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Editorial

Educational Opportunity! Fifth International Congress on Ambulatory Surgery on "Making a World of Difference Through Ambulatory Surgery"

In May 2003, there will be a unique opportunity to share knowledge and experience with your international colleagues in Ambulatory Surgery. The Fifth International Congress on Ambulatory Surgery will be held in Boston, USA on May 8–11, 2003. Held in the USA for the first time, the International Congress will bring together ambulatory surgery professionals from around the world for more than three days of educational sessions and networking. The Congress is presented every two years by the International Association on Ambulatory Surgery, and will be cosponsored by the Society for Ambulatory Anesthesia and the Federated Ambulatory Surgery Association, in conjunction with their Annual Meetings. This will be an opportunity for attendees to have at one meeting the shared expertise and perspectives from all types of ambulatory surgery settings. Over 55 sessions are being planned on a variety of surgical, anesthesia, nursing and administrative topics, along with poster sessions and pre-meeting practical workshops. Post-convention tours to Ambulatory Surgery Centers will be available. The overwhelmingly popular Saturday Night event and accompanying guest tours are part of the program. Dr. Burton Epstein will deliver the Nicoll Memorial Lecture during the Opening Ceremony on May 8th, which will also include remarks from prominent national speakers and a Keynote Lecture. Over 200 exhibitors are expected to participate, and the opportunity for networking will be unprecedented. The Sheraton Boston Hotel will serve as headquarters hotel for the event. Program information, including online registration and abstract submission, may be found at both the SAMBA and FASA websites, http://www.sambahq.org/ and http://www.fasa.org/.

Beverly K. Philip MD,
Director, Day Surgery Unit,
Brigham and Women's Hospital
and Associate Professor of Anaesthesia,
Harvard Medical School,
Department of Anesthesiology,
Perioperative and Pain Medicine,
75 Francis Street,
Boston, MA 02115
USA,
Tel: 617-732-8215;
fax: 617-277-2192;
e-mail: bphilip@zeus.bwh.harvard.edu

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Use of elastomeric pumps for continuous intravenous analgesia administration in ambulatory surgery pain management

Sergi Boada [a,*], Jordi Recasens [a], Juan Papaceit [a], Benjamin Solsona [a], Judit Saludes [a], Jordi Escuder [b], Maria Rull [a]

[a] *Department of Anesthesiology, Ambulatory Surgery Unit, Joan XXIII Universitary Hospital, Tarragona, Spain*
[b] *Department of Surgery, Ambulatory Surgery Unit, Joan XXIII Universitary Hospital, Tarragona, Spain*

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Abstract

Aim: To evaluate the feasibility and security of the use of elastomeric infusion pumps for the administration of continuous intravenous analgesia during the post-operative period of potentially painful surgical operations performed in the context of ambulatory surgery. *Material and methods:* Prospective study with 40 patients scheduled for inguinal hernia repair, haemorrhoidectomy, knee arthroscopy and foot orthopedic surgery. At the end of surgery a LV-5 of 5 ml/h Baxter® elastomeric infusor was connected. Intravenous ketorolac, tramadol and ondansetron were supplied for 55 h. Daily out-patient controls were performed by the nurses of the post-operative out-patient care unit. Pain intensity by means of a plain oral scale, the need for supplemental oral analgesics and the level of patient satisfaction were evaluated daily. *Results:* 92.5% of the patients reported absence or slight pain 48 h after the surgical operation, and 7.5% referred to moderate pain. No severe pain was reported by the patients in the first 72 h of the post-operative period. 7.5% of the patients felt nauseated, 15% vomited and 10% had discomfort at the venous puncture point. No patient required re-admission after discharge. 87.5% of the patients revealed satisfaction with the analgesic treatment. *Conclusion:* The use of invasive out-patient analgesic techniques could have viability in some procedures in which oral analgesics are unable to control the post-operative pain. Comparative studies would be needed in order to elucidate the procedures that could benefit from these techniques in our context.

Keywords: Elastomeric pumps; Pain management; Ambulatory surgery

1. Introduction

Persistent post-operative pain can lead to problems in the flow of patients in day surgery units (DSUs) by delaying discharges, impeding the application of fast-track programmes in recovery rooms, increasing the contact of the patients with medical staff after discharge and increasing re-admission rates [1].

In the majority of procedures performed in DSUs, post-operative pain can be managed by means of analgesic techniques based on the administration of oral analgesia. However, there are some surgical procedures that can cause moderate to severe pain and where the use of oral analgesics can be ineffective [2]. Rawal et al. [3] published an epidemiological study with 1035 patients submitted to a variety of out-patient procedures in which they observed that around 30% of the patients referred to moderate to severe pain in the first 48 h of the post-operative period despite the analgesic drugs supplied. Twenty percent of the patients displayed sleep problems on the first post-operative night because of severe pain. Surgical operations such as foot surgery, knee or shoulder reconstruction, haemorrhoidectomy, inguinal hernia repair or varicose vein surgery can frequently produce severe post-operative pain [4,5] and subsequent failure of conventional post-operative analgesia. In these cases, it would be useful to dispose of invasive out-patient analgesic techniques such as the

* Corresponding author. Address: Servicio de Anestesia Reanimación i Terapéutica del Dolor, Hospital Universitario Joan XXIII de Tarragona, C/Dr. Mallafré Guasch s/n 43007 Tarragona, Spain
E-mail address: sbp@tinet.fut.es (S. Boada).

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maintenance of intravenous lines for continuous infusion systems or PCA, the use of the subcutaneous access or even catheters for continuous regional techniques.

The aim of this study is to evaluate the feasibility and security of the use of elastomeric perfusion pumps for the administration of continuous intravenous analgesia during the post-operative period of potentially painful surgical procedures performed in the context of day surgery. The analgesic quality achieved with the two type of drugs used in this study will be evaluated.

2. Material and methods

Prospective study with 40 ASA I–III patients scheduled for ambulatory haemorrhoidectomy, foot surgery, bilateral inguinal hernia repair and knee arthroscopy with meniscectomy. Informed consent was obtained. Exclusion criteria were patients younger than 18 years, a body weight less than 50 kg or greater than 90 kg, any contra-indication to the use of non-steroidal anti-inflammatory drugs, allergy or hypersensivity to tramadol, important psychic disturbances and an unwillingness to participate in the study.

Pre-operatively an intravenous catheter was placed in the non-dominant superior extremity (preferably in the forearm or in the back of the hand avoiding the antecubital flexure). An Abbocath® equal or less than 18 G in size was used. The Abbocath® was fixed with MEFIX® adhesive strips shaped as a lace overlayed with transparent TEGADERM®. A three-way tap between the Abbocath® and the intravenous equipment was allowed at this stage for intra-operative use. Once the intravenous catheter was placed, sedative and antiemetic drugs were given according to departmental procedure.

The anaesthetic technique consisted of spinal blocks with hyperbaric mepivacaine at a dose according to the criteria of the anesthetist in charge. Ten minutes before the end of the surgery, 30 mg of ketorolac and 50 mg of tramadol were administered intravenously.

Post-operatively the three-way tap was removed and the patient admitted to the post-anesthesia care unit (PACU-1). There a 275 ml infusor Baxter® LV-5 system was connected to the intravenous catheter. The infusor system had been previously charged with one of two different analgesic solutions according to the following:

- *Analgesic solution A:* for haemorrhoidectomy and foot orthopedic surgery: ketorolac 180 mg, tramadol 500 mg and ondansetron 16 mg diluted with saline.
- *Analgesic solution B:* for knee arthroscopy and inguinal hernia repair: ketorolac 180 mg, tramadol 200 mg and ondansetron 16 mg diluted with saline.

In the PACU-2 phase, the nursing staff familiarized the patients and their relatives with the infusor system. They detected potential 'problem-patients' who might be non-collaborative for the removal of the infusor system and excluded these from the study. At this stage the patients met the out-patient care staff.

At discharge, a last revision of the infusor system was performed. A normal oral drug pack was also given to the patients to be used if the infusor system be removed early either unintentionally or according to out-patient care staff criteria. They were also given rescue analgesic, which consisted of tramadol (50 mg) one tablet per day.

The out-patient follow-up by the Out-patient Care Unit consisted of three visits. One during the evening/night on the day of surgery, the second during the evening/night of the day after and the third during the morning of the third post-surgical day.

At these visits the following was undertaken:

- Review of the infusor system and intravenous catheter integrity.
- Detection of potential undesirable effects that could be attributed to the analgesic drugs supplied (nausea, vomiting, dizziness) and detection of patients' problems with the infusor system (discomfort in the venous puncture zone or with the reservoir).
- Early removal of the system when deemed necessary by the out-patient care staff criteria and transfer to oral analgesics.
- Removal of the system at the end of the study at the third out-patient visit.
- Filling in the data collection paper.

The data evaluated in the study were:

- Out-patient evaluation of pain by means of a Plain Oral Scale (no pain, slight pain, moderate pain, severe pain).
- Out-patient evaluation of the degree of patient satisfaction with the infusor system (satisfied, some discomfort, uncomfortable).
- The need for rescue analgesic tablets.
- Collection of incidences that could be attributed either to the drugs used or to the infusor system.

3. Results

Forty patients (20 men and 20 women, aged 18–65 years) were studied. The distribution according to procedure was five hallux valgus operations, 19 haemorrhoidectomies, seven knee arthroscopies and nine bilateral inguinal hernia repairs. In the distribution of the pain intensity per day (Table 1) no patients had severe pain. Slight or absence of pain occurred in 80% of patients on the first day, in 92.5% during the second day

Table 1
Pain intensity distribution per day

	First day	Second day	Third day
No pain	42.5% (17)	62.5% (25)	80% (32)
Slight	37.5% (15)	30% (12)	15% (6)
Moderate	20% (1)	7.5% (3)	5% (2)
Severe	0%	0%	0%

and in 94.9% the third day. Twenty percent of the patients had moderate pain on the first day, 7.5% on the second day and 5.1% on the third day.

The distribution of pain intensity per day according to the procedure revealed that 100% of the patients operated on for hallux valgus (Table 2) had no pain on the third post-operative day. Among the patients who underwent haemorrhoidectomy (Table 3), 31.6% had no pain on the first post-operative day, 42.1% referred to slight pain and 26.3% had moderate pain. 84.2% had no pain on the third day, 10.5% slight pain and 5.3% moderate pain. Following knee arthroscopy (Table 4), there were no patients with moderate pain, 83.3% of the patients had no pain on the third post-operative day and 16.7% had slight pain. The greatest percentage of either slight pain (37.5%) or moderate pain (12.5%) on the third post-operative day was observed in the group who had had bilateral inguinal hernia repair (Table 5).

Five patients on the second post-operative day (12.5%) and six patients on the third day (15%) required analgesic rescue with tramadol tablets (Table 6). Bilateral inguinal hernia repair was the procedure in which the most rescues were needed.

Side effects were observed in 11 patients (27.5%) attributed to the analgesic drugs. 7.5% of the patients had nausea, 15% vomited and 5% had dizziness. Analgesic A solution had been given to 8 out of these 11 patients.

Regarding problems with the infusor system, 10% of patients referred to discomfort at the venous puncture point and 12.5% had discomfort with the infusor system reservoir. The system was removed before the end of the study in only two patients (5%). In both cases the cause was pain at the venous puncture point. No other problems due to the system were recorded and no patient required re-admission to the hospital after discharge.

Table 2
Pain intensity in foot orthopedic surgery

	First day	Second day	Third day
No pain	60% (3)	80% (4)	100% (5)
Slight	20% (1)	20% (1)	0%
Moderate	20% (1)	0%	0%

Table 3
Pain intensity in haemorrhoidectomy

	First day	Second day	Third day
No pain	31.6% (6)	62.2% (12)	84.2% (16)
Slight	42.1% (8)	31.6% (6)	10.5% (2)
Moderate	26.3% (5)	5.3% (1)	5.3% (1)

Table 4
Pain intensity in knee-arthroscopy

	First day	Second day	Third day
No pain	71.4% (5)	71.4% (5)	83.3% (5)
Slight	28.6% (2)	28.6% (2)	16.7% (1)
Moderate	0%	0%	0%

Table 5
Pain intensity in inguinal hernia repair

	First day	Second day	Third day
No pain	33.4% (3)	44.4% (4)	50% (4)
Slight	44.4% (4)	33.4% (3)	37.5% (3)
Moderate	22.2% (2)	22.2% (2)	12.5% (1)

Table 6
Analgesic rescue need with oral tramadol (50 mg)

Procedures	First day	Second day	Third day
Hallux valgus	0	1 (20%)	0
Haemorrhoidectomy	0	3 (15.8%)	2 (10.5%)
Knee arthroscopy	0	0	1 (14.3%)
Inguinal hernia repair	0	1 (11.1%)	3 (33.5%)
Total	0	5 (12.5%)	6 (15%)

The degree of patient satisfaction was as follows: 87.5% were very satisfied, 7.5% had some discomfort and 5% were uncomfortable.

4. Discussion

Analgesic techniques in ambulatory surgery have to be effective with minimal side effects, secure and easy to manage for the patient [6]. In the majority of ambulatory procedures post-operative pain can be managed with analgesic techniques based on the administration of tablets. However, they can be ineffective in some surgical procedures [2]. The use of invasive analgesic techniques on an out-patient basis with the support of Out-patient Care Units makes the total control of intense post-operative pain possible. This facilitates early discharge, reduces re-admission, decreases mor-

bidity and decreases the cost of surgical procedures. It also potentially increases the range of surgical procedures that be performed on an out-patient basis [7].

The use of out-patient continuous regional techniques with the administration of local anaesthetic in out-patient procedures has been well documented. Rawal et al. published two series of 70 and 149 patients [2,8], undergoing a variety of day surgery procedures, in which an elastomeric infusion system PCA-like was used connected to a peridural multiperforated catheter inserted into different places—subcutaneous in the surgical wound, in the brachial plexus sheath or intra-articular. The patients self administered boluses of local anaesthetic at different concentrations and volume depending on the type of surgery and the catheter localization. They were even trained for the out-patient removal of the catheter. Checks were performed daily by specialized staff and by phone. In both series the analgesic control was good or excellent in more than 85% of the patients and there was high satisfaction with the system. There were no problems detected either technical or infection. Klein et al. [9] published two cases of patients undergoing major ankle surgery with continuous sciatic nerve block and they were discharged with a continuous infusion of 0.2% ropivacain for 27 h through a disposable elastomeric pump with which they successfully extended the analgesic blockade effect. In both cases patients and relatives were instructed in detecting any side effects due to the local anaesthetic and to clamp down on the infusor if such occurred. They were also instructed on the removal of the catheter, which was successfully performed. Each patient was given a phone number of the medical staff to be used if problems occurred. The authors expressed the need for choosing collaborative, serious and participatory patients in these kind of analgesic techniques. Chelly et al. [10], with regard to the two cases described above, considered it inadequate to transfer the responsibility for the care of continuous analgesic blockade catheters to the patients and that out-patient monitoring by specialized staff was necessary. The same authors defended the use of electronic PCA pumps which allow the rate of continuous infusion of local anaesthetic to be reduced. Ganapathy et al. [11] used continuous regional blockades and elastomeric PCA pumps in seven out-patient cases. Patients were instructed both orally and with written material in the use of the infusor, bolus administration, side effect detection and catheter removal. Daily checks by medical staff were made by phone. Two disconnections of the infusor system occurred in two patients all the content of the pump reservoir was emptied in a few minutes and in another case the catheter detached on the way home. Analgesic quality was documented as excellent and there were no problems with the removal of the catheter or with the bolus administration; however, the authors considered the infusor system as imprecise and they doubted its security when used in continuous perineural blockades. Goldstein et al. [5] used an out-patient electronic conventional PCA infusion pump to give subcutaneous morphine as post-operative analgesia in 41 out-patients who underwent haemorrhoidectomy. In this case, nurses of an out-patient support unit undertook daily checks. The results were satisfactory achieving a good control of the pain and a high degree of acceptance by the patients, without increasing either the side effects or the re-admission rate.

