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Obituary

Dr. Domingos Marques

Dr. Domingos Marques, Anesthetic-in-Chief and Head of Anaesthetics Department, Hospital Geral de Santo António, Porto, Portugal, died on the 3rd of March 2005. He was a pioneer of ambulatory anaesthesia in Portugal, developing one of the first day surgery units of the country. He was a founder associate of the Portuguese Association of Ambulatory Surgery (APCA), where he served as Vice-President till the day he died. He was Editor-in-Chief of the Portuguese day surgery journal called *Revista Portuguesa de Cirurgia Ambulatória*, official clinical journal of the APCA. He was also one of the APCA delegates at the International Association for Ambulatory Surgery (IAAS) since 1998.

During his lifetime he made national and international contributions in many field of the anaesthesiology becoming a very respected Portuguese anaesthesiologist among his peers.

Man of outstanding capacity from the professional or personal point of view, as a leadership, as a fellow-soldier fighting causes (as day surgery, emergency, teaching residents, . . .), as a friend. All IAAS members that have met him at the meetings will remember his kindness and dedication. Friends and colleagues will miss forever his friendship.

The Portuguese Anaesthesiology and the Portuguese and International Ambulatory Surgery Communities are in deep mourning, and a feeling of meaningless took our souls. We hope, at least, that the work left by Dr. Domingos Marques be followed by his peers.

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Ambulatory treatment of haemorrhoids with the infrared coagulator

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Abstract

The objective of the study was to demonstrate the effectiveness of infrared photocoagulation (IRC) for the outpatient treatment of internal haemorrhoids.

One hundred and seven consecutive patients were prospectively studied during a 2-year period in a general surgery ambulatory practice using a Redfield infrared coagulation system without anaesthesia or sedation.

There was improvement in 73% of patients. Fifty-nine percent of patients became asymptomatic and 14% of patients had partial improvement with reduction in bleeding and prolapse. No response was seen in 15%.

Infrared coagulation should be considered as a simple trouble-free option in the outpatient management of haemorrhoids.

Keywords: Haemorrhoids; Infrared coagulation; Outpatient treatment

1. Introduction

Prolapse and bleeding from haemorrhoids is a very common condition in the population over 50 years [1]. The overall incidence of haemorrhoids is similar in many geographic regions of the world. It has been reported as 4.4% in some Western nations and a similar incidence has been reported from the African and Indian continents [2]. The prevalence of haemorrhoids is thought to be more common than the reported incidence. In a review of 835 patients 86% were found to have haemorrhoids on proctoscopy [1].

Since the development of infrared coagulation in 1978 [3] several reports have compared the results of the treatment of first and second-degree haemorrhoids with infrared coagulation to other modalities not requiring surgical excision. These studies have shown that infrared coagulation has acceptable efficacy as a tool for outpatient management of first and second-degree haemorrhoids [4,5].

2. Materials and methods

A sequential cohort of patients seen between 1999 and 2001 was studied to examine the outcome and effectiveness of infrared coagulation as a suitable outpatient modality in the management of all stages of haemorrhoids. All patients who presented to a general surgery ambulatory suite were evaluated by a single surgeon and offered infrared coagulation as the first treatment modality for all grades of haemorrhoids.

The data collected included the patient demographics, the extent of haemorrhoid disease, the details of infrared treatment, outcome (complete response, partial response or no response), need for re-treatment, complications and follow-up information.

Because of the vague nature of a response of improvement in symptoms, patients were asked to state whether there was improvement in bleeding or prolapse or both symptoms.

All patients were evaluated with inspection, digital examination, anoscopy with and without straining, and sigmoidoscopy. Patients with a suspected colonic lesion were subjected to barium enema or colonoscopy if indicated. Other causes of rectal bleeding were excluded from the study.

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The classification of haemorrhoids used was as follows:

- First-degree haemorrhoids are non-prolapsing and remain within the anal canal.
- Second-degree haemorrhoids prolapse during straining, and spontaneously reduce.
- Third-degree haemorrhoids prolapse requiring manual reduction.
- Fourth-degree haemorrhoids are prolapsed and irreducible.

2.1. Equipment

The equipment used was an infrared coagulator (Redfield Corp., Montvale, NJ).

The coagulation of tissue was performed by means of infrared radiation while applying mild mechanical pressure to the tissue. The infrared coagulator consists of a transformer an infrared radiator and a slightly curved light guide with a contact tip made of Teflon that does not adhere to tissues. A low voltage tungsten halogen lamp (15 V) produces the infrared beam that is focused into the light guide.

The amount of infrared energy transmitted to the tissues is determined precisely by a timer that is set at 1.5 s, limiting the depth of tissue coagulated to 3 mm.

This allows uniformity in the extent and depth of coagulation of the haemorrhoid and removes the element of error [3].

2.2. Technique

The patients were placed in the left lateral position and the haemorrhoid examined using a slotted anoscope. All haemorrhoids were treated during the same visit by three pulses applied via the light guide at the neck of the haemorrhoid. No analgesics or sedation was used and patients were able to depart the ambulatory suite after treatment. Patients were asked to grade their acceptance of the treatment at the initial visit by indicating the level of discomfort during the procedure using a visual analogue pain score.

Medications including stool softeners or analgesics were only administered if requested.

Patients were reviewed 21 days, after treatment and again at 42 days and 6 months.

3. Results

One hundred and seven patients with a diagnosis of haemorrhoids were treated with infrared coagulation. Eight patients (7.5%) had first-degree 52 patients (48.5%) had second-degree haemorrhoids, 43 (40%) had third-degree hemorrhoids, and four (3.7%) had fourth-degree haemorrhoids. There were 47 males and 60 females seen who had examination of a total of 370 haemorrhoids with follow-up over a period of 6 months. The mean age of patients was 41.2 years with an age range of 18–89 years. Of the patients seen 25 did not return for further evaluation. Eighty-two patients had long-term follow-up examination. There was improvement in 73% of patients. Of these 59% of patients became asymptomatic and 14% of patients had partial improvement with reduction in bleeding and prolapse. No response was seen in 15%, four of these patients with third-degree haemorrhoids failed to respond and required haemorrhoidectomy. Seventeen patients required two treatment sessions and one patient required three sessions before improvement in symptoms was detected. Minor pain and bleeding occurred in approximately 6% of patients. Five patients complained of discomfort during the procedure and this was addressed by repositioning the anoscope and resuming coagulation at a more proximal level above the dentate line. All the complications following infrared coagulation were observed within the first 7 days: mild anal pain in 5/82 patients (6.0%) and mild bleeding in 7/82 (8.5%). Seventeen patients required two treatments and one patient required three sessions before improvement in symptoms was detected. No significant differences were found regarding the effectiveness of infrared coagulation for the treatment of first- or second- or third-degree haemorrhoids.

There were no long-term complications resulting from infrared coagulation in any patient.

4. Discussion

Internal haemorrhoids are normal vascular cushions that are important for continence [6]. During defecation the haemorrhoidal cushions are subjected to pressure and slide downwards weakening the fibromuscular bonds which keep them in place resulting in haemorrhage and prolapse [5]. Surgical treatment of haemorrhoids with haemorrhoidectomy has been declining in popularity since the advent of non-surgical measures. Several methods have evolved which attempt to restore the normal position of the haemorrhoids by fixation to the underlying fibromuscular layer.

The best known methods include rubber band ligation, infrared coagulation, sclerotherapy, laser photocoagulation and cryotherapy [5,7,8].

The effect of infrared treatment is immediate reduction in blood flow to the haemorrhoid followed by necrosis at the point of coagulation that is controlled by a timed exposure that limits the depth of penetration of infrared energy to 3 mm.

Despite several trials comparing effectiveness of these modalities no single treatment has emerged as superior to the other [5].

In a recent review infrared coagulation and rubber band ligation were shown to have equal efficacy for the management of all grades of haemorrhoids, despite a higher relapse rate in patients with third-degree haemorrhoids [4]. Both treatments have the advantage of being ambulatory resulting in convenient outpatient care. Additional costs are negligible with infrared coagulation as is the need for special training. Rubber band ligation requires training and replacement bands are necessary for each procedure. Infrared coagulation also

results in less trauma, but may require re-treatment for relapse [9].

Rubber band ligation has been associated with a significant incidence of post treatment pain more marked than infrared coagulation, although fewer patients require re-treatment for relapses than infrared coagulation [2]. The small advantages in efficacy seen with rubber band ligation is negated by the increased incidence of complications particularly pain. The improved long-term efficacy seen following treatment with rubber band ligation may result from the increased depth of tissue destruction, which follows the placement of the rubber band at the upper end of the haemorrhoid.

Sloughing of the haemorrhoid follows placement of the rubber band, resulting in scarring and fixation of the mucosa to the underlying fibromuscular layer [7].

Rubber band ligation has also been associated with complications such as recto-vaginal fistula, pelvic inflammation, and bacteremia and in rare cases tetanus [10–12].

Reviews, which have compared sclerotherapy with infrared coagulation and rubber band ligation, have demonstrated the need for adequate training, an increased frequency of recurrent symptoms and an increased need for repeat therapy with sclerotherapy [4].

The procedure is therefore not considered a first option for the management of symptomatic first and second-degree hemorrhoids [13].

The main disadvantage of surgical haemorrhoidectomy is the well-known occurrence of postoperative pain and the protracted period of postoperative recovery. Cost and inpatient hospitalisation are lesser considerations.

Infrared coagulation is a procedure that is entirely office-based and is inexpensive.

The procedure is easily learned and apart from mild pain and occasional discomfort as seen in our patients is almost free of complications [14]. Despite the necessity for repeat treatment the procedure has no long-term complications and may be repeated over and over again without significant morbidity. The few side effects include mild delayed bleeding that may occur days after treatment or mild pain that may be due to coagulation of haemorrhoids close to the dentate line.

In conclusion in this review of 107 patients there were no severe complications requiring therapy.

The procedure was used in patients representing several age groups and repeat treatment was well tolerated. The technique is easily learned, rapidly performed, requires no anaesthesia and may be used for all grades of haemorrhoids with little short or long-term morbidity.

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Cancellations in day-case ENT surgery

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Abstract

Introduction: In excess of two million operations are performed in a day-case/ambulatory setting in the United Kingdom each year. Cancellations in elective surgery cost the National Health Service (NHS) over £265 million per year.
Methodology: This is a retrospective study in which the total number of elective ENT operations performed at The Guy's & St. Thomas' NHS Trust in a 6-month period were investigated for a range of demographic factors including, age, gender and ethnicity with regards to their relationship to operative cancellation rates.
Results: The overall cancellation rate was 19.9% (21.7% for females and 18.5% for males—this was statistically significant ($p < 0.001$)). There was a statistically significant difference between the three age groups ($p < 0.001$). There was a significant difference between the two commonest reasons for cancellation—"patient failed to arrive" and "patient unfit". The cancellation rate for day-case operations was 11.4% and this was significantly lower than that for elective operations at 21.6% with ($p < 0.001$). The cancellation rates were 16.0% for Caucasians, 23.7% for blacks and 22.6% for Asians. There was a significant increase in cancellations during the winter months.
Discussion/recommendations: Attention should be paid to subgroups at higher risk of operative cancellation (0 to 20-year olds, ethnic minorities, non-day case) especially in the winter months. The reason(s) for cancellation should be clearly recorded in the patient's notes. Medical staff at all levels should be given appropriate training as to the clinical significance of good note-keeping and its enforcement. The coding system for the classification of operative cancellations should be extensive and descriptive so as to include a broad range of categories.

Keywords: Cancellation; Demograhic; Day-surgery; Ambulatory surgery; ENT

1. Introduction

Day-case surgery has rapidly expanded as a cost-effective and resource-conserving surgical intervention to the point that well in excess of two million operations are performed in a day-case/ambulatory setting in the United Kingdom alone each year. Cancellations in elective surgery can cost the National Health Service (NHS) up to £266 million per year [1,2]. Studies have shown that 5% of patients fail to attend when summoned from a waiting list for routine ENT surgery [3]. One of the most common reasons cited for the wastage of theatre time is failure of patients on waiting lists to attend for operations when sent for [4,5]. This is not the sole reason for cancelled operations and previous studies have failed to investigate the plethora of alternative demographic factors that may play a significant role.

The literature shows that theatres are only used for 50–60% of the time for which they are available [6]. This suggests that valuable theatre time is being wasted and waiting lists are unnecessarily prolonged due to cancelled operations. Pre-admission clinics can improve efficiency and alleviate the financial burden of cancelled operations [7], although this view has not been unanimously accepted [8]. Whether the patients are assessed 24 h prior to the operation or 30 days before, makes no significant difference to the cancellation rate [9]. Attention to a multitude of factors involved with patient operative care including pre-operative screening, lab testing, compliance with fasting guidelines

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and pharmacological advice coupled with suitable explanation about the operative procedure can help to reduce morbidity and cancellation rates [10].

By taking advantage of the vast numbers of ENT operations performed at The Guy's & St. Thomas' NHS Trust, London, UK the present study aims to address the issues, which have been largely ignored in the literature including detailed breakdowns of reasons for operative cancellation. These reasons will then be demographically sub-classified in terms of age, gender, ethnicity and seasonal variation so that meaningful recommendations can be formulated so as to improve current clinical practice.

2. Methodology

This is a retrospective study in which the total number of elective ENT operations performed between the period of 1st July and 31st December 2002 were investigated. All ENT patients operated on during this period were selected from The Guy's & St. Thomas' NHS Trust database. The total number of ENT operations performed in this 6-month period was 1414. After the removal of emergency operations, the total sample size was 1100.

An overall cancellation rate was determined. There are a myriad of reasons for cancelled operations and the commonest have been displayed along with their associated frequencies. The most frequent causes of cancellations were analysed in the context of a range of demographic factors including, age, gender and ethnicity were investigated with regards to their relationship to cancellation rates. Appropriate statistical analyses were performed when required on a number of different variables.

3. Results

The overall cancellation rate was 19.9% (219/1100) Table 1.

The Fig. 1 shows the reasons for cancellation that had a frequency greater than 5%.

A chi-squared test revealed that there was a significant difference between "patient failed to arrive" and "patient unfit" Table 2.

Age (see Table 3).

Gender: the overall cancellation rate was 21.7% (102/469) for females and 18.5% (117/631) for males—this difference was statistically significant ($p < 0.001$).

Table 1
Comparison of the overall cancellation rates of studies in ENT surgery

Study	Overall cancellation rate (%)
Thomson [11]	30.1 (89/296)
Current study	19.9 (219/1100)
Hampal and Flood [3]	16.93 (548/3236)
Dingle et al. [7]	9.5 (415/3739)

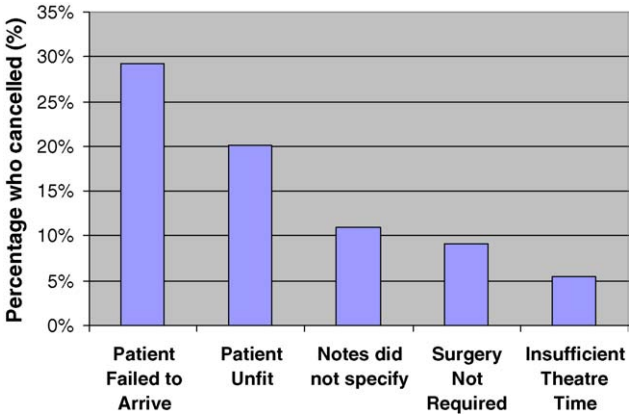

Fig. 1. The five commonest reasons for cancellation of ENT operations.

Table 2
The average ages and frequencies for the five commonest reasons for operative cancellations

Reason for cancellation	Average age (years)	Frequency (%)
Patient failed to arrive	32.1	29.2
Patient unfit	34.4	20.1
Notes did not specify	35.6	11.0
Surgery not required	22.1	9.1
Insufficient theatre time	37.4	5.5

Table 3
The frequencies of cancellation amongst different age groups

Age group (years)	Frequency of cancellation (%)
0–20	21.6 (80/371)
21–40	19.4 (64/330)
>41	19.0 (76/399)

There was a statistically significant difference between the three age groups ($p < 0.001$).

Table 4
The frequency of cancellation amongst different ethnic groups

Ethnic group	Frequency of cancellation (%)
White	16.0 (118/739)
Black	23.7 (36/152)
Asian	22.6 (14/62)
Mixed	24.1 (7/29)
Other	30.4 (7/23)
Not specified	40 (38/95)

Ethnicity (see Table 4).

Monthly non-attendance rate (see Fig. 2).

Day-case and elective cancellation rates: the cancellation rate for day-case operations was 11.4% (20/175) and this was significantly lower than that for elective operations at 21.6% (200/925) with $p < 0.001$.

4. Discussion

The overall rate of operative cancellations was 19.9% in the sample of 1100 patients. This is similar to the 16.9% found

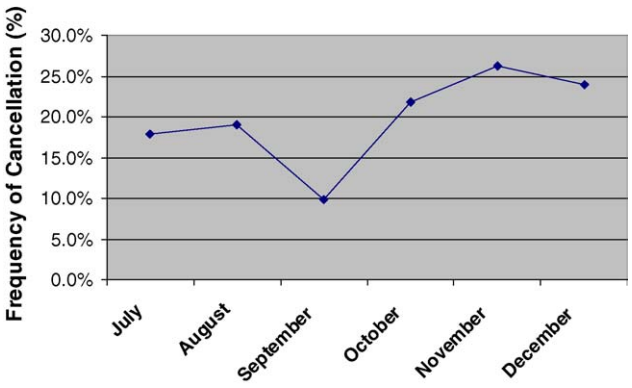

Fig. 2. The monthly variation of cancellation rate.

by Hampal and Flood [3] but significantly greater than the 9.5% found by Dingle et al. [7]. In the sample, a total of 24 different reasons were stated in the patient records for operative cancellations with the patient failing to arrive being the commonest at 29.2%. This contrasts with Thomson's study (1991) where the majority of patient's were cancelled for unknown reasons [11]. Hampal and Flood found that 14.6% of operations were cancelled due to non-attendance of the patient, which compares with 12.8% being cancelled by the hospital [3]. 5.5% of cancelled operations were due to insufficient theatre time—undoubtedly a hospital-based reason.

Patients self-cancelled in 3.2% of operations. Previous recommendations suggest that patients should be reminded of their operative date either by a letter or a telephone call [3]. Forgetfulness was not found to be a major source of operative cancellations in our study, but has been found to be significant by others [12].

