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Editorial

With this issue, *Ambulatory Surgery* enters its third year of publication. Since its launch in 1993, the journal has established itself as a multidisciplinary forum addressing not only a broad range of clinical issues, but also topics fundamental to the management and development of modern ambulatory surgery worldwide.

Both the authorship of the papers published and the growing readership of the journal reflect the developing interchange of ideas and experience between the various national associations and groupings that have been formed as ambulatory surgery and day care have developed over the last 25 years.

This internationalisation is now recognised with the formation, this March, on the occasion of the 1st International and 3rd European Congress on Ambulatory Surgery in Brussels, of the International Association for Ambulatory Surgery.

The Association has taken as its objectives:

- To provide an international multidisciplinary forum for the interchange of information and advancement of ambulatory surgery.
- To encourage the development and expansion of ambulatory surgery.
- To promote education and high quality ambulatory surgery.
- To promote research into ambulatory surgery and disseminate the results of this research.
- To provide a data bank of information.
- To establish guidelines.
- To act as an advisory board to interested parties for development and maintenance of high standards of patient care in ambulatory surgery facilities.
- To organise meetings and seminars.
- To establish close relationships with other societies concerned by ambulatory surgery.
- To stimulate the development of national societies of ambulatory surgery.

The founding full members of the IAAS are:

Association for Ambulatory Surgery (Germany)
Belgium Association of Day Surgery
British Association of Day Surgery
Day Clinic Association (South Africa)
Dutch Association of Day Care and Short Stay
French Association of Ambulatory Surgery
National Day Surgery Association (Australia)
National Multidisciplinary Working Group for the Diffusion of Day Surgery (Italy)
Spanish Association of Major Ambulatory Surgery.

The Swedish Association of Day Surgery and the Swiss Association of Surgery are founding associate members.

The Federated Ambulatory Surgery Association (USA) and the Society for Ambulatory Anaesthesia were both represented at the discussions prior to the formation of the IAAS but have yet to formally affiliate.

Ambulatory Surgery has been adopted as the official journal of the Association, and will not only reflect the scientific endeavours of the new organisation but also act as a vehicle for the exchange of news and activities of the member groups.

Paul Jarrett

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Hair-follicle obstruction – hidradenitis suppurativa and pilondal cyst: clinical features and histological picture

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In this prospective study, 50 consecutive patients with hidradenitis (HS) and/or pilonidal cyst were reviewed. The patients were questioned about predisposing factors and at operation biopsies were taken and examined for apocrine glands with or without inflammation. Fifty-two per cent of the patients had acne, 25–33% had previously been treated for HS in the same or another region. Only 62% of the patients had apocrine glands at microscopy, with abscess in 33% of cases, which did not affect the healing of the wound. We concluded that HS is a recurrent disease with typical clinical features, however, it was felt that the name 'hidradenitis' was inadequate and should probably be substituted with 'obstructed hair-follicle'.

Key words: Hidradenitis suppurativa, cystis pilonidalis, histopathology, treatment

Introduction

Hidradenitis suppurativa (HS) is a recurrent disease, initially described by Velpeau in 1839[1]. The aetiology of HS is unknown, but several predisposing factors and associated conditions are seen[2]. The clinical features have been shown not always to correspond with a clear-cut histological picture; e.g. furunculosis and inflamed atheroma are often included in the differential diagnosis. The aim of this study was to relate the clinical and histological picture of HS, as this could be important both for the initial treatment and for the prevention of HS. As some authors include pilonidal cysts in the disease complex[3] and many patients suffer from both HS and pilonidal cysts, with or without inflammation, we have chosen to include both groups of patients.

Materials and methods

This prospective study included 50 consecutive patients submitted to our specialist centre, with HS and pilonidal cysts, from 1st August, 1989 to 1st May, 1993. All were treated on an outpatient basis with excision and in most cases primary closure of the wound, and all were seen 1 week later. From all abscesses and pilonidal cysts, tissue was sent for histopathological examination in order to demonstrate apocrine glands and inflammation of surrounding tissue[4]. No bacterial culture was made, nor was any kind of antibiotic used.

The patients were interviewed in order to discover any predisposing factors such as inheritance, relation to pregnancy, influence of oral contraceptives (OCs) and other associated conditions.

The clinical features were compared to the histological pattern and the results of treatment were evaluated in relation to the presence of apocrine glands, i.e. if a genuine hidradenitis was found.

The biopsy specimens were fixed immediately in formaldehyde and histopathological examination was made after HE staining (haematoxylin-eosin). The presence of apocrine glands was noted, as was infiltration of leucocytes and signs of abscess.

Results

After informed consent, 50 patients participated in the study; 14 men (28%), (median age 35.5 yr, range 22–68 yr) and 36 women (72%), (median age 29 yr, range 16–63 yr). Six patients (all female) had recurrent disease during the observation period.

The affected areas in the patient material are shown in Table 1. As far as pilonidal cysts were concerned, the male:female ratio was 5:2. Fifty-eight biopsies were examined from the 50 patients; in 31 cases (62%) apocrine glands were found at microscopy. In only half of these, abscess of inflammation was verified.

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Table 1. Location of the disease in 50 patients presenting with HS ± pilonidal cyst

	Men		*Women*	
Regio anogenitalis				
Pilonidal cysts (± inf)	5		2	
Nates	1		5	(3 ptt)
Perineum	1		–	
Scrotum, labiae, mons pubis	3		5	(2 ptt)
Regio axillaris	2		11	
Right side		10 (8 ptt)		
Left side		4		
Bilateral		1		
Regio genitofemoralis	2		18	
Right side		14 (13 ptt)		
Left side		6		
Bilateral		1		

Forty-five patients (90%) were treated with excision of the afflicted area and primary suture. Ten per cent of the patients had recurrence of disease and large abscess areas and were treated with excision, but without closure of the wound. All wounds healed after less than 14 days. The five patients whose wounds were treated with excision only all had hidradenitis previously, either at the same location or in another region. All five had apocrine glands revealed on histopathological examination, but only two of them had signs of abscess on microscopic examination.

Eighteen per cent of the patients had neither family history of HS nor recurrence of the disease. Sixteen per cent had only experienced acne without concomitant HS. Forty-eight per cent of the women had been on OCs for between 2 and 10 yr without effect on the disease. None had been given high-dose oestrogen combination pills. One patient had her first occurrence of HS in the genito-femoral region during pregnancy.