There are no references to out-patient continuous endovenous infusion through elastomeric infusors in the context of out-patient surgery. In view of the lack of previous experience, our study was designed with the support of the out-patient care unit which allowed the patients to be monitored daily. There were no observed important technical problems or problems due to the intravenous catheter or the infusor system. The two cases of early elastomeric pump removal were due to pain at the venepuncture site, but in both cases the puncture had been made in the wrist. The venepuncture place of choice might be in the forearm. All the beginning of the study five patients reported discomfort in motion with the reservoir of the infusor system, which was not been observed again when an elastic net for fastening the reservoir to the forearm was given to the patients (Fig. 1). Regarding pain control, satisfactory values of pain intensity were achieved but in the haemorrhoidectomy and in foot surgery cases, a high incidence of side effects associated with the use of the analgesic solution with the higher tramadol concentration were registered. The most difficult procedure for pain control and the one which required the most analgesic rescues was bilateral inguinal hernia repair. Here good pain control with the infusor system at rest was observed by the out-patient care staff, but when patients moved, the whole evaluation of pain intensity

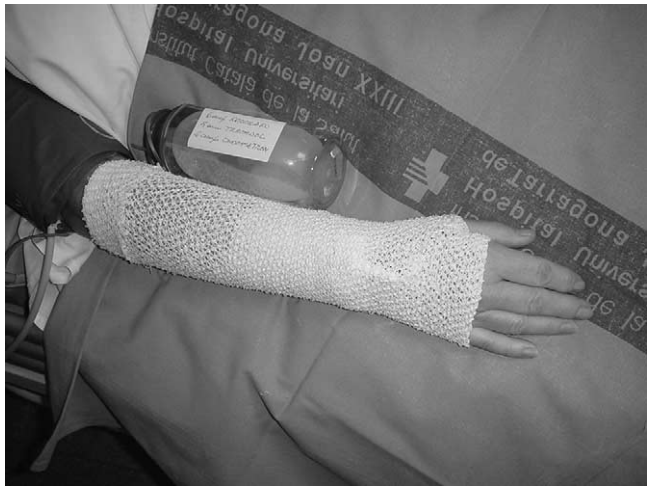

Fig. 1. Elastic net for fastening the resevoir to the forearm.

increased. Our study did not reflect the differences in pain intensity at rest and in motion. In these cases it would be better to use PCA systems.

We think that our study demonstrates the feasibility and security of the use of out-patient intravenous analgesic solutions in achieving an acceptable control of post-operative pain. Further work is needed in order to establish the optimum analgesic solutions per procedure and to reduce the incidence of side effects. Also needed are comparative studies with traditional analgesic techniques for determining the procedures that could benefit from these invasive techniques in order to be included in out-patient programmes.

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Comparison of the automated Dinamap blood pressure monitor with the mercury sphygmomanometer for detecting hypertension in the day case pre-assessment clinic

Trevor R. Coe *, Kerri Houghton

Department of Anaesthetics, Torbay Hospital, Lawes Bridge, Torquay, Devon TQ2 7AA, UK

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Abstract

Patients will be rejected from surgery by nurse-led pre-assessment clinics and will need to be assessed by their general practitioners if their blood pressure is higher than a pre-determined value. We have assessed the accuracy of the Dinamap automatic blood pressure recorder compared with manual mercury sphygmomanometry for detecting pre-operative hypertension in the day case pre-assessment clinic under everyday conditions. Two hundred consecutive patients attending for day case surgery pre-assessment had their blood pressure measured using the automated and the manual methods. We found that the Dinamap over-read systolic blood pressure by a mean of 8.38 mmHg and under-read diastolic pressure by a mean of 1.68 mmHg when compared with manual readings. Of the patients 6.5% would have been inappropriately diagnosed as hypertensive using the Dinamap and thus potentially rejected from day surgery and inappropriately referred to their general practitioner.

Keywords: Arterial pressure; Measurement; Equipment; Automatic and manual sphygmomanometers

1. Introduction

Hypertension causes significant morbidity and requires treatment before elective anaesthesia [1,2]. In our day surgery unit patients are pre-assessed by the nursing staff and part of this process is measurement of blood pressure. Exclusion from surgery is based on detecting hypertension, as defined by our Day Surgery Unit protocol, using an automated blood pressure machine. Rejection results in referral back to the general practitioner (GP) for assessment. We have been contacted on numerous occasions by GPs who have subsequently found many of these patients to be normotensive on manually measuring the blood pressure. Any disparity of readings between general practice and the Day Surgery Unit can cause confusion and delays in surgery.

The automated blood pressure monitor has been shown to be reliable as a trend monitor in anaesthesia [3]. The ability of automated blood pressure monitors to give accurate, single blood pressure measurements has only been investigated compared to manual sphygmomanometry in pregnant women [4], children [5], 50–54 year olds [6], known hypertensive patients [7] and diabetics [8]. It has not been assessed for accuracy in the heterogeneous population that presents for day surgery. Manual measurement of blood pressure using the mercury sphygmomanometer may be used to recheck raised blood pressure in the clinic, but there has been no published data to confirm its usefulness in this setting.

This study was performed to determine whether the automated monitor accurately detected hypertension in the pre-assessment clinic and thus appropriately excluded patients from day surgery.

* Corresponding author. Present address: 29 John Street, Ponsonby, Auckland, New Zealand

E-mail address: trevcoe@paradise.net.nz (T.R. Coe).

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2. Method

The study population consisted of 200 consecutive patients attending the nurse led pre-assessment clinic for day case surgery. Approval for the study was obtained from the Medical Ethics Committee. All patients were over 16 years old and were classified as ASA 1 or 2. The patients were assessed in the same room using a procedure for pre-operative assessment that is standard in our hospital. A questionnaire assessment taking, on average, 15 min was completed with the patient resting in an armchair. Blood pressure was then measured with the patient remaining seated. All patients had readings taken with the manual mercury sphygmomanometer and the automated Dinamap (model 8100) vital signs monitor (Critikon), with the order of use being determined randomly. The same arm and appropriate cuff size were used for both methods with the patient sitting comfortably and the arm relaxed on a supportive pillow.

Nurses who routinely carry out this task performed the pre-assessments. Blood pressure was taken manually following the guidelines of the British Hypertension Society using the phase 5 diastolic pressure [9]. Both measuring devices were calibrated before starting the study.

The mean differences between manual and Dinamap readings were analysed using the paired t-test. Regression analysis was also performed to assess the correlation between the two forms of blood pressure recording and in order to see whether a predictive equation could be produced. The R^2 value gives an indication of the degree of fit of the line, with a value of one indicating a total fit, and a value of zero indicating no correlation. $P < 0.05$ was considered significant.

The sample size of 200 gave a power of 75% to detect a 5 mmHg difference in systolic pressure and a power of over 95% to detect the same difference in diastolic pressure with a type 1 error rate of 0.05.

3. Results

The characteristics of the patients studied are shown in Table 1.

Table 1
Patient characteristics—mean (S.D.) or percentage

Age (years)	46.3 (16.8)
Sex (M:F)	102:98
Weight (kg)	74.3 (13)
Height (cm)	170.1 (9.6)
Treated hypertensive (%)	11
Ischaemic heart disease (%)	5
Diabetes mellitus (%)	0.5
Smoker (%)	29.5

The mean difference between manual and Dinamap readings was -8.38 mmHg (95% confidence intervals -6.8–-9.96, $P \ll 0.001$) for systolic pressure and 1.68 mmHg (95% confidence intervals 0.42–2.94, $P < 0.01$) for diastolic pressure. When the data was divided into two groups according to the first method of blood pressure measurement (manual first or Dinamap first) it was found that there was no significant difference between the two groups ($P = 0.56$ for systolic pressure and $P = 0.71$ for diastolic pressure). Comparing patients with or without known hypertension, there was no significant differences between the manual and Dinamap mean differences in the two groups for systolic or diastolic pressure ($P = 0.71$).

The scatter diagrams for systolic and diastolic measurements are shown in Figs. 1 and 2. The regression lines and R^2 values are shown, where y is the predicted manual reading and x is the Dinamap reading.

Plots of the difference between the two measurements against the average measurement are shown in Figs. 3 and 4 for systolic and diastolic readings, respectively, according to the method of Bland and Altman [10]. The limits of agreement between the two methods (mean of the difference (manual minus Dinamap) ± 2 S.D.) were -31.1 to $+14.3$ mmHg for systolic, and -16.5 to $+19.8$ for diastolic blood pressure measurements (represented by the broken horizontal lines). The mean differences (-8.38 and 1.68 mmHg for systolic and diastolic measurements, respectively) are represented by continuous horizontal lines.

Table 2 shows the number of patients who had raised blood pressure (systolic pressure greater than 200 mmHg and/or diastolic pressure greater than 110 mmHg) who would have been excluded automatically from day surgery. Table 3 shows the number of patients who had a less extreme elevation of blood pressure (systolic pressure between 160 and 200 mmHg and/or diastolic pressure between 95 and 110 mmHg). None of these patients had known ischaemic heart disease that would have automatically excluded them from immediate day surgery.

4. Discussion

The measurement of blood pressure at the pre-assessment clinic is one of the factors that will determine suitability for day surgery. This study has shown that in our day surgery unit, the automated blood pressure recording is, on average, approximately 8 mmHg greater than the manual systolic reading and 2 mmHg less than the manual diastolic reading. Both results are statistically significant ($P \ll 0.001$ and $P < 0.01$, respectively).

The regression line on the scatter diagram for diastolic measurements shows a trend for the Dinamap to over-read at higher pressures, and under-read at

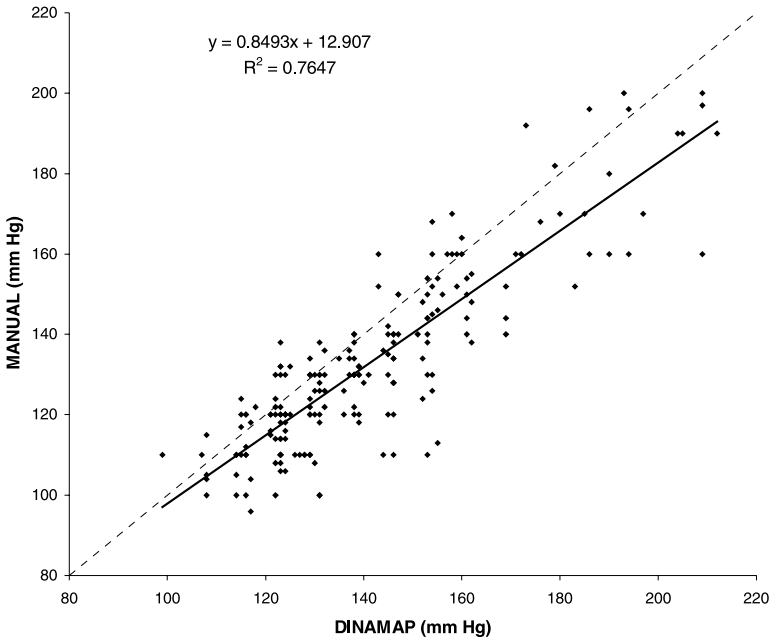

Fig. 1. Scatter diagram and regression line (bold) for systolic blood pressure readings, with line of identity (dotted).

lower pressures with a crossover point at 83 mmHg. Despite an average error of −2 mmHg over the whole range of pressures in this study (47–124 mmHg), at the significant clinical pressures (> 95 mmHg) the error is much larger and is likely to result in inappropriate cancellation if the blood pressure is not checked manually.

The regression line for systolic pressure measurement shows a similar trend with a crossover point at 86 mmHg. At significant clinical pressures (> 160 mmHg) the systolic error (averaging 8 mmHg over the whole range 99–212 mmHg) is likely to be proportionately greater than the diastolic error, resulting in a greater number of inappropriate cancellations if the systolic pressure is not checked manually.

The World Health Organisation criterion for normotension is a blood pressure less than 140/90 and for hypertension a blood pressure greater than 160/95 [11].

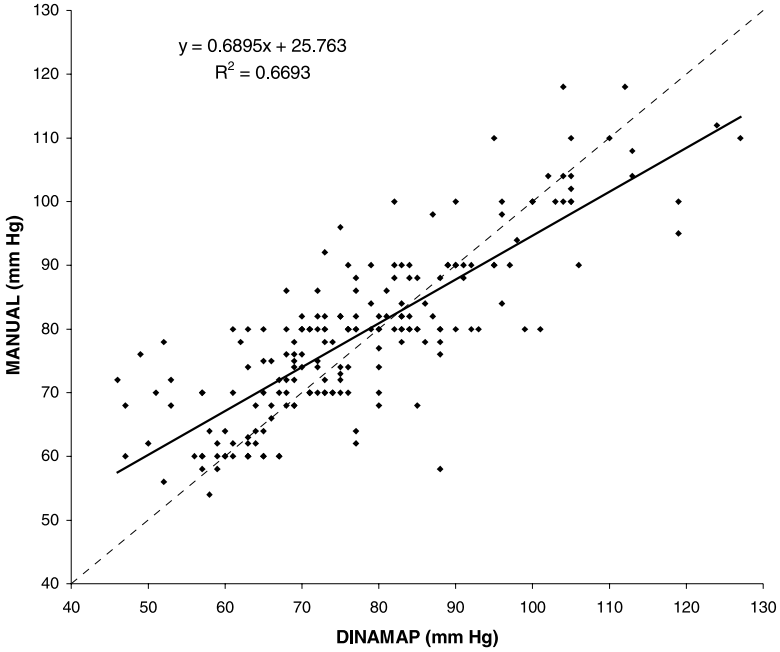

Fig. 2. Scatter diagram and regression line (bold) for diastolic blood pressure readings, with line of identity (dotted).

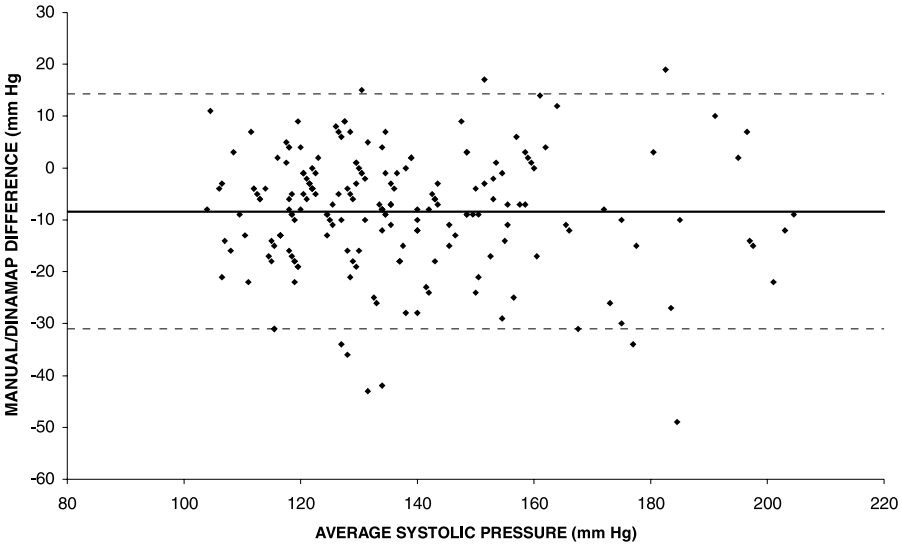

Fig. 3. Plot of the difference between manual and Dinamap systolic measurements against average systolic pressure, with mean of differences (bold line) and 95% limits of agreement (broken lines).

Table 2
Number of patients with raised blood pressure (BP greater than 200/110) at pre-assessment according to the detection method

	Method of detection		
	Dinamap alone	Manual alone	Both
Systolic hypertension	3 (1)	0	0
Diastolic hypertension	3 (2)	1 (1)	2 (1)
Systolic and diastolic hypertension	2 (2)	0	0

Number of these with known hypertension in brackets.

Recommendations are that treatment should start in middle age if either systolic is greater than 160 mmHg or diastolic is greater than 95 mmHg [12].

Anaesthesia in untreated hypertensive patients can result in well-recognised hazards [1,2]. Although controlled hypertension in otherwise fit patients does not make the patient unsuitable for day surgery, the level at which the blood pressure is perceived to be controlled is difficult to determine [13]. It has been suggested that elective surgery should be cancelled for patients with diastolic arterial pressures exceeding 110 mmHg [14]. Mild hypertension should be controlled but even this may not influence mortality [15].

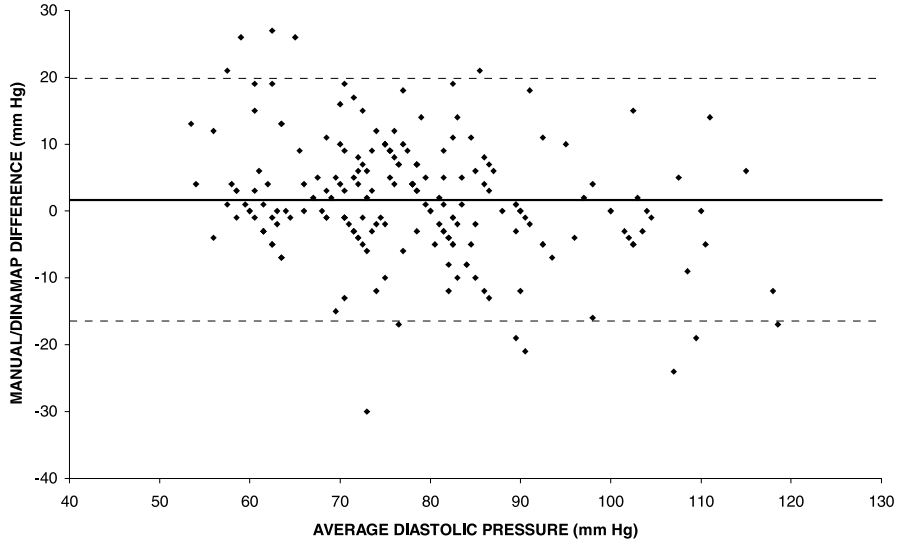

Fig. 4. Plot of the difference between manual and Dinamap diastolic measurements against average systolic pressure, with mean of differences (bold line) and 95% limits of agreement (broken lines).