There was a statistically significant correlation between increasing age and decreasing frequency of operative cancellation and this is consistent with the literature [3]. This may be due to generational differences in attitudes towards doctors as well as differences in time commitments with children subject to the scheduling of their parents (e.g. difficulty being released from work) as well as their school (e.g. public exams). The nature of ENT illnesses may be a contributing factor with many being self-limiting and many patients self-medicating [13].

Similarly, the greater cancellation rate among women may be due to the extra commitments in the home or at work. This contrasts with Hampal and Flood's study where non-attenders were significantly more likely to be males [3]. They cited a lack of desire among males to take time off work during a relative economic depression at the time [3]. The cancellation rates were 16.0% for Caucasians, 23.7% for blacks and 22.6% for Asians.

The dip in cancelled operations in September may relate to the holiday season with many doctors on annual leave and children returning to school. The significant increase in cancellations during the winter months may relate to worsening of the weather, increased transport difficulties and a greater strain on the health service at this time of year may lead to disproportionally more hospital-based cancellations. This trend is consistent with that found by Leese et al. [13] when they studied ENT outpatient clinic attendance. It has also been reported that the commonest cause of patient self-cancellation is upper respiratory tract infection, which is commoner in winter and is considered to be a contraindication for ENT surgery [7].

The advantages of the pre-admission clinic have been discussed at length in other studies [7,8,11]. The timing of the pre-admission clinic may have a role to play. If the pre-admission clinic is too close to the date of the surgery, then should a cancellation occur, there is less time for adjustment of the lists. If the pre-admission clinic is too early with respect to the date of the surgery, the parameters relating to the fitness of the patient could change significantly between pre-admission and the operation. This should be taken into account when deciding how far in advance of an operation pre-assessment should occur.

The significantly greater cancellation rate for non-day case operations compared with day-case procedures is intriguing. In one respect the longer post-operative recovery time with non-day case operations requires an improvement in planning on behalf of the patient and the hospital and scheduling difficulties could be a contributing factor. Conversely, patients scheduled for non-day case procedures are more likely to have serious illnesses and thus one can infer that cancellations would be less likely. We found that only 15% (3/20) of day-case cancellations were due to the patient failing to arrive and only 5% (1/20) due to the patient being unfit. This compares with 29.2 and 20.1% for non-day case operations, respectively. Thus increasing the number of procedures performed as a day-case will lead to a lower overall cancellation rate with the time and resource savings that accompany that change.

A limitation with this study is that 11% of cancelled operations had no specific reason recorded in the notes i.e. 'notes did not specify'. These outcomes illustrate the need for a more concerted effort with regards to the accuracy of note-keeping for reasons relating to audit, maintenance of standards, clinical governance and strengthening the hospital's medico-legal position.

The principal problem of almost 30% of cancellations being due to a failure of the patient to arrive requires further investigation. Previous studies have shown that this can be due to the patient being incorrectly listed, another intervening illness, the inability to take time off work, social reasons, poor communication, short notice, having the procedure performed elsewhere, improvement in their medical condition, a change of mind or postal address [3,4,11,14]. In contrast with Hampal and Flood's study though, this study did not find forgetfulness to be a major source of operative cancellations [3].

5. Conclusion

This study has evaluated a variety of factors that may lead to the cancellation of ENT operations. An attempt has been

made to explain these factors and trends and whether they are fully understood determines the scale of cost and resource saving which can be made in ENT. A number of changes have been proposed to attempt to improve efficiency in this regard which can be universally applied in all ENT centres across the UK.

6. Recommendations

As a result of this study the following recommendations are proposed:

1. Meticulous attention should be paid to subgroups at higher risk of operative cancellation (0 to 20-year olds, ethnic minorities, non-day case) especially in the winter months.
2. The timing of the pre-assessment clinic should be evaluated to ensure that it allows for maximum flexibility within the system.
3. Patients should be provided with a telephone reminder 3 days prior to their operation and this should be used as a mechanism to confirm their intention to attend.
4. The maximum number of ENT operations should be performed in the day-case setting as appropriate.
5. A concerted effort should be made to ensure that medical records are kept up to date and that the reason(s) for cancellation of an operation is clearly stated in the patient's notes. Medical staff at all levels should be given appropriate training as to the clinical significance of good note-keeping and its enforcement.
6. The coding system for the classification of operative cancellations may need to be expanded to include a broader range of categories.

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Ambulatory Surgery

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Breast cancer surgery in a day case setting: Where do the Netherlands stand in 2004?

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Abstract

To assess to what extent day case surgery for breast cancer is practised in the Netherlands a questionnaire was sent to 105 surgeons/hospitals. In 2004, 30% of the hospitals performed minor and 3% performed major breast cancer surgery in a day case setting. Sixteen percent of the hospitals indicated planning to introduce day case surgery for minor and major breast cancer surgery. The basic requirements for this development are widely available. Potential obstacles can be overcome by adjustments in organisation, logistics and financial reimbursement, thus making day case surgery available to more patients while reducing health care costs.

Keywords: Breast cancer; Surgery; Ambulatory; Survey; Netherlands

1. Introduction

Breast cancer is the most common cancer among women in the Netherlands with 11,300 new cases per year in 2000 [1]. Most of these women undergo surgical treatment during a hospital admission with a mean length of stay (LOS) of 4.1 days in 2003 [2]. Hospital admission is one of the largest cost contributors in the total treatment of breast cancer [3,4].

The introduction of the sentinel lymph node procedure reduced the invasiveness of the surgical treatment for breast cancer for a large part of the breast cancer patient population thus reducing the need for clinical care. In addition, the introduction of specialised breast care nursing (BCN) facilitated adequate pre, peri and postoperative education and counselling of patients. Positive results from studies assessing day case and ultra-short stay on feasibility, emotional well-being and safety in other countries and health care systems [5–7] led to the development of a fast track breast cancer surgery programme in our hospital in 2001. Introduction of the programme reduced the mean LOS from 3.7 days in June 2000 to 1.1 days in 2002. Forty-six percent of the cases were performed in a day case setting and a further 35% was discharged after an overnight stay (unpublished data). Subsequently, this fast track breast cancer care programme became daily practice.

Key elements in this care programme are a well-organised care process, with surgical and anaesthetic care according to modern standards, with a prominent role for the breast care nurse giving extensive education and counselling to the patient and informal carer, on wound and drain management, on physical activity and independence, emphasizing the advantages of home recovery and coordinating outpatient, inpatient and home care.

An increasing number of hospitals expressed their interest in copying the programme. To what extent breast cancer surgery in a day case setting is performed in Dutch hospitals in 2004, is unknown.

Neither is it known to what extent the above key elements are being practised outside a comprehensive fast track care programme. The aim of this study was to evaluate the current practice of breast cancer care in view of the implementation of day case surgery and to give an insight into the willingness

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to introduce this together with the real or perceived obstacles when organising day case surgery for breast cancer in the Netherlands.

2. Patients and methods

For evaluation of the current state of breast cancer care key elements for a successful day case surgery programme were identified. To that end items describing general aspects of organisation of breast cancer care were defined. These are preoperative (presence of a breast unit, BCN or NP, education and counselling), perioperative (anaesthetic screening and anaesthetic techniques, logistics concerning the sentinel lymph node procedure and image guided localisation, type of surgeon performing the surgery, length of hospital stay) and postoperative aspects of care (availability and degree of home care nursing facilities). Perceived obstacles and necessary conditions when organising day case surgery were recorded.

A written questionnaire was developed consisting of 32 multiple choice and open questions. For answers on incidence it was recorded if they were based on estimates or on actual data base figures. The questionnaire was sent to the surgeon most involved with breast cancer treatment employed in the surgical units of 105 hospitals performing breast cancer surgery. They were asked to complete the questionnaire in cooperation with the breast care nurse, if available. Reminders were sent one month later, followed by a telephone call to the surgeon or breast care nurse 2 months later.

3. Results

Seventy-six of the 105 questionnaires were returned. Table 1 shows the number and percentages of returned questionnaires in relation to the type of hospital.

3.1. Organisation of care

General and organisational aspects of care for the different types of hospitals are described in Table 2.

Table 1
Number and percentages of returned questionnaires

	Numbers sent	Numbers returned[a] (%)
University hospitals (UH)	8	7 (87%)
Teaching hospital (TH)	39	31 (79%)
Non-teaching hospital (NTH)	58	38 (66%)
Total	105	76 (72%)

[a] No significant difference ($p = 0.075$).

3.1.1. Preoperative

Eighty-five percent (65/76) of the hospitals have a breast unit. Fig. 1 shows the services that are available within the breast unit as advised by the Dutch guidelines (based on the BASO guidelines) [8]. Multidisciplinary outpatient consultation was available in less than a third of the hospitals.

A breast care nurse or nurse practitioner (NP) was absent in two hospitals. In 11 hospitals, both BCN and NP were available. In all cases, the BCN and/or NP was introduced to the patient preoperatively. The degree in which the different aspects of the job specification of the BCN and NP were fulfilled varied widely (Table 3). Communication with and education of the patient concerning the diagnostic process, treatment options and surgical procedures were in most cases performed by the surgeon as well as the BCN or NP. This verbal information was supported by leaflet information in 75/76 hospitals.

3.1.2. Perioperative

In 89% of the hospitals, it was possible for anaesthetists to screen patients preoperatively in an outpatient setting. Generally, all types of surgical procedures varying from excision biopsies to modified radical mastectomy were performed under general anaesthesia. In very few hospitals, the excision biopsy, (re)lumpectomy and sentinel lymph node procedure were performed under local anaesthesia (2, 1 and 2 hospitals, respectively).

The organisation of the sentinel lymph node procedure and image guided localisation are described in Table 2.

In 3% of the hospitals, breast surgery is exclusively performed by breast surgeons (>50 primary breast cancer surgery procedures per annum), in 14% breast surgery is performed by the general surgeon and in 30% of the hospitals breast

Table 2
General and organisational characteristics

General and organisational characteristics	7 UH[a]	31 TH[a]	38 NTH[a]
Number of beds	816 (291; 460–1283)	612 (167; 300–900)	350 (192; 120–1300)
Number of patients diagnosed with breast cancer yearly	133 (25; 100–163)	194 (92; 80–450)	124 (67; 50–350)
Number of operations yearly	212 (47; 150–279)	232 (115; 70–500)	140 (78; 40–400)
Percentage of surgical staff members performing breast surgery	17 (12; 6–40)	47 (25; 14–100)	63 (25; 25–100)
Outpatient preassessment clinic anaesthesiology	100%	90.3%	84.2%
Department of nuclear medicine available in the hospital	100%	93.5%[b]	52.6%
1 day or 2 days sentinel lymph node procedure	6/7	15/31	17/38
Only 1 day sentinel lymph node procedure	1/7	7/31	10/38
Only 2 days sentinel lymph node procedure	–	8/31	11/38
Image guided localisation available in the hospital	100%	100%	100%

[a] Mean (S.D.; min.–max.).
[b] In one hospital the sentinel lymph node procedure is not performed in patients with breast cancer.

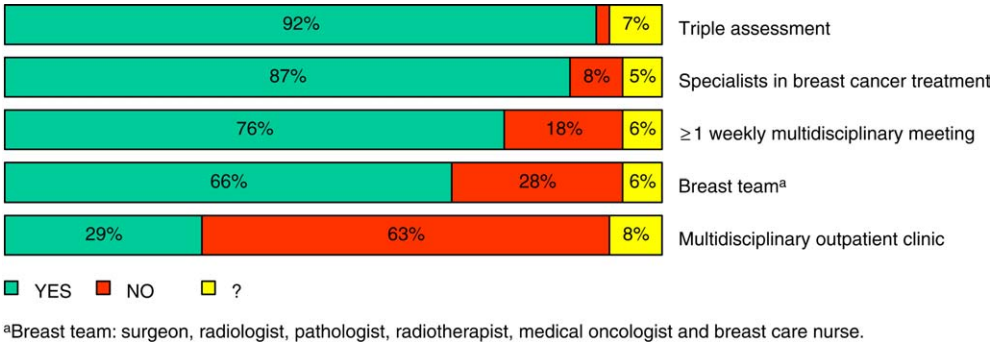

Fig. 1. Organisation of breast units.

Table 3
Tasks performed by the BCN and NP

Tasks	BCN ($n = 70$)[a] (%)	NP ($n = 16$) (%)
1. Giving nursing care to the patient with breast cancer and their relatives	63 (90)	12 (75)
2. Has the final responsibility for the coordination of the care for the patient with breast disease	25 (36)	12 (75)
3. Has the final responsibility in logistics of care of the patient with breast disease	21 (30)	14 (87)
4. Stimulates the expertise of the nurses involved in the care for the patient with breast disease	66 (94)	16 (100)
5. Does research or implements study results	23[b] (33)	16 (100)
6. Takes anamnesis and performs physical examination during the diagnostic proces	7 (10)	14 (87)
7. Independently gives consultation for wound control	40[b] (57)	14 (87)
8. Independently gives consultation for follow-up	18[b] (26)	14 (87)

[a] Oncology nurse working at the breast unit is added to the BCN.
[b] One time question not answered.

surgery is performed by the surgical oncologist or breast surgeon [9]. In the remaining hospitals breast surgery is performed by a combination of the breast surgeon, surgical oncologist and general surgeon.

The mean estimated LOS was 1–2 days in 5% of the hospitals, 2–3 days in 26%, 3–4 days in 29%, 4–5 days in 17% and 5–6 days in 11%. For the remaining 12% the LOS was not disclosed. Fourteen percent of the data was retrieved from databases.

3.1.3. Postoperative

In addition to the surgeon, the specialised nurses (BCN or NP) played an important role in giving psychosocial support to the hospitalised patient. In 5/76 hospitals, a general nurse on the nursing ward had this task. In 59/76 (78%) hospitals, patients were discharged with a telephone number that could be reached 24 h a day.

Supportive care at home by the home care organisation for uncomplicated wound care, drain care or psychosocial support is not available after discharge in 11/76 (15%) hospitals. In 38/76 (50%) hospitals, all three care aspects can be offered. Home care nursing is available the evening of discharge after day case surgery in 9/65 hospitals, in 14/65 hospitals it is available the day of discharge and in 29/65 it is available the day after discharge. In 4/65 hospitals, home care nursing is available at the specific request of the patient or at a later point in time. Nine times the question remained unanswered. Home care nursing is in 7/65 performed by a nurse specialised in breast cancer care and in 46/65 cases by non-specialised nurses. The question was not answered 12 times.

3.2. Day case surgery

In 2/76 hospitals, simple mastectomy with or without sentinel lymph node biopsy (SLNB) or an axillary lymph node dissection (ALND) with or without breast conserving surgery (BCS) is generally performed in a day case setting. Modified radical mastectomy (MRM) was usually not performed in a day case setting (Table 4).

3.2.1. Obstacles and necessary conditions for success

Table 5 shows the most frequently perceived obstacles for breast cancer surgery in a day case setting. Six surgeons did not answer the question.

Table 4
Type of surgery generally performed in a day case setting

	Yes	No	?
Excision of benign breast lesions	75	1	–
Excision biopsy suspect for breast cancer	65	8	3
(Re)lumpectomy	54	21	1
(Re)lumpectomy and SLNB	23	52	1[a]
ALND	2	72	2
(Re)lumpectomy and ALND	1	75	–
SM	2	74	
SM and SLNB	1	73	2[a]
MRM	0	76	–

[a] Question was answered with not applicable/type of surgery is not performed.

Table 5
Anticipated problems with breast cancer surgery in a day case setting

Problem	Frequency, $n = 70$
Technical medical	
Drain	20
Major wound surface (simple mastectomy/axillary dissection/direct reconstructions)	18
Postoperative pain management	14
Complication (rebleed/infection)	12
None	11
Other (seven aspects)	17
Organisational	
Sentinel lymph node procedure–image guided localisation–operation schedule–combination	10–6–6–5
None	12
Infrastructure for education and counselling	9
Home care nursing	5
Other (nine aspects)	9
Psychosocial	
Unreliable home situation/singles–older patient	13–10
Counselling during hospitalisation (nurses, peers)	18
Fear, emotional well-being and coping problems	13
Wish or expectation of patient or relative	11
Wound confrontation	6
Other (12 aspects)	18

At the time of the questionnaire, 12/76 surgeons had actual plans to start day case surgery for all types of surgical procedures for breast cancer. Fifty-seven surgeons indicated necessary conditions for success. Most frequently mentioned conditions for success were: good organisation of after care and home care ($n = 18$), extensive education, counselling and perioperative care ($n = 14$), organisational and logistical adjustments and fine tuning ($n = 10$), guaranteed patient satisfaction and the patient being allowed to choose to be discharged or not ($n = 9$), inclusion of patients with low comorbidity scores, only inclusion of lumpectomies with SLNB and simple mastectomies (SM) with SLNB or less and adequate pain control ($n = 9$), increased employment and greater job responsibilities for the BCN ($n = 4$) and financial compensation for introducing day case surgery ($n = 4$).

4. Discussion

In 2004, breast cancer surgery is mainly practised in an inpatient clinical setting. Minor surgery, e.g. lumpectomies and lumpectomies with SLNB, are performed in, respectively, 71 and 30% of the hospitals in a day case setting, but major breast surgery (SM, ALND and MRM) is only rarely performed in a day case setting. The survey indicates that there is an interest in day case surgery for all types of breast cancer surgery.

For successful implementation of day case surgery in all Dutch hospitals, a thorough analysis should include patients, health care professionals and the context of the care process. It is essential to make an inventory of the current practice of all involved disciplines and to identify real and perceived obstacles as well as promoting factors for the individual health care professional, the social environment and the health care system [10]. For the current survey the surgeons were chosen as the target group, as they are the coordinators of care during the diagnostic process and the primary treatment of breast cancer. This makes the surgeon the most important initiator of innovations of the care process. Without his cooperation implementation of day case surgery is doomed to fail.

Using a questionnaire for data collection may introduce a selection bias together with a risk of having estimates rather than actual figures. These aspects should be taken into consideration while interpreting the results.

Surgeons indicated that intramural and extramural education and counselling of the patient is the most important factor in introducing day case surgery. Breast care nurses and specialised nurse practitioners are very well capable to address these aspects of care and are already available in most hospitals. The current involvement of the BCN and the home care nursing organisation in the care process of the breast cancer patient is very diverse and in many cases insufficient for day case surgery. To facilitate day case surgery BCN's in many hospitals should spend more time with the patient and should be given more responsibilities. To provide continued quality of care the home care organisation should entail updated specialised care from the moment of discharge onwards. Finding adjustments in the reimbursement system could also contribute to the implementation of day case surgery.