Fifty-two per cent of the patients had present or earlier acne, 24% had earlier had axillary HS, 38% had had HS in the genitofemoral region and 32% had either had pilonidal cyst or HS in the perineum (Table 2).

Table 2. Predisposing factors to HS and pilonidal cyst

Patients with	*AX*	*GF*	*PIL*	*n*	%
n	13	20	17	50	100
Predisposing factors	3	3	1	7	14
Acne	9	9	8	26	52
Recurrent AX	6	3	3	12	24
Recurrent GF	5	10	4	19	38
Recurrent PIL	2	5	9	16	32
No predisposing factors or recurrent HS/PIL	1	8	3	9	18
Acne only	2	3	3	8	16
OC	5	9	1	15	48

AX, Axillary hidradenitis; GF, hidradenitis in the genitofemoral region; PIL, pilonidal cyst/HS in the perineum; OC, oral contraceptives.

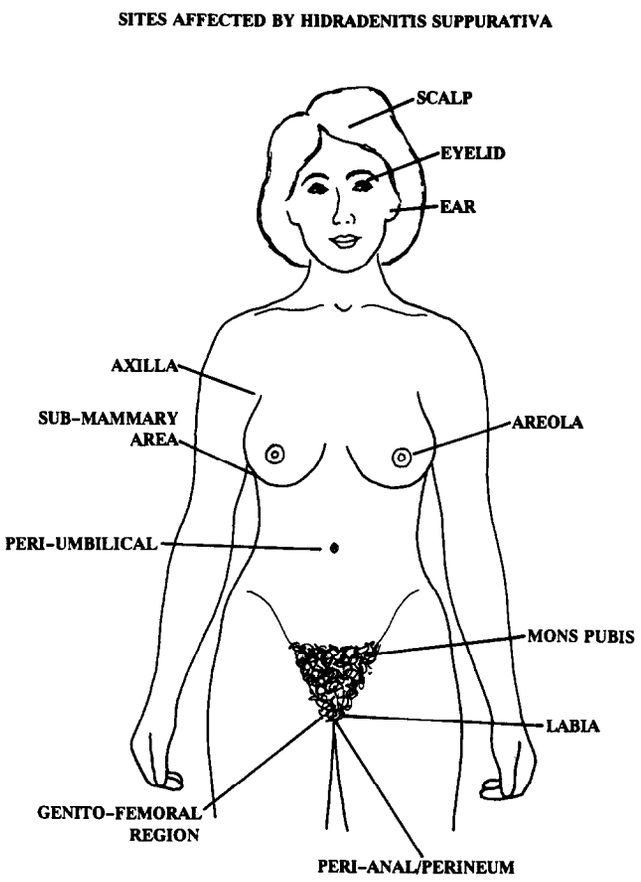

Figure 1. Distribution of apocrine glands

Discussion

The most frequent locations for HS are the axillae, anogenital region and under the breasts (Figure 1). Women are more likely to be affected than men (13:5)[5]. The disease often starts during puberty and may present itself as either acute or chronic. The origin is a hair-follicle adnex with apocrine glands (Figure 2)[6]. The differential diagnoses are furunculosis and inflamed atheroma; tuberculosis (TB) and actinomycosis are also seen but less frequently[7]. Several associated conditions are often seen in connection with HS. Endocrine factors – many patients improve during pregnancy and worsen in the puerperium. Changes in the bleeding pattern such as shorter intermenstrual periods and menorrhagia are seen[8] and often an eruption of the disease is seen just before menstruation[5]. Comedones (especially behind the ears) are seen in connection with HS[9] and an 'obstructed follicle-triad' has been described. This includes HS, acne conglobata and perifolliculitis capitis abscendens et suffodiens[4]. Eunuchs neither develop HS nor acne, which supports the theory of an endocrine cause[7]. Furthermore it has been demonstrated that women with acne have an increased amount of androgens in their blood[10]. Stellon et al.[11] reported on seven women with HS who used OCs. Some of the women got better when they were put on OCs with a higher oestrogen/progesterone ratio. Jemec[8] felt that the disease is seen in predisposed persons and Fitzsimmons[12] disclosed autosomal dominant inheritance in some families with HS. Twelve cases of squamous cell