Table 3
Number of patients with raised blood pressure (BP between 160/95 and 200/110) at pre-assessment according to the detection method

	Method of detection		
	Dinamap alone	Manual alone	Both
Systolic hypertension	10 (2)	0	4 (3)
Diastolic hypertension	2 (0)	4 (0)	7 (2)
Systolic and diastolic hypertension	4 (0)	0	4 (2)

Number of these with known hypertension in brackets.

In our unit patients with raised blood pressure (diastolic pressure greater than 95 mmHg and/or systolic pressure greater than 160 mmHg) after resting 15 min will not be immediately suitable for day surgery. Those patients with diastolic pressures greater than 110 mmHg and/or systolic pressures greater than 200 mmHg are referred back to their GP for stabilisation. The patients with intermediate raised blood pressure will only be booked for surgery if otherwise fit and they have their blood pressures checked regularly by their GPs and they know it is usually normal. The other patients will be refused immediate day surgery until the GP has rechecked blood pressure and is happy that it is normal.

In the study 46 patients (23%) were defined as having hypertension by one or both methods of measurement. Eleven patients would have been immediately refused day surgery because of blood pressures greater then 200/110. Of these, two patients had their hypertension detected by both methods. One patient was found to be hypertensive by manual measurement only and may have been inappropriately admitted for day surgery. The remaining eight patients were only detected using the Dinamap monitor and so would have been inappropriately excluded from day surgery, had their blood pressures not been checked manually. Within the group of patients found to have less severely raised blood pressure, there were 12 patients who would have been excluded because they had not had their blood pressure previously checked. Of these, five were detected to have hypertension by both measurement methods, two would have been missed if the Dinamap was used alone and five would have been inappropriately excluded if the blood pressure had not been checked by manual measurement.

Overall these results represent a potential 6.5% inappropriate exclusion rate and 1.5% inappropriate inclusion rate. Using both methods of measurement, we have a 5% rate of appropriate referral back to the GP from day surgery because of hypertension.

Bland and Altman [10] have shown that plots of difference in measurements against average provides the most meaningful information regarding the accuracy of the mean difference and standard deviation over the measured range. These graphs for systolic and diastolic pressures both show a trend in bias with a tendency for the mean difference to increase (i.e. the Dinamap reading becomes greater) with increasing magnitude of pressure. For systolic readings this is a very small trend with a weak relationship as there is large scatter of results. The diastolic plot shows a greater trend in difference with increasing magnitude. However the scatter is still wide with a weak correlation.

In the present study the correlation between the two methods was not very high (R^2 0.77 for systolic pressure and 0.67 for diastolic pressure). It would be expected that there would be high correlation between the two methods as they are both designed to measure the same variable. The wide limits of agreement between the two methods shown in Figs. 3 and 4 reveal a considerable degree of variability. There are obvious sources of variability within the study. Although the number of nursing staff participating in the study was limited, several day unit nursing staff were used for pre-assessment and, therefore, despite pre-study training in the protocol for blood pressure measurement, there could still be inter-individual observer error. This study reflects what is the standard practice of the day unit with all its consequences. There was greater potential for observer bias when performing the measurement owing to the fact that the nurse taking the second reading was not blinded to the first result. This would have had little potential for bias when the second reading was automated, but when the second reading was manual the result may have been influenced by the known Dinamap reading. A comparison of the two sets of data according to the order of the two measurements shows only a very small numerical difference (<1 mmHg for systolic and <0.5 mmHg for diastolic pressures) and no statistically significant difference between the two groups. The Hawksley random-zero sphygmomanometer has been used for many years to assess the accuracy of blood pressure monitors because of its apparent ability to blind the observer to the actual pressure reading until after it has been measured. More recent data has shown that this apparatus is consistently inaccurate when compared to the standard mercury sphygmomanometer [16]. It has been suggested that the random-zero sphygmomanometer should not be used any more in blood pressure trials and that the standard mercury sphygmomanometer should be the gold standard. The latter machine was used in this trial.

Inappropriate cuff size and different arm position would affect readings [17,18] but in the study the same, appropriate cuff size was used for both measurements and with the arm in the same position.

Unlike previous studies comparing automatic with manual readings, a heterogeneous group of patients of various ages and disease range including known hyper-

tensives was studied. As the automated method was compared with the manual method of measurement in each patient, these factors should not have biased the results. Indeed we were particularly interested in investigating measurement errors in such a varied population that attends for day surgery.

It is common practice for blood pressure to be rechecked using the same method of measurement if hypertension is detected. In our study only single readings with each method were used. In the study of Bassein et al. [7], three measurements using each method were used and they found that the first reading was always significantly higher than the subsequent two. Some people find the Dinamap more uncomfortable than the manual method and this could have biased the results. By randomly varying the measurement method used first, we hoped to remove any bias that may have been present due to this first measurement phenomenon. Mancia [19] studied the alarm reaction of doctors on blood pressure measurement. He showed that this 'hypertensive' reaction peaks at 4 min and has returned to normal by 10 min after first approach of the doctor. There is a similar but milder reaction to nurses. In our study, blood pressure was not taken until approximately 15 min into the consultation, which should have removed this alarm effect.

There are of course great fluctuations in blood pressure over a 24-h period [20] and even within a short period of time, so this could contribute to error, but again 15 min of resting should have reduced this to a minimum.

Although the criteria for definition of hypertension are fixed, the decision to treat will be based on a series of readings over time (days rather than minutes). In nurse run pre-assessment clinics, strict guidelines need to be laid down for acceptance for surgery. The study shows a significant rejection rate on the basis of hypertension by definition, though how many of these ultimately require treatment is unknown. It is important to identify patients with potential clinical hypertension even if they are not undergoing anaesthesia as it has been shown that reducing blood pressure is important both in middle aged and elderly people to reduce vascular events [12,21]. Treatment trends have tended to be to lower pressure to the 160/90 level. Recent work has suggested that reducing the diastolic pressure to at least 83 mmHg will produce further benefit [22].

In conclusion, we have found that although the automated Dinamap blood pressure reading will be clinically reliable at normotensive values, the error, particularly for systolic measurement, will increase at borderline hypertensive levels and higher. We would recommend that, in order to prevent patients being inappropriately refused day surgery, blood pressure should be rechecked using a manual sphygmomanometer if the Dinamap gives a hypertensive reading.

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Postoperative outcomes in ambulatory surgery Are they the same, worse or better?

Walther R. Minatti *, Juan Perriello, Mario Dicaprio, Leandro Pierini, Alejandro Mendiburo

Hospital Privado de Comunidad, Mar del Plata, Córdoba 4545, Buenos Aires CP 7600, Argentina

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Abstract

Background: Many authors have claimed that ambulatory surgery results in less wound infections although there is little good evidence for this. *Objective:* To obtain evidence of the influence of ambulatory surgery on the postoperative results in groin hernia surgery. *Method:* Patients undergoing elective hernia repair were included. Hematoma, wound infection and recurrence rates were analysed. Two hundred and twenty-three ambulatory and 71 inpatient procedures were studied. *Results:* The morbidity rate was 11% in ambulatory patients and 21% in inpatients and the recurrence rate 5.5 and 12.5%, respectively. *Conclusion:* Ambulatory surgery does not increase the postoperative morbidity or recurrence rates in groin hernia surgery.

Keywords: Wound infection; Ambulatory surgery; Ambulatory outcome

1. Introduction

Many have claimed that ambulatory surgery results in less wound infections compared with inpatient treatment although there is little good evidence for this.

It should be understood that once ambulatory surgery programmes pass the implementation stage it is almost impossible to be able to carry out research with a higher evidence level, as a control group of patients will not be available for comparison. Outcomes will also be affected by the type of Ambulatory Surgery Unit—an integrated hospital unit is not the same as a Freestanding unit.

2. Objective

To obtain evidence of the influence of ambulatory surgery on postoperative results in groin hernia surgery.

3. Method

In a 19-month period we carried out a retrospective study of groin hernia repairs undertaken in a hospital based ambulatory surgery unit. Only the postoperative recovery room and ward area were specific to ambulatory surgery patients.

Patients undergoing elective repair for either primary or recurrent inguinal or femoral hernias between August 1996 and March 1998 were included.

A modified Bassini technique was used either under spinal or epidural anaesthesia. No patient received preoperative antibiotics.

Analysis for postoperative hematomata and wound infection was undertaken on the 13th postoperative day. Patients were checked for recurrence from 1 month postoperatively onwards.

We excluded all patients that failed to attend postoperatively as well as those lost to long term follow up. In order to minimise the risk of analytical error patients were excluded if there were surgical procedure problems, per-operative complications, postoperative pain, etc. Inpatient treatment was undertaken when patients

* Corresponding author. Fax: +54-223-4990099
E-mail address: wminatti@hotmail.com (W.R. Minatti).

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requested this, when they lived alone or when they lived a long distance from the ambulatory surgery unit.

We define ambulatory surgery as surgery where the patient is admitted, operated on and discharged on the same working day.

The diagnosis of infection was clinical and it was made by recognising Celcius' signs or pus drainage from the wound.

Follow up for recurrence was made by direct medical examination or phone control.

The data was analysed in two non-comparative groups: outpatients and inpatients.

4. Results

Between 01-08-96 and 28-02-98 361 groin hernia repairs were performed. There were 238 (66%) ambulatory and 123 inpatient procedures (see Table 1).

Were excluded 23 cases that were lost to follow up: 15 of outpatient's group and eight of inpatient's group. Forty-four further inpatients were excluded as there were surgical procedure problems. Thus we analysed two groups: (A) 223 outpatients; and (B) 71 inpatients (see Table 2).

Postoperative morbidity was 11% (25/223) in outpatients and 21% (15/71) in inpatients (see Table 3).

There was no mortality.

Follow up was similar in both A and B groups with a overall recurrence rate of 7–5.5% in group A and 12.5% in group B (see Table 4).

5. Discussion

The demographic data is similar in both groups but they are not comparable because of the retrospective nature of the research. For this reason we did not look to see if the data was statistically significant.

Morbidity and recurrence rates are similar to international reports [1–3]. Results vary between the groups but appear best for the ambulatory surgery group. It is not easy to explain but hematomata and recurrences have a direct relationship with the quality of the surgical technique and not to the ambulatory modality itself.

Wound infections were the same in both groups, but there are reports that refer to a lower rate in ambulatory patients therein short stay and other settings [4,5].

The evidence supports a real benefit for patients from ambulatory surgery and supports its continuance.

Table 1
Procedures

	Ambulatory ($N = 238$)	Inpatient ($N = 123$)
Inguinal hernioplasty	192 (80.5%)	88 (71.5%)
Bilateral inguinal hernioplasty	24 (10%)	26 (21%)
Hernioplasty in recurrent hernia	14 (6%)	7 (6%)
Femoral hernioplasty	6 (2.5%)	–
Inguinal hernioplasty + hydrocelectomy	2 (1%)	2 (1.5%)

Table 2
Demographic data

	Outpatients ($N = 223$)	Inpatients ($N = 71$)
Average age	67 years (range 20–88)	63 years (range 23–87)
Gender	Male 85% Female 15%	Male 83.5% Female 16.5%
ASA	ASA I 39.5% ASA II 51% ASA III 9.5%	ASA I 38% ASA II 52% ASA III 10%

Table 3
Morbidity

	Outpatients ($N = 223$)	Inpatients ($N = 71$)
Hematomas	10% (22)	20% (14)
Wound infections	1.5% (3)	1.5% (1)
Morbidity	11% (25/223)	21% (15/71)
General morbidity	13.5% (40/294)	

Table 4
Follow up and recurrence

	Outpatients ($N = 223$)	Inpatients ($N = 71$)
Follow up	26 months (range 1–50)	27 months (range 1–48)
Recurrence	12 cases (5.5%)	9 cases (12.5%)
Overall recurrence	7% (21/294)	

6. Conclusion

The study suggests that ambulatory surgery does not increase the immediate postoperative morbidity or recurrence rates in groin hernia surgery.

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Survey on postoperative pain control in ambulatory surgery in Hong Kong Chinese☆

Yuk Pang Yeung *, F.L. Cheung, C.Y. Ng, Andrew Yip Wai Chun

Department of Surgery, Day Surgery Center, Kwong Wah Hospital, 25 Waterloo Road, Kowloon, Hong Kong

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Abstract

Purpose of the study: Pain is one of the most common reasons accounting for delayed discharge, unanticipated hospital admission and patient dissatisfaction in patients undergoing ambulatory surgical procedures. The pattern of postoperative wound pain and efficacy of analgesia was examined in a local Chinese population in Hong Kong to assess the adequacy of the current analgesic protocol. *Scope (Method & Result):* Between January 2000 and December 2001, patients who had undergone surgery in the ambulatory centre were recruited into this study. Telephone interviews were conducted about 24 h after surgery using a standardized questionnaire. Degree of wound pain, amount of analgesics required and level of pain control with analgesics provided would be recorded. The overall response rate was 99.8%. Significant pain was reported from 64 patients (8.2%). Amongst these 64 patients, 26.5% (17/64) had unsatisfactory pain relief with the current analgesic regimen. A high incidence of postoperative pain was observed in the patients undergoing inguinal herniorrhapy. *Conclusion:* This study identified the groups of patients with unacceptable postoperative pain, which indicates the need to refine the current surgical, anaesthetic and analgesic techniques. It was confirmed that postoperative telephone surveys are an important adjunct in planning improvement of ambulatory surgical services in the future.

Keywords: Ambulatory surgery; Analgesia

1. Introduction

In ambulatory surgical patients, wound pain is a common reason for delayed discharge, unanticipated hospital admission and patient dissatisfaction [1–3]. Adequate analgesia is important as hospital admission or readmission has undesirable effects of increasing the cost of ambulatory surgery. In a study on more than 10,000 patients who had underwent ambulatory surgery, the incidence of significant pain was only 1.7% in the ambulatory centre, but up to 5.3% at 24 h postoperatively [1]. Pain control accounted for 18–25% of unplanned hospital admission or readmission [4,5] and therefore ambulatory surgical patients require a perioperative analgesic technique that is effective, has minimal undesirable side effects and can be easily managed away from the surgical centre [3].

It has been shown that multi-modal analgesia provided superior analgesia with a lower side effect profile [2], and over the years this analgesic regimen has been practiced in our ambulatory surgery centre. In this study, we prospectively examined the pattern of wound pain and efficacy of pain control in our patients in the next day after their operations.

2. Method

This study was performed between January 2000 and December 2001. All patients over the age of 3 years were included in this study. Before incision, patients were given a dose of diclofenac as a suppository. Peripheral nerve blocks and wound infiltration with local anaesthetic were commonly used in addition to the general anaesthetic techniques. Acute pain control was carried

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* Corresponding author. Tel.: +852-278-15051; fax: +852-278-15264

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Table 1
Operations performed in day surgery centre, January 2000–December 2001

Operations	Number in children	Number in adult
Phimosis	430	–
Inguinal herniotomy	81	–
Breast surgery	–	165
Inguinal herniorrhapy	–	41
Lipoma excision	4	20
Unilateral orchidopexy	25	–
Excision of preauricular sinus	15	3
Excision of cutaneous lumps	22	3
Release of tongue tie	8	–
Endoscopic procedures	8	–
Scar revision	3	2
Miscellaneous	22	21
Total	618	255

out during the patient's stay in the ambulatory centre. Upon discharge, they were given diclofenac suppositories (0.5 mg/kg) for 2 days together with oral analgesics such as non-opioid agents for 1 week. In the case of children, paracetamol suppositories might be prescribed instead.

Telephone interviews were conducted about 24 h after the surgery. Nursing staff of the ambulatory surgery centre used a standardized questionnaire to enquire about the degree of wound pain, the amount of analgesia required and the level of pain control. Patients were asked to classify their postoperative pain as none, mild, moderate or severe. They were also asked whether they had returned to the hospital or other doctors. Pain was considered significant if it was described as moderate or severe. Further questions were also answered during the phone survey.