Patient satisfaction is frequently stated as an important factor for success in day case surgery. Improvement of patient care and satisfaction is one of the strongest motives for health care professionals to change practice. Despite the fact that the literature suggests that day case surgery patients are happier, recover sooner, are better socially adjusted and show an improved emotional well-being compared to hospitalised patients, day case surgery is often not perceived as an improvement for the patient, mainly because of the fear of emotional distress [6,7,11–14].

The most frequently mentioned medical problems associated with day case surgery are discharge with a drain, risk of complications and pain in the home situation. Various studies describe different solutions to the drain problem: sending the patient home with a drain but with adequate preoperative education and counselling, adequate nursing support at home, axillary padding or simply not using a drain after an ALND [5,6,15–21]. Furthermore, no increase in complication rate is seen after day case surgery and postoperative pain is often adequately controlled with local wound infiltration and oral analgesics [7,18,22–24]. The majority of the unplanned admissions are caused by postoperative nausea and vomiting. With ongoing anaesthetic improvements these postoperative complaints may decrease [18]. Although it is often arbitrarily stated that surgical procedures in the day case setting should not last more than 1 h, in our experience procedures up to 2 h present no difficulties.

Inclusion of the sentinel lymph node procedure with or without image guided localisation in the day case setting have necessitated adaptation in hospital routines as they are associated with more complex planning procedures. The results of the questionnaire show that irrespective of the setting in which the sentinel lymph node procedure is performed and even in the absence of a nuclear medicine department in the hospital, the performance of the sentinel lymph node procedure in a day case setting was possible.

The patient choosing to be admitted on the day of surgery is mainly caused by a lack of feeling safe and of fear for postoperative pain at home [25]. Such inclinations should be curbed by giving detailed education and counselling on these care issues in the pre, peri and postoperative outpatient setting and in the home situation.

Contrary to the conviction of some surgeons, there are definite psychosocial advantages for the patient who is treated in a day case setting. They adjust emotionally better and tend to have less psychological distress symptoms compared to hospitalised patients [7]. Patients feel in control of the situation, tend to downgrade the seriousness of the operation and are more keen to recover [6,16]. Furthermore, sick leave of patients is shorter if treated in an outpatient setting [7,26].

The vast majority of the medical, organisational and psychosocial problems feared by surgeons when starting ambulatory breast cancer surgery can be resolved. The basic infrastructure that is required for day case surgery, the breast unit, is available in most hospitals, albeit that the contribution of both the BCN and district nurse in the care process should be expanded. With the patient at the centre of the care process and with a well organised team, day case surgery will be accessible for a larger number of patients while at the same time reducing health care costs.

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Factors influencing patient disposition after ambulatory herniorrhaphy

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Abstract

Purpose: To determine factors associated with patient disposition status other than discharge to their customary residence (DCR) after elective, ambulatory inguinal hernia repair (IHR).
Materials and methods: $N = 7953$ patients who underwent IHR were identified in the National Survey of Ambulatory Surgery (NSAS). Disposition status was examined by age, sex, race, type of anesthetic, anesthesia provider, expected source of payment, laterality of the procedure, facility type and US region. Logistic regression was used to examine independent risk factors for such disposition status.
Results: Independent risk factors for disposition status other than DCR included anesthesia type, anesthesia provider, increasing age of the patient, and bi- versus unilaterality of the procedure. Differences in disposition status were also found by facility type and US region in which the procedure was performed.
Discussion: The increased cost associated with a disposition status other than DCR requires identification of factors that independently contribute to such an outcome. In this study a number of anesthesia related and unrelated factors were identified that may impact on the disposition of patients undergoing ambulatory inguinal hernia repair. In light of limitations inherent to analysis of large databases our results should be interpreted with caution and prospective trials are needed for validation of our findings. The value of our results may lie particularly in the hypothesis generation for such trials.

Keywords: Ambulatory; Inguinal hernia repair; Disposition status; Risk factors

1. Introduction

Inguinal hernia repair (IHR) is among the most commonly performed surgical procedures. Over 20 million such procedures are performed per year worldwide [1]. Due to advances in surgical technique and anesthetic management, this procedure can be safely and cost-effectively performed on an outpatient basis. However, cost-effectiveness in large part depends on the ability to discharge patients to their customary residence (DCR) on the day of surgery. Disposition status of a patient other than DCR after ambulatory surgery creates financial burdens for the health care provider, the patient and their insurer. The goal of this study was to identify anesthesia- (type of anesthesia and provider) and patient-related (age, sex, laterality of the procedure) factors that contribute to an unanticipated discharge status in the setting of elective IHR using a large, national database. We also examined the influence of facility type (free-standing ambulatory surgical centers (FASC) and hospital-based ambulatory surgical centers (HSC)) and US region where the procedure was performed on disposition status.

2. Materials and methods

2.1. The National Survey of Ambulatory Surgery

Data collected in the National Survey of Ambulatory Surgery (NSAS) were accessed. The plan and operation of

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the NSAS has been previously published in detail [2]. In brief, the NSAS was conducted by the National Center for Health Statistics from 1994 to1996 to compile nationally representative data of ambulatory surgery procedures and practices performed in both freestanding ambulatory surgery and hospital-based ambulatory surgery facilities. The hospital universe included Medicare-participating, non-institutional hospitals exclusive of military, VA and Federal facilities in the 50 States and the District of Columbia. Facilities specializing in dentistry, podiatry, abortion, family planning or birthing were also excluded from NSAS. Hospitals included in the survey were required to have an average length of stay of less than 30 days to be considered short-stay and to have at least six beds.

After extensive pre-testing by the US Bureau of the Census, the survey was based on a sample of data collected from over 700 facilities. Response rates were 88% for hospitals and 70.5% for free-standing facilities (1994 data), respectively. Adjustments were made in the NSAS to minimize the impact of non-response on final estimates. Extensive measures were employed by the Division of Data Processing at the National Centers for Health Statistics to ensure accuracy, consistency, logic and completeness of the data.

To be eligible for inclusion in NSAS, patients had to be scheduled for ambulatory surgery with admission and discharge occurring on the same day. Patients admitted to the hospital, either as an inpatient prior to surgery or through the emergency department, were excluded. In addition, a patient was only included if he did not leave the facility before surgery and if the purpose of the visit was outpatient surgery.

Post-ambulatory procedure admissions were included in the survey. The original location of the patient prior to surgery was recorded during the sampling phase of the survey, but was not available in the database for further analysis.

Data from each visit were abstracted from the medical record. Information collected in the survey included diagnosis and procedure codes (ICD-9-CM), age, sex, race, type of anesthesia, anesthesia provider, facility type and US region in which the procedures were performed.

2.2. Analysis

The public access NSAS data files for 1994–1996 ($N = 364{,}858$) were obtained from the Centers for Disease Control and Prevention (CDC), read into a statistical analysis software program and concatenated. Patients who had ICD-9-CM procedure codes for either uni or bilateral IHR (53.00–53.05 and 53.10–53.17, respectively, Table 1) as their primary procedure codes (out of five possible procedure codes) were identified ($N = 7953$) and included in the study sample. Only approximately 5% of these patients had an additional procedure code listed. The most common secondary procedure code was related to the primary procedure, i.e. laparoscopy/peritoneoscopy, suggesting a further characterization of surgical technique.

Table 1
ICD-9 procedure codes for inguinal hernia repair included in this study

53.0 Unilateral repair of inguinal hernia
53.00 Unilateral repair of inguinal hernia, not otherwise specified inguinal herniorrhaphy
53.01 Repair of direct inguinal hernia
53.02 Repair of indirect inguinal hernia
53.03 Repair of direct inguinal hernia with graft or prosthesis
53.04 Repair of indirect inguinal hernia with graft or prosthesis
53.05 Repair of inguinal hernia with graft or prosthesis, not otherwise specified
53.1 Bilateral repair of inguinal hernia
53.10 Bilateral repair of inguinal hernia, not otherwise specified
53.11 Bilateral repair of direct inguinal hernia
53.12 Bilateral repair of indirect inguinal hernia
53.13 Bilateral repair of inguinal hernia, one direct and one indirect
53.14 Bilateral repair of direct inguinal hernia with graft or prosthesis
53.15 Bilateral repair of indirect inguinal hernia with graft or prosthesis
53.16 Bilateral repair of inguinal hernia, one direct and one indirect, with graft or prosthesis
53.17 Bilateral inguinal hernia repair with graft or prosthesis, not otherwise specified

The ICD-9 procedure codes that were used to identify patients undergoing inguinal hernia repair.

Patients for whom a disposition status was recorded were identified. Disposition status (DCR versus admission to hospital, discharge to recovery care center or discharge to observational status) was examined by age, sex, race, type of anesthetic, anesthesia provider, type of facility, US region and the laterality of the procedure. DCR was defined as discharge to the patient's normal place of residence, i.e., home, nursing home, or prison. Observational status was defined as stay at the operating facility for up to 72 h for "observation", but the patient was not considered an inpatient. The percentages of disposition status other than DCR were determined for subgroups within each category (Table 3). Odds ratios were calculated to determine if patients with specific characteristics were more likely to have a disposition status other than DCR. A logistic regression model was then developed where disposition status was the dependent variable (0 = disposition to customary residence, 1 = not discharged to customary residence) and the characteristics above were independent, categorical variables. Ninety-five percent confidence intervals were calculated.

Anesthesia types were categorized as local, MAC/sedation, general, epidural, spinal, other and not stated. A single anesthetic type is listed when this particular technique was the *only* reported mode of anesthesia. Common combinations of anesthesia types were considered and examined separately.

Races studied include those identified in the NSAS as white, black, "other" and not stated. Races classified as "other" included American Indian, Eskimo, Alaskan Native, Asian and Pacific Islander. No further race categories were included in the NSAS.

3. Results

Table 2 shows the characteristics of the study population ($N = 7953$). The majority of patients was male, white, privately insured, and had a unilateral hernia repair performed under general anesthesia administered by an anesthesiologist.

Table 2
Study group characteristics

Categories	Patient group	Number of patients $N = 7953$	Percent of total
Sex	Male	7012	88.2
	Female	941	11.2
Age (years)	Below 1	527	6.6
	1–14	1616	20.3
	15–44	2064	26.0
	45–64	1868	23.5
	64+	1878	23.6
Race	White	4854	61.0
	Black	535	6.7
	Other	244	3.1
	Not stated	2320	29.2
Laterality of procedure	Unilateral	6752	84.9
	Bilateral	1201	15.1
Anesthesia type	Local	284	2.3
	Local and MAC/sedation	562	7.1
	MAC/sedation	646	8.1
	General	4236	53.3
	General and MAC/sedation	164	2.1
	General and local	232	2.9
	Epidural	539	6.8
	Spinal	516	6.5
	Other	459	5.8
	Not stated	415	5.2
Anesthesia provider	Anesthesiologist	4324	54.4
	CRNA	1283	16.1
	Anesthesiologist/CRNA	1030	13.0
	Other physician	374	4.7
	Other	246	3.1
	Not stated	696	8.8
Insurance type	Private	4277	53.8
	Medicare/-aid/other Government	2396	30.1
	Other pay	832	10.5
	Not Stated	448	5.6
Facility type	Hospital based	6094	76.6
	Freestanding	1859	23.4
US region	NorthEast	2081	27.2
	MidWest	1582	20.6
	South	2317	30.2
	West	1683	22.0

The characteristics of the study population ($N = 7953$). The first column contains categories, the second describes subgroups with each category. The third and fourth column show the proportion as a total number and in percent, respectively.

Most cases were performed in a hospital-based ambulatory care center.

Disposition status was noted for 7663 (96.4%) of patients undergoing IHR. Of those, 581 (7.6%) were not DCR after surgery. Table 3 shows the percent within each variable group that was not DCR. The highest percents of patients who were not DCR were those who received the combination of general and MAC/sedation anesthesia (18.4%), those who received spinal anesthesia (17.6%), and those who received their anesthetic by an "other" provider (15.3%).

Table 3
Percent of patients with disposition status other than DCR within each group

Categories	Patient group	Percent within patient group not DCR
Sex	Male	7.8
	Female	6.2
Age (years)	Below 1	5.7
	1–14	2.0
	15–44	7.2
	45–64	9.1
	64+	11.8
Race	White	9.4
	Black	6.8
	Other	4.2
	Not stated	4.3
Laterality of procedure	Unilateral	7.4
	Bilateral	8.8
Anesthesia type	Local	1.1
	Local and MAC/sedation	4.5
	MAC/sedation	3.5
	General	9.0
	General and MAC/sedation	18.4
	General and local	3.4
	Epidural	1.5
	Spinal	17.6
	Other	7.2
	Not stated	0.8
Anesthesia provider	Anesthesiologist	5.6
	CRNA	13.0
	Anesthesiologist/CRNA	10.0
	Other physician	11.0
	Other	15.3
	Not stated	1.9
Insurance type	Private	5.9
	Medicare/-aid/other Government	10.3
	Other pay	8.0
	Not stated	8.3
Facility type	Hospital based	9.3
	Freestanding	2.3
US region	NorthEast	2.7
	MidWest	7.1
	South	15.1
	West	3.7

The percentage of patients within each patient group that had a disposition status other than discharge to their customary residence (DCR) after inguinal hernia repair.

Table 4
Odds ratios and 95% confidence intervals for disposition status other than DCR based on univariate analysis

Categories (referent)	Patient group	Odds ratio	95% CI
Sex (male)	Male	1	1
	Female	0.78	0.59, 1.04
Age (years) (15–44)	Below 1	0.78	0.52, 1.12
	1–14	0.27	0.18, 0.39*
	15–44	1	1
	45–64	1.23	1.02, 1.63
	64+	1.72	1.38, 2.15*
Race (white)	White	1	1
	Black	0.70	0.49, 1.00
	Other	0.43	0.22, 0.81*
	Not stated	0.44	0.35, 0.55*
Laterality of procedure (unilateral)	Unilateral	1	1
	Bilateral	1.22	0.98, 1.53
Anesthesia type (general)	Local	0.12	0.03, 0.47*
	Local and MAC/ sedation	0.48	0.32, 0.73*
	MAC/sedation	0.37	0.24, 0.57*
	General	1	1
	General and MAC/ sedation	2.23	1.52, 3.45*
	General and local	0.36	0.18, 0.74*
	Epidural	0.16	0.08, 0.31*
	Spinal	2.16	1.67, 2.80*
	Other	0.78	0.54, 1.14
	Not stated	0.08	0.03, 0.26*
Anesthesia provider (Anesthesiologist)	Anesthesiologist	1	1
	CRNA	2.53	2.04, 3.14*
	Anesthesiologist/ CRNA	1.90	1.49, 2.42*
	Other physician	2.10	1.48, 2.99*
	Other	3.06	2.11, 4.46*
	Not stated	0.33	0.18, 0.59*
Insurance type (private)	Private	1	1
	Medicare/-aid/other Government	1.83	1.52, 2.20*
	Other pay	1.39	1.04, 1.84*
	Not stated	1.43	0.99, 2.08
Facility type (freestanding)	Hospital based	4.36	3.17, 6.00*
	Freestanding	1	1
US region (Northeast)	Northeast	1	1
	Midwest	2.76	1.99, 3.82*
	South	6.43	4.82, 8.59*
	West	1.41	0.98, 2.03

The odds ratios and 95% confident intervals (95% CI) for disposition status other than DCR obtained from the univariate analysis (i.e., every variable was only compared to a referent variable within each patient category). The referent group is shown in parenthesis in the category column.
* Significant at $P < 0.05$ at alpha level.

Table 5
Odds ratios and 95% confidence intervals for disposition status other than DCR based on multivariate analysis

Categories (referent)	Patient group	Odds ratio	95% CI
Sex (male)	Male	1	1
	Female	0.891	0.72, 1.33
Age (years) (15–44)	Below 1	0.47	0.30, 0.75*
	1–14	0.19	0.13, 0.29*
	15–44	1	1
	45–64	1.41	1.09, 1.81*
	64+	1.81	1.30, 2.52*
Race (White)	White	1	1
	Black	0.64	0.43, 0.94*
	Other	0.54	0.27, 1.07
	Not stated	0.64	0.50, 0.84*
Laterality of procedure (unilateral)	Unilateral	1	1
	Bilateral	1.40	1.09, 1.81*
Anesthesia type (general)	Local	0.05	0.01, 0.25*
	Local and MAC/ sedation	0.24	0.15, 0.38*
	MAC/sedation	0.31	0.20, 0.50*
	General	1	1
	General and MAC/ sedation	1.83	1.17, 2.86*
	General and local	0.43	0.20, 0.92*
	Epidural	0.33	0.16, 0.69*
	Spinal	1.05	0.78, 1.39
	Other	0.53	0.35, 0.79*
	Not stated	0.14	0.04, 0.46*
Anesthesia provider (Anesthesiologist)	Anesthesiologist	1	1
	CRNA	1.32	1.04, 1.67*
	Anesthesiologist/ CRNA	1.37	1.05, 1.79*
	Other physician	4.60	3.05, 6.94*
	Other	4.70	3.05, 7.25*
	Not stated	0.43	0.23, 0.79*
Insurance type (private)	Private	1	1
	Medicare/-aid/other Government	1.27	0.96, 1.70
	Other pay	1.02	0.75, 1.40
	Not stated	1.83	1.20, 2.79*
Facility type (freestanding)	Hospital based	3.80	2.66, 5.42*
	Freestanding	1	1
US region (northeast)	Northeast	1	1
	Midwest	1.82	1.29, 2.58*
	South	4.39	3.22, 5.97*
	West	1.76	1.18, 2.62*

The odds ratios and 95% confident intervals (95% CI) for disposition status other than DCR obtained from the multivariate analysis (i.e., the calculation of the OR was performed while controlling for all other variables). The referent group is shown in parenthesis in the category column.
* Significant at $P<0.05$ at alpha level.

Table 4 shows results of the univariate analysis. While no differences in the odds for a disposition other that DCR were found by sex or laterality of the procedure, disposition status other than DCR varied significantly within all other variable groups studied.

Table 5 shows the results of the regression analysis. When controlling for all studied variables the choice of local and epidural anesthesia significantly decreased the risk for disposition status other than DCR when compared to general or spinal anesthesia. Administration of anesthesia by a non-anesthesiologist physician significantly increased the odds

of disposition status other than DCR when compared with an anesthesiologist. The odds ratio for disposition status other than DCR among patients receiving care from a Certified Registered Nurse Anesthetists (CRNA) or an anesthesiologist/CRNA team, were also higher than with a solo anesthesiologist, but lower than those of non-anesthesiologist MDs. The odds ratios for non-DCR disposition status among those receiving care from CRNA's and anesthesiologist/CRNA teams were reduced in the multivariate, whereas for non-anesthesiologist MD's the odds were higher in multivariate analysis.