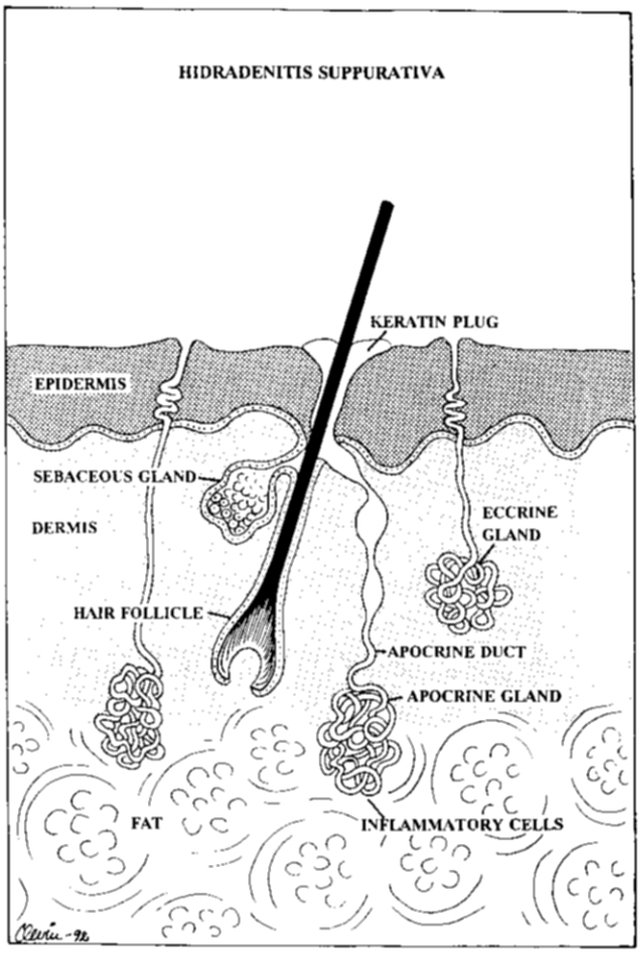

Figure 2. Hidradenitis suppurativa – pathogenesis

carcinoma in patients with chronic HS have been described[13]. Obesity and diabetes mellitus (DM) may be mentioned as associated metabolic factors[7]; although no significant connection has been disclosed between DM and HS. O'Loughlin reported findings in which 22% of the patients had impaired glucose tolerance[14]. Mechanical and chemical factors such as shaving and ointments for hair removal may also provoke HS. Diarrhoea and chronic salpingitis are infections commonly seen in connection with HS. The congenital factor is where pilonidal cysts occur as part of the 'obstructed follicle triad'[3]. Franckowiak et al.[15] have thoroughly described the aetiology and pathogenesis of the pilonidal cyst. Pilonidal cysts are more frequently seen in men in their twenties (3 : 1). Strangely enough, the disease is not seen in Asians. The microbe most frequently found in bacterial cultures from HS is *Staphylococcus aureus*[16]. A recent publication has demonstrated that in perineal HS, *Streptococcus milleri* was the most common pathogen[17]. Shelley et al.[18], concluded that a bacterial infection in an obstructed apocrine gland is a prerequisite for the development of HS. They made a study in young men who had one axilla shaved and plastered for a week. Three out of 12 developed clinically and histologically verified HS. The microscopic picture was dominated by nonspecific, acute as well as chronic inflammation, not always including the apocrine glands. Often, concomitant epidermal cysts, 'atheroma' are seen[19]. The description 'HS' is often looked upon as a misnomer, as the disease in reality is a deep folliculitis which only secondarily involves the glands[3,4].

The treatment of HS varies depending on whether a single abscess is found[20], where the roof is excised under local anaesthesia and the wound is treated openly afterwards, or if several abscesses are present, eventually occupying most of the axilla. For example, some authors recommend surgical excision of the whole afflicted area and later transplantation of skin[7], whereas others laser evaporate the area until no more pus is seen[21]. A new method for surgical treatment of HS in the perineum has recently been described by Brown[22] as a 'deroofing' procedure, where the top of the abscess is extirpated, while the bottom is left to achieve renewal of the epithelium.

In our study, 90% of the patients had the afflicted area excised, the wound was closed primarily and rapid healing was achieved. In 10% of the cases, we chose to treat the wound unsutured, partly due to the family history and partly because of the size of the affected area. The wounds also healed rapidly in these cases. All these patients had apocrine glands at histopathological examination but only two of the five patients had regular abscess formation.

That HS is a recurrent disease is shown by the fact that in our study between 25% and 33% of the patients had earlier experienced eruption of disease, either in the same place or in a totally different location. Furthermore, more than 50% of the patients had acne as part of the disease feature, but only one patient had diabetes mellitus.

Conclusion

Hidradenitis suppurativa is a clinical diagnosis which is used concerning inflammation, most frequently in the axillae, the genitofemoral region, or the perineal area. Apocrine glands were only present in 62% of the patients at histopathological examination and regular abscess formation was seen in only 33% of these cases. As the clinical and histological diagnoses are not always congruent, it would be more correct to name the disease 'hair follicle obstruction'. The condition of the apocrine glands has no effect on the healing of the wounds. Recurrences healed as rapidly as the first time cases.

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Experience with varicose vein surgery in a day surgical centre

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The Vascular Surgery Department at the Royal North Shore Hospital commenced a day-only surgery programme to expedite the treatment of patients with varicose veins and to reduce the waiting list for these procedures. The aim was also to assess the efficacy of the Day Surgery Centre (DSC) in reducing the waiting list for varicose vein surgery and to evaluate the acceptability of day only surgery, and the results of that surgery, for both surgeon and patient. We conducted a retrospective review of 73 patients who had had varicose vein surgery in the DSC since its use by the vascular unit in January 1992. The operations were performed by a consultant vascular surgeon or fellow in vascular surgery. The patients were reviewed at 1 and 6 weeks postoperatively. Seventy-three patients had their operations in the DSC, 16 of these patients had intercurrent medical illnesses. The surgical procedures took a median of 73 min and the median postoperative time until readiness for discharge was 159 min. All patients were able to be discharged on the day of surgery. At follow-up 20 patients had some postoperative difficulty. Seventy percent of the patients with cosmesis as a presenting symptom failed to attend the routine follow-up appointments. The increase in the DSC utilization rate from 23% in the first 12 months to 60% in the last 12 months of the study reduced the waiting list time from 300 days in 1992 to 68 days in 1994. This median decrease of 7.8 months is significant (95% confidence limits 3.7–12.5 months). The subgroup of patients who failed to attend the routine follow-up appointments emphasizes the psychosocial, as well as the physical, aspects of the surgical problems of varicose vein sufferers in the community. This experience demonstrates that varicose vein surgery in the DSC is a safe and efficacious approach to the modern management of varicose veins, and since its introduction has resulted in a significant reduction in the waiting list for this surgery.

Key words: Varicose veins, ambulatory surgery, waiting list, anaesthesia, complications, deep venous thrombosis

Introduction

Rationing of healthcare resources and the emergence of hospital management tools such as diagnostic related groups (DRGs) have encouraged hospitals to develop more cost-effective approaches to the management of common surgical problems. Outpatient and day-only surgery have had an exponential growth over the last 10 yr. The range of procedures and patient selection criteria is expanding. Currently, in North America, over 50% of elective surgery is performed on an outpatient basis. Healthcare funds have continued to encourage hospitals to provide short-stay facilities wherever possible[1]. The treatment of varicose veins in a day surgery unit has been demonstrated to be a safe and acceptable procedure. Patients and their families have readily adapted to the concept of a short-stay procedure and prefer to avoid hospitalization if at all possible[3,4,9].

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Patients with venous disease tend to be disproportionately represented on vascular surgery waiting lists because they have previously required admission to the same long-stay beds as patients with critical arterial disease. In an attempt to overcome this problem, the Vascular Surgery Department at the Royal North Shore Hospital (RNSH) in 1992 commenced a day-only surgery programme to perform varicose vein surgery in the free-standing Day Surgery Centre (DSC) on the hospital campus. The initial 29 month experience forms the basis for this report.

Methods

A retrospective review of the vascular registry and hospital inpatient case records from January 1992 to May 1994 identified 157 patients who had undergone varicose vein surgery at RNSH. A subgroup of 73 patients had their operation in the DSC. This group constitutes the cohort for this report.

In the DSC there were 76 varicose vein operations performed on 83 legs. Seven patients had a bilateral

procedure at the same admission while three patients underwent surgery on the contralateral leg at a second separate procedure. Fifty-one patients (51 out of 73) were female. The mean age was 43 yr (range 20–78 yr).