3. Results

The details of operations performed in our ambulatory surgery centre are listed in Table 1. Six-hundred and eighteen paediatric and 255 adult patients had an ambulatory surgical procedures performed. All had their procedures performed under general anaesthesia and all belonged to ASA (American Society of Anesthesiologists) class I or class II. Ten patients were admitted after the operation giving an admission rate of 1.1%. Two patients were admitted for pain control after inguinal herniorrhapy and the rest were hospitalized for reasons other than pain. Six patients were read-

Table 2
Pain survey of paediatric ambulatory surgical patients

Operations	All	No pain	Mild pain	Moderate pain	Severe pain
Phimosis	430	121	268	38	3
Inguinal herniotomy	81	20	56	5	–
Lipoma excision	4	3	–	1	–
Orchidopexy	25	7	15	3	0
Excision of preauricular sinus	15	2	10	3	–
Excision of cutaneous lumps	22	12	10	–	–
Release of tongue tie	8	7	1	–	–
Endoscopic procedures	8	8	–	–	–
Scar revision	3	0	1	2	–
Miscellaneous	17	8	9	–	–
Total	613	188 (30.6%)	370 (60.4%)	52 (8.5%)	3 (0.5%)

Table 3
Pain survey of adult ambulatory surgical patients

Operations	All	No pain	Mild pain	Moderate pain	Severe pain
Breast surgery	165	59	101	5	0
Inguinal herniorrhapy	41	3	26	12	0
Lipoma excision	20	15	5	0	0
Excision of preauricular sinus	3	2	1	0	0
Excision of cutaneous lumps	3	1	1	1	0
Scar revision	2	1	0	1	0
Miscellaneous	14	7	5	2	
Total	248	88 (35.5%)	139 (56.0%)	20 (8.1%)	1 (0.4%)

Table 4
Incidence of significant pain and success of pain control in the top five performed procedures

Procedures (number of patients)	Number with significant pain (%)	Number with satisfactory analgesia in case of significant pain (% success of pain relief)
Circumcision ($n = 430$)	41 (9.5%)	37 (90.2%)
Breast procedures ($n = 165$)	5 (0.6%)	0 (0%)
Inguinal herniotomy ($n = 81$)	5 (6.2%)	4 (80%)
Inguinal herniorrhapy ($n = 41$)	12 (29.3%)	6 (50%)
Orchidopexy ($n = 25$)	3 (12%)	2 (66.7%)

mitted within 48 h after discharge but none related to pain. There were only two patients who could not be contacted by phone on the first postoperative day giving a response rate of 99.8%. The results on postoperative pain severity in paediatric and adult patients are listed, respectively, in Table 2 and Table 3.

In the paediatric group of 613 patients, parents or patients were asked to complete the telephone survey. Altogether 9.0% ($n = 55$) complained of moderate to severe wound pain. Among these 55 patients, nine children (16.4%) did not have satisfactory pain control even after taking the analgesics provided, though their parents did not seek further medical advice for the unresolved pain. 4.7% of parents ($n = 29$) had further questions asked and 2.3% ($n = 14$) of them thought telephone survey useful.

In the adult group of 248 patients who had completed questionnaires, 8.5% of patients ($n = 21$) complained of moderate to severe wound pain and satisfactory relief by analgesics could be achieved in 62% (13/21). However, no further medical consultation was reported from those with significant pain. Two percent ($n = 5$) of adult patients had further questions for our staff and 1.2% ($n = 3$) regarded phone follow-up useful.

In the five most common performed procedures, the incidence of significant pain and efficacy of analgesia are listed in Table 4.

4. Discussion

With the introduction of ambulatory surgery, concepts for control of postoperative pain have progressed as a result of the observation that early control of pain can reduce its subsequent evolution. It has previously been demonstrated that pre-emptive analgesia was valuable in maintaining satisfactory pain control following ambulatory surgery [6]. Local anaesthetic supplementation may further decrease the severity of wound pain in the early postoperative period. However, patients might still experience significant pain after they have been discharged [3]. One of the aims of this study is to look into the issue of postoperative pain in patients who had undergone ambulatory surgical procedures.

There are many factors that can account for postoperative pain, such as surgical and anaesthetic techniques as well as patient's characteristics [2,5]. It has been shown that postoperative pain occurred more often in young male patients, those with a higher body mass index and prolonged operations [1]. Certain types of surgery were associated with a higher incidence of incisional pain [1]. In this study, significant wound pain was reported in 64 patients (8.2%). The most common procedures associated with significant wound pain were inguinal herniorrhapy (29.3%), orchidopexy (12%) and circumcision (9.5%). This finding is in good accordance with other studies [1,2]. Of those 64 patients, 17 (26.5%) had unsatisfactory pain relief with the current analgesic regimen but none of them chose to seek further medical attention. There was no hospital readmission for wound pain control.

Those undergoing circumcision or orchidopexy had a satisfactory pain relief of 66.7–90.2%, implying that the current analgesic protocol appeared adequate and satisfactory. In the case of inguinal herniorrhapy, a higher failure rate of 50% was observed. Because of the high incidence of postoperative pain and significant failure rate of analgesia, we further analysed this group of patients with respect to different risk factors that might predispose to postoperative pain. In comparing the two subgroups of herniorrhapy patients with or without significant pain, there was no significant difference between their gender, ages, and duration of operation, ASA classes, body mass indices, wound complication rate or method of anaesthesia/analgesia. However, the number of patients precludes further statistical analysis. Nonetheless, this high incidence of pain in herniorrhapy patients reflects the need to refine the current surgical techniques or analgesic protocol.

In breast ambulatory surgery, the incidence of pain was not common and was only 0.6% in our study. Those five patients who complained of significant pain did not have satisfactory pain control at all. This leads to our suspicion of minor wound complication such as bleeding, though we could not prove this for certain.

From our results, we believe that the likelihood of pain and unanticipated admission is related more to the type of anaesthesia and analgesia, and surgical procedure rather than the patient's clinical characteristics [5]. Further studies are required to improve pain control and patient satisfaction in those high-risk procedures or patients.

5. Conclusion

Significant wound pain was reported from 64 patients (8.2%) in this telephone follow-up study. 26.5% (17/64) had unsatisfactory pain relief by the current analgesic regimen. A high incidence of postoperative pain was observed in the patients undergoing inguinal herniorrhapy, which was indicative of the need to refine the current surgical, anaesthetic and analgesic techniques. This study also confirmed that a postoperative telephone survey is an important adjunct in planning improvement of ambulatory surgical services in the future.

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The results of 1 day surgery in proctological practice

P. Labaš *, B. Ohrádka, M. Čambal, J. Fillo

University Hospital Bratislava, Comenius University, Mickiewiczova 13, 813 69 Bratislava 1, Slovak Republic

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Abstract

In the last 9 years the authors have operated on 745 patients with proctological problems in the out-patient department under local regional or caudal peridural anaesthesia. These included 432 haemorrhoidectomies, 29 lateral internal sphincterotomies, 166 anal stretches, 56 trans-sphincteric fistulas, 41 ischiorectal abscesses and 21 rectal prolapses. Patients were discharged home after a mean stay of 5.3 h. About 6.4% (48) of operated patients had some problems in the first 24 h (bleeding, pain, discharge, retention of urine). All patients were checked after 3, 7 and 14 days. About 87% of patients were satisfied with their surgical treatment. Most proctological diseases could be operated on as 1 day surgery cases safely. Day surgery is an attractive alternative to impatient surgery as it lowers cost without increasing morbidity.

Keywords: One-day surgery; Proctology; Protological diseases

1. Introduction

The benefits of day surgery have been amply emphasised over the past few years. Early mobilisation, reduced nosocomial infection, prevention of thromboembolic disease, psychological benefits and reduced costs are the factors encouraging the surgeon to discharge the operated patient from hospital as soon as possible. Adopting such a programme can lead to significant savings without compromising the quality of care The physical and psychological benefits of such an approach outweighs any minor inconveniences for patients and their families (Kambouris, 1996 [7]).

2. Material and methods

In the last 9 years we have safely operated on 745 patients with proctological problems in the out-patient department under local regional (100 cc 0.5% Xylocain with adrenalin 1:200 000) or caudal peridural anaesthesia using 20 ml 0.5% Marcain or 30 ml 1% Xylocain). For postoperative analgesia we used a combination of long lasting analgesics and non-steroidal antiinflamatory drugs. The procedures included 432 haemorrhoidectomies (Morgan–Milligan procedure), 29 lateral internal sphincterotomies, 166 anal stretches with alcohol blockade, 56 trans-sphincteric fistulas (silk thread, elastic ligatures), 41 ischiorectal abscesses (drainage, silk thread), 21 rectal prolapses (Delorme-Rehm+Thiersch plastic with wire). Patients were observed for a mean of 5.3 h (0.5–8 h) postoperatively and then discharged home. The operating surgeon was on call for any postoperative problem that might occur (Table 1).

Table 1

Type of operation	Mean age	Number of operations
Haemorrhoidectomy	36.7	432
Anal fissure	32.3	195
Perianal transsphincteric fistula	38.5	56
Anal and rectal prolapse	67.4	21
Ischiorectal abscess	43.7	41
Together		745

* Corresponding author. Tel.: +421-2-529-21765; mobil: +421-905-618-925; fax: +421-2-529-23842

E-mail address: peterlabas@hotmail.com (P. Labaš).

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3. Results

About 6.4% (48) of operated patients had some problem in the first 24 h postoperatively (bleeding, pain, discharge, retention of urine). Of these five patients were admitted due to retention of urine or pain. The rest were discharged home after being seen.

All patients were checked after 3, 7 and 14 days. Up to the third postoperative day 11.4% of patients had a problem—all were analgesic related. About 87% of patients were satisfied with this type of treatment: 13% would have preferred hospitalisation (social and hygienic problems).

About 79.5% (592) of patients were operated on under caudal peridural anaesthesia (20 cm^3 0.5% Marcain) with optimum and satisfactory analgesia and the rest were operated on under local anaesthetic infiltration (Xylocain 0.5% and adrenaline 1:200 000. Postoperative pain was satisfactorily controlled with a combination of a long acting analgesic (Tramadol) and a non steroidal antiinflamatory drug (Diclofenac).

About 72% of patients with haemorrhoids were of III degree and they were discharged 3 h after the operation. Telephone contact was established with patients until the 6th day after surgery and they were reviewed on the 7th and 14th days after operation. About 42% reported mild post-operative pain but in 12% the pain was severe. Postoperative complications were haemorrhage, perianal abscess, retention of urine and transitory gas incontinence. Late complications included, four recurrences but no stenoses. In 89% of patients results were satisfactory, but 2% of patients were not satisfied with the operation. With the introduction of new analgesic drugs this procedure is now well established in an ambulatory setting with good results and low cost.

The decongestion of the hemorrhoidal cushion is the main principle in treating piles. Haemorrhoidectomy should be performed mainly in cases of haemorrhoidal prolapse. Results of the three most often used techniques (Morgan–Milligan, Parks and Ferguson) are more or less comparable, although the presentation of the details in the literature is contradictionary (Buchmann, 1989 [3]; Carditello, 1994 [5]). Each surgeon should use the technique that suits him best. We prefer the operation described by Morgan–Milligan.

4. Discussion and conclusions

One day surgery—defined by the fact that the patient enters the hospital in the morning and returns home late in the day requires the observance of a series of criteria which are absolutely necessary to achieve the highest quality and the greatest possible safety. Most important is good collaboration with the anesthetist. Material conditions, rooms and medical staff have to be appropriate. Indications for the performance of day surgery are many but depends on the experience of the surgeon. Limits are ruled by the general status of the patients, their social conditions and surroundings and excellent collaboration with general practioners. Economic advantages seem to be obvious but still have to be fully calculated. It is above all necessary to persuade the public hospital administration and the social security structures of the advantages of 1 day surgery (Hollender, 1991 [6]).

The principles for operations in the out-patient department are similar for proctology and general surgery. The trained and experienced surgeon is able to perform operations above the pectinate line, for example for polyps or proiapsing tumors without stretching the anal sphincters and without anaesthesia being necessary. Below the dentate line, local anesthesia is sufficient for operative treatment of the following diseases: perianal thrombosis, tumour of the skin and the connective tissue, skin tags, second degree hemorrhoids, segmental anal prolapses, anal fissures, uncomplicated anal fistulas and perineal abscesses. The postoperative treatment follows the rules of healing by second intention (Bock and Jongen, 1991 [2]).

Rubber band ligation could be performed on 44.8% of patients. Postoperative urinary complications (retention of urine) were seen in 20% of patients in hospital care. About 90% of haemorrhoids could be treated conservatively or with rubber band ligation (Bleday et al., 1992 [1]).

The conditions for 1 day surgery operations are the patient's compliance, the cooperation of the family, a fully equiped operating theatre and last, but not least, a qualified surgical team. The pre- and postoperative management must be perfectly organised. Even oncological surgery can be performed provided the general standards for radical tumour surgery can be realised. With careful selection and indication complications are rare in outpatient surgery. None of the patients died (Saeger and Klug 1995, [9]).

With the current expansion of day surgery many patients scheduled for elective surgery will receive their treatment on a day basis. Day case anesthesia exerts a profound effect on the success and feasibility of day case surgery. In patient anaesthetic techniques are not always the most suitable in this area where even minor morbidity is important.

Paediatric surgeons confirm the benefit of this type of organisation in terms of reduced nosocomial infections, reduced local and general postoperative complications, reduced psychological traumas and increased socioeconomic advantages (Burattini et al., 1994, [4]).

Even thyroid and parathyroid surgery is feasible and safe on outpatient basis and results in a 30% savings in hospital cost. After extensive operations patients continue to require admission for postanaesthetic complica-

tions, social reasons or the presence of serious comorbid disease (Mowschenson and Hodin, 1995 [8]).

There is another very important psychological factor from the surgeon's point of view. Even very experienced surgeons, knowing that patient is going to be discharged, are more careful during a 1 day surgery operation. The sense of responsibility for the patient treated at home is greater and this factor could explain the lower complication rate after this type of surgery.

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The effect of intra-articular neostigmine, tramadol, tenoxicam and bupivacaine on postoperative pain

Nurten Kayacan *, Neval Boztuğ, Gulbin Arici, Bilge Karsli, Meliha Erman

Department of Anaesthesiology and Reanimation, Faculty of Medicine, Akdeniz University, Antalya, Turkey

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Abstract

Objctive: The present study, investigates the analgesic effects and complications of intra-articular neostigmine, tramadol, tenoxicam and bupivacaine on postoperative pain in patients undergoing day case knee arthroscopy. *Subjects:* Group 1 received 0.5 mg neostigmine, Group 2 received 100 mg tramadol, Group 3 received 20 mg tenoxicam, Group 4 received 20 ml 0.5% bupivacaine (control) in 20 ml normal saline intra-articularly at the end of the surgery. All patients had the same anaesthetic technique. Patients were observed in the recovery room with respect to pain scores, haemodynamic changes and postoperative analgesia at 1, 2 and 4 h postoperatively. Analgesic therapy in the recovery room was managed with 25 mg bolus doses of meperidine when the patients had visual analosue scale (VAS) scores higher than three points. The patients were discharged from hospital with a prescription for diclofenac 75 mg to be used as required. They were asked to complete their pain measures at 24 h and record their analgesic consumption. *Results:* There were no significant differences among the study groups regarding pain scores, haemodynamic changes, the first analgesic requirement time and complications. All patients in our study had adequate postoperative analgesia without any severe complication. *Conclusion:* Intra-articular administration of neostigmine, tramadol, tenoxicam or bupivacaine is a simple and effective postoperative analgesic technique after outpatient arthroscopic knee procedures.

Keywords: Postoperative analgesia; Arthroscopy; Neostigmine; Bupivacaine

1. Introduction

Arthroscopic surgery of the knee is a common day case procedure. The recent growth in day surgery has presented new challenges in the field of postoperative pain management. Difficulties in adapting common methods of acute postoperative pain management in hospitalized patients to outpatients has resulted in inadequate treatment of pain following day surgery. The search continues for an ideal analgesic technique that is site specific, long-lasting, easily administered and has a high therapeutic safety index [1].

Satisfactory analgesia after arthroscopic knee surgery can be provided with intra-articular bupivacaine, but relief may last for only a few hours [2]. Non steroidal antiinflammatory drugs have been documented to be effective in the treatment of postoperative pain [3,4].

Spinal or epidural administration of the acetylcholine esterase-inhibitor neostigmine results in a dose-dependant analgesia. This central delivery of neostigmine is limited by dose-related side effects such as nausea, vomiting and pruritis caused by cephalad spread of neostigmine in the cerebrospinal fluid [5].

Tramadol not only interacts with opioid μ receptors, but also inhibits the withdrawal of noradrenaline and seretonin in the central nervous system [6].

This study was designed to compare the analgesic effects and complications of intra-articular neostigmine, tramadol, tenoxicam or bupivacaine on postoperative pain in day case knee arthroscopy.

* Corresponding author. Tel.: +90-242-227-4343/55328; fax: +90-242-227-8836

E-mail address: nurtenkayacan@yahoo.com (N. Kayacan).