Increasing age remained a risk factor for disposition status other than DCR in the multivariate analysis. Bi- versus unilaterality of the procedure slightly but significantly increased the risk for such disposition status in multivariate but not univariate analysis. Those identified as black had a lower likelihood of discharge to other than DCR compared to whites when controlling for other factors.

4. Discussion

In the setting of ambulatory surgery, discharge of a patient to any location other than their customary residence can be viewed as "unanticipated." The increased cost associated with unanticipated disposition status requires identification of factors that independently contribute to such an outcome. In this study we demonstrate that age, laterality of the procedure, type of anesthesia provider, anesthetic technique, race, type of insurance, region, and facility type may impact the disposition of patients undergoing ambulatory inguinal hernia repair.

4.1. Type of anesthetic

A number of studies have found a correlation between anesthetic factors and disposition status after ambulatory surgical procedures [3–11]. The estimated rate for anesthesia-related causes for unanticipated admission to the hospital after ambulatory surgery is between 12 and 44% [6–8,11]. Nordin et al. examined the impact of the type of anesthesia used on disposition status in the setting of inguinal hernia repair. The authors found that local anesthesia was associated with far fewer admissions to the hospital when compared to regional or general techniques [3]. These results are similar to our findings. However, we were able to further separate those patients receiving regional anesthesia into spinal and epidural groups. Our analysis showed that the risk for disposition status to other than DCR was significantly higher among those receiving spinal when compared to epidural anesthesia.

A number of authors have reported the potential benefits of local anesthesia compared to general or spinal techniques [12–23]. Cited advantages include earlier ambulation [13,18,22], a shorter time to home-readiness [12,15], and a decreased incidence of urinary retention [12–14,18,20], nausea and vomiting [3,12,13,23] and pruritus [12]. Lower cost [12], lower pain-scores [3,12,13] and the ability to test the integrity of the repair during the procedure have also been cited as favorable factors [19,20]. Patient satisfaction also seems to be higher when local anesthesia is used [12,13,19,21].

Common side effects of general anesthesia are post-operative nausea and vomiting (PONV) and higher pain scores [3,12], potentially contributing to higher rates of admission. The administration of inhalational gases and opioids has been linked to PONV and may explain the increased risk of disposition status other than DCR in the groups that received MAC/sedation and general anesthesia. Interestingly, when general anesthesia was combined with local anesthesia, the odds ratio was significantly lower for a disposition status to other than DCR. This may reflect a decreased need for opioids during and after the procedure, thus reducing the risk of nausea and vomiting and pain. When general and MAC/sedation were recorded together, the odds ratio for disposition status other than DCR was significantly above that for general anesthesia alone. This may reflect a conversion from MAC/sedation to general anesthesia for a variety of reasons, which may include intra-operative complications. The authors caution that this interpretation is purely speculative as data to confirm it are not available in the NSAS database. The designation of multiple anesthetic techniques for a single procedure could not be interpreted with certainty and our assumptions have to remain speculative.

Spinal anesthesia is burdened with urinary retention [3,12] and this may be the reason for the increased likelihood for prolonged post-operative care. Nordin et al. report that 29% of patients had to undergo catheterization after spinal anesthesia for IHR [3]. We found that disposition status other than DCR after spinal was the same as for general anesthesia after IHR.

Epidural anesthesia has the advantage of a lower incidence of post-dural puncture headache, and transient radicular irritation when compared to spinal anesthesia and thus may contribute to the lower rate of unfavorable post-surgical dispositions.

4.2. Anesthesia provider

Attempts to study the impact of type of anesthesia provider on outcome have been made in the past and are subject to a wide range of criticism. Studies comparing outcomes between CRNAs and anesthesiologists are rare and focus mainly on mortality, morbidity and cost as outcome variables. Publications supporting the superiority of either side can be found [24,25]. Analysis of the NSAS data suggest that when controlling for age, race, sex, laterality of the procedure, type of anesthesia, insurance type, US region and facility type, patients with a CRNA listed as the anesthesia provider are more likely to have a disposition status other than DCR after elective, ambulatory herniorrhaphy when compared to anesthesiologists alone. Interestingly, the odds for disposition status other than DCR were even higher among

patients receiving care from non-anesthesiologist MDs than for CRNAs, increasing the risk 4.6-fold compared to anesthesiologists.

4.3. Demographics

Patient-related characteristics such as age and sex have been reported to influence disposition status after ambulatory surgery. Junger et al. reported a prolonged stay for females after ambulatory surgery [9], while others have found male gender to be a risk factor [11]. Although differences were found in our univariate analysis, no significant gender-differences were found by multivariate analysis. Advanced age is consistently associated with an increased risk of unplanned admission to the hospital after ambulatory surgery [5,9–11,26]. In concordance with these findings, our data suggest that patients over 64 years of age have a significantly higher chance for a disposition status other than DCR when compared to those 15–44 year old.

4.4. Insurance and race

Race and insurance type are known to influence medical treatment. Studies across medical specialties suggest that socio-economically disadvantaged and minority patients are at risk of receiving care that is not deemed the standard of care [27,28]. A study examining the impact of these factors on disposition status in an emergency department setting showed that patients with Medicare or other government insurance were more likely to be admitted to the hospital than privately insured patients. The same study found that members of minority groups were less likely to be admitted [29]. Although in a different setting, these findings mirror our results. Higher admission rates among Medicare/Medicaid recipients may be explainable by the difficulties these patients face regarding follow-up care and medical access [29,30], leading physicians to keep these patients in the hospital. In this context, Fortier et al. report that 19.5% of unanticipated hospital admissions after ambulatory surgery are related to "social reasons" [11].

4.5. Laterality

Surgical reasons for unpredicted disposition status have been reported to be between 38 and 62% [7,8,11]. Performance of bilateral versus unilateral IHR has been studied in the past with no significant impact on rates of overnight admission. However, a trend was seen (9.6% versus 4.3%, respectively), and the study including a sample size of $N = 243$ may have been underpowered to detect significance for this outcome [31]. In our study, when controlling for all other studied factors, patients undergoing bilateral inguinal hernia repair were significantly more likely to have a disposition status other than DCR than those undergoing a unilateral procedure, although the finding was on the borderline of significance.

4.6. Facility and US region

When comparing free-standing and hospital-based ambulatory centers, both univariate and multivariate analysis showed an increased risk of DCR associated with hospital-based centers. This may reflect a number of factors that cannot be captured by the NSAS including lower thresholds for admission, patient selection and triaging to appropriate facilities based on co-morbidities.

Multivariate analysis showed a significantly higher risk of not DCR for patients undergoing procedures in the South, Midwest, and West compared to the Northeast. This suggests that conventions of medical practice in the US may vary by region, emphasizing the need to more closely examine the systems that dictate post-operative care in different regions.

4.7. Limitations

Although we used a large, national sample, our findings must be interpreted in the context of the limitations inherent to secondary data analysis. Administrative databases collect data for many reasons; however, it is rarely for evaluation of clinical practice. As such, information needed to definitively answer questions related to clinical practice is often not available in databases. Our analysis of the NSAS is retrospective in nature and prohibits examination and incorporation of impact factors other than those provided by the survey. One of the biggest concerns surrounding outcome studies based on large databases has been the lack of sufficient risk adjustment to control for differences in patients' overall health status. The NSAS does not provide information on factors such as the ASA physical status. Age and diagnosis codes provide only minimal information about the individual's state of health, especially in the context of ambulatory surgery, in which procedures and documentation tend to be problem-focused. In this context, 99% of patients in our analysis had a single diagnosis code reflecting the diagnosis of inguinal hernia recorded while only 3.4% had a second diagnosis. However, the authors who include ASA class or similar health status classifications in studies evaluating risk factors for prolonged hospital stay or admission after ambulatory surgery have found no [9] or limited impact [5,8] of this variable on the studied outcome. Gold et al. noted in their study of 9616 patients that 96% of patients admitted to the hospital after undergoing ambulatory surgery were ASA class 1 or 2 [10]. Patient preference may also play a role in the type of anesthesia selected, but is not recorded in the NSAS. In addition, despite information about major geographical regions, medical practices may vary on a more local level and thus these differences in practice were not captured by the NSAS. Although administrative databases do not provide definitive answers to clinical questions, they are able to provide a "snap-shot" of practice in time, thus allowing researchers to generate hypotheses for further research.

4.8. Conclusion

In conclusion, we identified a variety of independent risk factors for disposition status other than DCR in the setting of ambulatory inguinal hernia repair. Due to medical innovation and the passage of time, these data may reflect an historical "snap-shot" of practice. However, they may also represent the need to reexamine practice. In light of limitations inherent to analysis of large databases our results should be interpreted with caution. These results appear to confirm other findings in the literature and may be used to generate hypotheses for the prospective trials that are needed for validation of our findings.

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Recovery time and patient satisfaction in ambulatory knee arthroscopy Prospective study comparing three anaesthetic methods

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Abstract

The aim of this study was to compare recovery time and satisfaction of patients operated under two anaesthetic techniques. A randomised-controlled trial that enrolled ASA I–II patients submitted to ambulatory knee arthroscopy was designed. Patients included were randomly assigned to one of the three study groups: general intravenous anaesthesia (TIVA), spinal anaesthesia with lidocaine (LIDO), and spinal anaesthesia with prilocaine (PRILO). Spinal groups did not receive supplementary sedation. Major outcome measures considered were both the time to discharge from the post-anaesthesia care unit (PACU) and from the day-case surgical unit (DSU), the incidence of adverse events, postoperative need for analgesics and patients satisfaction. One hundred and twenty patients were enrolled. Mean time from the patients comes into operating room to discharge from PACU was 125 ± 27 min for the PRILO group, 109 ± 24 min for the LIDO group and 106 ± 34 min for the TIVA group ($P < 0.01$). Time to discharge from the ASU was 279 ± 37 min for the PRILO group, 261 ± 53 min for the TIVA group and 241 ± 36 min for the LIDO group ($P < 0.001$). No significant differences were observed in the appearance of adverse events, the need for postoperative analgesics and the degree of patient satisfaction among the study groups. A shorter recuperation time was observed in the LIDO group, but more TIVA patients preferred to have the same anesthetic again. All three anaesthetic methods are useful for ambulatory knee arthroscopy.

Keywords: General anaesthesia; Spinal anaesthesia; Safety; Efficacy; Satisfaction; Ambulatory surgery

1. Introduction

The growing importance of day-case surgery (DCS) over the last 10 years has encouraged research into new tools or techniques to improve quality of care [1,2] to reduce length of stay and complications that arise from the techniques employed [3,4] and to maintain patient satisfaction as an overall measure of procedure success [5–8]. There are several techniques of ambulatory anaesthesia, no single technique being considered ideal. In the surgery of the lower limbs or abdomen, including knee arthroscopy, general or loco regional anaesthesia can be used. Despite being very different techniques, there are minor differences between them [9–11]. This is due to the advances made in anaesthesiology in recent years, such as new anaesthetic drugs that are degraded by plasmatic esterases more quickly [12], improvements in air management techniques that are now safer and less invasive [13], or the development of needles that are less damaging to the dura mater and nerve tissue [14]. The current debate over the ideal technique for DCS and the large number of articles that refer to transient radicular irritation caused by intradural lidocaine [15–17], has led us to compare two anesthetic techniques and also two different local anaesthetics used in intradural anaesthesia, testing alternatives to lidocaine, such as prilocaine which is used in similar doses [18]. Several factors can affect the choice of one technique or another, including preferences of the anaesthetist or the patient, fear of complications derived from its application,

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legal implications of these complications, and reduction in the duration or cost of procedures [19–21]. The aim of this study was to examine the efficacy of intradural anaesthesia compared with general anaesthesia in terms of recovery times and times to discharge from the ASU in DCS patients undergoing knee arthroscopy and to compare adverse events, rates of hospitalization and degree of patient satisfaction between the anaesthetic techniques.

2. Materials and methods

A randomised-controlled trial was designed with three parallel groups and was approved by the Hospital Ethics Committee. All ASA I–II patients between the ages of 20 and 65, with no history of duodenal ulcer and with a body mass index of less than 35 kg/m^2 who were scheduled to undergo outpatient knee arthroscopy in the year 2002 were invited to participate. Patients who agreed to participate in the study and gave written informed consent were randomly assigned to one of the three study groups by means of a sealed, numbered envelope which contained the group they had been assigned to, taken from a table of random numbers. TIVA group patients were given general anaesthesia using intravenous propofol at a dose of 2 mg/kg/h and remifentanil a 0.2–0.4 μg/kg/h, both by continuous infusion, the airway maintained by controlled ventilation and laryngeal mask. LIDO group patients were administered spinal anaesthesia using 3 ml lidocaine at 1.5% and PRILO group patients were given spinal anaesthesia using 3 ml prilocaine at 1.5%. The spinal anaesthesia was injected into the intervertebral space level L2–L3 using a 25-gauge Whitacre pencil-point spinal needle. Spinal group did not received supplementary sedation.

All patients were premedicated the night before with 10 mg oral diazepam obtained in the preanesthetic visit. In the preanesthesia room, patients were given an intravenous bolus of 1.5 mg midazolam and an infusion of 100 ml saline solution with 75 mg diclofenac, 10 mg metoclopramide and 50 mg ranitidine, according to the guidelines of preoperative treatment in our centre. Before the surgical wound was closed, 10 ml bupivacaine 0.5% with epinephrine was administrated into the knee in all patients. Postoperative analgesics both at the ASU and at home were the same for all study groups: diclofenac, 50 mg/8 h; paracetamol, 500 mg/ 8 h; administered alternatively and diazepam 10 mg at night, all taken orally and for 2 days.

Results were measured in terms of recovery time (T_1), defined as the time from the patient comes into the operating room until the patient had completed the criteria for discharge from the PACU (as established by White et al. [22]) and the time to discharge from the ASU (T_2), defined as the time from the patient comes into the operating room until the patient had completed the criteria for discharge from the ASU (as established by Aldrete [23]). The following adverse postoperative events were also recorded: headache, urine retention, and nausea and vomiting. Pain intensity was assessed using a visual analogue scale (VAS) which ranged from 0 points (no pain) to 10 points (maximum pain intensity). Nurses who were unaware of the group, the patients belonged to measured these results every 20 min in the PACU and later in the DCU. In the PACU and the DCU, a written visual analogue scale measured pain, and in the 48 h control pain was measured by verbal analogue scale. A satisfaction questionnaire was given to the patients by phone 48 h after discharge. The questionnaire evaluated: “degree of satisfaction with the anaesthesia received, postoperative pain rating, level of information received on the anaesthetic procedure to be used, and incidence of adverse events (nausea, vomiting, headaches and urine retention)”.

A sample size of 40 patients per group, a total of 120 patients, was estimated to be needed to detect a difference of more than 30 min in recovery times, with a p value of 0.05 and an statistical power of 80%. The main characteristics of the study sample have been described as proportions for categorical variables and means and standard deviation for continuous variables. Analysis of variance (ANOVA) was used to compare mean times and the Kruskal-Wallis test to compare pain measures (VAS) between the three study groups. The χ^2-test was used to compare proportions between categorical variables. Statistical significance was accepted if p value was <0.05.

3. Results

During the study period, 152 patients were found to complete the selection criteria, of which 32 (21%) declined to participate. Reasons for refusal were patient preference for loco regional anaesthesia (59%), patient preference for general anaesthesia (22%) and unwillingness to participate in a clinical trial (19%). A total of 120 patients were finally enrolled. The main characteristics of the patients are presented in Table 1 and no significant differences were found between the three groups for any of the characteristics assessed.

The results of the times studied are presented in Table 2. No significant differences were found between the three study groups for duration of operation but there were significant differences between the PRILO group and the other two groups for time to discharge from the PACU (T_1); and significant differences between the LIDO and PRILO groups for time to discharge from the DCU (T_2).

No significant differences were found between the groups for mean pain rating scores (taken from VAS) in PACU and ASU; the scores were respectively 1.8 ± 2.0 and 0.9 ± 1.1 for the TIVA group, 1.3 ± 1.7 and 0.8 ± 0.9 for the PRILO group, and 1.5 ± 1.9 and 1.0 ± 1.0 for the LIDO group. Percentages of rescue analgesic use in PACU were 53% for the TIVA group, 25% for the PRILO group, and 40% for the LIDO group, not reaching the statistical significant level. In ASU, these percentages were 28% for the TIVA group, 25% for the PRILO group and 18% for the LIDO group, not reaching sig-

Table 1
Demographic data of the patients that agreed to participate in the study

Group	TIVA	LIDO	PRILO	*p*
No patients	40	40	40	
Sex (females, %)	28	38	43	0.41
Age mean (S.D.)	41.7 (11.0)	43.2 (13.7)	40.3 (15.6)	0.64
BMI mean (S.D.)	25.9 (3.1)	26.8 (4.1)	25.6 (3.9)	0.35
ASA				
I (%)	75	58	78	0.14
II (%)	25	42	22	
Previous arthroscopy (%)	20	18	28	0.53
Associated pathology				
Arterial hypertension (%)	10	5	8	0.77
Diabetes mellitus (%)	0	3	10	0.09
Respiratory disease (%)	10	3	10	0.39
Degenerative arthropathy (%)	8	10	23	0.15

BMI: kg/m^2; S.D., standard deviation.

nificant difference either. No differences were found between the groups for postoperative adverse events. The overall percentage of postoperative complications (nausea, vomiting, headache, urinary retention was 6% in the TIVA group, 5.5% in the PRILO group and 4.7% in the LIDO group, without any case of Transient Neurologic Syndrome. Two patients had to be hospitalized, one from the TIVA group due to intraoperative change in surgical indication and the other from the LIDO group due to hyperthermia. No patients had to be admitted after home discharge.

Results of the satisfaction questionnaire are presented in Table 3. Of note is the fact that 100% of the TIVA group stated that they would have the same type of anaesthesia if the operation were repeated, compared with 82% from the PRILO group and 85% from the LIDO group ($P = 0.03$). No significant differences were observed between the three groups in assessment of anaesthesia used, mean postoperative pain rated on a verbal scale, and adverse events.

4. Discussion

Best anaesthetic technique for day-case surgery is controversial [24]. Our hypothesis before the study was that TIVA reached shorter discharge time and gave higher satisfaction levels of the patients, but it has not been proved.