Patients referred by their family doctor were assessed at the vascular surgery outpatient clinic or in the consultant's rooms. Following an initial clinical assessment all patients considered suitable for surgery had a venous duplex scan performed and their suitability for day-only surgery was also assessed. This assessment was made in conjunction with the patient considering their health profile, the type of support available in the home environment and the extent of their venous disease.

Patients requiring extensive surgery (e.g. bilateral long and short saphenous procedures, gross varicose disease) or where surgery was felt likely to be in excess of 90 min, were considered to be unsuitable for day-only surgery. Similarly, if there were major medical comorbidities, such as patients on anticoagulation, significant major organ failure, or receiving complex hormonal or steroid therapy, the patient was not considered suitable for day-only surgery.

Analysis

Only data from the first operation (n = 73) for each patient has been included in the analysis of waiting list times, operative times and any potential difficulties associated with the DSC. Data from all 83 legs was used in the analysis of the surgical complications. For the purposes of statistical analysis all data was treated as non-parametric. Confidence intervals for differences between medians were determined by the Wilcoxon rank sum test.

Comorbidity

Patients who had significant intercurrent problems, such as diabetes mellitus, steroid dependent asthma, or significant hypertension underwent an anaesthetic review before a final decision concerning day-only surgery was made. Sixteen out of 73 patients (22%) who underwent day-only surgery had a significant but stable comorbidity (Table 1). In 1992, 23% (11 out of 48) of the total varicose vein patients were considered suitable candidates for the DSC; by the end of 1993, this cohort had increased to 60% (45 out of 73).

Table 1. Sixteen patients with significant but stable co-morbidity

Co-morbidity	n
Hypertension	4
Obesity	2
Asthma (requiring regular bronchodilators)	4
Maintenance thyroxine	2
IDDM*	1
Hydrocephalus	1
LLI†	1
Recent alcohol abuse	1

*Insulin dependent diabetes mellitus.
†Lower limb ischaemia

There was a significant incidence of concurrent hormonal manipulation therapy in women. The oral contraceptive pill was used by 35% (12 out of 34) of the premenopausal group. In women aged 50–70 yr, 50% (8 out of 16) were using oestrogens as part of their hormonal replacement therapy. Women receiving hormonal therapy were required to cease this medication 1 month prior to surgery.

Symptoms and signs

Seventy-two patients had symptomatic varicose veins (Table 2). Eighteen patients had signs of chronic venous insufficiency or superficial thrombophlebitis. No patient with superficial thrombophlebitis had ultrasound evidence of an underlying deep venous thrombosis. In the other 55 patients the commonest symptoms were pain or ache. In addition, 31% (17 out of 55) of this group were worried by the cosmetic appearance of the veins. Only one patient underwent surgery solely for the appearance of the veins.

Operation performed

The operation performed (Table 3) was determined by physical examination in conjunction with the venous duplex results. Patients requiring distal avulsions only in the contralateral leg, underwent combined bilateral

Table 2. Seventy-two patients with symptomatic varicose veins

Symptoms (worse leg) (n = 73)			
Patients without clinically manifest CVI*	55	Patients with clinically manifest CVI or thrombophlebitis	18
Pain or ache	51	Superficial thrombophlebitis	8
Swelling or heaviness	17	Pain or ache	5
Cosmesis†	21	Ulceration	3
		Lipodermatosclerosis	2
		Pigmentation only	5
		Swelling or heaviness	0
		Cosmesis	0

*Chronic venous insufficiency.
† One patient complained of cosmetic appearances only, 32 patients complained of multiple symptoms.

Table 3. Type of surgery

Site of first operation performed (73 patients)	
Long saphenous and avulsions	37
Long saphenous and avulsions plus perforator ligation	22
Short and long saphenous plus avulsions	5
Short saphenous only	2
Avulsions only	4*
Avulsions plus perforator ligation	3

*Plus seven performed on the contralateral side during the same procedure.

procedures (n = 7). Those patients requiring high ligation and stripping in the contralateral leg underwent a second separate procedure.

DSC procedure

Patients were admitted for either a morning or afternoon list and would arrive at the DSC 90 min before their operation to allow admission formalities to be completed, as well as review by the nursing, anaesthetic and surgical teams. The patient was re-examined by the surgeon and the veins requiring avulsion were marked with an indelible pen. Patients with incompetent perforator veins were re-examined with duplex scanning in the vascular laboratory on the day of surgery, and the level of the perforator marked, before attending the DSC.

The ambulatory patient was escorted into the operating theatre where a general anaesthetic was administered. The patient received no premedication and underwent induction of anaesthesia with propofol and a short-acting narcotic. Ventilation was spontaneous with a volatile agent, except for the seven patients who underwent surgery in the prone position, who were intubated and ventilated after administration of a muscle relaxant. All patients received intravenous fluids and an intramuscular non-steroidal analgesic during surgery.

Postoperatively the patient was transferred to the recovery ward and later discharged into the care of a responsible adult. On discharge, an appointment was made for the patient to be reviewed in the outpatient department or in the consultant's rooms in 1 week. Three days supply of an oral analgesic and a prescription for a further course of analgesia were given to the patient. The instructions given preoperatively concerning analgesia, wound care, aspirin, early mobilization and a follow-up appointment were reinforced, both verbally and with a written instruction sheet. Contact 'phone numbers to call the surgeon at the hospital, if there were any problems, and follow-up appointment details were included on the instruction sheet.

Deep venous thrombosis (DVT) prophylaxis

Female patients receiving hormonal manipulation were requested to cease this treatment 6 weeks before surgery. On admission to the DSC, all patients received 5000 IU heparin subcutaneously, as part of their DVT prophylaxis, and were instructed to take 150 mg aspirin a day, until the first postoperative visit at 1 week. Early postoperative ambulation was encouraged.

Results

The median operating time was 73 min (range 40–135). The median postoperative recovery time was 159 min (range 147–167 min) at which stage patients were ready for discharge. Two patients remained in the DSC waiting room after formal discharge until their transport arrived. All patients were able to leave the DSC at the conclusion of the recovery period and no patient required re-admission within the following 24 h. One patient contacted the surgeon by 'phone for advice concerning postoperative pain, but did not require an unscheduled appointment.