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2. Material and method

After Faculty Ethics Committe approval and informed patient consent were obtained, 40 patients, classified as ASA I or II and scheduled for arthroscopic knee surgery were enrolled in this study. Exclusion criteria included age younger than 18 years or older than 60 years, use of analgesic within the last 24 h before the operation, relevant drug allergy, need for surgical debridement or synovectomy for postoperative intra-articular drainage.

No patients had premedication before the anaesthesia. Anaesthesia was induced with 0.1 mg fentanyl, 2 mg vecuronium, 5–7 mg/kg thiopental and 100 mg succinylcholine. For maintenance of the anaesthesia, 50% nitrous oxide in oxygen and 1–2% inspired sevoflurane were used. Additional opioid (0.1 mg fentanyl) was only given just before starting the operation.

Patients were prospectively studied and assigned in a randomized double-blinded manner to one of four treatment groups to evaluate postoperative analgesia.

Group 1 received 0.5 mg neostigmine, Group 2 received 100 mg tramadol, Group 3 received 20 mg tenoxicam, Group 4 received 20 ml 0.5% bupivacaine (control) intra-articularly. The study solutions were injected into the knee joint at the end of the surgery in 20 ml normal saline 10 min before tourniquet release.

The study patients were introduced to the visual analogue scale (VAS) before anaesthesia. For the VAS, the 100 mm scale included 0 as an indication of 'no pain at all' and 100 as an indication of 'the worst possible pain'. The test was performed at rest by a single interviewer, who was not aware of the study medication given.

Patients were observed in the recovery room with respect to haemodynamic changes and postoperative analgesia at 1, 2 and 4 h postoperatively. An observer blinded to the patient's group assignment obtained haemodynamic data (systolic and diastolic blood pressure, heart rate), VAS scores and also recorded the time at which the patient first requested pain medication. Analgesic therapy in the recovery room was managed with 25 mg bolus doses of meperidine when the patients had VAS scores above three points. The presence of nausea, vomiting, hypotension, bradycardia and sedation were also recorded for each patient in the recovery room. Patients satisfaction about the analgesic drugs was measured using a 0–4 grade scale, 0, bad; 1, mild; 2, good; 3, very good; 4, excellent.

Patients were discharged from the hospital with a prescription for diclofenac 75 mg to be used as required and they were asked to complete their pain measures at the 24 h and record their analgesic consumption. Each patient was interviewed by telephone at 24 h postoperatively.

2.1. Statistical analysis

Kruskal–Wallis test was used to compare haemodynamic changes, pain scores and the time to first analgesic requirement. A χ^2 analysis was used for comparison of categorized data such as hypotension and bradycardia. Results are shown as mean $\pm$S.E.M. A P-value of <0.05 was considered to be statistically significant.

3. Results

As shown in Table 1, there were no significant differences among the study groups regarding demegraphic data including age, gender and the duration of anaesthesia and surgery. The VAS scores at 1, 2, 4 and 24 h postoperatively for the four groups are shown in Fig. 1. There were no statistical differences among the groups regarding postoperative VAS scores at all times. The time to first analgesic requirement was the shortest in the tenoxicam group (6.77 ± 4.91, 7.40 ± 5.91, 4.30 ± 4.9, 7.0 ± 5.49, respectively). This difference was not statistically significant. The total analgesic consumption during the first 24 h period was similar among the groups (1.77 ± 1.48, 1.80 ± 0.63, 2.20 ± 2.0, 1.60 ± 0.69, respectively). No significant differences were found when we assessed haemodynamic changes 1, 2, 4 h postoperatively ($P > 0.05$) (Figs. 2–4).

When we assessed postoperative complications, the highest incidence of nausea was observed in the tramadol group. Hypotension was only noted in the tramadol group. We did not record any bradycardia. Sedation was observed in two patients in the neostigmine group, in one patient in the tenoxicam group and in one patient in the bupivacaine group.

When patient satisfaction about the analgesic methods used was compared, no significant differences were found among the groups ($P > 0.05$).

4. Discussion

Knee arthroscopy is one of the most common day case procedures and many studies focused on intra-articular local anaesthetics and opioids have been done to investigate the optimal postoperative analgesia for this procedure [1,2,7–9].

Optimal postoperative pain control for ambulatory surgery should provide complete analgesia of long duration with minimal side effects, facilitate recovery and preferably should have a local site of action [10].

We assessed the effectiveness of intra-articular solutions of neostigmine, tramadol and tenoxicam compared with bupivacaine and we also compared our results with the other investigations. In the present study, we

Table 1
Demographic data

	Neostigmine	Tramadol	Tenoxicam	Bupivacaine
Age (years)	43.50±12	39.50±14.93	41.9±11.11	43.00±12.44
Gender (M/F)	4/6	5/5	3/7	2/8
The duration of surgery	50.00±20.27	45.00±16.32	43.50±10.28	53.00±14.56
The duration of anaesthesia	64.60±19.44	70.00±15.45	54.50±7.97	66.00±16.29

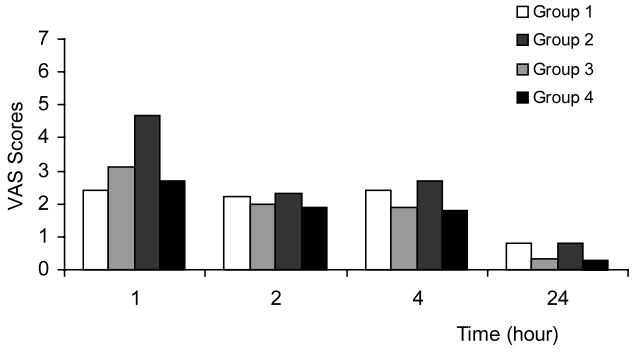

Fig. 1. The changes of VAS scores.

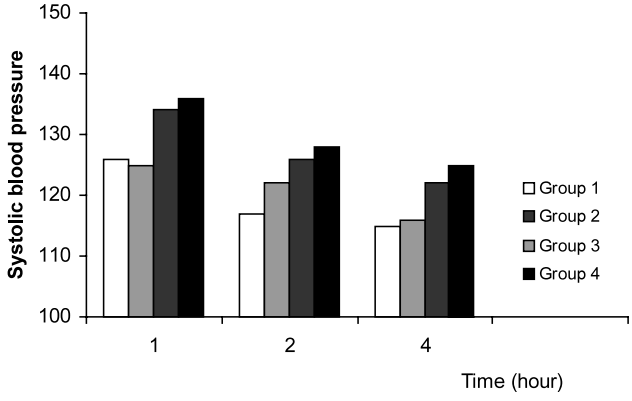

Fig. 2. The changes of systolic blood pressure.

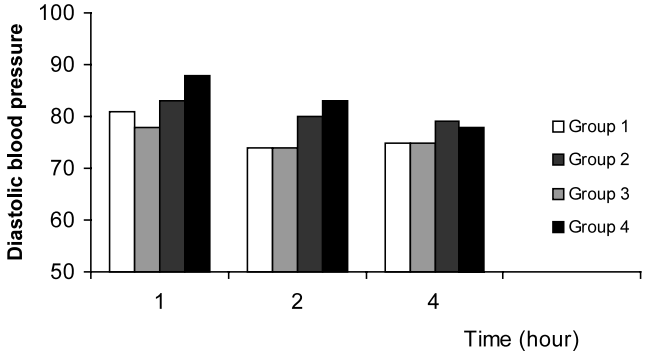

Fig. 3. The changes of diastolic blood pressure.

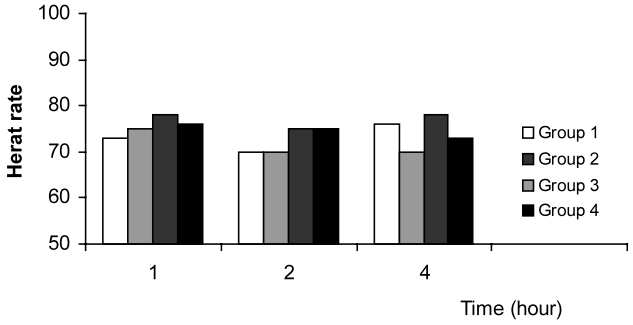

Fig. 4. The changes of heart rate.

achieved an effective analgesia in all treatment groups without any severe side effect.

Recently new interest has focused on cholinergic systems that modulate pain perception and transmission. The analgesic effects of neostigmine are more likely to be related to muscarinic than to nicotinic receptor stimulation [5,11].

Lin-Cheng et al. studied different doses of intra-articular neostigmine and morphine in patients undergoing knee arthroscopy and they showed that intra-articular injection of neostigmine produced a moderate but significant analgesic effect [5].

A study of intra-articular non-steroidal anti-inflammatory drugs revealed an analgesic effect equivalent to that of intra-articular local anaesthetic agents and morphine [12]. Elhakim et al. compared tenoxicam 20 mg both intra-articularly and intra-venously with saline [4]. They concluded that intra-articular tenoxicam 20 mg provided better analgesia and decreased the requirements of postoperative analgesic compared with intra-venous tenoxicam 20 mg. In the study which was performed by Colbert et al., intra-articular tenoxicam was found superior to the intra-venous route [3].

Cook et al. compared intra-articular tenoxicam 20 mg with 0.25% bupivacaine and saline. They concluded that there were no differences between pain scores in any of the three groups and less analgesic was used in the first 24 h in the tenoxicam group [12]. Although we reached the highest VAS scores and the most postoperative analgesic consumption in the tenoxicam group, this difference was not significant. We reached adequate analgesia in the tenoxicam group as well as the other groups.

Opiate receptors and endogenous opiates have been demonstrated in brain and spinal cord and also in peripheral nerves and the dorsal root ganglia [1]. Opioids administered intra-articularly produce conflicting data with respect to their analgesic efficacy. Some reports showed intra-articular opioids to be ineffective [13]; others reported a significant positive effect on postoperative analgesia [14].

Antinociceptive effects of opioids have been attributed primarily to an activation of receptors located in the central nervous system. However, animal studies revealed the existence of peripheral opioid binding sites, which appear to become especially active in the presence of inflammation [15]. These first observations were later confirmed in human clinical trials [16].

Haynes et al. observed that the addition of bupivacaine to morphine was of no benefit [9]. Pooni et al. compared intra-articular fentanyl with bupivacaine for postoperative pain relief after knee arthroscopy. The results showed that intra-articular bupivacaine produced superior analgesia in the immediate postoperative period [2]. We observed the lowest VAS scores in the bupivacaine group at all times except at 1 h.

We conclude that the intra-articular administration of neostigmine, tramadol, tenoxicam and bupivacaine after day case arthroscopic knee procedures is a simple, effective, safe and well-toleretad analgesic technique, offering superior postoperative pain control.

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Laparoscopic cholecystectomy as a 'session' surgery

T.S. Amarnath *, R.A. Coulthard, J.J.T. Tate

Department of General Surgery, Royal United Hospital, Bath BA1 3NG, UK

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Abstract

Aims: To introduce laparoscopic cholecystectomy to our Day Surgery Unit and assess the implications of a 6 h postoperative stay in unselected patients. *Methods*: A retrospective analysis of data was performed in which the case notes of a series of 170 consecutive patients undergoing day case laparoscopic cholecystectomy were studied. All patients with symptomatic gallstones were considered for day case laparoscopic cholecystectomy. Patients were excluded if there was major medical co-morbidity but not solely on the basis of age or Body Mass Index (BMI). Surgery was performed in a dedicated Day Surgery Unit and cholangiography was performed selectively. All patients were assessed at 6 h postoperatively for discharge and followed up by telephone at 24, 48 h and 2 weeks postoperatively. *Results*: Of 170 patients 121 (71.1%) were discharged at 6 h, 116 reported no problems and were satisfied with day case treatment. Two (1.6%) patients required a GP visit at home within 24 h and three (2.5%) patients required readmission. Forty-nine (28.9%) patients required admission, the commonest cause for admission being postoperative pain and nausea (10.6%) in approximately equal proportions. Three were admitted as they had open surgery. One patient required further surgical intervention (laparoscopy). *Conclusion*: Laparoscopic cholecystectomy as a 'session' surgery, with planned discharge 6 h after operation, is successful in the majority of unselected patients even though a significant number of overnight admissions are to be anticipated.

Keywords: Laparoscopic cholecystectomy; Session surgery; Day case surgery

1. Introduction

In recent years laparoscopic cholecystectomy has become the standard treatment for symptomatic gallstones, based on reduced abdominal discomfort, shorter hospital stay and earlier return to normal activity [1].

The Audit Commission Report of 1990 encouraged more widespread use of day case procedures [2] and improvements in anaesthesia have led to a reduction in postoperative discomfort and nausea, making this possible. There have been several studies in the last decade confirming the feasibility and cost-effectiveness of performing laparoscopic cholecystectomy as a day case procedure in selected patients [1,3–6].

Some authors have questioned the safety of performing this procedure on a day basis and strict selection criteria have been proposed [6–9].

A study was conducted in our centre showing that, even in unselected patients, discharge at 6 h after laparoscopic surgery was feasible and safe in the majority of patients [4]. We used this as a basis to introduce laparoscopic cholecystectomy with a 6 h postoperative stay to our day surgery unit. The purpose of this study was to review our experience over the last 3 years.

As 'day case' surgery has been varyingly interpreted as that requiring just one overnight stay or as discharge within 24 h of admission, we have labelled this as 'session surgery' to reflect the fact that patients were discharged within 6 h of the operation.

2. Methods

All patients with symptomatic gallstones were considered for day case laparoscopic cholecystectomy. Patients were excluded at the time of initial out-patient consultation or at the preoperative visit to the day surgery unit 2 weeks before the proposed operation if

* Corresponding author. Present address: Princess Margaret Hospital, Swindon SN1 4JU. Tel.: +44-1225-824542; fax: +44-1225-825484

E-mail address: amarjyothi@bigfoot.com (T.S. Amarnath).

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they had major medical co-morbidity or inadequate social support; but not solely on the basis of age, Body Mass Index (BMI) or any clinical features of gallstone disease. Procedures performed during an inpatient episode following emergency admission were excluded from this study. These included acute cholecystitis not settling on conservative management, laparoscopic cholecystectomy done during admission for acute pancreatitis. All cases undertaken in the 42 months, between February 1998 and August 2001, were reviewed.

Patients were invited to attend the Day Surgery Unit 2 weeks before the scheduled operation and were seen by the surgeon, anaesthetist and a nurse. This allowed confirmation of indication for surgery, exclusion of complications whilst on the waiting list, standard anaesthetic assessment and clarification about the social support available. The company of a responsible adult was requested not only on the day and night of the operation but also for the following 24 h. Patients were given clear information about what to expect and written consent was obtained at this stage.

Patients were admitted to the dedicated day surgery unit in the morning. Oral Ciprofloxacin (750 mg) and 3500 U of Tinzaparin [subcutaneous low molecular weight heparin] were given for wound infection and DVT prophylaxis, respectively. Surgery was performed on a morning operating list, in a dedicated day surgery theatre by one consultant surgeon or his team under direct supervision. Cholangiography was performed selectively based on a history of jaundice, deranged liver function tests on preoperative biochemistry or intra-operative findings. All patients had a vacuum drain to the gall bladder fossa. Local anaesthetic (0.5% bupivacaine) was infiltrated into the wounds.

All patients were reviewed between 4 and 6 h postoperatively by a member of the operating team. Patients' fitness for discharge was assessed at 6 h postoperatively primarily by nursing staff. Patients were then followed up by telephone calls at 24, 48 h and 2 weeks postoperatively by a member of the unit's nursing staff. A record was kept of patients who were transferred for inpatient stay and the notes of these patients were recalled retrospectively for this study.

3. Resu1ts

One hundred and seventy patients were included in the study (147 (86.4%) female, 23 (13.6%) male), the mean age was 45.95 years (range 21–77). Of these, 121 patients (71.1%) were discharged home at 6 h postoperatively. There was no significant age or sex difference between the discharged and admitted groups.

The reasons for admission were established retrospectively from the patients' notes (Table 1). Of 49 patients who had an overnight stay, 44 patients' notes were available for analysis. The most common causes for admission were pain and nausea in almost equal proportions, accounting for 36.7% of admissions (10.6% of all patients undergoing laparoscopic cholecystectomy) (Table 1). Four patients were admitted at the request of the surgeon on the basis of difficult dissection and all of these patients were discharged at 24 h. Three patients (6.1% of admissions) required conversion to open surgery (1.8% conversion rate).