Table 2
Times studied

Mean times	Operation time (min)	T_1 (min)	T_2 (min)
TIVA	38.3 ± 12	106.2 ± 34	260.8 ± 53
LIDO	39.0 ± 11	109.5 ± 24	241.3 ± 36
PRILO	38.3 ± 8	125.4 ± 27	278.9 ± 37
Differences between groups			
TIVA–LIDO	−0.7	−3.3	19.5
PRILO–LIDO	0.7	15.9[#]	37.6[##]
PRILO–TIVA	0.0	19.2[#]	18.1

[#] $p < 0.05$.
[##] $p < 0.001$.

The results of our study show that the different anaesthesia techniques studied have similar efficacy and safety profiles and are all well accepted. Regarding recovery times, PRILO group patients needed between 15 and 19 min more than the other two groups to complete the criteria for PACU discharge (T_1). The differences between the mean times to discharge from ASU (T_2) were only significant between the PRILO and LIDO groups, the PRILO group staying 38 min longer because its effects last longer. No significant differences were found between the groups PRILO and TIVA or LIDO and TIVA for T_2. According to these results, the intradural anaesthesia with lidocaine best fulfils the criteria for discharge from DCU, although in our opinion, prilocaine could be a good spinal anaesthesia when the surgical procedure lasts between 90 and 120 min as the duration of the block is assured for the length of the surgery. TIVA procedure has shown excellent recovering times, that can be compared with those of spinal anaesthesia, and is a good alternative for the patients who reject spinal anaesthesia. We believe that the choice of anesthesia technique however should also include other criteria, such as safety and resource optimization. In this context, it is worth mentioning the current controversy over the relation between the use of intradural lidocaine and transient neurological syndrome [16,17]. In the present study, no transient neurological syndrome was observed in any group.

Good levels of post-operative analgesia were reached, probably related to the protocolization of the treatment and the surgical wound intraoperative infiltration. The overall percentage of adverse events (nausea, vomiting and headaches) was very similar to those documented in the literature [3,4]. No case of Transient Neurologic Syndrome was detected, which could be related to the low concentrations of local anaesthetic used, as several authors have recommended [16,17]. No differences were observed between groups as regards side effects. In spite of that, the statistical power of our study was not enough to achieve conclusive results in that way, specially regarding side effects with very low incidence.

Table 3
Telephone questionnaire results

Questions	Value	TIVA	PRILO	LIDO	*p*
If you had the operation again, would you accept the same kind of anaesthesia that you were given for this operation?	Yes	100	82.5	85	
	No		17.5	15	0.03[a]
How would you rate the kind of anaesthesia you were given?	Very good	60	37.5	40	
	Good	40	62.5	52.5	
	Average	0	0	5	0.14
	Bad	0	0	2.5	
	Very bad	0	0	0	
How would you rate the postoperative pain?	No pain	15	32.5	25	
	Mild pain	52.5	50	35	
	Moderate pain	25	17.5	25	0.35
	Severe pain	5	0	10	
	Unbearable pain	2.5	0	5	
How would you rate the information you were given about the anaesthesia you received?	Very good	30	37.5	32.5	
	Good	65	52.5	60	
	Average	2.5	7.5	7.5	0.86
	Bad	2.5	2.5	0	
	Very bad	0	0	0	
Adverse events	Nausea	5	0	5	0.66
	Vomiting	2.5	0	0	0.35
	Headaches	10	12.5	12.5	0.93

Expressed in percentage.
[a] Significant differences between groups TIVA vs. LIDO, and TIVA vs. PRILO.

The results of the satisfaction questionnaire show a high degree of acceptance of the ambulatory procedure patients had undergone rather than preferences for other anaesthesia techniques. All patients from the TIVA group declared they would accept the same type of anaesthesia if they had the same operation again, while patients from the intradural groups were more doubtful (PRILO 17.5% and LIDO 15% would not). The memory of the spinal puncture, the pain it caused and poor tolerance of the complete block of the lower extremities during the postoperative period could be the reasons for this rejection. Although patients with spinal anaesthesia did not receive supplemental sedation, we do not believe this could influence significantly patient satisfaction. Further studies on quality of recovery from general anaesthesia with the new drugs available compared with spinal anaesthesia would be of interest. Almost all patients in the study rated the quality of the anaesthesia very high, with only three patients from the LIDO group rating the anaesthesia as mild or bad. Finally, 90% of patients rated the clarity of the information received as good or very good. We would like to underline the importance of providing good pre-, per- and post-operative information for the success of ambulatory procedures.

Twenty one percent of the candidates to be enrolled in the study declined to participate, which could be considered as a limitation of the study. There were several reasons for refusing to participate, the main one being patient preference for a particular anaesthesia, usually intradural. People associate loco regional anaesthesia with local anaesthesia and therefore consider this technique to be safer than general anesthesia [20]. However, we do not think that the percentage of refusals caused a relevant selection bias.

In summary, the results obtained in this study suggested a shorter recovery time in the LIDO group, while more TIVA patients preferred to have the same anesthetic again. However, no differences were found between groups in the overall satisfaction. Moreover, the small differences observed between groups do not seem to have an important clinical relevance. Although lidocaine must be used with caution because of the transient neurological syndrome risk, due to the equivalent efficacy profile of the three anaesthetic procedures evaluated for low extremities ambulatory surgery, the choice to use one or another must be based on other criteria, such as patient's values and preferences.

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Bispectral Index® and the incidence of apnea during monitored anesthesia care☆

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Abstract

Purpose: The Bispectral Index (BIS) provides an estimate of depth of consciousness during sedation. If apnea can be shown to correlate with BIS, then a potential improvement in safety during MAC/sedation may be achieved.
Scope: Ninety-nine patients undergoing MAC anesthesia were monitored with BIS for level of consciousness, and capnography for apnea detection. The anesthesia provider was blinded to BIS and capnography data. Forty-nine percent of subjects experienced apnea independent of medical history, procedure, or medication. BIS immediately preceding apneic episodes (55 ± 18) was frequently lower than that recommended for an upper limit during general anesthetics (<60). The incidence increased as depth of consciousness decreased with a 50% likelihood of developing apnea at a BIS of 56.
Conclusions: The incidence of apnea during MAC is high, and incidence increases as BIS decreases.

Keywords: Apnea; Depth of consciousness; Monitored anesthesia care

1. Introduction

Apnea is a frequent occurrence during monitored anesthesia care (MAC, or sedation administered by anesthesiologists and anesthetists) procedures, with a reported incidence as high as 25% [1]. Due to improvements in surgical techniques and development of improved intravenous sedative agents, conscious and deep sedation are employed increasingly in operating rooms, clinics and offices by anesthesiologists and non-anesthesiologists. Some of these caregivers may have little to no formal training in pharmacology, physiologic monitoring or resuscitation. Although apnea and airway obstruction can be accurately detected by capnography during these procedures [1], there have been no studies that examine the ability of new technologies to predict apnea occurrence.

Bispectral Index (BIS) is a parameter derived from the bipolar scalp encephalogram that has been shown to estimate level of consciousness during anesthesia and sedation. Anesthesia providers primarily use BIS to assure that patients are unaware during general anesthesia [2,3]. This study was designed to test the hypothesis that the risk for apnea during MAC procedures may correlate with level of consciousness as measured by BIS.

2. Materials and methods

Patients scheduled to undergo procedures with MAC/sedation were enrolled after signing an Institutional Review Board (IRB) approved consent form. In a previous study

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[1], we observed a 26% incidence of apnea for at least 20 s. Assuming similar incidence, we sought to capture data during at least one episode of apnea in at least 25 patients. Therefore, we planned to enroll 110 patients, assuming eight patients would drop out or be otherwise unevaluable. Patients were excluded from study participation if they were pregnant, age <18 years, or could not maintain an SpO_2 of >88% on room air. Drop-out criteria included the need to place an artificial airway to maintain ventilation, or the need to institute artificial ventilation.

All patients were monitored with BIS (A-2000, Aspect Medical Systems, Newton, MA, XP Version 4.0) for level of consciousness, and capnography for apnea detection (NPB-70 handheld capnometer, Nellcor, Pleasanton, CA—sampling rate 50 ml/min). 5-lead ECG and SpO_2 monitoring were displayed continuously for all patients. Non-invasive blood pressure was measured every 2.5 min.

Sedation was administered with propofol ± fentanyl ± midazolam at the discretion of the anesthesia providers (anesthesia residents and nurse anesthetists supervised by faculty anesthesiologists at a large teaching institution), and doses were recorded. All patients received oxygen via nasal cannula with a minimum flow rate of 2 l/min, titrated as needed to maintain $SpO_2 > 94\%$. The anesthesia provider was blinded to both BIS and capnography data.

Data were collected at baseline and every 3 min, unless otherwise triggered by apnea for >60 s or $SpO_2 < 88\%$. Values for SpO_2 and $P_{ET}CO_2$ were collected during the last minute of each 3 min interval. Apnea or airway obstruction for 60 s, detected using capnography, triggered notification of the anesthesia care provider if the apnea was undetected by routine monitoring. Sixty seconds was specifically chosen due to safety concerns of the IRB.

At the conclusion of the case, the anesthesia provider was asked to determine the deepest level of sedation achieved using standard definitions of sedation/analgesia [4] (minimal, moderate, or deep). This was then correlated with actual incidence of apnea occurrence.

2.1. Statistical analysis

Categorical data were analyzed using Pearson's chi-squared test. The relation between potential predictive variables (BIS value, patient demographics, and type of procedure, sedative and analgesic) and the occurrence of apnea was assessed by logistic regression analysis using SigmaStat for Windows Version 3.0 (SPSS, Chicago, IL).

3. Results

Ninety-nine patients who ranged in age from 19 to 78 years (51 ± 13 years) and weighed from 49 to 170 kg (83 ± 19 kg) were studied. There were 48 females and 51 males. Eighty-three percent of patients received midazolam, 85% received propofol, and 35% received fentanyl, with most receiving a combination of medications. Medication given was not predictive of apnea occurrence (19 of the 36 subjects receiving fentanyl became apneic (53%), 37 of 83 for midazolam (45%), and 46 of 86 for propofol (53%)). Orthopedic, vascular, pain, and gastroenterology procedures were included in the study protocol.

Table 1
Apnea as related to BIS mean, minimum and maximum values

Apnea	*N*	BIS (M ± S.D.)	BIS_{min} (M ± S.D.)	BIS_{max} (M ± S.D.)
Y	49	71 ± 14	48 ± 17	91 ± 11
N	50	83 ± 12	67 ± 17	96 ± 5

Table 2
Temporal pattern of BIS as a function of apnea event

Time to apnea	BIS_{min} (*N*)	BIS_{min} (M ± S.D.)	BIS_{min} (Min)	BIS_{min} (Max)
>3 to <6 min before	47	73 ± 19	32	98
<3 min before	47	55 ± 18	25	91

Forty-nine (49.5%) of 99 patients experienced 60 s of apnea. None of the episodes of apnea were detected by the anesthesia provider. All were detected by capnography. No subjects required ventilation or airway placement, and thus none met dropout criteria. Average time to apnea was 15 ± 13 min after onset of sedation. Twenty patients desaturated to below 90%, 3 in the non-apnea group, and 17 in the apnea group (6 prior to and 11 after apnea occurrence). Lowest saturation reached was 88%. There were no differences in heart rate or blood pressure throughout the study.

Patients that became apneic had mean BIS of 71 ± 14, compared to 83 ± 12 in the group that did not experience apnea. Mean, minimum and maximum BIS data related to apnea are shown in Table 1. Average BIS during the 3 min immediately preceding apnea was 55 ± 18, and BIS for the immediately preceding 3 min averaged 73 ± 19 as shown in Table 2. Anesthesia provider ability to correlate subjective depth of sedation with risk of apnea was poor as shown in Table 3.

4. Discussion

As previously shown, the incidence of apnea during MAC has been shown to be high [1], and although it can be reliably *detected* by capnography, apnea cannot be reliably *predicted* with current standard monitors. With recent studies highlighting the increased risk of morbidity and mortality during office-based procedures [5], many of which are performed under IV sedation, it is important to identify means of improving patient safety. We therefore designed this study to examine the correlation between a processed-EEG measure of consciousness and apnea.

Table 3
Sedation level as assessed by anesthesia providers as related to BIS mean, minimum and maximum values and incidence of apnea

Apnea	Sedation judgment	*N*	BIS (M ± S.D.)	BIS_{min} (M ± S.D.)	BIS_{max} (M ± S.D.)
Y	Minimal	10	77 ± 10	58 ± 17	92 ± 9
Y	Moderate	30	70 ± 14	48 ± 17	90 ± 11
Y	Deep	9	66 ± 18	36 ± 14	92 ± 13
N	Minimal	30	88 ± 6	73 ± 14	97 ± 4
N	Moderate	17	79 ± 12	60 ± 15	95 ± 6
N	Deep	3	62 ± 22	40 ± 26	96 ± 2
All groups		99	77 ± 14	57 ± 20	93 ± 8

The Bispectral Index Score (BIS) is a derived parameter from the scalp electroencephalogram used for monitoring level of consciousness during administration of anesthetics and hypnotics [6]. BIS has been shown to correlate well with anesthetic depth and sedation for a number of agents [7]. Kim et al. showed that BIS values at apnea occurrence following induction of anesthesia with propofol or thiopental were 40 ± 14 or 58 ± 13, respectively [8]. The minimum, maximum and range for BIS data was not supplied, but onset of apnea during induction of general anesthesia appears to correlate with that obtained in our sedation study. Typically, BIS values of 65–80 are indicative of loss of conscious information processing and recall. Although BIS has been extensively studied during sedation, the impact of sedation depth on apnea has not.

The "levels of sedation/analgesia" as defined by the ASA include minimal, moderate, and deep levels, and criteria for each are reproduced in Table 4 [4]. Deep sedation is associated with ventilation that "may be inadequate", and "airway intervention may be required". This is clearly undesirable, especially when sedation is administered by personnel without formal training in resuscitation and airway management. A continuum of sedation exists during sedative medication administration. The more sedated one becomes, the more likely one is to experience airway difficulties. Since BIS measures consciousness, it follows that the risk of apnea should increase below a certain BIS level.

In our study, we have found that the average BIS of patients that became apneic was lower than those in patients that did not experience apnea (71 ± 14, compared to 83 ± 12). More importantly, the BIS immediately preceding apneic episodes (55 ± 18) was frequently lower than that recommended for an upper limit during general anesthetics (<60). As depth of consciousness decreased, the incidence of apnea increased.

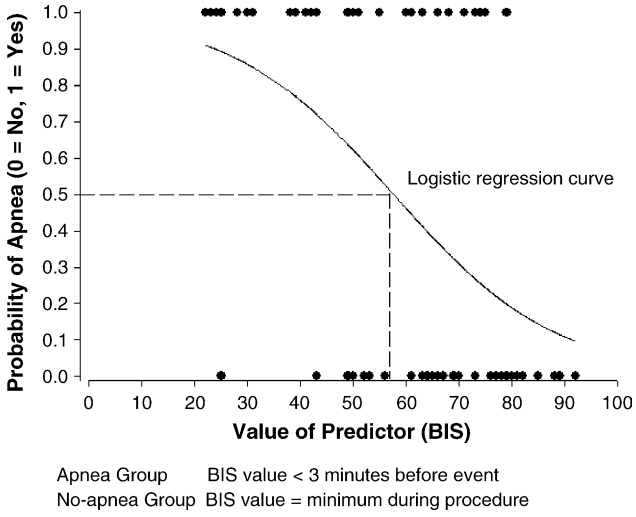

Fig. 1. Probability of apnea as a function of BIS.

When probability of apnea was plotted against BIS, logistic regression analysis revealed that the likelihood of apnea development was 50% at a BIS of approximately 57, as shown in Fig. 1.

The ASA Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists discuss level of consciousness monitoring, but limit the discussion to the clinical assessment of patient response to verbal command [4]. Based on our findings and previous recommendations as outlined by the aforementioned ASA guidelines, we recommend that processed-EEG monitoring be further studied in large patient populations to further delineate risk factors for development of apnea. Although we found no difference based on patient age, sex, or other comorbid conditions, a much larger sample size with a broad variety of clinically uti-

Table 4
Definitions of general anesthesia and levels of sedation/analgesia (approved by ASA House of Delegates on October 13, 1999, and amended on October 27, 2004 [4])

	Minimal sedation (anxiolysis)	Moderate sedation/analgesia ("conscious sedation")	Deep sedation/analgesia	General anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

lized sedatives is warranted. Considering that the risk of processed-EEG monitoring is minimal, the additional monitoring of depth of consciousness that these monitors provide may add value during sedation cases. Indeed, education about the benefits of depth of consciousness monitoring may be even more appropriate for non-anesthesia providers.

In conclusion, we have shown that apnea during procedural sedation is common, and that it is more likely to occur as level of consciousness is progressively depressed, with BIS prior to apnea frequently in the range of general anesthesia (i.e. <60). With apnea frequently associated with oxygen desaturation (20% of our study population desaturated to below 90% despite use of supplemental oxygen), monitoring depth of consciousness with processed EEG may result in an improvement in patient safety during procedural sedation.

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Review

Recent developments in ambulatory surgery in Portugal

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Day surgery has greatly increased all over the world since the 90's. Nevertheless, many European countries such as Portugal have not kept pace with this development in the surgical field. Having an almost completely free national health service (NHS) easily accessed by society, Portugal presents similar demographic data (percentage of population older than 65-year-old), health clinical indicators (infant mortality rate, life expectancy) or human resources (physician ratio) to the most developed countries of the world [1]—Table 1. However, costs within the health service have increased greatly in the last few years, making Portugal the fourth highest spender of its gross domestic production health in the European Community after Germany, France and Greece.

The hospital network is composed of 82 public surgical hospitals and 92 smaller private hospitals. Since 2001, there has been a change in the management of public hospitals. These hospitals have been divided into two main groups. One is called the SPA group (Public Administration Sector group) and is a continuity of the previous system. It includes 50 hospitals and the majority of the Portuguese University Hospitals (except Hospital Geral Santo António, at Porto). The other group is named the SA group (Anonymous Society group) and includes 32 hospitals. The SA hospitals, although not formally based on a profit enterprise management, were created with the intention of being more rational from an economic point of view and more effective in cost containment. After 3 years of experience, it seems that the SA hospital group has become more efficient and effective with lower costs than the same hospitals in the group in previous years [2]. However, a quality analysis has not yet been done and further studies should be performed in order to investigate the results of this Portuguese experience.

