2.27
Gynaecology	19	890	2.13
General surgery	15	1141	1.31
Otolaryngology	4	751	0.53
Orthopaedic-traumatology	3	1206	0.24
Ophthalmology	3	2066	0.14
Urology	1	908	0.11

Table 6
Admissions in spinal anaesthesia patients

Year	Age	ASA	Local anaesthetic	Surgical procedure	Cause
1995	42	II	Prilocaine 5%	Inguinal hernia	Emergence delay
1996	31	II	Prilocaine 5%	Haemorrhoids	Urinary retention
1996	49	II	Prilocaine 5%	Inguinal hernia	Micturition difficulties
1996	47	I	Prilocaine 5%	Inguinal hernia	Micturition difficulties
1996	57	II	Prilocaine 5%	Inguinal hernia	Micturition difficulties
1996	54	II	Lidocaine 5%	Inguinal hernia	Micturition difficulties
1996	40	II	Prilocaine 5%	Inguinal hernia	Urinary retention

The percentage in the Viladecans public hospital was 1.54%, a figure comparable to the percentages presented in other published series, which range from 0.68 to 4.1% [3,4]. We must bear in mind that the number of admissions also depends on the discharge criteria established by each unit.

In our unit, the criteria which the patient must satisfy include the following: the same cognitive capacity and cardiovascular and respiratory stability as presented before the intervention; capable (commensurate with age) of walking, dressing, keeping down a diet, urinating, and being aware of surroundings. Pain must be of a degree controllable by oral analgesics.

Additionally the patient and family should wish to go home as previously planned. Easy access to the hospital, both by phone and in person is essential. Refusal of a patient to go home would in itself be a reason for admission, without additional cost.

During the first 3 years of the unit's operation 11% of patients were admitted (12), even though they fullfilled the requirements for discharge as outlined above. Their admission was occasioned by non-compliance with the protocols for schedules and patient selection then in force. This measure was adopted by all physician members of the unit in order to avoid any unnecessary risks and to ensure that the unit could operate safely. We have to bear in mind that ambulatory surgery was then a new system and that there was no experience in Spain of several types of surgery in this context, on a sustained or permanent basis.

4.1. Admissions due to surgical complications

Surgical complications accounted for 42.5% of admissions in the period studied in the ambulatory surgery unit (Table 4), a figure comparable to those in the international literature, which vary from 39% [5], 57.5% [6] and 70.7% [7].

Haemorrhoidal surgery required the most admissions (Table 1), with 31.5%. Haemorrhage was the most common surgical complication, followed by extension of the surgical procedure due to unforeseen complexity or additional surgery. Both these findings concur with other published series [5,7].

Infections of the surgical wound deserve special attention as, surprisingly, these are absent from the wide-ranging series published on the causes of admissions in ambulatory surgery [5–7]. Holtz et al. [8] conclude, after reviewing the literature on the current state of postdischarge surveillance of nosocomial infections of the surgical wound, that the control methods being used by health centers are inadequate, and, moreover, that the Centers for Disease Control and the Joint Commission for the Accreditation of Healthcare Organizations currently have no strong guidelines on the subject. These authors stress the need for a postdischarge control program in order to validate the surveillance of postoperative complications in ambulatory surgery. Sands et al. [9] state that 84% of surgical infections occur after discharge, that the routine surveillance methods for infection in ambulatory surgery have

Table 7
Admissions due to delay in emergence in general anaesthesia

Year	Age	ASA	Surgical procedure	Inhaled	TIVA[a]	Opioids
1991	35	II	Carpal tunnel syndrome	Yes	No	Yes
1993	36	II	Tied fallopian tubes	Yes	No	Yes
1995	3	II	Adenotonsillectomy	Yes	No	No
1996	3	II	Adenoidectomy	Yes	No	No

[a] TIVA total intravenous anaesthesia.