Table 1
Outcome in 170 unselected 'day case' laparoscopic cholecystectomy patients

Outcome	Number of patients	Total (%)
Discharged home same day	121	71.1
Admitted on day of surgery	49	28.9
Abdominal pain	8	4.7
Nausea	10	5.9
Drowsiness	4	2.3
Elective by surgeon	4	2.3
Elective by anaesthetist	3	1.8
Open surgery	3	1.8
Drain output	5 (include 1 bile leak)	2.9
CBD exploration [laparoscopic]	1	0.5
Social reasons	2	1.1
Other (↑↓BP, chest pain etc.)	4	2.3
Notes unavailable	5	2.9

Three patients (1.8%) were admitted overnight electively by the anaesthetist on the basis of history of coexisting medical conditions (one cerebro vascular accident, one paroxysmal atrial fibrillation), including one patient who was monitored on the High Dependency Unit overnight for left ventricular failure. In all three the decision to admit overnight was made prior to operation.

One of the admitted patients required further surgery at 24 h with laparoscopy, peritoneal drainage and reinsertion of drain for bile leak from an accessory biliary radical in the gall bladder fossa. Following this, the leak settled conservatively and the patient made an uneventful recovery.

Three (2.5%) of the discharged patients required readmission following discharge. One of these presented within 24 h with nausea and vomiting and was found to have a paralytic ileus, which resolved within 3 days. A further patient was readmitted at 36 h with severe upper abdominal pain and suspected bile leak, but was found on ultrasound scanning to have an abdominal wall haematoma, which settled on conservative management and the patient was discharged within 48 h. The medical team readmitted one further patient with pleuritic chest pain, which settled conservatively, again within 48 h. No significant cause was found.

Following telephone follow up, all patients expressed satisfaction with their treatment on a day case basis,

except one patient who in retrospect would have preferred to have stayed for pain relief as an inpatient.

4. Discussion

There has been a change in approach over the last few decades with procedures previously requiring inpatient care, such as inguinal hernia repair, being performed routinely on a day case basis. The feasibility of performing laparoscopic cholecystectomy has been proven in several studies over the last decade with a good degree of success [3–6]. The Audit Commission report of 1990 encouraged the expansion of day case surgical services and more major procedures such as laparoscopic cholecystectomy would appear to lend themselves to this [2].

As provision of day case surgery expands, an increasing number of medically stable patients of ASA grade III are utilising day surgery facilities [4]. Caution has been advised by some authors, concerned by the possibility of failure to recognise major and potentially life-threatening complications in patients managed as outpatients and they advocate strict criteria for selection of patients suitable for day case laparoscopic cholecystectomy [7]. Our study was set out to show that patients can be listed for day laparoscopic cholecystectomy on the same basis as any other day case procedure and that the majority of patients would be suitable for discharge at 6 h postoperatively without any detriment to their care.

The difference should also be stressed between day case, as in our practice with 6 h stay, and some studies which have included patients who were admitted overnight, yet stayed less than 24 h in hospital. It has been observed that, whilst this does reflect the tendency towards earlier mobilisation and shorter hospital stay, it does not truly represent a day case or outpatient procedure [8]. If we chose this definition, 94% of our patients were discharged within 24 h.

The key difference in our practice is that unselected patients are offered day case treatment if they have no serious co-existing medical conditions when they attend the day surgery unit 2 weeks prior to their procedure and can arrange for a companion at home for the 2 days following the procedure. This preoperative visit not only allows screening for co-morbidity, but also introduces the patient to the unit, allowing the patient an explanation of day case treatment and a realistic expectation of outcome. Assessment is carried out by surgeon, anaesthetist and nurse, thus minimal review is required on the day of surgery. Similar preoperative visits have been advocated in other studies [3].

Anticipation of the commonest reasons for unsuitability for discharge postoperatively (pain, nausea, drowsiness) found in the feasibility study have been key to reducing the number of patients unsuitable for same day discharge from 68.8 to 28.9% [4]. The key to this is anaesthetic technique and premedication with analgesic and antiemetic agents and, therefore the anaesthetist has a key role in allowing day case treatment. Despite these advances, pain, nausea and drowsiness still accounted for 45% of overnight admissions. Improvements in anaesthetic methods with advances in anaesthetic drugs resulting in a lower incidence of the postoperative symptoms of nausea, vomiting and drowsiness as well as improvement in analgesic methods and drugs will undoubtedly reduce the admission rates. About 66% of all admitted patients could have been easily managed on a 23 h stay ward and this is our next planned development which would prevent unexpected admissions impinging upon elective beds.

Safety remains the paramount concern and seven (5.1% of total, 18.9% of admitted) patients were admitted 'electively' by either the surgeon or anaesthetist on the basis of operative or anaesthetic concerns even though patient appeared well and ready to go home. Of these patients who were thought to have benefited from a prolonged period of observation, none suffered any serious complication prolonging their inpatient stay. Two patients were kept in because expected social support at home was not available. This awareness will undoubtedly contribute to patients' safety and a resulting low readmission rate. Though some other studies [10] show much lower admission rates, (less than 10%), their patient satisfaction surveys indicate that 33% of those operated on day cases would have preferred to have had the procedure as an inpatient, which justifies our higher admission rates especially considering the fact that our patients were not selected on the basis of age or BMI for day case procedure.

Three patients were readmitted during this study, none of which required further surgical intervention or suffered serious complications or detriment from being discharged on the day of surgery. Indeed only one patient was readmitted in the first 24 h, the other two patients re-presented with problems not evident at 24 h, and therefore, an overnight postoperative admission would not have prevented their readmission. Only one out of 170 patients expressed dissatisfaction with day case treatment on follow up by telephone 2 weeks postoperatively.

We conclude that whilst safety is paramount, day case laparoscopic cholecystectomy is feasible and desirable in the majority of patients, even without strict selection criteria or on medical grounds. We believe good patient motivation and arrangements for social support especially from the patient's family is more important. A significant number of overnight admissions and even a number of later readmissions should be accepted. This said, our rates of admission compare favourably with

other studies in selected patients [3,5]. We have a surgical and anaesthetic team who are enthusiasts for laparoscopic surgery but we believe these results could be repeated anywhere. If extrapolated nationally, this technique could not only impact on patient waiting times for the treatment of cholelithiasis, but also result in significant cost savings. This, and not simply small scars, is the true potential of laparoscopic surgery for gallstone disease.

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Improving surgical service utilization
An application of program budgeting and marginal analysis

Shannon Spenceley, Lisa Halma *

Chinook Health Region, Lethbridge Regional Hospital, Room 4K-110, Auxiliary Wing, Lethbridge AB, Canada T1J 1W5

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Abstract

The economic framework, 'Program Budget Marginal Analysis' (PBMA) has been used by health care managers internationally to help set priorities and allocate resources within and across programs of care. The authors describe the use of the PBMA framework to guide a pilot project aimed at improving surgical services utilization in a regional hospital in a Western Canadian health region. The focus of the pilot project was the shifting of four selected inpatient procedures to an ambulatory approach while maintaining or improving standards of patient care.

Keywords: Outpatient surgery; Ambulatory surgery; Resource allocation; Surgical services utilization

1. Introduction

Accountability is a buzzword in all facets of the public sector. As competition intensifies for dwindling resources, the need increases for sound decision-making about resource allocation and priority setting. This is especially true in the health sector where staff is repeatedly being asked to 'do more with less'. Insufficient resources constitute a major issue facing surgeons in Alberta [1]. One method that has been used by health authorities internationally in order to free up more surgical resources is to shift procedures from an inpatient to an outpatient (day surgery)[1] setting [2,3]. In the United States the volume of outpatient surgeries performed increased by over 300% from 1979 to 1989, and it continues to rise [4–6]. Increases in the number of outpatient surgical procedures performed have also been reported for larger surgical centers in Canada [7] and the province of Alberta. The Alberta Ministry of Health reports that in 1993–94, 69.3% of all surgeries done in Alberta were day surgeries; in 1995–1996, this percentage had increased to 74.3% [8].

The focus of this paper is a pilot project undertaken in a 277 bed acute care hospital in the Chinook Health Region (CHR) in Southern Alberta. This project consisted of a thorough examination of the volume and nature of selected outpatient surgeries, in an attempt to streamline surgical bed utilization and better meet the growing need for surgical services in the region. In 1999–2000, approximately 11,000 surgical procedures were performed in this hospital, with just over 50% of all surgeries performed on an outpatient basis. One explanation that has been asserted for this lower local figure is the substantially higher percentage of seniors residing in the CHR when compared to other Alberta Health Authorities,[2] the thinking being that an ambulatory approach is less often appropriate with elderly surgical patients. Even when this was taken into account, however, it was discovered that opportunities

* Corresponding author. Tel.: +1-403-382-6631
E-mail address: lhalma@mail.chr.ab.ca (L. Halma).

[1] Note for the purposes of this document the terms day surgery and outpatient surgery will be synonymous and indicative of a surgical procedure where the patient is operated on and discharged home in less than 24 h.

[2] Based on data taken from Calgary and Capital Health Region Annual Reports (1999/2000) and the Chinook Health Region's Continuing Care 10-Year Plan (2000).

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existed for expanding the ambulatory option in providing surgical services.

The Director of Acute Care was interested in using a 'Program Budgeting and Marginal Analysis' (PBMA) framework to further examine the possibilities. The defining goals of the resulting project were:

– to increase the volume of outpatient surgeries while maintaining or improving standards of patient care, and
– to improve surgical service utilization in order to allow more surgical needs to be met.

This paper describes the process undertaken by the Surgical Program team in order to meet these goals.

2. The ambulatory surgery PBMA project

PBMA is a decision making framework that has been used by managers in the UK, Australia and New Zealand to help set priorities and allocate resources within and across programs of care [9].

The program budget consists of relevant costing and/or activity data about the program or topic under investigation. Simply put, the program budget addresses the question, 'how can we know where we are going if we do not know where we are?' by providing decision-makers with a picture of current resource spending and allocation patterns [9]. The marginal analysis component of this framework examines whether or not services provided should be changed [9]. The primary focus of marginal analysis is to maximize the marginal net health gain(s) through changes in the way resources are allocated and services are delivered.[3] In summary, PBMA involves assessing the costs and benefits of proposed changes in the delivery of health care, in order to increase overall benefit within existing budgetary constraints. The guiding PBMA framework and the subsequent processes undertaken by the Surgical Program team are detailed in Fig. 1.

One of the first steps in applying the framework involved the establishment of a core project team. This team consisted of:

- CHR Health Care Analyst (a masters prepared registered nurse),
- University of Calgary Health Care Economists (2),
- CHR Research Associate (a masters prepared researcher),
- CHR Case Costing Coordinator.

The health care analyst provided the clinical expertise needed to assess, review and synthesize the literature and additional information related to the provision of ambulatory surgical services. The economists, recognized experts in the use of the PBMA model, assisted the Surgical Program participants with application of the framework. The Case Costing Coordinator supplied surgical costing and activity data, and the research associate calculated the potential resource impacts of implementing the evidence-based recommendations, and kept participants 'on track' in terms of using processes consistent with the PBMA framework.

The core team made an initial presentation of the PBMA framework to the Directors of Acute Care and of the Medical/Surgical program, the Chief of Surgery, the Nursing Unit Managers for the Day Surgery Unit (DSU), Post Anaesthetic Recovery Room (PARR) and Surgical Suite, as well as several surgeons. At this meeting, the framework was introduced and a surgical services case study was presented [10]. A program budget based upon the average inpatient and outpatient costs of different surgical procedures was also reviewed, and the group discussed how the framework could be applied within the current setting to identify surgical procedures for shifting from an inpatient to outpatient setting. Discussion culminated in the approval to proceed with the PBMA Pilot Ambulatory Surgical Project. Further, consideration of a number of factors including PBMA principles, literature support [11–13,4] and physician preference resulted in the selection of four high volume procedures (laparoscopic cholecystectomy, inguinal hernia repair, reduction mammoplasty, and rotator cuff repair) for the pilot. It was also established at this initial meeting that representatives of this larger group would actively participate as an 'expert advisory panel', in order to guide the core team in its work.

In order to build a solid foundation for the project and any resulting recommendations, it was decided that four major processes would be embarked upon by core team members:

- extensive literature review,
- pursuit of practical expertise from individuals in organizations providing ambulatory surgical services,
- internal policy review,
- surgical patient chart audit.

Within each process, major components of ambulatory surgical service provision defined the parameters of the inquiry. These components included patient selection for an ambulatory approach; patient education and preparation; pain/nausea management; discharge criteria and patient follow up.

[3] It is important to remember that whenever resources are allocated to one option, some benefit will be lost because resources were not allocated to an other option(s); these lost benefits are called opportunity costs.

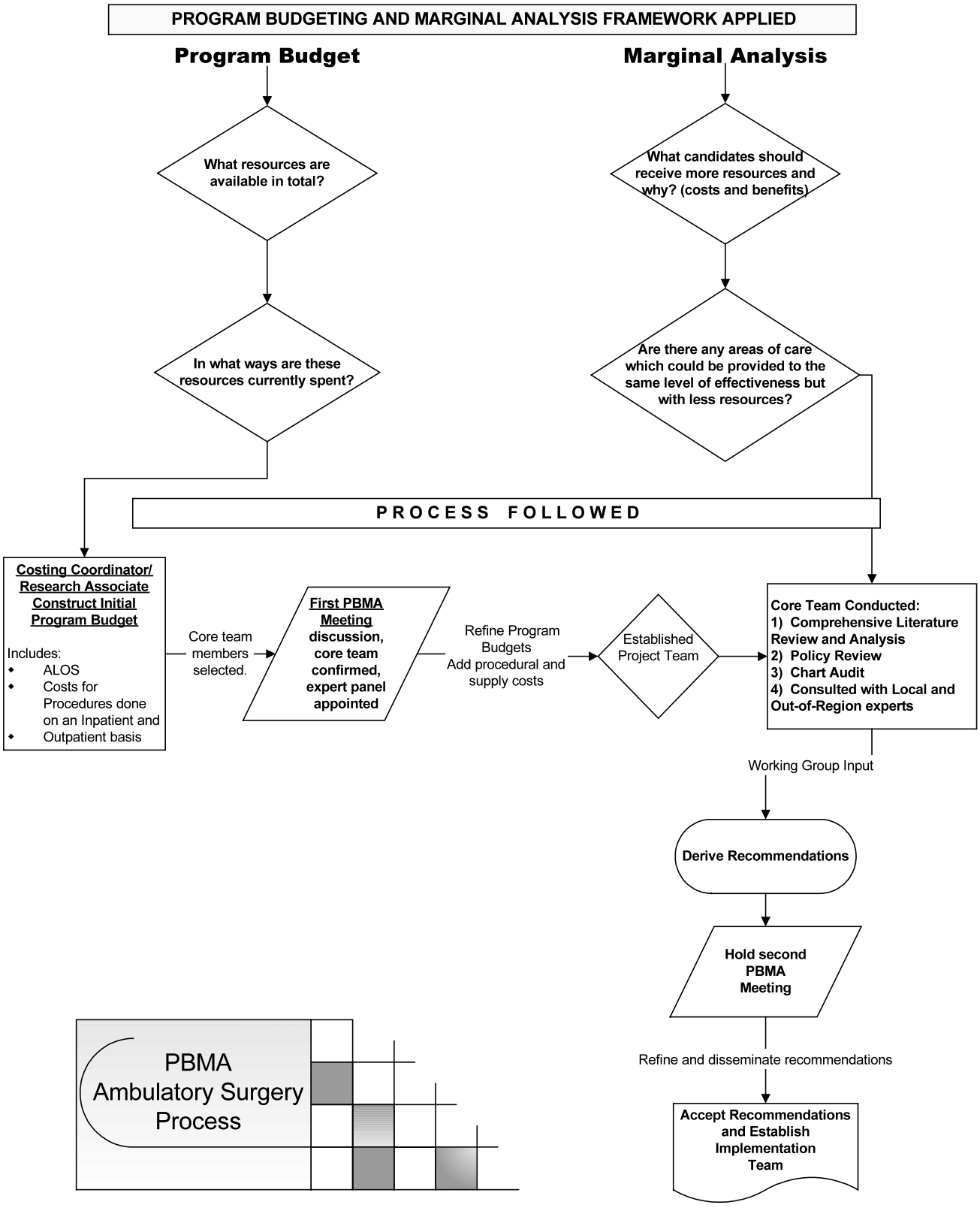

Fig. 1. The PBMA framework as applied to the ambulatory surgery project.

3. Literature review

The review was limited to articles published no earlier than 1995, with rare exceptions for older but seminal articles published in the area. The review focused on, but was not limited to, research articles in peer-reviewed medical, nursing or allied health journals. Databases searched included MEDLINE, HEALTHSTAR, the Cochrane Database and the Cumulative Index of Nursing and Allied Health Literature (CINAHL). Approximately, 200 articles were chosen for review by the health care analyst, and were rated by the analyst and research associate according to Sackett's [14] criteria for evaluating published evidence. Of the 200, 178 were found to be useful and were included in the analysis. In order to accommodate wider review of the analyzed evidence, an annotated bibliography of reviewed articles was developed, and then shared with the expert advisory panel.