The last National Survey on ambulatory surgery (AS) [3], showed that 46,111 major surgeries were performed on a day surgery basis, that is, 14.6% of a total of 315,642 non-emergency surgeries. This represents a doubling of day surgery performed in the last 2 years and a three-fold increase in the period of 4 years, from 1999 till 2003—Table 2. Looking back to our last report on the Portuguese evolution of AS [4], this is an extraordinary increase especially because the major difficulties for the development of AS are still present. We still have a restrictive non-competitive legislation and financing of day surgery, where day procedures have a mean financing value between 50 and 60% of the same procedure performed as an inpatient. Moreover, there is a lack of Health Policy towards the promotion of day surgery, in spite of an increased waiting surgical list and increased health costs in the last couple of years.

The author stresses the fact that only major surgery was considered. Minor surgery performed with local anaesthesia without the presence of an anaesthesiologist, was not included in the data presented in Table 2, and this represented in 2003, 127,073 surgeries. If we had included minor surgery in our data we would have performed 173,184 surgeries on a day basis, representing 39.1% of a total of 442,715 non-emergency surgeries. This is a critical point when analysing data from national surveys as in the majority of cases all types of surgeries are included. Minor surgery can represent, as much as 40% of all non-emergency surgery introducing bias in national reports where there is no distinction between minor and major surgical cases.

In the 2001 National Survey very few hospitals had more than 30% of non-emergency surgery performed on a day surgery basis [5]. The 2003 National Survey showed that 12 Portuguese hospitals undertook more than 30% and 18 hospitals between 15 and 30% of non-emergency surgery, respectively, on a day basis. Almost 70% of all hospitals included (in a number of 80) had an AS programme running in their hospitals.

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Table 1
Demographic and health indicators of Portugal and the most developed countries of the world

	Portugal	Canada	France	Germany	Italy	Japan	United Kingdom	United States of America
Population (million)	10.4	31.4	59.5	82.5	58.0	127.4	59.2	288.4
Population >65 years (% total)	16.6	12.7	16.3	17.3	18.6	18.4	15.9	12.3
Infant mortality (deaths per 1000 live births)	5.0	5.2	4.2	4.3	4.7	3.0	5.3	6.8
Female life expectancy (in years)	80.5	82.2	82.9	81.3	82.9	85.2	80.4	79.8
Male life expectancy (in years)	73.8	77.1	75.6	75.6	76.8	78.3	75.7	74.4
Physician ratio (per 1000 inhabitants)	3.2	2.1	3.3	3.3	4.4	2.0	2.1	2.4
Health costs (in % of GDP)	9.3	9.6	9.7	10.9	8.5	7.8	7.7	14.6

OECD Data—2002.

Table 2
Results from the Portuguese National Surveys on ambulatory surgery

	1999	2001	2003	Difference 2003–2001 (%)
	N (%)	*N* (%)	*N* (%)	
Total performed surgery	376913	391701	428647	9.4
Total non-emergent surgery	269755	290597	315642	8.6
Total ambulatory surgery	14837 (5.5)	20870 (7.2)	46111 (14.6)	120.9

Other facts were relevant in this increase. The regions where day surgery was not developed had more significant increases than other regions. At the present time, AS is nationally and homogeneously developed in all regions of the country: north (13.6%), middle (17.4%), Lisbon and Tejo Valley (14.5%), Alentejo (17.1%) and Algarve (16.9%). The exceptions are still the Islands of the Azores and Madeira where day surgery has not yet begun.

Lathouwer and Poullier published [6] international data on day surgery from 29 OECD countries. There, for 18 basket procedures selected as the most significant for AS, Portugal had a rate of 9.9% (7693 in a total of 77,394 surgeries). In our last report [4], we found for the same group of procedures in 2001 a national rate of 15.7% (14,530 in a total of 92,585 surgeries). Two years later, the 2003 national survey pointed out a national rate of 21.9% (26,395 in a total of 120,642 surgeries), reflecting a continuous progression of day surgery in Portugal—Table 3.

There has been an important increase in the majority of surgical procedures. However, there is still an enormous difference between hospitals—Table 4.

Despite the difficulties, we think that the future looks promising for day surgery in Portugal. First, in spite of the financial barriers there was a three-fold increase in the last 4 years (1999–2003). Second, there has been a major increase in the awareness of AS among public and private health authorities, especially in the SA Hospital Group owing to the creation of a national commission for establishing adequate national guidelines and policies. Finally, there has been an improvement in the financing of day surgery, at least in the SA Hospital Group, where the average reimbursement value for day cases has been increased to 80% of the same Diagnosis related groups (DRG) for inpatients.

In spite of the recent developments of day surgery in Portugal, the Portuguese Association for ambulatory surgery's leaders do feel that there is still a long way to go in order to reach the national rates that we can find in the majority of North America and western European countries. This potential development added to future governmental and financial pressures will increase the scope of AS by changing selection

Table 3
Results of 18 groups of interventions eligible as ambulatory surgery (results from the third National Survey in Portugal – 2003 – and comparison with the previous survey performed in 2001)

Surgical procedure	2003			2001 (%)
	Performed as outpatient, *N*	Total surgery performed, *N*	%	
Knee arthroscopy	89	4702	1.9	1.3
Extraction of teeth	426	952	44.7	17.7
Cataract surgery	8476	27122	31.3	29.6
Hernia repair	3252	22015	14.8	9.3
Dilatation and curettage uterus	2623	7531	34.8	11.5
Vein ligation	1274	9574	13.3	8.7
Tonsillectomy	668	7190	9.3	4.2
Adenoidectomy	602	3968	15.2	14.3
Myringotomy	554	3719	14.9	8.5
Laparoscopic sterilisation	620	2636	23.5	13.1
Squint surgery	442	1527	28.9	9.5
Submucous resection (ENT)	42	2660	1.6	1.2
Excision of breast lump	1082	3766	28.7	27.5
Anal procedures	313	2483	12.6	13.7
Circumcision	1730	4207	41.1	29.9
Dupuytren	266	1252	21.2	18.4
Carpal tunnel decompression	3096	7881	39.3	30.6
Orchidopexy-varicocoele	580	1949	29.8	18.0
Implanted devices	260	5508	4.7	6.4
Total	26395	120642	21.9	15.7

Table 4
Upper and lower percentage of day surgery activity in NHS Hospitals for some examples of procedures

Surgical procedure	Best (%)	Worst (%)
Cataract surgery	87.1	0
Hernia repair	100.0	0
Vein ligation	97.0	0
Laparoscopic sterilisation	100.0	0
Circumcision	100.0	0
Carpal tunnel decompression	98.7	0

criteria policy to allow sicker patients to undergo more extensive surgery. Focus should turn then to quality issues in order to keep ambulatory surgery a very safe and effective way of performing surgery.

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Review

Bladder function after ambulatory surgery

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Abstract

Micturition is a complex process under both involuntary and voluntary control. A variety of pathological conditions, as well as certain surgical and anesthetic procedures cause urinary retention, which may have long lasting consequences. Patients undergoing ambulatory surgery have traditionally been required to void prior to discharge; however, this practice is increasingly being questioned. Ultrasound scanning of the bladder is an accurate method of measuring urine volume in postoperative patients. It may be useful as a non-invasive method of monitoring bladder volume, thus avoiding unnecessary bladder catheterization whilst at the same time preventing prolonged overdistension. We present an algorithm for managing ambulatory patients in both low and high-risk groups for postoperative urinary retention.

Keywords: Urinary retention; Outpatient anesthesia; Ultrasound

Contents

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1. Introduction

Until relatively recently, voiding was considered one of the prerequisites for discharge from an ambulatory surgery center [1]. Current evidence suggests this criterion is no longer valid, at least not for all patients [2]. In this review, our goal is to discuss bladder function following ambulatory surgery under the following headings: anatomy and physiology of voiding; the potential complications of urinary retention and overdistension of the bladder; the risk factors for retention; incidence and diagnosis of urinary retention. We shall also review strategies for safe management of bladder function after ambulatory surgery, and the use of ultrasound measurement of bladder volume.

2. Anatomy and physiology of micturition

2.1. Anatomy of the lower urinary track

The anatomy and nerve supply of the lower urinary tract in males is shown in Fig. 1. The detrusor muscle is composed of smooth muscle fibers; as the bladder fills, stretch receptors in the bladder wall transmit sensory signals via pelvic splanchnic nerves to synapse in the sacral cord, with projections to the micturition center in the brain. The efferent limb of the reflex includes:

(a) Preganglionic parasympathetic neurones originating from S 2–4 traveling in pelvic splanchnic nerves to peripheral ganglion cells in the wall of the bladder. Activation of these fibers initiates contraction of the detrusor muscle.
(b) Sympathetic efferents emanating from T10 to L2 traveling through superior and inferior hypogastric plexuses to innervate the internal urethral sphincter. These fibers are inhibited during voiding resulting in opening of the bladder neck, decrease in urethral pressure and increase in detrusor tone. These fibers are active during continence.
(c) Somatic efferents arising from S 2–4, traveling in the pudendal nerves to the striated muscle of the external urethral sphincter. Inhibition of these nerves results in external sphincter relaxation during voiding.

2.2. The micturition reflex

Voiding is a reflex action (the micturition reflex) that requires simultaneous contraction of the detrusor muscle of the bladder, and relaxation of the internal and external urethral sphincters. Micturition is complex, being controlled at both a spinal level and by higher centers in the brain [3,4]. The stimulus to trigger this reflex is stretching of the bladder as urine volume increases. The bladder volume at which there is a strong desire to void is termed the “cystometric capacity”. This volume is similar in men and women and varies between 400 and 600 ml [5,6]. Maximal rates of urine flow

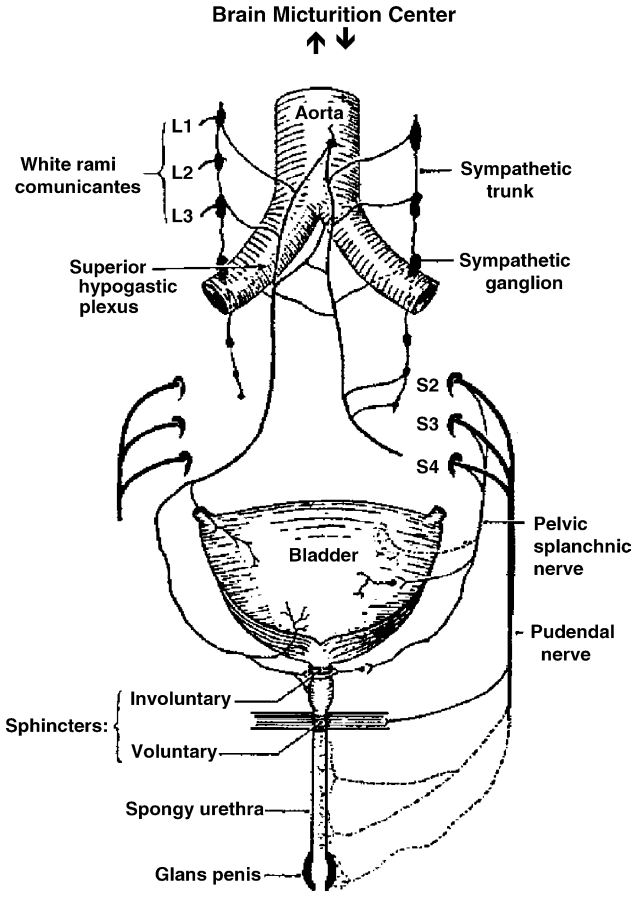

Fig. 1. Diagram of the micturition reflex neural pathways. Reproduced from Moore KL. Clinically Oriented Anatomy. 3rd ed. Baltimore: Williams and Wilkins; 1992, with permission.

are measured when detrusor pressure reaches between 43 and 50 cm of water [5].

2.3. Higher center control of micturition

The entire micturition reflex arc is subject to modulation or control by centers in the brain located in the dorsolateral pons (the pontine micturition center), the diencephalon and the cerebral cortex. Both voluntary and involuntary control of micturition is influenced by these centers in the brain. Further modulation of the micturition reflex can occur within the spinal portion of this pathway. There are a number of receptors in the micturition pathway capable of responding to dopamine, serotonin, norepinephrine, GABA, excitatory and inhibitory amino acids, opioids, acetylcholine and neuropeptides [4]. The precise role of these receptors in the normal voiding mechanism is unclear.

3. Urinary retention and overdistension of the bladder

3.1. Etiology and effects of urinary retention

The causes of urinary retention or failure to void are numerous and described in Table 1. Continued distention of the bladder as occurs with urinary retention has a number of consequences. In some instances, bladder sphincters fail and overflow incontinence ensues. In rare instances, perforation of the bladder may result from persistent ischemia triggered by over distention of the bladder or other insults [7,8]. With chronic obstruction, there may be overdistension of the ureters (hydronephrosis), and ultimately, urosepsis due to stasis [9].

3.2. Animal models of bladder overdistension

A number of animal models have been developed to investigate the pathophysiological consequences of bladder overdistension. Bladder overdistension for 3–10 h or longer is followed by decreased parasympathetic activity, structural changes in parasympathetic efferent nerve endings in the wall of the bladder, decreased cholinergic nerve density and patchy areas of hypoinnervation [10–13]. These changes are believed to be ischemic in origin. Bladder distention and contraction against a closed bladder neck have been shown to cause ischemia and hypoxia of the bladder wall followed first by endothelial cell damage, submucosal hemorrhages and submucosal edema; and then by progressive neurologic injury [14–17]. Other studies have reported that in a majority of animals, a temporary period of dysfunction is followed by full return to normal function in approximately 1–2 weeks [15–17]. The injury caused by stretching appears to be variable in severity, persistence and frequency of occurrence; and thus dependent on the duration of overdistension and pressure attained within the bladder cavity.

3.3. Effects of bladder overdistension in humans

The effects of urinary retention in humans have not been extensively studied because it is not possible for ethical reasons, to investigate the effects of bladder overdistension other than in anecdotal fashion. Thus, Mayo et al. [18] described a series of four patients with overstretched bladders that occurred during labor and childbirth. They reported frequency, stress incontinence, and the patients were only able to void by straining. One patient, who was in urinary retention for 48 h, with a residual volume of 2500 ml, had an atonic bladder for 3 weeks, but recovered normal voiding

Table 1
Causes of urinary retention

Failure or depression of bladder contraction	Neuraxial local anesthetic [5] Neuraxial or systemic opioids [41–43] Anticholinergic agents Ischemia of parasympathetic nerve endings in the wall of the bladder caused by bladder over distention [19]
Failure of sphincters to relax	Increased sympathetic activity caused by pain, emotion or bladder over distention [50]
Mechanical obstruction to urine out flow	Enlarged prostate gland Child birth Rectal pathology Radiation therapy Instrumenttion
Lack of coordination between bladder contraction and sphincter relaxation	Spinal cord injury or dysfunction [4,51] Neuropathies including diabetes
Failure of sensory input to reach spinal cord or higher brain centers	Spinal cord injury or dysfunction Spinal and epidural anesthesia [5]

function after 2 months. Three others continued to void by straining; two of these received operative repairs, and one eventually required an ilioconduit. In three of these women, bladder biopsies revealed collagen deposition in the intercellular space as described in animals subjected to overdistension [19]. Although overdistension certainly occurred in all these women, other forms of bladder trauma during childbirth could have accentuated or accounted for some of the ensuing bladder dysfunction.

3.4. Repeated episodes of retention

In a report by Tammela et al. [20], it was noted that patients who developed one episode of retention after surgery, were more likely to develop a second episode than patients without an antecedent episode. The authors hypothesized that the first episode may have caused a stretching injury to the bladder that subsequently predisposed to a second episode of retention, re-retention. This relationship was confirmed in two subsequent studies [21,22]. In the latter studies, bladder distension was prevented by overnight catheterization on the night of surgery. Subsequent episodes of overdistension (> 700 ml) and retention were less common when patients had been protected by overnight catheter drainage, as compared to drainage on an as needed basis. At the very least, an initial episode of over distention may serve as a marker identifying patients prone to develop retention.

In a previous study [2], we observed no change in bladder function in 24 patients in whom postoperative bladder volumes exceeded 600 ml for 1–2 h, as compared to patients with lesser maximum volumes in the first 5 days after surgery.

Overall, the existing data suggest that sustained overdistension of the bladder (>3–4 h) is undesirable because it may be associated with temporary alteration of bladder function for days or weeks, and in some instances, may even lead to permanent damage and altered function.

Permanent injury may be manifest by one or more of the following conditions; weak stream, inability to completely empty the bladder leading to frequency and nocturia, the need for multiple, daily bladder catheterizations, or a permanent indwelling catheter.

4. Risk factors for urinary retention

There are numerous factors cited in the literature as predisposing to urinary retention [22–29]; these are outlined in Table 2.

In practical terms, the factors that are most often associated with urinary retention after outpatient surgery include:

(a) Spinal/epidural anesthesia.
(b) Groin hernia repair or rectal surgery.
(c) Urologic surgery.
(d) Previous history of urinary retention.
(e) Underlying neurologic dysfunction.
(f) Excesive fluid administration.

Table 2
Risk factors for urinary retention [22–29]

Surgical procedures and factors	Gynecological Anorectal Urological Inguinal hernia repair Recumbency
Urethral obstruction	Instrumentation Radiation therapy Prostatic enlargement Childbirth
Medical conditions	Preceding history of urinary retention Neurological dysfunction including diabetes Psychological factors
Anesthetic factors	Excessive fluid administration Opioids Anticholinergics Neuraxial blockade

4.1. Surgical procedures

In two previous studies, the incidence of retention in patients undergoing non-pelvic surgery, in the absence of the above risk factors, was very low −0.5% [2,23]. Similarly, the incidence of retention in patients undergoing outpatient gynecologic surgery (transvaginal surgery, or pelvic laparoscopy) was very low (0% of 40 patients). After inguinal hernia repair, the incidence has varied from 14 to 35% [2,30]. In our studies [2,23], where bladder volume was measured by ultrasound, we observed an incidence of 5%, with no incidence of recurrence (re-retention) after a single in–out catheterization in patients undergoing herniorrhaphy. After rectal surgery, reported rates have again varied from 1 to 52% [2,23,28,29] depending on methods of measurement and fluid management. We observed an incidence of urinary retention of 20% when bladder volumes were monitored by ultrasound, with a 25% incidence of re-retention following a single in–out catheterization.

In one study of recumbent patients confined to bed after foot surgery, we observed an 18% incidence of retention both in patients who had analgesia provided by sciatic nerve block, or by systemic opioids. Retention appeared to be related primarily to recumbency, particularly in patients with a history of retention (unpublished observations).