At the 1 week follow-up appointment 20 patients were recorded as having some postoperative difficulty. Seven patients had a small haematoma related to the course of the long saphenous vein or the groin incision, while 12 were concerned about bruising or induration. None of these findings were clinically significant. The patients were reassured, encouraged to wear surgical support stockings and given some hyaluronidase cream for symptomatic relief. These symptoms had all resolved by the 6 week review and none required surgical intervention. Three patients had inflamed wounds that were treated with antibiotics. No frank sepsis was recorded. No positive microbiology cultures were recorded. One patient, who had undergone short saphenous vein surgery, complained of paraesthesia in the distribution of the sural nerve, but this had resolved by the 6 week review. Five patients required repeat appointments for injection sclerotherapy of residual veins or telangiectasia as part of their treatment programme.

One patient, a 58-yr-old female receiving hormonal replacement therapy, was admitted to hospital on postoperative day 10 with pleuritic chest pain. This patient had a saphenofemoral ligation with stripping of the long saphenous vein to the level of the knee and multiple avulsion phlebectomies of her lower leg varices. The repeat venous duplex study demonstrated fresh thrombus in the peroneal veins and behind the valve cusps of the popliteal vein. The technecium^{99} ventilation-perfusion scintogram was normal. After initial treatment with intravenous heparin, this patient was discharged on maintenance warfarin for 6 months.

Four patients (7%) failed to attend any postoperative follow-up, while 23 (32%) failed to attend the 6 week appointment. Fifty per cent (2 out of 4) of the patients who failed to attend any follow-up visit and 70% (16 out of 23) of the patients who failed to attend the second follow-up visit were single women who had stated that cosmesis was a major reason for their initial referral.

Day surgery utilization rates and alteration in waiting list times

The utilization rate of the day surgery facility, for suitable patients for varicose vein surgery, changed from 23% of the potential patient group in the early part of our experience, to 60% towards the end of the study period. The advent of the day-only programme has shortened the median waiting period for varicose vein surgery from 300–68 days. This reduction of 7.8 months is highly significant (95% confidence limits 3.7–12.5 months).

Discussion

The advent of day-only surgery for varicose veins has coincided with a change in the surgical approach to varicose veins, which facilitates this transition to the DSC[5]. This approach is characterized by a reduction in the number of patients who require inpatient care, changes in anaesthetic practices, a reduction in the long operating time for varicose veins and the development of alternatives to the radical avulsion of varicosities, including the classical 'strip to the ankle' saphenectomy[6]. The principles of ambulatory venectomy[7] and outpatient techniques, such as stab avulsions using phlebectomy hooks and modified groin-to-knee stripping, have been developed by surgeons *pari passu* with the concept of minimally invasive surgery[8,9].

Patient selection is the fundamental consideration in running a day-only surgical programme. Jarrett refers to day-only surgery as "patient care tailored to meet the needs of the non-sick"[10]. Generally, the patients should be young, otherwise fit candidates with no significant intercurrent illness. As our experience with the DSC increased, the criteria for suitable patient selection was extended. In our study 7 out of 73 patients were over 60 years of age but in otherwise good health. This subgroup tolerated a same-day surgical procedure with no adverse effects, suggesting that the patient rather than the age group should be the criterion applied in selection. Similarly, the patients with significant comorbidity (Table 1) had an uneventful experience in the DSC. This increase in our confidence with day-only surgery is reflected in the utilization rate for this facility. At the beginning of the programme only 23% of varicose vein patients were considered to be suitable for the DSC, but 2 yr later, 60% of varicose vein patients were considered to be suitable for the DSC. This increase in the utilization rate is highly significant (95% confidence limits of the difference in the utilization rate is 0.21–0.53).

In addition to being medically fit for a day surgery programme the patient should be 'socially fit'[14]. The social circumstances of the patient must be carefully considered and access to community nursing support should be available[4]. The appropriate patient should have a support person in attendance on the first night after discharge and preferably for part of the first few postoperative days providing some domestic help. The patient must live in a suitable environment for recuperation. The family doctor should be aware of their patient's admission to the DSC. The appropriate referral to the community nursing service, if necessary, should be made prior to surgery.

As part of the preoperative evaluation all patients should have a venous duplex study performed prior to admission. The routine use of the duplex study allows accurate preoperative diagnosis of the site of reflux or perforator disease. This approach is important to individualize each operation to ensure the permanent removal of both varicosities and the sources of venous hypertension[11]. Although 70% of patients with primary varicose veins have saphenofemoral reflux, up to 30% have atypical reflux or atypical varices with no reflux[1]. Variation in venous anatomy and pathology are common reasons for recurrent veins[13]. In addition, the cohort of patients with morphologically normal valve leaflets in the presence of a dilated valve annulus can be identified and may be offered a valvuloplasty procedure if appropriate[16].

Preoperative preparation should include a full and detailed discussion of the risks and benefits of the proposed surgery, particularly if cosmesis appears to be a significant indication for surgery for the patient. Certain surgical problems are best treated by anticipation. Apart from an understanding of day-only surgery, an awareness of the usual postoperative complications is important. Problems such as paraesthesia, bruising, haematoma, and wound infection should be fully discussed. Varicose vein surgery can be complicated by deep venous thrombosis[12] and whilst uncommon it is of such potential major significance that it must be discussed in the preoperative consultation.

Our experience suggests that a significant number of patients have cosmetic concerns and the decision to seek treatment, and the results of that treatment have a psychological as well as a physical significance. The low attendance rate at the follow-up visits of this group of patients suggests that these patients perceive their venous disease as part of a body image problem. Once the offending veins have been removed, this problem has been rectified and thus no medical review is necessary. These patients should be told that the varices will be replaced by scars and that the final cosmetic result will vary from patient to patient. In the current medicolegal environment the patient and the surgeon should be aware of all potential complications before, rather than after, surgery.

Day surgery should be regarded as a consultant-based service[15]. The DSC has a policy that only specialist surgeons and anaesthetists may operate in the centre to minimize the operating time and to maximize the potential benefit to the patient. This policy answers a common criticism that varicose vein surgery is often left to the most junior and inexperienced member of the

team[14]

In conclusion our experience demonstrates that a day-only programme for varicose vein surgery has significantly reduced both the number of patients on our waiting list and the time a patient could reasonably expect to spend on such a list. The DSC has an efficient patient flow from admission, to procedure, to discharge. The complication and readmission rates were acceptable. Use of the DSC is a safe and efficacious approach to the modern management of varicose veins.

We would recommend that other vascular units consider the use of their day surgery facility to provide access to this surgical service for those patients who require operative management of their venous disease.