Table 8
Admissions due to pain

Year	Age	ASA	Type of surgery	Type of anaesthesia
1990	21	II	Inguinal hernia	Inhaled
1991	41	II	Tied fallopian tubes	Endovenous
1991	32	I	Haemorrhoids	Epidural
1991	52	II	Inguinal hernia	Epidural
1991	37	I	Inguinal hernia	Epidural
1992	46	II	Crural hernia	Inhaled
1992	24	II	Removal femoral Kuntcher's rod	Endovenous
1993	69	II	Inguinal hernia	Intradural
1994	13	I	Phimosis	Inhaled
1994	45	II	Giant lipoma	Endovenous
1995	57	II	Inguinal hernia	Intradural
1996	37	I	Knee arthrotomy	Intradural
1996	29	I	Inguinal hernia	Intradural
1996	51	II	Inguinal hernia	Intradural

not been validated, and that 63% of infections are treated outside the surgical unit. The percentage of infections of the surgical wound in our unit was 7.4% (8).

Finally, there was a noteworthy case of deep venous thrombosis after arthroscopic knee surgery. In 1996 we introduced a protocol for the administration of prophylactic doses of low molecular weight heparine in the types of patients and types of surgery considered to be at risk from thromboembolism. This is begun on the day of surgery until the patient is able to walk normally, or until the end of the first postoperative week.

4.2. Admissions due to anaesthetic causes

Admissions due to anaesthetic causes represented 15.7%, a figure similar to the 14% reported elsewhere [6].

The principal cause was a delay in anaesthetic emergence in 11 patients (10%), of which four were subjected to general anaesthesia and seven to spinal anaesthesia (four cases presented a delay in spontaneous micturition which was unresolved at the unit's closing time, one patient had prolonged motor and sensory weakness which lasted more than 6 h from the start of the spinal anaesthesia and two cases of urinary retention), difficulties in micturition made up 5.5% of the total percentage of admissions, comparable to the 5.1% of the series of Gold et al. [5].

Accidental spinal anaesthesia during the application of retrobulbar anaesthesia was the cause of 2.7% of admissions (3/2015). The risk of this happening (0.15%) confirms other authors' findings that the morbidity of this technique is extremely limited [10]. This problem was successfully solved in every case by the provision of cardiocirculatory and ventilatory backup for approximately 60 min.

Finally, there were three admissions due to accidental perforation of the dura in epidural anaesthesia; only one of these resulted a postspinal headache, (1/397 or 0.2%), which was overcome by rest in a supine position, and the administration of analgesics and hydration over 3 days. Likewise, in a series of 682 epidurals, Sarma et al. [11] observed 0.3% of dural punctures with headaches, which required the application of a blood patch for relief of postspinal headache.

4.3. Admissions due to pain

Postoperative pain is still a problem in some types of surgery. In our study, the percentage of admissions due to pain was 13% (14), an intermediate rate in comparison with those of other publications, which range from 18.5% to 8.8% [5,7].

4.4. Admissions due to vomiting

Intractable vomiting is a significant cause of admissions in ambulatory surgery, with levels of up to 36% in some centers, and it is the principal cause of complications in the postanaesthesia care unit in other centers [12,13].

The percentage of admissions due to vomiting in our unit was 7.4% (8); this low rate can be a result of the following factors: the homecare administration of anxiolytics the night before the operation; the administration of blockers of H_2 receptors in patients at risk of bronchoaspiration (due to diabetes, obesity, hiatus hernia, a history of ulcus, etc.); and premedication with endovenous droperidol 0.014 mg/kg 5–10 min before induction in all patients receiving narcotics. Moreover in the majority of lower abdominal surgery cases, with the exception of gynaecological laporoscopies we administered local-regional anaesthesia.

5. Conclusions

The percentage of admissions in our unit is comparable to ambulatory surgery units in other countries.

Vomiting was not major cause of admission; principal causes of admission were haemorrhage and pain.

Infection is a cause of admission following ambulatory surgery.

Gathering data on admission due to infection presents a challenge as this complication appears after discharge and subsequent treatment, in many cases, takes place in a centre distinct from the original ambulatory surgery unit.

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