4.2. Pediatric patients

In pediatric patients, urinary retention has been less well studied. Although neuraxial (caudal) anesthesia was previously thought not to affect the ability to void in infants and children, a recent report by Koomen et al. [30] describes two children who developed urinary retention after caudal anesthesia with 0.25% bupivacaine. The diagnosis was made by ultrasound scanning of the bladder and confirmed by bladder drainage. The authors suggested ultrasound would be a useful non-invasive tool for evaluating bladder function in selected

pediatric patients after surgery (caudal anesthesia, hypospadias repair, etc.), and recently ultrasound scanners have been developed specifically for assessing bladder volume in pediatric patients.

4.3. Neuraxial anesthesia

4.3.1. Spinal local anesthesia

The incidence of retention after spinal anesthesia in adults varies considerably, again depending on the method of detection, and the type and dose of local anesthetic. A number of studies confirm that urinary retention is associated with long acting spinal anesthetics such as bupivacaine [5,31,32] and tetracaine [33]. In an elegant study, Kamphuis [5] demonstrated that the micturition reflex took on average 460 min to recover after spinal anesthesia with 10 mg of bupivacaine, compared to 235 min after 100 mg of lidocaine. More recently Breebaat et al. [31] demonstrate the ability to void after spinal anesthesia with 60 mg of lidocaine returned after 245 ± 65 min, 40 min faster than after 10 mg of levobupivacaine or 15 mg of Ropivacaine. Kopacz and colleagues have recently published a series of studies using 2-chloroprocaine as a short-acting local anesthetic for spinal anesthetics. When compared to both bupivacaine [34] and procaine [35] in volunteers, bladder function returned to normal more quickly after 2-chloroporcaine than the other two local anesthetics. Furthermore in an observational study of 122 patients who received 2-chloroprocine spinal anesthesia [36], only five patients had problems voiding postoperatively and of these, four had undergone transurethral surgery and the other underwent a perirectal procedure.

4.3.2. Epidural local anesthesia

Mulroy et al. [32] demonstrated that epidural anesthesia with 2-chloroprociane resulted in more rapid recovery of bladder function than lidocaine. The frequency of catheterization in women undergoing caudal epidural anesthesia for childbirth has also been demonstrated to be increased with longer acting local anesthetics [37].

When the route of neuraxial administration is compared, several studies have demonstrated more rapid resolution of the urinary effects of epidural local anesthetics compared to those of spinal local anesthesia [32,38].

4.4. Opioids and urinary retention

4.4.1. Neuraxial opioids

Urinary retention is well reported after epidural administration of morphine, the incidence varies from 15 to 90%. In some studies the effect is dose related [39,40] although Rawal et al. [41] demonstrated immediate detrusor relaxation and urinary retention lasting between 14 and 16 h in 15 male volunteers who received varying doses of epidural morphine. This study also demonstrated that complete reversal of urinary retention due to epidural morphine could be achieved with 0.8 mg of intravenous naloxone. The effects of intrathecal sufentanil and morphine on bladder function were studied in human male volunteers [42]. A dose-dependant suppression of detrusor contractility and decreased sensation of urge was reported. Recovery from these effects was faster after sufentanil compared to morphine, and was dose dependent.

When fentanyl was added to local anesthetics procaine, lidocaine and bupivacaine for spinal anesthesia, the urinary effects were found to be prolonged [32].

4.4.2. Systemic opioids

Rawal [41] demonstrate that doses of intramuscular or intravenous morphine comparable to epidural opioid doses do not cause urinary retention. Other studies however have shown urodynamic effects due to systemically administered opioids. Malinovsky et al. [43] made cystomanometric measurements in postoperative patients who were given a variety of different opioids. He found that intravenous fentanyl, buprenorphine, morphine and nalbuphine all altered the central control of bladder activity and caused delayed full bladder sensation. Of the opioids studied however, only fentanyl and buprenorphine inhibited detrusor contraction.

4.4.3. Mechanisms of opioid induced urinary retention

The mechanisms of urinary retention following opioid administration, both systemically and neuraxially are multiple and not fully understood [41,43]. The neuraxial effects may occur centrally at the level of the primary micturition center in the pons where opioid receptors are present. Alternatively, the rapid onset of detrusor relaxation also suggests an inhibitory effect of epidural opioids on sacral parasympathetic outflow. It has also been suggested that opioid receptors are present in the bladder in a similar way to the ones demonstrated in the vas deferens and ileum of animals, and that urinary retention is a result of direct action of opioids on bladder opioid receptors [44].

5. The importance of residual volume and voiding by straining

In a study of voiding in patients undergoing spinal anesthesia in our institution [45], bladder volume was monitored in all patients before and after voiding, and all patients were required to void or were catheterized before discharge. Of particular interest and concern was the observation that although some patients reported having voided, the postvoid residual urine volume was still very high (400–700 ml) signifying that the micturition reflex had not really recovered. Patients however, were able to force urine flow by tightening their abdominal muscles (voiding by straining), particularly when they were aware that voiding was a necessary prerequisite to being discharged to home. In such instances, measurements of voided volume (obtained by having patients void into a urine collection receptacle) were very low, and consistent with ultrasound measurements of bladder volume before and after voiding. Patients were unable to sense overdis-

tension when it existed (painless retention); neither were nurses able to correctly estimate bladder volume using traditional methods of palpation, and knowledge of the patient's fluid status, duration of surgery, etc. Similar findings, but slightly less remarkable, were observed in patients undergoing a variety of surgeries under general or local anesthesia (non-neuraxial blocks) [23]. There was an inverse correlation between voided volume and the residual volume. Thus, it was likely that patients who had voided at least 300–400 ml had low residual volume (<200–300 ml), whereas patients who voided less than 300–400 ml tended to have high residual volumes (>300–400 ml). Using a portable ultrasound to scan the bladder provided the only reliable means of determining bladder volume before or after voiding [23]. With spinal anesthesia in particular, the residual volume was often exceedingly high (greater than the normal bladder capacity of 600 ml) even though patients reported having "voided". Discharge of such patients may expose them to the potentially harmful side effects of prolonged overdistension. The likelihood of overdistension appears to be minimized by using short duration drugs for spinal anesthesia [32].

6. Risks of bladder catheterization

The hazards of unnecessary urinary catheterization include; urethral injury (creation of a false passage, stricture formation, prostatitis, hemorrhage), bladder injury and infection [46]. In a recent review of catheter-associated urinary tract infections(CAUTI), Tambyah [47] notes that the most important risk factors for CAUTI are prolonged catheterization, female sex and catheterization outside the sterile environment of the operating room.

Finally, most patients find catheterization, even in–out catheterization both uncomfortable and embarrassing and would prefer to avoid it if possible.

7. Ultrasound measurements of bladder volume

7.1. Validation of ultrasound measurement of bladder volume

A number of studies have demonstrated that ultrasound scanning is superior to other methods of predicting bladder volume, such as palpation, duration of surgery and estimation from the volume fluid administered intraoperatively [2,23,45,48]. In one study [23], fluids administered intraoperatively or duration of surgery had weak but significant correlations with bladder volume at the end of surgery (correlation coefficients of 0.26 and 0.32, respectively). The bladder scan measurements of bladder volume on the other hand, correlated strongly ($r = 0.9$, $p < 0.0001$) with catheterized urine volumes. In the same study patients and nurses were asked to estimate the of urine volume just before voiding. These "guesses" were compared with volume of urine measured by ultrasound and by actual volume voided. Patients and nurses were unable to accurately estimate urine volume in 56 and 46% of cases, respectively [23] (Figs. 2–4).

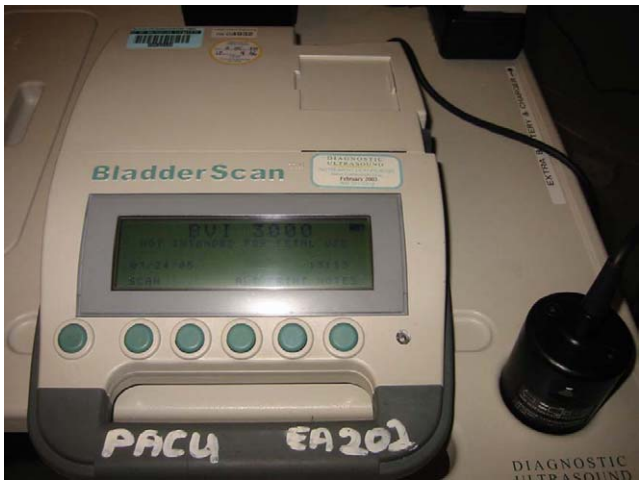

Fig. 2. BladderScan™ BVI 3000 portable bladder ultrasound device.

7.2. Portable ultrasound devices

Portable ultrasound devices are available that permit non-invasive measurement of bladder volume, and in many instances avoid unnecessary bladder catheterization. They may also be used to measure postvoid residual bladder volume to confirm that voiding has been complete.

Nurses can learn to use the ultrasound device after five minutes of bedside instruction [45]. Ultrasound scanners are available in some institutions for use in the postanesthesia care unit (PACU), the emergency room and on the ward to monitor bladder volume. The portable ultrasound scanner is accurate ±20% at bladder volumes of <700 ml, and ±25% at

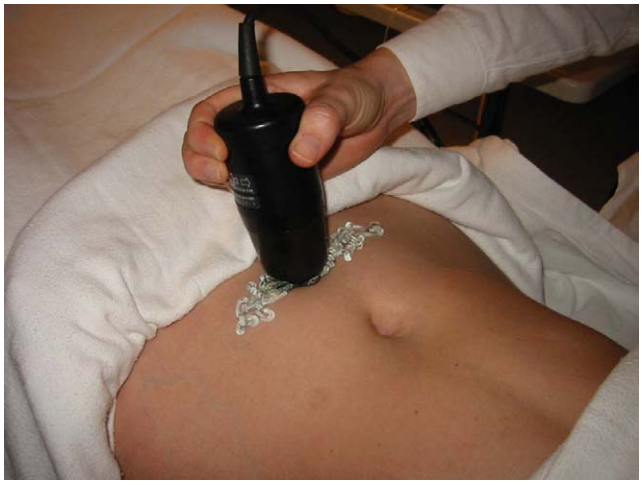

Fig. 3. BladderScan™ BVI 3000. The scanner is gently but firmly moved over the lower abdomen. The scanner may be used for both males and females by selecting the appropriate button during the device set up.

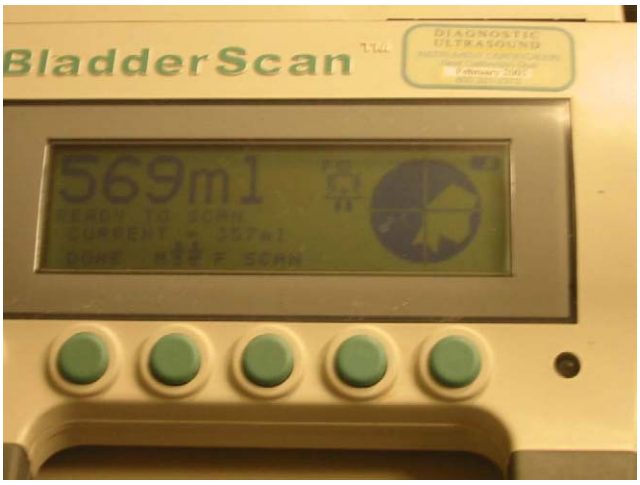

Fig. 4. BladderScan™ BVI 3000. Close up of the screen. The volume bladder is shown on the left and the icon on the right demonstrates a good quality scan because the white area extends across the crosshairs of the dark circle.

volumes >700 ml [49]. It is sufficiently sensitive and accurate enough to detect clinically significant overdistension.

8. Safe management of bladder function after outpatient surgery

There are several studies suggesting that voiding before discharge is unnecessary in outpatients without risk factors for an increased incidence of retention [10,23,32].

8.1. Low-risk of urinary retention

Low-risk patients can be defined as having the following characteristics:

a. General anesthesia, peripheral nerve block or monitored anesthesia care (MAC).
b. Non-pelvic, non-urologic surgery.
c. Most outpatient gynecologic surgeries (transvaginal, or pelvic laparoscopy who undergo intraoperative bladder drainage).
d. Most patients having spinal or epidural anesthesia with short-acting local anesthetics such as lidocaine, procaine or 2-chloroprocaine.

In one study of 242 low-risk patients [2], voiding was not required in patients fit for discharge. There were no subsequent episodes of retention in the 12% who left without voiding or in the remaining 88%. In patients with no other risk factors for urinary retention, who were deliberately administered significant quantities of IV fluids intraoperatively (10 ml/kg), or given anticholinergic drugs or moderate doses of opioids, there were also no incidences of urinary retention. The likelihood of retention approximated zero (one patient requested bladder drainage immediately on arriving in the recovery room with a bladder volume of 600 ml). In another study, only one of 229 low-risk patients requested catheterization because of discomfort at a bladder volume of 420 ml before discharge [23]. Mulroy, as previously described, reported a 1.5% incidence of retention (three out of 201 ambulatory patients) with short-acting neuraxial blocks [32]. However, it should be noted that the bladder volume was monitored by ultrasound in their patients, and patients were only discharged without having voided if the bladder volume was <400 ml at the time of discharge.

8.2. High-risk of urinary retention

High-risk patients can be defined as having:

a. Pelvic surgery (hernia, rectal, penile, urologic).
b. A positive history of retention or spinal cord disease.
c. Spinal or epidural anesthesia with agents of long duration such as bupivacaine, tetracaine and ropivacaine.
d. The use of neuraxial opioids combined with local anesthetics.

Their risk of retention varies from approximately 3–20% [24–26]. Factors that may increase the likelihood of retention, particularly in high-risk patients; include mandatory recumbency, anticholinergics, neuraxial or systemic opioids, high volumes of intravenous or oral fluids.

The following recommendations are made for managing bladder function after ambulatory surgery, based on the information provided above:

1. Request that all patients empty their bladder before surgery.
2. Use short-acting local anesthetic agents such as lidocaine, procaine or 2-chloroprocaine for neuraxial anesthesia.
3. Avoid neuraxially administered opioids and large doses of systemic long acting opioids.
4. Identify patients who are NOT at significant or increased risk of retention, and allow such “low-risk” patients to be discharged without concern for voiding.
5. Identify patients who are at increased risk of retention, and require that such patients either:
   a. Void spontaneously and have a residual volume of <300 ml measured by ultrasound or a voided volume of >300 ml if ultrasound is not available.
   b. Undergo in–out catheterization to empty the bladder completely if unable to void within an hour of otherwise being fit for discharge if ultrasound is not available or if the bladder volume exceeds 500–600 ml for 1 h as measured by ultrasound.
6. Tell all patients (both high and low-risk) to return to a hospital if unable to void in 8–10 h (See Table 3).

It is important that patients and staff appreciate that overdistension for >4 h should be avoided. In Table 3 “critical times” have been calculated based on various predicted bladder volumes at the time of discharge. The critical time is the number of hours to achieve a bladder volume exceeding normal bladder capacity of 600 ml for 4 h calculated for two

Table 3
Predicted times to achieve critical bladder volume of 600 ml for >4 h

Starting residual volume in the bladder (ml)	Critical time in hours to achieve bladder volume of >600 ml for 4 h	
	Urine formation at 50 ml/h	Urine formation at 100 ml/h
0	16	10
100	14	9
200	12	8
300	10	7
400	8	6
500	6	5
600	4	4

rates of urine formation (50 ml/h and 100 ml/h), and with varying residual bladder volumes at the time of discharge. The critical time is conjectured as the limit of "safe time" for a patient to be unable to void after leaving the hospital. It is based on the results of animal studies and may be somewhat conservative.

9. Conclusion

It is important to question the old barriers to efficient recovery and discharge after ambulatory surgery. Thus, the need to void before discharge may obviously be unnecessary in a majority of situations. However, it is important that our interest and attentiveness to potential problems relating to bladder function not be discarded entirely. Rather, the emphasis must change towards educating patients and nursing staff about safer practices, treatment algorithms and modern non-invasive modalities of assessing bladder function.

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Review

Postdischarge nausea and vomiting: A review of current literature

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Abstract

Postoperative nausea and vomiting continues to occur in approximately one-third of patients who have surgery despite newer medications and emerging guidelines for care. There is a paucity of literature that relates to patients who experience postdischarge nausea and vomiting after outpatient surgery. The purpose of this article is to review the current knowledge in the area of postdischarge nausea and vomiting. The findings were that the problems with postdischarge nausea and vomiting (PDNV) have not been as thoroughly assessed and evaluated as nausea and vomiting immediately postsurgery. More research needs to be conducted in this population, as the rate of surgeries performed in this setting will only increase.

Keywords: Postdischarge nausea and vomiting (PDNV); Postoperative nausea and vomiting (PONV); Ambulatory surgery; Postoperative complication

Contents

1. Introduction

Postoperative nausea and vomiting (PONV) is a known complication for patients after surgery and has been called the "big, 'little problem"'[1]. In spite of newer anesthetic agents, antiemetic medications, and considerable research into the subject, one-third of all postoperative patients continue to experience PONV at some point after surgery [2–4]. In a recent study of six interventions for prevention of PONV, the average incidence was 34% [5]. The incidence of PONV in high-risk patients with four determined risk factors can be as high as 70–80% [6].

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Today, approximately 65% of all surgeries are conducted in the outpatient surgery setting [7]. The Federated Ambulatory Surgery Association states that approximately 6 million surgeries are performed yearly in 3300 ambulatory surgery centers [8]. The current healthcare environment requires that patients are quickly and efficiently moved through the system from admission to discharge.

Only a small number of studies are available that specifically examine strategies to reduce PDNV [9]. Much time and effort has been expended in research and publication regarding PONV. However, most of this research was conducted in the postanesthesia care unit (PACU) or in postanesthesia phase II immediately before patient discharge home. There is a paucity of literature that details the problems associated with nausea and vomiting experienced by patients after discharge home. The problems with postdischarge nausea and vomiting (PDNV) have not been as thoroughly assessed and evaluated as PONV immediate postsurgery. When conducting the literature review for this article, using "postdischarge nausea and vomiting" as a keyword elicited only two articles from CINAHL (1982–2004). PubMed delivered 56 articles with the same keyword, but some articles that only had one or two lines applicable to the subject.

To perform the literature search for appropriate articles, the author used the keywords "ambulatory surgery" (933 results), "nausea and vomiting" (948 results), and "postoperative complications" (5749 results). Combining those three keywords in one search resulted in 26 articles. The authors then searched the abstracts for suitable articles. The authors also searched the reference lists in those articles for additional articles. The result was 24 articles that specifically mention nausea and vomiting after discharge home. Of those 24 articles, several had only one to two sentences that were applicable. One of the articles was a systematic review and analysis of postdischarge symptoms, including nausea and vomiting. The purpose of this review is to synthesize a review of the literature that has been published on the subject of postdischarge nausea and vomiting.