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Esmolol as an anaesthetic adjunct in ambulatory surgery

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The aim of this study was to compare the efficacy of esmolol and fentanyl as anaesthetic adjuncts. Forty healthy patients presenting for laparoscopic tubal fulguration were randomly assigned to either an esmolol or fentanyl protocol, as part of a nitrous oxide/muscle relaxant anaesthetic technique. Blood pressure and heart rates, measured pre- and post-induction and intubation, showed no significant differences nor did the times of return of cognitive function and extubation respectively. Patients from the esmolol group were both ambulatory and discharged significantly sooner than the fentanyl group. The incidence of nausea and urinary retention, combined as adverse recovery room events were significantly higher in the fentanyl group. Esmolol proved to be a satisfactory substitute for narcotics in a nitrous oxide/relaxant anaesthetic technique and was associated with shorter times to ambulation and discharge.

Key words: Ambulatory surgery, anaesthetic adjuncts, esmolol, fentanyl

Introduction

The therapeutic use of pharmacologically active substances tends to evolve from the original intent as dictated by experience and research. For example propranolol (Inderal) was introduced primarily as a treatment for systemic hypertension and as an antiarrhythmic[1]. With respect to the practice of anaesthesia, the negative chronotropic effects of systemic propranolol have been used as an adjunct to controlled circulatory techniques, and to protect the heart from adrenergic stimulation associated with a variety of clinical conditions and situations. Similarly, the more recently introduced highly cardioselective, systemic beta adrenergic blocker, esmolol hydrochloride (Brevibloc, Anaquest Inc., Liberty Corner, NJ, USA) is utilized systemically to attenuate the cardiovascular response to laryngoscopy, to treat supraventricular tachycardias and as an adjunct to controlled circulatory techniques. In addition, esmolol has been found useful in the perioperative control of dysrhythmias and blood pressure[2].

Subsequent experience with the drug has produced evidence for the efficacy of esmolol as an anaesthetic adjunct. Geva et al. used esmolol as a substitute for fentanyl in 15 patients, as an adjunct of nitrous oxide/muscle relaxant technique. In this study, esmolol proved to be a useful replacement for fentanyl, resulting in stable haemodynamics, a low hormonal stress response, good recovery and no recall[3]. Concomitant studies in the rat showed that esmolol in a dose of 500 $\mu g\ kg^{-1}\ min^{-1}$ decreased halothane minimum alveolar concentration (MAC) by 10–15%[4]. More recently, Perel and Shneider found even greater reductions of the MAC for halothane in rats breathing nitrous oxide[5].

The aim of the present study was to assess the efficacy of esmolol as an anaesthetic adjunct in a homogeneous patient group with respect to type and duration of surgery, age or sex.

Methods

Forty women having an ASA physical status I or II and presenting for elective laparoscopic tubal fulguration were enrolled in the study. Patients with a history of hypertension or reactive airway disease were excluded. Of these 40 patients, 21 were classified as physical status II, 17 of these on the basis of smoking. Informed consent was obtained for the experimental protocol approved by our Institutional Review Board. Patients were assigned to either a fentanyl or an esmolol protocol via a computer-generated randomization sequence. All patients received 5% dextrose in 0.45% saline via an 18-gauge cannula in the left arm, and were monitored with an automatic sphygmomanometer, a three-lead electrocardiogram (EKG), pulse oximeter, precordial stethoscope, and a twitch monitor. Inspired/expired nitrous oxide and carbon dioxide were monitored by a

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mass spectrometer (Perkin-Elmer, Milwaukee, WI, USA). All patients received intravenous midazolam (0.02 mg kg^{-1}) prior to induction. Patients were induced with propofol, 2.5 mg kg^{-1}, ventilated with 70% nitrous oxide in oxygen, paralysed with vecuronium 0.1 mg kg^{-1}, intubated with a 7.0 mm endotracheal tube using a MacIntosh-3 blade upon disappearance of all neuromuscular activity. All endotracheal intubations were carried out on the first attempt. Following the securing of the endotracheal tube, an orogastic tube was passed, suctioned and left in place. Blood pressures were measured continuously following induction, every minute for 2 min following intubation and every 3 min subsequently. Inspired nitrous oxide levels were kept at 70%. Minute ventilation was adjusted to give end-tidal carbon dioxide levels of 22–25 mmHg. Muscle relaxation was maintained with intravenous vecuronium as monitored by the train of four.

Patients randomized to fentanyl received 2 μg kg^{-1} during induction. Subsequent fentanyl was given at the discretion of the anaesthesiologist either in anticipation of surgical stimulation or a perception of light anaesthesia as judged by increases of blood pressure and heart rate. Patients randomized to esmolol received a loading dose of 2 mg kg^{-1} during induction. Following intubation an esmolol infusion was started using an infusion pump (Bard MedSystems, North Reading, MA, USA). Initial infusion rates were set at approximately 300 μg kg^{-1} min^{-1} and adjusted in anticipation of increased surgical stimulation (e.g. abdominal trocar insertion), or in response to sudden increases in heart rate, blood pressure, or most importantly, pupillary dilation. Except for the pupillary response, the indications for adjustments of the anaesthetic were the same for both fentanyl and esmolol. Esmolol infusion or fentanyl administration were discontinued following abdominal decompression and removal of instruments from the cervix and abdomen. The abdominal wounds were infiltrated with 5 ml 0.25% bupivacaine for postoperative analgesia. Muscle relaxation was reversed with neostigmine 0.07 mg kg^{-1} and glycopyrrolate 0.015 mg kg^{-1} following return of the patient to the supine position together with a 1/4 train of four. Nitrous oxide was discontinued at the time of reversal of muscle relaxation. Times from reversal of the muscle relaxants to a return of cognitive function, such as eye opening or a hand squeeze upon command, together with the time from reversal of muscle relaxants to extubation, were noted. In addition, times between extubation and ambulation and patient discharge were recorded. Recovery room events were supervised and recorded by the same experienced recovery room nurses who were only told that the patients had received a balanced nitrous oxide relaxant technique. To be eligible for discharge the patients had to meet specified objective criteria which included: stable vital signs, presence of swallow, cough and gag reflexes, absence of respiratory distress, patient ambulatory, absence of dizziness, nausea, or vomiting, patient alert and oriented, patient successfully voided, and a postanaesthesia recovery score of 10[6,7]. All patients were questioned prior to discharge and at home the next day, regarding recall.