4. Practical expertise

Expert panel members suggested other surgical facilities in Alberta for contact by the health care analyst. Specific questions regarding the components of ambulatory surgical service were asked of managers directly responsible for ambulatory surgery units in these facilities. Additional contacts were sought in other Canadian health care organizations based upon the recommendations of the managers interviewed. In total, seven separate surgical facilities were contacted, and valuable operational information was gained. In order to place the information in local context, interviews were also conducted by the health care analyst during the same period of time with local surgical nurse managers.

5. Policy review

Policies were reviewed by the analyst with an eye to their support of each phase of the ambulatory surgical process. Due to a number of organizational shifts in management structure in the previous 2 years, it was found that many policies were present only in draft form. Those that did exist in final form required updating. As such, the current project offered a timely opportunity for policy revision based upon the most current research evidence.

[4] The confidence interval was calculated using the Survey System confidence interval calculator available at http://www.surveysystem.com/sscalc.htm#factors.

6. Surgical patient chart audit

A review of randomly selected hospital charts for each of the four identified procedures (where the procedure of interest was the only procedure completed) was undertaken by the project analyst and research associate using an audit tool that focused the review on each phase of the surgical process. A 10% sample of all procedures of each identified type performed in fiscal year 2000–2001 at the regional hospital was calculated as providing a statistical confidence level of $\pm 14\%$.[4] This only improved to $\pm 10\%$ with a doubling of sample size to 20%. The 10% sample, therefore, was deemed adequate by the core team to satisfy the goal of the audit: an overview of current practice patterns.

7. Developing and communicating resulting recommendations

The review of literature and communication with external experts was extremely important in establishing a baseline of 'best practices'. The provision of the annotated literature analysis was extremely useful in establishing confidence in the resulting recommendations, and in enhancing the credibility of the process in the eyes of the medical practitioners on the expert panel. The evidence was well-received, but as one member stated 'there were no big surprises' forthcoming in the information. There was also an expressed perception that local patients were 'different' from those populations reported in the literature, and may be less appropriate choices as ambulatory surgery candidates. The review of current practice patterns from actual patient charts was extremely revealing and somewhat surprising to the group. It was discovered that there were a number of improvements that could be made in each phase of the surgical process. It also became apparent that many patients having one of the selected procedures as inpatients were, in fact, good candidates for an ambulatory approach to their surgery. Space does not permit a detailed listing of all the project recommendations. A brief description of the general recommendations for changes in surgical services offered at this regional hospital is as follows:

1) It appeared feasible to provide an ambulatory option to approximately 40–50% of laparoscopic cholecystectomy patients, 45–55% of inguinal hernia repair patients, 65–75% of patients having reduction mammoplasty and 45–55% of patients undergoing rotator cuff repair.
2) A need was identified for the DSU nursing staff and possibly an anesthetist to have some form of contact with DSU patients prior to the day of surgery.

3) A need was identified for standardized preoperative patient education material, developed specifically for DSU patients.
4) There appeared to be potential for improving the prevention and treatment of postoperative nausea and vomiting (PONV), utilizing risk stratification criteria. Issues suggested for closer examination included: the current heavy reliance on opioid analgesia, as well as the low incidence of intraoperative PONV prophylaxis.
5) There existed a potential to improve pain control, and it was recommended that the use of local anesthetic infiltration as well as the increased use of non-steroidal anti-inflammatory drugs (NSAIDS) be explored further.
6) There was potential to refine PARR discharge and home readiness criteria, utilizing evidence based tools.
7) There was a need identified to develop a postoperative follow up process for DSU patients.
8) Substantial policy gaps existed, and would require focused attention as changes were implemented.

Detailed review of a comprehensive project document outlining each phase of the ambulatory surgical service process and the attendant recommendations [15] comprised most of the second meeting with decision-makers from the Surgical Program. Subsequent meetings were then held with other stakeholder surgeon groups. The purpose of these meetings was to examine and discuss the recommendations put forth in the Ambulatory Surgery document in light of local experience and to decide how to proceed. After these initial meetings, a working group was established consisting of the Directors of Medical/Surgical Program and Transitional Care (responsible for the preoperative assessment clinic), Surgical Program nurse managers from all impacted areas, the Surgical Program nursing educator, representatives from Health Records, Booking and Information Systems, and two core team members (the research associate and health analyst). The mandate of this group was to implement the changes in practice that were now supported in principle by the Surgical Program team.

8. Discussion

At the time of writing, several changes have been implemented and evaluation is currently underway. Implemented changes for patients having one of the four selected procedures are outlined in Table 1.

Discussion of an evaluation plan began with the first meeting of the project implementation working group. It was decided that evaluation processes would examine:

1) Patient satisfaction. The modified Perceptions of Quality of Hospital Care [17] patient satisfaction instrument would be used to capture satisfaction levels pre- and post-transition to the new care processes. It was also intended that satisfaction levels would be compared for patients having specific procedures as inpatients or day cases.
2) Incidence of events such as unanticipated admissions for booked day surgery patients within the first 24 h, as well as visits to the emergency room (ER) would be monitored.
3) Postoperative symptom management. Focused analysis of information obtained on telephone follow up by an assigned DSU staff nurse within 24 h of surgery would take place. The focus of the initial analysis would be the management of pain, and PONV.
4) Surgical process analysis. It was decided that a focused chart audit on patient care management and flow through the system as related to overall outcomes would be useful.
5) Staff/physician satisfaction with transition. A focus group approach to this component of evaluation was supported.

Formal evaluation of the project has not been completed, so it is not yet possible to report results. The shifting of the four identified procedures will continue to be treated as a pilot project, and further expansion of ambulatory services based upon this work will not occur until thorough evaluation of the pilot has taken place.

It is not premature, however, to offer the following reflections on what the PBMA process brought to this endeavor. Two simultaneous and iterative processes were taking place throughout this project. An extensive review of published evidence and of local and external expertise was carried out, and provided the desired direction for forward movement. As progress was made towards the application of the collected evidence to the local context, the use of the PBMA framework helped the team to construct a realistic map of alternative routes to desired outcomes. The PBMA framework is built upon the assumptions that resources are constrained and that decisions about program funding always involve tradeoffs. Consideration of these tradeoffs or 'opportunity costs' allows decision-makers to take into account not only what may be gained, but perhaps more importantly, what will be lost by funding option A at the expense of option B. Within this health region, tools existed to facilitate the exploration of the costs associated with the proposed shifts to an ambulatory mode of service. A costing database that interfaced with our Regional information system (Meditech) made it possible to develop a program budget for classifying resource expenditure by surgical procedure, surgical setting and surgeon. These mechanisms enabled the

Table 1
Implemented changes to date

Phase					Comments/challenges
Preop	Physicians assess candidacy for day surgery on list of agreed-upon, evidence-based, consistent criteria	Patients receive standard education/package	Patients complete self-administered history form in physician office, sent in with booking form Concise, consistent physical examination form developed with physician input; to be sent in with booking	Patient contact established with PAC Patients assessed against PONV risk stratification criteria	Extensive education with physicians and their office staff required, and should be repeated as consistency tends to decrease if this is not done Extensive physician input and collaboration critical in development of physician documentation instruments
Intraop	Increased use of local anesthesia	Anesthetists report referral to and use of PONV risk criteria			Difficult to specifically monitor actual intraoperative changes in physician practice
Postop	Standardized minimum discharge criteria implemented	DSU documentation tools streamlined	Standardized discharge plan developed; individualized as necessary	Potential problem areas identified and noted on-line at discharge, for follow up by phone call next day	Online documentation is not yet a reality in our region, and was new to all staff involved
	Stage 1 (PARR) and 2 (home)				Extensive educator support was key to success, and RN's now very supportive of online documentation
Follow up	Phone call within 24 h, standardized assessment tool developed	Follow up call documented on-line using Meditech			On-line documentation should allow for timely reporting of collected evidence—problem areas can be addressed sooner

core team to obtain and provide decision-makers with detailed information on the number of cases, the average length of stay (ALOS), procedural costs and total case costs associated with the identified procedures. This data proved invaluable when it came to projecting the number of cases that could be potentially shifted to an ambulatory mode of service, and the resulting number of bed days that could be saved. It provided a starting point from which costs and benefits could be calculated or determined for individual recommendations. A strength of the PBMA framework is that it provides decision-makers with the opportunity to 'evaluate the benefits of a health service with the actual or estimated costs' [16]. For example, a recommendation went forward to refer all day surgery patients to the Pre-operative Assessment Clinic (PAC) as the published evidence indicated that patient education and the timely completion of preoperative diagnostics resulted in improved patient outcomes, reduction in ER visits and in surgical cancellations. As such recommendations surfaced and were 'percolated' through the PBMA process, decision-makers were provided with projections about the resource, staffing and space implications associated with such changes. Managers were then able to systematically weigh projected benefits against these projected costs.

Also integral to the PBMA process is a review of the historical provision of services. An understanding of existing structures and processes was developed through interviews with care providers and ancillary staff. This information was transformed into a process flow map that captured the entire surgical process from the perspective of the patient. Group review and discussion highlighted areas for improvement. For example, it was discovered that Booking and DSU processes were often delayed by the late submission of a completed patient history from the referring surgeon. In order to address this obstacle to efficient service, it was recommended that patients complete a portion of the history form independently, leaving a brief and concise standardized section for physician completion. The completed form would then be submitted by the surgeon with the surgical booking form. This two-part (but one page) form was constructed with extensive feedback from physicians, patient educators and internal health records experts, and is currently being piloted quite successfully.

PBMA processes support the generation and discussion of creative options to implement the desired program changes. The dynamics of the expert panel on this project necessitated starting with concrete examples, in order to stimulate discussion and encourage progress. Consequently, during the second PBMA meeting, panel members were presented with two potential options that would allow for wide scale implementation of the project recommendations viz. development of an ambulatory surgery clinical pathway, and/or the establishment of an ambulatory surgery preoperative clinic. For each option, expected benefits and costs were outlined in order to illustrate how the many individual recommendations might be actualized in our environment. These options served as useful starting points for discussion. Ultimately, the panel opted to combine elements from each of these options and implement the recommended changes incrementally.

It was the observation of core team members that the PBMA approach had a positive impact on the decision making processes of the Surgical Program team in this project. Use of PBMA principles required focused interaction, discussion and creativity as options were generated and costs were realistically compared. The framework was useful as the team focused upon increasing the volume of ambulatory surgery performed while maintaining or improving standards of patient care within existing budgetary constraints. PBMA provided an explicit framework for directors, nursing unit managers, clinicians and surgeons to consider specific practice and process changes which would allow the achievement of these goals with four selected procedures. It seems likely that the PBMA process will be of continued value as a decision making framework should further expansion be supported by the evaluation of this pilot project.

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Longterm functional recovery following day-case laparoscopic sterilisation: inhalational versus TIVA maintenance☆

B. Carvalho *, J.I. Benton, P.J. Vickery, J.R. Sneyd, P.R.F. Davies, J.A. Langton

Department of Anaesthesia, Derriford Hospital, Plymouth, Devon PL6 8DH, UK

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Abstract

In this study we have evaluated the influence of anaesthetic technique on functional recovery and symptom distress following gynaecological surgery. Previous studies in this area focus on in hospital recovery parameters and no anaesthetic technique comparison study has followed patients postoperatively, daily for a week. We studied 99 females undergoing laparoscopic sterilisation; they were randomly allocated to receive either total intravenous anaesthesia with propofol or isoflurane inhalational anaesthesia.

The results showed no significant differences between the two groups in respect to functional recovery, nausea, vomiting or pain over the 7 day study period.

In both groups, functional recovery was relatively slow; with some patients taking 7 days to achieve normal function and energy levels. We found that 90% of patients required help at home on Day 1.

Keywords: Propofol; Isoflurane; Recovery; Randomised controlled trial

1. Introduction

A number of previous studies have compared different induction and maintenance anaesthetic agents in the ambulatory setting; however, most studies have focused on the recovery parameters within the Day Surgery Unit [1–3] rather than functional recovery of the patients within their home. Studies comparing health economic comparisons [4–7] between intravenous and inhalational agents have primarily focused on cost to the Day Surgery Unit and not on basic functional recovery, requirement for home help, and days absent from work by either the patient or their partner. A few studies have followed patients for 24 h [8], 72 h [9,10] and intermittently up to 1 week after surgery [11] but there are no studies that have followed up patients daily for a week. We have measured a spectrum of parameters including recovery times, postoperative pain, nausea and vomiting (PONV) and progress through the day unit, as well as functional recovery and return to normal daily activities and work as well as patient reliance on medical or community help. We have tried to evaluate if any of these factors are influenced by the anaesthetic technique.

2. Methodology

Following Local Ethical Committee approval and informed consent we enrolled 99 female patients scheduled for day-case laparoscopic sterilisation into the study. Patients under 18 years of age and those with epilepsy, hiatus hernia or gastric reflux or who were otherwise unsuitable for day surgery were excluded. Preoperatively a research nurse conducted a structured interview with the patient to collect demographic data and known risk factors for PONV [12] including concurrent medication, date of the last menstrual period, history of migraine, motion sickness or previous PONV. Randomisation was by a computer generated

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* Corresponding author. Address: Department of Anaesthesiology, Stanford University Medical Center, Stanford, CA 94305-5640, USA. Tel.: +1-650-7231406; fax: +1-650-7258544

E-mail address: brendan_carvalho@hotmail.com (B. Carvalho).

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random number scheme and sealed envelopes. We used a semi-open study design in which the attending anaesthetist was aware of the allocated treatment but the patient, the research nurse and recovery staff were not.

No premedication was given. Following the application of standard monitoring, venous access was obtained and a 1 l infusion of Hartmann's solution was started. All patients were pre-oxygenated, and they received intravenous glycopyrrolate 0.2 mg and fentanyl 1.5 μg · kg^{-1}. Anaesthesia was induced with propofol 0.5 mg · kg^{-1} followed by 10 mg every 10 s until loss of consciousness when a laryngeal mask airway was inserted.

Patients in the inhalational anaesthesia group (Group Iso) received nitrous oxide 66% in oxygen with isoflurane, initially 1% (inspired fraction) and subsequently 0.8% (end tidal concentration). Subsequent adjustments were made as clinically indicated with a minimum 0.6% end tidal concentration of isoflurane maintained until the end of surgery. Supplementary doses of fentanyl 25 μg were administered by the anaesthetist as was clinically indicated. Patients in the TIVA group (Group Ti) received an infusion of propofol 6–12 mg kg^{-1} h^{-1} and breathed an air/oxygen mixture. Supplementary doses of fentanyl 25 μg were administered as clinically indicated. In both groups, gentle manual ventilation was continued until there was adequate spontaneous ventilation returned. A fresh gas flow of 9 l min^{-1} was used in the anaesthetic room and 3 l min^{-1} in the operating room. At the completion of surgery, administration of anaesthetic agents was discontinued and all patients breathed 100% oxygen at 9 l min^{-1}.

Rectal diclofenac 100 mg was administered before commencement of surgery. Both fallopian tubes were occluded using Filshie clips and Bupivacaine 0.5% 10 ml was instilled onto the fallopian tubes at the end of the sterilisation and an additional 10 ml was infiltrated into the laparoscopy incisions by the surgeon.

No prophylactic anti-emetic was given, and when the patients were in the recovery area, they were questioned about nausea at 10 and 60 min after eye opening. Any patients experiencing nausea or vomiting were offered intravenous ondansetron 4 mg. If nausea or vomiting persisted for 30 min following administration of ondansetron then intramuscular prochlorperazine 12.5 mg was administered.

All personal recording data and following patients (research nurse and recovery staff) were blinded to treatment groups of patients. Pain scores were recorded in the recovery area at 10 and 60 min after the end of anaesthesia. If necessary, incremental doses of intravenous morphine 2 mg at 5 min intervals or two tablets of co-codamol 30/500 (codeine 30 mg and paracetamol 500 mg in each tablet) were given according to standard hospital protocols. At discharge, all patients were given a standard pack containing co-codamol 30/500 mg × 16 tablets and diclofenac 50 mg × 6 tablets and a written instruction sheet to take home.

Drugs recorded included total doses of anaesthetic agents (fentanyl, propofol), morphine and anti-emetic requirements in recovery. Pain during recovery from anaesthesia and surgery was scored by the patient using an 11 point scale from 0 (none) to 10 (worst imaginable) and the presence of nausea and vomiting was recorded. Times to various recovery parameters were documented including times spent in each part of the recovery area (Stage 1, high intensity nursing care; Stage 2, low intensity nursing care; Stage 3, self care pre-discharge waiting area).