2. Postdischarge nausea and vomiting

2.1. Incidence

It is possible that PDNV has been underreported in the past because the symptoms were not identified [10]. Upon discharge, patients are not as accessible to surveillance and care by healthcare workers, which may have contributed to underreporting of these symptoms [11], Carroll et al. [11] found an overall incidence of more than 35% in 211 ambulatory surgery patients who had one of four selected surgeries: laparoscopy, dilation and curettage, arthroscopy, or hernia repair. Interestingly, most of the patients who experienced PDNV in the study had not experienced PONV before discharge. Wu, Berenholtz, Pronovost, and Fleisher found an incidence of postdischarge nausea (PDN) that ranged from 0% to 55% and an incidence of postdischarge emesis (PDV) that ranged from 0% to 16% in a systematic review that evaluated the incidence of reported postdischarge symptoms and included PDNV [12]. In a systematic review of randomized, controlled studies published in the English literature, the authors examined whether routine prophylaxis with antiemetics affected the incidence of PDNV after ambulatory surgery. The overall incidence of PDN was reported as 32.6% (35.7% placebo and 31.2% treatment) and the overall incidence of PDV was 14.7% (19.6% placebo and 12.1% treatment) [13].

2.2. Risk factors

The cause of PONV is multifactorial [10]. Risk factors can be described as related to the patient, the surgical procedure, the anesthesia, and the postoperative period [2]. Apfel et al. developed a risk score to predict the chances a patient would experience PONV. The final score had four predictors: female gender, history of motion sickness or PONV, nonsmoking, and the use of postoperative opioids. If no risk factors were present, the incidence of PONV was 10%. With 1, 2, 3, or 4 risk factors present, the incidences were 21%, 39%, 61%, and 79%, respectively [6].

There are no studies that specifically determine risk factors related to PDNV. Carvalho et al. [14] evaluated the influence of inhalational versus total intravenous anesthesia (TIVA) maintenance on functional recovery and symptom distress after gynecological surgery. No significant differences were found between the two groups with respect to functional recovery, nausea, vomiting or pain. In 1 study of 211 outpatients who had one of four selected surgeries, PDNV was not related to PONV in the immediate postoperative period [11] while in another study 95 healthy, female patients who had PONV immediately after laparoscopic surgery were reported to be four times more likely to experience PDNV [15].

2.3. Consequences

PONV is known to have physiologic consequences as well as an impact on patient satisfaction [3,16–20]. Identified consequences for the postdischarge patient include impaired sleep time due to vomiting [21], drowsiness as a side effect of the rescue antiemetic [15], increased anxiety for parents of pediatric patients [22], a delay in resumption of activities of daily living (ADL) [11,12], and a decision by the patient not to self-administer an analgesic for pain because they believe it is related to the nausea and vomiting [23,24].

2.4. PDNV published information

Pfisterer et al. [25] studied the incidence and impact of PONV before and after discharge following outpatient surgery. A total of 586 patients from nine countries were enrolled in the study. Upon leaving the facility 64 patients experienced PONV, with 29 reporting moderate and 8 reporting severe symptoms. Another 76 patients experienced

PDNV while traveling home. Some patients experienced PDNV 5 days after surgery. There was also an impact on activities of daily living and time lost from work. Of the 129 patients who experienced PDNV, 35% lost time from work or normal activities requiring 21 patients to take one or more days off work and 21 friends and relatives to take time off from work to assist the patient. The authors go on to state that PONV is "either not adequately recognized or treated in hospital and beyond, or that some of the antiemetic agents may be inadequate" [25].

Enever et al. [26] compared postdischarge morbidity after outpatient dental care under general anesthesia between pediatric patients with and without disabilities. Symptoms were similar in both groups and included nausea and vomiting (20%), unexpected drowsiness (13%), and need for pain relief at home (42%). One patient was readmitted for persistent nausea and vomiting. Ernst and Thwaites [27] evaluated postdischarge pain, nausea and vomiting of outpatients undergoing elective surgeries over a 2-month period. The type of surgeries were general surgery, orthopedic, dental, ENT, and gynecology. They discovered that more patients suffered from nausea and vomiting after discharge (33% nausea; 10% vomiting) than before discharge (16% nausea; 6% vomiting). The authors concluded that pain, nausea, and vomiting are persistent problems after discharge and that they increase in incidence after discharge.

Amanor-Boadu and Soyannwo [28] followed pediatric patients from time of discharge to first outpatient visit. They discovered that the most prevalent problem was pain (18.9%), but also discovered that vomiting (12.2%) was a significant finding. These authors did not address nausea in this population. The authors conclude that "concerns for safety and comfort of the patients should extend beyond the recovery room to the ward and home"[28].

Young et al. [29] examined whether enhanced discharge education would make a difference once patients returned home after outpatient surgery. While compiling symptoms that occurred after surgery, the authors discovered that many patients stated they were not feeling hungry, had no interest in food, or felt nauseous during the first 2 days at home. The enhanced teaching package, a procedure-specific patient educational tool, that was implemented had no effect on patient recovery or the patient's ability to self-manage. The authors concluded that the patient's own understanding of self-care affected the recovery more significantly than the enhanced teaching package.

Waterman et al. [30] conducted qualitative research of postoperative pain, nausea, and vomiting after discharge. They discovered that one-third of patients found the pain and nausea worse than they had imagined. They also discovered that some patients are reluctant to take their pain medications because they felt they were related to the nausea. One patient stated, "The first day post-op was awful . . . I had pain but I was reluctant to take painkillers because of nausea"[30]. The authors incorporate recommendations based on their interviews with the patients that include advising patients preoperatively on how to manage nausea and side effects of drugs and deferring discharge for those who have higher levels of pain or who are nauseous.

Kangas-Saarela et al. [31] studied patients' experiences with outpatient surgery. This was a survey of the incidences of pain, nausea, and vomiting and patient satisfaction. Overall, 11.3% of patients surveyed experienced nausea either during recovery, travel home, or after arriving home. The authors believe that the lower than usual incidence of nausea was due to the high number of orthopedic cases who received regional anesthesia during surgery. See Table 1 for a summary of studies.

2.5. Management and treatment

Prevention of PONV and PDNV begins with the anesthesia plan preoperatively. Because only one-third of surgical patients will experience PONV or PDNV, prophylaxis is warranted only in high-risk patients [32]. The decision to give antiemetics should be based on risk factors with a focused plan of care developed to decrease the chances the patient will experience PONV/PDNV, e.g. use of local anesthetics to decrease opioid need or limiting use of neuromuscular agents to avoid reversal agents. There is no one drug that can block all pathways mediating nausea and vomiting. Different classes of drugs are available that affect one or more receptor sites, and alternative treatments for PONV are becoming more common although not yet tested specifically in the PDNV population [2,3,32–34]. Most alternative treatments are completed in conjunction with pharmacologic methods of controlling nausea and vomiting.

One systematic review and three studies were found in which the efficacy of pharmacologic treatment was considered in patients with PDNV. Gupta et al. [13] conducted a systematic review of randomized controlled trials to determine if the routine prophylactic use of antiemetics affected the incidence of PDNV after ambulatory surgery. A total of 815 patient had PDN with an overall incidence of 26% PDN in the treatment group and 40.4% in the placebo group. A significantly lower risk of PDN was discovered with ondansetron 4 mg, dexamethasone 4–10 mg and combination treatment with more than one drug compared to placebo. The overall incidence of PDV was 14.6% in the treatment group and 26.5% in the placebo group. The relative risk was lower with ondansetron 4 mg and combination treatment with two or more drugs than with placebo.

Tang et al. [35] compared ondansetron and droperidol as a prophylactic antiemetic agent for elective outpatient gynecologic procedures. This study was included in the above systematic review. Droperidol 1.25 mg and ondansetron 4 mg significantly reduced the incidence of PDNV when compared to placebo or droperidol 0.625 mg. Parlow et al. [15] assessed the efficacy of prophylactic administration of promethazine for PDNV after ambulatory laparoscopy. An intramuscular injection of either saline or promethazine 0.6 mg/kg was administered to patients immediately prior to discharge

Table 1
Studies addressing PDNV

Reference	Publication year	Study	PDNV	PDN	PDV	Findings
Amanor-Boadu and Soyannwo [28]	1997	Complications after pediatric outpatient surgery			12.2%	Need to continue to trend complications postdischarge to aid in prevention
Carroll et al. [11]	1995	Patient experiences with nausea and vomiting after discharge from outpatient surgery	35%			Significantly more likely to report impairment in daily activities if PDNV present. Little correlation between predischarge NV and PDNV. Few patients called HCP or purchased products to treat NV
Carvalho et al. [14]	2002	Long-term functional recovery: inhalation vs. TIVA		35% (during journey)	10.3% (during journey)	Incidence of PONY similar between two groups (TIVA and inhalation)
Enever et al. [26]	2000	Postoperative morbidity following outpatient dental care under general anesthesia in pediatric patients with and without disabilities	20%			No differences between groups of patients with and without disabilities. N/V most commonly reported symptom
Ernst and Thwaites [27]	1997	Incidence and impact of pain, nausea and vomiting after outpatient surgery		33%	10%	Pain, nausea, vomiting serious and persistent problems postdischarge, increasing in incidence after discharge
Fetzer et al. [24]	2005	Self-care activities for PDNV required for inclusion in study	PDNV required for inclusion in study			Few patients contacted their HCP. Significant number of patients believed PDNV due to analgesics and therefore did not self-administer analgesics
Grenier et al. [22] one of three	1998	Quality at home of pediatric patients after outpatient surgery			9%	PDV and agitation was one of three main causes for anxiety by parents
Gupta et al. [13]	2003	Routine prophylactic use of antiemetics on incidence of PDNV after ambulatory surgery		32.6%	14.7%	Prophylactic treatment with ondansetron 4 mg or combination with two drugs produced significant decrease in PDNV
Kangas-Saarela et al. [31]	1999	Patients' experiences of outpatient surgery		6%		Decreased incidence of PDN probably due to high number of patients in study who received regional anesthesia
Kokinsky et al. [21]	1999	Postoperative comfort after pediatric outpatient surgery	20%			Incidence of PDNV significantly higher in those patients given intraoperative opioid (fentanyl)
Parlow et al. [15]	1999	PDNV after ambulatory laparoscopy is not reduced by promethazine prophylaxis		48%	17%	Patients requiring an antiemetic in PACU are at higher risk for PDNV. Prophylactic promethazine IM before discharge did not reduce the incidence of PDNV
Pfisterer et al. [25]	2001	An international study of PONV in outpatient surgery	21.4% (prophylactic antiemetic) 19.2% (no prophylactic antiemetic)			Some patients reported N/V up to 5 days after surgery. Inadequate control of PDNV remains a problem
Tang et al. [35]	1996	Comparison of ondanstron and droperidol for antiemetic prophylaxis in outpatient gynaecological procedures		68% (P), 57% (D), 41% (D2), 32% (O)	52% (P), 27% (D), 15% (D2), 14% (O)	Incidence of emesis and need for rescue significantly lower with both droperidol and ondansetron groups
Waterman et al. [30]	1999	Postoperative pain, nausea, and vomiting—a qualitative perspective				One-third of the group (55) reported pain and nausea worse than imagined

Watt-Watson et al. [23]	2004	Pain management following discharge after outpatient surgery		14%		Patients stopped taking analgesics despite considerable pain due to side effects of constipation or nausea
Wright et al [36]	1999	Efficacy of promethazine suppositories for home use after outpatient surgery	55%			Promethazine suppositories well-tolerated; used by 89% of patients with access. All patients who used reported decrease in nausea
Wu et al. [12]	2002	Systematic review and analysis of postdischarge symptoms after outpatient surgery		0–55%	0–16%	Postdischarge symptoms may be significant factor in patient's resumption of normal activities patient recovery. Need further studies to determine impact
Young et al [29]	2000	Does enhanced discharge instruction make a difference after outpatient surgery		13–16% (Day 1), 7–9% (Day 4)		Majority of patients did not experience problems with recovery at home. Patients needed carer assistance for average of 3 days. The enhanced teaching package made no difference

home. There was no difference between the placebo group and treatment group regarding the incidence of PDNV. The incidence of "excessive drowsiness" was notably higher in those patients who had received promethazine ($P = 0.008$).

Wright et al. [36] evaluated the effectiveness of promethazine suppositories in decreasing nausea and vomiting in adult outpatients following discharge home. Patients who had a prolonged stay in PACU due to PONV, developed PONV after the IV was discontinued, or had a long car trip home were given two promethazine suppositories (25 mg each) upon discharge. A high percentage of the patients who had PDNV used the suppositories. All patients who used the suppositories stated that their PDNV improved after use, and no significant side effects were reported. Promethazine suppositories were determined to be clinically, as well as, cost effective.

2.6. Guidelines for determining prevention and treatment

There were five algorithms published for the care and treatment of PONV. Gan [10] lists patient and surgical risk factors and advises avoidance of those risk factors. The algorithm is specific for prophylactic antiemetic therapy and lists options for mild to moderate risk (1–2 factors), moderate to high risk (3–4 factors) or very high risk (>4 factors). The author believes that a multimodal approach to prevention of PONV should be adopted that includes identification of preoperative risk factors, reduction of avoidable risk factors, and use of combination antiemetics. The guideline is based on the 45 references, a mixture of clinical and research, included in the article.

Watcha [4] identified guidelines for prophylaxis and therapy of PONV. Patients were divided into four groups based on estimated risk: low risk (<10%), mild to moderate risk (10–30%), high risk (30–60%), and extremely high risk (>60%). This guideline lists suggested prophylaxis, as well as, suggested rescue antiemetics. The references for the guideline are two editorials published by White and Watcha [37,38]. One discusses the use of meta-analysis in improving an understanding of treatment of PONV, and the other includes recommendations on prophylaxis of high-risk patients based on several studies referenced in the editorial.

Gan et al. [39], in a consensus guideline, listed an algorithm for management of PONV. The algorithm begins with evaluation of risk and divides patients into low, moderate or high-risk groups. This algorithm does suggest consideration of nonpharmacologic therapies, consideration of regional anesthesia, and reduction of baseline risk factors, as well as, antiemetics alone or in combination for treatment. This group of experts considered an evidence rating scale that was based on study design and also considered strength of recommendation based on expert opinion. The panel consisted of 10 physicians, 1 pharmacist, and 1 certified registered nurse anesthetist. Notably missing from the panel were expert perianesthesia registered nurses. There has been concern voiced in the literature about the make-up and selection

of the expert panel and the fact that the panel was funded by a pharmaceutical company [40,41]. Others considered it important that for the first time, an international expert panel attempted to determine a guideline based on evidence-based strategies [20].

Tramer [20] describes a possible decision tree for PONV prophylaxis. Patients are identified as positive or negative for risk. If patients are positive for risk factors, the decision tree suggests keeping baseline risk low and describes a prophylactic antiemetic cocktail. Tramer recognizes the difficulty in defining what "high-risk" actually means and assuring that the appropriate patients are identified. Tramer further discusses the need for evidence concerning the efficacy of therapeutic antiemetic cocktails. He believes that trials are needed to determine the best rescue treatment for patients who continue to vomit after surgery and that minimal effective doses are unknown. Tramer's premise is that more research is needed for dissemination of best practices and implementation of evidenced-based guidelines.

Golembiewski and O'Brien [33] illustrate the most extensive algorithm that covers the immediate perioperative period. It begins with assessment of risk factors in the preoperative period. Patients are divided into mild to moderate risk (1–2 factors), moderate to high risk (3–4 factors), or very high risk (>4 factors). For all groups there is consideration of intraoperative and postoperative factors that can decrease the incidence of PONV or treat PONV should it occur, and then suggests rescue antiemetics. The algorithm is based on nine references; two that discuss systematic reviews of the literature.

None of the algorithms, guidelines, or decision trees attempts to guide management of nausea and vomiting in the postdischarge phase of patient care. Two of the algorithms address prophylactic antiemetic therapy only. Even those algorithms that discuss postoperative care are specific to the immediate postanesthesia phase of care. The only guidelines based on an evidence rating scale were those from Gan et al. [39].

2.7. Future implications

Very little research has been conducted specifically regarding PDNV. We do know that postdischarge symptoms, including PDNV, can affect patient recovery and resumption of normal activities. We do not know how those symptoms impact the recovery, how extensive the delay in recovery remains, or the costs attributable to these symptoms [12].

Pfisterer et al. [25] suggest the need to consider risk factors when using antiemetics for outpatients. The authors also suggest that future studies should compare the use and effectiveness of older antiemetics with newer antiemetics. They state that the newer antiemetics seem to result in less impact on postdischarge activity (due to less drowsiness or other side effects.) Other authors [10] suggest that study of the neurokinin 1 (NK-1) receptor antagonists may hold hope for the future in terms of preventing or limiting PDNV. Further suggestions for research include creation of valid and reliable instruments to collect information on postdischarge symptoms [12].

Carroll et al. [11] found that patients who experienced PDNV were more likely to report delay and inability to perform their normal daily activities. The authors also discovered that patients usually did not call the health professional or purchase products to treat the problem. Fetzer et al. [24] discovered that only 7 of 190 subjects who experienced PDNV contacted a health care provider for PDNV symptoms. These authors discovered that patients' most common response to PDNV was to stop the pain medication, even though pain can contribute to nausea and vomiting.

One practice implication would be to provide education for patients including more detailed instructions for managing the PDNV episodes [11]. The patient's ability to self-manage should be considered because Young et al. [29] discovered that the ability to self-manage was related to the patient's understanding of self-care. Fetzer et al. [24] call for an antiemetic algorithm for patients to use upon discharge home. This algorithm would take other algorithms one step further by adding the period of time that patients are recovering at home. This algorithm would also need to be written in lay-terms, easy to understand and follow. Instructions for patients' home care could also include suggestions for complementary therapy. Further research is needed to validate the usefulness of complementary therapies at home for PDNV.

The economic impact of postdischarge symptoms, including PDNV, is not known [12]. Research implications include studying the economic impact of PDNV on delays in resumption of normal activities and examining cost-effectiveness, cost-benefit, cost utility, as well as, direct and indirect costs. These costs include not only the costs of unplanned hospital admission or increased rescue medication, but also delays in return to work, time that must be taken off, not only by the patient, but by the caregiver [12].

3. Conclusion

In conclusion, PDNV continues to be a problem for at least one-third of patients after return home. More research needs to be conducted in this arena as the rate of surgeries in the outpatient setting is only going to rise. Suggestions for study include antiemetic efficacy in the postdischarge setting, the effectiveness of a detailed education program for these patients, and economic impact.

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