Data are expressed as means ± SEM. Results were analysed by a one-way analysis of variance followed by Student's paired t test. χ^2 tests were used for descriptive variables. A P value less than 0.05 was considered statistically significant.

Results

Two patients from the fentanyl group developed mild wheezing during the surgical procedure with increased peak airway pressures but no arterial oxygen desaturation. In these patients, isoflurane was added to the anaesthetic, the patients removed from the study, and their place in the randomization sequence repeated. No patients from the esmolol group were removed from the protocol. There were no differences between the two groups with respect to age, height, weight and duration of anaesthesia (induction to extubation), as shown in Table 1. In addition, blood pressure and heart rates showed no significant differences between the two groups at rest (basal), before or after induction, or before or after intubation (Table 2). Time of return of cognitive function and time from muscle relaxant reversal to extubation showed no difference between the two groups (Table 3). Upon admission to the recovery room, postanaesthetic recovery scale (PARS) scores were very similar. Furthermore, 13 of the esmolol group and 11 of the fentanyl group, were described as drowsy upon admission to the recovery room. Only one patient of either group received an analgesic for postoperative pain: this was a patient of the esmolol group who received 12.5 mg of demerol intravenously. Patients from the fentanyl group took significantly longer to become ambulatory and to be discharged as shown in Table 3. The delay in both ambulation and discharge achieved significance at a P value of <0.01. Factors related to the use of narcotics thought to contribute significantly to delayed ambulation and discharge, namely nausea and urinary retention, are shown in Table 4. Such adverse recovery room events were significantly higher in the fentanyl group at a P value of less than 0.05 using a χ^2 square test. No patient from either group had any evidence of intraoperative awareness either immediately postoperatively or on the following day.

Table 1. Patient demographic and intraoperative data for the treatment groups (means ± SEM)

	Esmolol	*Fentanyl*
Group size (*n*)	20	20
Age (yr)	31.3 ± 1.7	33.8 ± 1.6
Height (cm)	139.0 ± 1.4	141.9 ± 1.4
Weight (kg)	65.4 ± 3.1	66.2 ± 3.7
Total fentanyl (μg)	–	225.0 ± 9.6
Total esmolol (mg)	1623.0 ± 70.1	–
Anaesthetic duration (min)	67.9 ± 3.3	72.6 ± 3.5

Table 2. Peri-induction/intubation haemodynamics (means ± SEM)

	SBP (mmHg)		DBP (mmHg)		HR (bts min^{-1})	
	Esmolol	*Fentanyl*	*Esmolol*	*Fentanyl*	*Esmolol*	*Fentanyl*
Basal	108.9 ± 3.5	115.1 ± 2.1	70.8 ± 2.9	75.1 ± 2.0	73.8 ± 2.6	75.4 ± 2.5
Pre-induction	126.4 ± 3.8	127.3 ± 2.8	72.1 ± 2.4	74.2 ± 2.8	73.3 ± 2.8	73.5 ± 2.9
Post-induction	91.5 ± 2.4	89.1 ± 2.9	54.3 ± 1.8	48.8 ± 2.1	76.9 ± 1.9	71.3 ± 2.9
Pre-intubation	93.3 ± 2.5	89.8 ± 2.9	55.0 ± 1.8	49.2 ± 2.1	79.0 ± 1.7	70.9 ± 2.8
Post-intubation	129.4 ± 3.6	131.7 ± 5.5	82.9 ± 2.5	80.1 ± 4.3	82.9 ± 2.2	82.0 ± 3.2

SBP, Systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

Table 3. Recovery times in minutes (means ± SEM)

Recovery times	*Esmolol*	*Fentanyl*
Reversal – cognitive response	2.3 ± 0.2	2.6 ± 0.2
Reversal – extubation	3.9 ± 0.2	4.2 ± 0.4
Extubation – ambulation	96.4 ± 6.4	133.4 ± 11.4*
Extubation – discharge	147.7 ± 7.4	190.6 ± 12.9*

*Significant at P value of <0.01.

Table 4. Recovery room events delaying discharge

	Esmolol	*Fentanyl*
Nausea and vomiting	1	5
Nausea only	3	4
Urinary retention	0	3
Total	4	12*

*Significant at P value <0.05.

Discussion

By confining this study to a single surgical procedure (laparoscopic tubal ligation) a high level of homogeneity was achieved with respect to the duration and degree of surgical stimulation together with morphology of the patient population studied. The patients in each group were equally divided between ASA physical status I and II. The high preponderance of smokers (42.5% overall) reflected current smoking trends.

The anaesthetic drugs for the control group, namely propofol, fentanyl, nitrous oxide and vecuronium, constituted a commonly used and appropriate anaesthetic technique for a laparoscopic tubal ligation carried out in an ambulatory surgery unit. We could not justify a control anaesthetic utilizing only the induction dose of propofol, nitrous oxide and muscle relaxant. Even with the use of midazolam for amnesia, the potential for awareness and significant cardiovascular instability in this young healthy population, was just too great. The long elimination half-life of fentanyl tends to result in significant cumulative effects when administered as a continuous infusion. Therefore, fentanyl is usually administered as repeated intravenous boluses and was so used in this study. In contrast, esmolol with an ultrashort elimination half-life, is invariably administered as a continuous infusion. Because of the differences in the most safe and effective methods of drug administration of the two groups in comparing fentanyl and esmolol as anaesthetic adjuncts, it was felt that a double-blind design would result in inappropriate fentanyl doses and less than optimal anaesthetic management. Recovery room care was provided by and assessments made by experienced recovery room nurses, who progressed the patients through the stages of recovery based on standard care patterns and discharge criteria as discussed above.

Any anaesthetic technique relying primarily upon nitrous oxide, modest hyperventilation, and a muscle relaxant has a high potential for intraoperative awareness[8]. Consequently, all patients were given the short-acting amnestic midazolam prior to induction (0.02 mg kg^{-1}). The high percentage of each patient group exhibiting observable sedation upon admission to the recovery room accounted for PARS scores of 8.9 ± 0.2 for the fentanyl group and 9.1 ± 0.2 for the esmolol group. With respect to the fentanyl group, such sedation was compatible with the cumulative residual sedation from midazolam, propofol and fentanyl. As there was no observable difference in sedation between the two groups, it was our impression that intravenous esmolol in the doses used (approximately 0.35 mg kg^{-1} min^{-1}) resulted in significant postoperative sedation.