Out of hospital, a research nurse followed up patients with daily telephone calls for 7 days. A structured questionnaire (Appendix A) was used which recorded pain, nausea and vomiting and included specific questions to elicit the patient's social function, mobility within the home, accidents, dependency on their partner, use of primary health care services and ability/inability to resume normal activities or employment (if applicable).

Statistical analysis was performed on Microsoft Excel 5.0 and SPSS 7.5 run on a personal computer. Tests used included student T-test, Mann–Whitney U-tests and Kaplan Meier analysis where appropriate. A P value $<$ 0.05 was taken as the point of statistical significance. If a 10% difference in longterm 100% recovery then 46 patients per group would have sufficient power (80%; 2 tailed; $P < 0.05$) to detect a significant difference [11].

3. Results

A total of 99 patients were enrolled into the trial, 50 randomised to Group Iso and 49 randomised to Group Ti. Groups were well matched for age, weight, and other epidemiological factors (Table 1). In particular the predicted risk of PONV [12,13] was similar in both groups.

Two patients were withdrawn from the study for protocol violations and no further data was collected from these patients. Five patients were admitted to hospital from the Day Surgery Unit. In the Iso group one patient was admitted for drowsiness/nausea and one for pain control. In the Ti group two patients were admitted for surgical observation and one patient was admitted for pain control. Of the five patients admitted to hospital, four patients (two in each group) required an overnight stay only and follow-up data was thereafter collected as normal. The fifth patient (Group Ti) required a stay of more than one night for surgical reasons and was therefore excluded from further follow-up.

Table 1
Demographic data

	Inhalational group (Group Iso) ($n = 50$)	Intravenous group (Group Ti) ($n = 49$)
Age (years)	34.7 (4.8)	35.0 (4.7)
Weight (kg)	64.9 (10.8)	64.0 (9.1)
Smokers	25	30
Menstrual cycle phase[a]	13/13/8/13/3	8/9/9/16/7
History of migraine	9	6
Previous PONV	7	5
History of motion sickness	9	14
Palazzo score	0.42 (0.015)	0.39 (0.003)
In paid employment	31	30
Resident partners	38	39

Data are mean (SD), or number as appropriate.
[a] 0–7/8–14/15–21/ > 21/unknown—days since start of last menstruation.

Whilst in the Day Surgery Unit there was no significant difference between the groups in the duration of anaesthesia or any of the recovery or discharge times (Table 2) or in the incidence of pain during their stay in the Day Surgery Unit (Table 3). There were no significant differences in the incidence of postoperative nausea between the two groups. However, more patients in the Iso group vomited (Table 3) but this was not statistically significant.

Median pain scores over the week at home were not significantly different between the two groups on any single day or overall (Fig. 1). The incidence of nausea at home was highest on the first 2 days after surgery (Fig. 1) but in some patients this lasted for up to 6 days. Vomiting on Day 1 was more frequent in the Iso group, but this was not statistically significant ($P = 0.07$).

Table 2
Anaesthetic details and early recovery

	Inhalational group (Group Iso) ($n = 49$)	Intravenous group (Group Ti) ($n = 48$)
Fentanyl ($\mu g \cdot kg^{-1}$)	2.8 (0.79)	3.1 (0.76)
Propofol ($mg \cdot kg^{-1}$)	2.89 (0.61)	5.91 (1.79)
Duration of anaesthesia (min)	18.4 (5.7)	20.2 (5.1)
Time in 1st stage recovery area (min)	16.5 (3.6)	18.0 (4.2)
Time in 2nd stage recovery area (min)[a]	160 (48.3)	143.8 (39.0)
Admitted overnight (n)	2	3

Data are means (SD), or number as appropriate and include all patients who received a per-protocol anaesthetic.
[a] This data does not include the five patients who were admitted to hospital.

Table 3
Pain, nausea and vomiting on day of operation

	Inhalational group (Group Iso) ($n = 49$)	Intravenous group (Group Ti) ($n = 48$)
Pain score at 10 min[a]	1.5 (0–8)	2 (0–9)
Pain score at 60 min[a]	4 (0–9)	4 (0–9)
Patients given morphine in recovery	9	4
Patients with nausea in recovery at 10 min[a]	1	0
Patients with nausea in recovery at 60 min[a]	5	4
Patients vomiting in recovery	11	6
Anti-emetic given in recovery	6	3
Journey time (min)[b]	27 (5–120)	21 (5–60)
Pain during journey home (median)[b]	3 (0–9)	3 (0–9)
Patients with nausea on journey home[b]	16	18
Patients vomiting on journey home[b]	6	4

Data are number of patients or median (range) as appropriate and include all patients who received a per-protocol anaesthetic.
[a] One patient in Group Iso was drowsy and could not co-operate with questioning at the 10 and 60 min time points.
[b] Excludes five patients (two Group Iso, three Group Ti) who were admitted to hospital.

There were no significant differences in the number of patients who sought advice, the nature of the advice sought or from whom the advice came. In the Iso group, 10 patients sought advice from their General Practitioner, 1 from the Day Surgery Unit, 1 from the Hospital and 3 from the Practice Nurse. The reasons for requesting advice included 7 patients with wound problems, 4 with pain and analgesia problems, 3 requiring medical certificates and 1 with an unrelated medical problem. In the Group Ti, 12 patients sought advice from their General Practitioner, and 1 from the Practice Nurse. Ten consultations were for wound related problems, 1 patient required a medical certificate, 1 was given an anti-emetic and 1 patient had an unrelated medical problem. No patients in this group sought advice regarding pain or analgesia.

There were no significant differences in the amount of help required at home by either group on any day or in total over the week (Fig. 2). One patient in the Iso group paid for additional help during the week, but no patients requested assistance from the Community Services.

The percentage of patients whose energy and activity levels (Fig. 2) had returned to normal over the 7 days was not significantly different between the two groups. There was a similar pattern in the time taken to return to walking normally (Fig. 2).

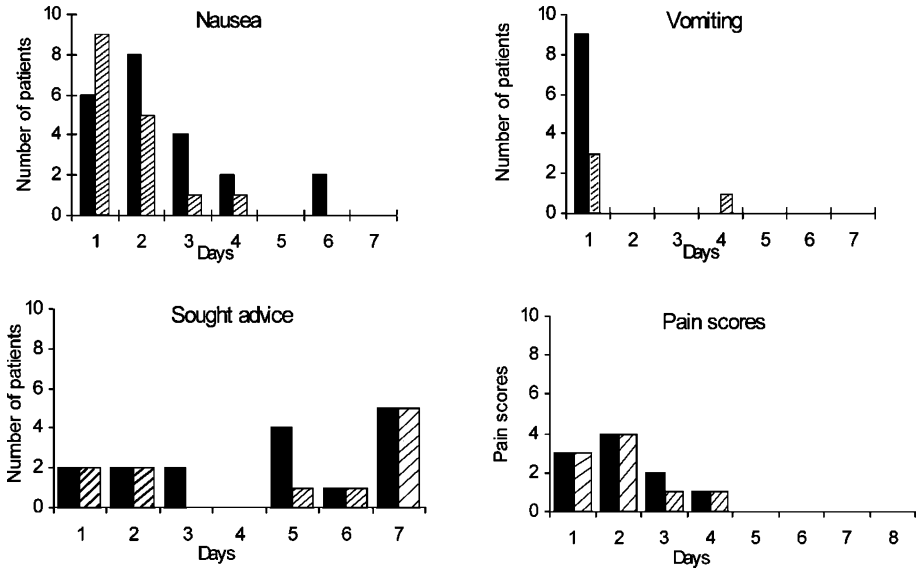

Fig. 1. Number of patients suffering nausea and vomiting, and those who sought advice in each group and median pain scores over the week post operatively. Solid columns represent the Group Iso and hatched columns represent the Group Ti.

Three patients in each group reported having accidents whilst at home. All the accidents were minor and involved spilling or dropping various domestic items. No patients received injuries from these accidents or required any treatment.

The total number of days taken off work by the patients who were in employment was statistically significantly different between the two treatment groups ($P = 0.04$). Of the employed patients, 89 of a possible 128 working days were taken off in the Iso group and 68 of a possible 119 days in the Ti group. There was no difference between the study groups in days taken off work by the partners.

4. Discussion

Few studies comparing intravenous and inhalational anaesthetic techniques in ambulatory surgery patients have extended their study period beyond discharge from hospital. Only one study by Swan et al. [11] followed patients for a week postoperatively, but unlike our daily questionnaire reporting occurred on Day 1, 4 and 7 and results were extrapolated. Our daily reporting provides a more detailed chronological account of functional recovery and symptom distress.

In this study we have tried to comprehensively evaluate the impact of the day-case laparoscopic ster-

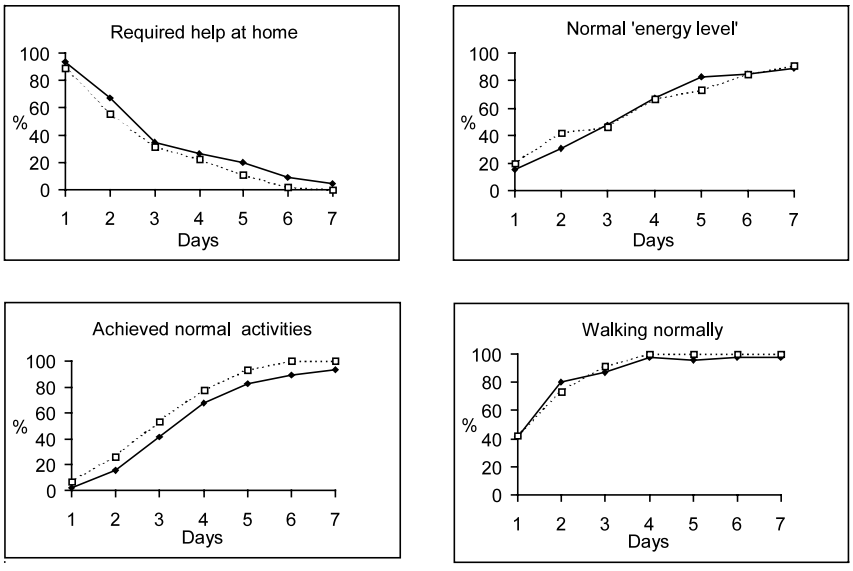

Fig. 2. Functional recovery of patients during the first 7 days. Graphs show percentages of patients reporting that they required help at home, had returned to their normal 'energy level', achieved their normal daily activities or were able to walk normally. (--□--) represent Group Ti, (—◆—) represent Group Iso.

ilisation on the patient and their carers in the community during the first postoperative week. In particular we focused on functional recovery and return to normal activities and the need for additional help at home. We selected this day case population as previous studies have suggested minimal pain and symptom distress in the postoperative period compared to other ambulatory surgery [14]. In our analysis, we chose to include those patients who were admitted to hospital and then discharged. This potentially contaminates the original experiment as the admitted group experienced different interventions during their overnight stay but adheres to the principle of an 'intention-to-treat' analysis.

Our 7 day structured telephone questionnaire was intended to explore functional recovery following minimally invasive ambulatory surgery and whether it was affected by the anaesthetic technique. We designed the study to evaluate the additional burden that postoperative dysfunction placed on their partners and the broader healthcare community. We were unable to demonstrate any differences in respect to functional recovery, return of 'energy level' and achievement of normal daily activities (Fig. 2) between the groups. We have clearly demonstrated a gradient of functional recovery and symptom distress following laparoscopic sterilisation (Figs. 1 and 2). The recovery patterns appear exponential, but patients on the whole, required the full 7 days to recover to baseline function. Our results differ from a previous study investigating the impact of balanced analgesia on laparoscopic sterilisation, which showed patients almost completely back to normal activities by Day 3–4 [15]. A questionnaire study by Philip [16] showed 38% of patients able to return to daily activities the day after surgery, the remainder required 3.2 ± 2 additional days. The difference may be due to system factors such as recommended recovery time as suggested by surgeons and the healthcare system. Pain management strategies and patient expectations will also influence recovery profiles.

Three patients in each group reported accidents whilst at home. All the accidents were minor and involved spilling or dropping various domestic items predominantly on the first postoperative day. These accidents may in part be due to residual cognitive impairment that has been shown to extend beyond 24 h post surgery [17].

Over 90% of patients required help on the first postoperative day, declining exponentially thereafter. There was no significant difference in the amount of help required at home by either group on any day or in total over the week (Fig. 2). One patient in the Iso group paid for additional help during the week, but no patients requested assistance from the Community Services. Partners, family and friends provided most of the help, which reduced the impact on healthcare and community facilities. Partners were the main providers and there was a correlation with days taken off work by the partners and help provided. Patients appeared to rely heavily on some form of help being available, however previous work has shown that nearly 30% of patients are alone at home following an operation in the ambulatory setting [18].

Measurement of time off work is fraught with difficulties. Firstly only 60% of our patients were employed and we have no data on the employed patients: whether self employed, expectations, nature of the job or if an anticipated period of leave was arranged. Many factors including age, education and income level, occupation, depression and patient's expectations have been shown to have a significant impact on the number of days taken off work [19]. In addition the timing of the operation in the week will affect time taken off work. We attempted to address these methodological problems by quantifying the number of days that could have been worked (i.e. days a patient would have worked if it was not for the surgery) and determining the proportion of these that were missed. Accepting the limitations of our analysis, the total number of days taken off work by the patients who were in employment was statistically significantly different between the two treatment groups ($P = 0.04$).

While not the primary objective of the study, we observed that the initial recovery and time spent in the day case unit were not significantly different. Similar periods were spent in the first stage recovery area and considering nurses were following standard discharge criteria, this suggests that the nursing staff blinded to the anaesthetic technique, did not perceive any differences in residual anaesthetic effects. The time spent in the 3rd stage of recovery was not included in the analysis as several patients spent no time waiting in the 3rd stage while others spent up to 2.5 h and we found that external factors including waiting for transport played a major role. The incidences of admission were also not significantly different between the two groups.

The incidence of PONV in this study was low and was similar between the two groups (Table 3). Both patient groups had similar predicted risks of PONV [12,13] (Table 1). These PONV findings should be taken with caution as the study is underpowered to detect potentially important differences with regard to nausea and vomiting and more patients in the Iso group received morphine rescue analgesia in recovery.

In summary, we have failed to show significant differences in functional recovery between propofol TIVA compared to propofol/isoflurane/nitrous oxide anaesthesia in day surgery gynaecological laparoscopic sterilisation. We have however observed that procedures described as '1-day' surgery are actually a '1-week' experience for the patient with slow functional recovery and resolution of symptom distress.

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Appendix A: Daily telephone questionnaire for patients

(1) How is your pain at the moment?

No pain *Worst pain I can imagine*
0 1 2 3 4 5 6 7 8 9 10

(2) How has your pain been in general since I last telephoned?

No pain *Worst pain I can imagine*
0 1 2 3 4 5 6 7 8 9 10

(3) Have you taken any painkillers? (*Yes*/*No*)

If yes, what have you taken? *Co-codamol 30/500 no. of tabs*
Diclofenac 50 no. of tabs
Others—specify

(4) Have you felt sick today? (*Yes*/*No*)
If yes, how bad has it been?

No nausea *Worst nausea I can imagine*
0 1 2 3 4 5 6 7 8 9 10

(5) Have you been sick today? (*Yes*/*No*)

If so, how many times were you sick? *Number of times*

(6) Have you needed to call your GP or anyone else for advice? (*Yes*/*No*)

If yes, who have you called? General Practitioner
Day Surgery Unit
Accident and Emergency Department
Other

Why did you seek advice? *Pain*
Sickness
Other—specify

(7) How much of what you *normally* do in and around the house have you managed? (e.g. cooking, cleaning, shopping, gardening, going out)

All or almost all/*Some*/*Little or nothing*

(8) Have you been walking about as normal today? (*Yes*/*No*)

(9) Compared with how you usually are, how much energy have you had today?

Much less	*0*
A little less	*1*
About normal	*2*
A little more than normal	*3*
Much more than normal	*4*

(10) Have you had any accidents today? (*Yes*/*No*)
(e.g. falling over, spilling something)
If yes, please specify what happened
Do you think that your recent DSU operation had any bearing on this accident? (*Yes*/*No*/*Don't know*)
If appropriate
Was today a working day for you? (*Yes*/*No*)
If yes, did you go to work? (*Yes*/*No*)
If appropriate
Was today a working day for your partner? (*Yes*/*No*)
If yes, did he/she take the day off because of your operation? (*Yes*/*No*)

(11) Is any one else helping you do the things you normally do? (*Yes*/*No*)
If yes, who is it? (*Partner*/*Other*)
Have you had to pay any money for extra help? (*Yes*/*No*)
(e.g. travel or childcare costs)

(12) Have you needed to get help from any Community Services that you would not normally use? (*Yes*/*No*)
If yes, please specify which ones. . .. .

(13) Have there been any other problems or things you would like to tell me? (*Yes*/*No*)
If yes, give details. . .. .

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