On average, the fentanyl group took significantly longer to ambulate and to be discharged from the recovery room. The greater incidence of nausea (vomiting) and urinary retention appeared to be the major reason for this difference: the effects of narcotics upon postoperative nausea being well documented[9] particularly when used as part of a balanced technique.

This study is consistent with previous observations that a continuous infusion of esmolol can reduce anaesthetic requirements in animals[4,5]. The interaction of drugs and/or ancillary anaesthetic techniques to produce a desirable therapeutic effect is a cornerstone

of modern anaesthetic practice. Such interactions ideally maximize desired effects and reduce pharmacological side effects of the drugs involved. Reductions of anaesthetic requirements have been attributed to hypocarbia secondary to hyperventilation[15], skeletal muscle paralysis[11] and autonomic drugs such as α-2 agonists. For example, the α-agonist, clonidine has been reported to reduce fentanyl requirement[12,13], and to enhance the effects of inhalational agents[14]. In the current study, moderate hyperventilation, skeletal muscle paralysis and esmolol had the potential to affect anaesthetic requirements.

Hyperventilation producing hypocapnia may affect anaesthetic requirements by a variety of possible mechanisms[15] including: the modification of alveolar anaesthetic concentrations of any concomitant inhalational agent; the inhibition of neural activity between the respiratory centres and the accessory muscles of respiration, particularly the abdominal muscles; and the production of cerebral vasoconstriction which may result in relative ischaemia of the cerebral cortex having a direct effect on the reticular activating system, the so-called forebrain deafferentation[10].

With respect to muscle relaxation, Forbes et al.[11], reported that pancuronium decreased the MAC of halothane by 25% in surgical patients. A direct effect on the central nervous system or a deafferentation of the central nervous system via an effect of pancuronium upon the muscle spindles, was put forward to explain the above interaction. A disinhibition of the accessory muscles of respiration due to the hypocarbia as discussed above could also contribute to this deafferentation. A subsequent study failed to confirm an effect of skeletal muscle relaxation upon anaesthetic potency[16].

There is currently little information concerning the site of action of esmolol as an anaesthetic adjunct. Partridge and Kon[4] postulated that if esmolol mediates its anaesthetic effect indirectly, it may do so by reducing circulating catecholamines. However, in the study of Geva et al.[3], plasma catecholamine levels were no different in the esmolol/nitrous oxide group, compared to the fentanyl/nitrous oxide group. Any sympatholytic drug has the potential to effect a hypnotic action via hypnogenic mechanisms postulated as the basis for active sleep. For example, Steriade and McCarley discuss two likely cerebral hypnogenic structures: the medullary solitary tract nucleus and the preoptic area of the basal forebrain, together with a wide variety of aminergic neurons utilizing norepinephrine, epinephrine and serotonin as neurotransmitters[17]. These neurons inhibit rapid eye movement (REM) and are located primarily in the locus coeruleus, dorsal raphe and the peribrachial region. It is of particular interest that the locus coeruleus, as a principal site of REM inhibitory aminergic neurons, is also a site of action of α-2 agonists together with a separate opiate enhancement mechanism[18].

A further possible mechanism of action of esmolol is by inhibition of the sympathomimetic actions of nitrous oxide. The increased sympathetic activity during nitrous oxide anaesthesia[19] has been found to antagonize both the central nervous system depression by isoflurane[20] and the isoflurane induced suppression of learning[21]. The primary anaesthetic in the current study is 70% nitrous oxide. Any potentiation of the potency of the nitrous oxide by the sympatholytic effects of esmolol could explain the efficacy of esmolol as a substitute for fentanyl in the technique under study.

In conclusion, in 40 patients undergoing laparoscopy for bilateral tubal ligation, anaesthetized with a nitrous oxide/muscle relaxant technique with modest hyperventilation, esmolol proved to be the equal of fentanyl in terms of peri-induction and intubation haemodynamics, operative conditions and restitution of cognitive function and independent respiration. Patients receiving esmolol had a lower incidence of nausea and urinary retention, were able to walk earlier and were discharged sooner than those who received fentanyl.

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Ambulatory surgery to cope with long patient waiting lists

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The objectives of this study were to test: (a) whether an Ambulatory Surgery Unit (ASU) would be operative in our environment; (b) to investigate patient acceptance and satisfaction rates for ambulatory surgery; and (c) to assess to what extent the unit would affect general surgery waiting lists. Between October 1990 and March 1994 a total of 552 patients underwent anaesthesia and surgery and were discharged on the same day. Postoperative follow-up was by phone call or home visit by a trained nurse the following day. Total satisfaction following the procedure was expressed by 98% of the patients. A total of 523 admissions for hernia, pilonidal cysts and proctology were saved by the ambulatory unit and the general surgery waiting list was reduced from 13 to 3 months.

Key words: Ambulatory Surgery Unit, waiting lists, patient acceptance

Long waiting lists for surgical procedures due to patient overcrowding are a common problem in many countries. There are several reasons that explain this phenomenon. First is the improvement in access to medical care, particularly where a national health system is present. Second, advances in medical knowledge and technology have broadened the scope of procedures offered, and finally, ageing in western populations has increased the incidence of many pathological conditions, suitable for treatment on an ambulatory basis.

By increasing the number of medical facilities and personnel, waiting lists could be reduced, however this would be economically prohibitive. A better alternative is to optimize the use of existing resources by reducing the number of beds and assisting specialists and, simultaneously, increasing the number of procedures performed over a given period of time.

Ambulatory surgery is an example of the latter solution[1,2]. Resources are almost exclusively used for the care that must be given by medical personnel (surgeons, anaesthetists and nurses) in a specialized setting (operating and recovery rooms). Postoperative care is given at home under supervision by visiting nurses and a medical telephone hotline.

The Hospital de Viladecans is a 114-bed public hospital located in an industrial area near Barcelona. In October 1990, an Ambulatory Surgery Unit (ASU) was created in order to cope with a steadily increasing waiting list. The unit was intended for procedures that traditionally required 2–7 days of hospital stay as well as for minor surgery under local anaesthesia, that was already being performed without hospital admission. The unit is used by the Departments of General Surgery, Orthopaedics, Gynaecology, Urology, Otorhinolaryngology, Ophthalmology and Dermatology.

Two operating theatres, a resuscitation room and a recovery room are for the exclusive use of the ASU. The head of the Department of Anaesthesia is in charge of the unit as the general coordinator. The unit has its own administrative and nursing personnel and is open daily from 8 am to 5 pm. Surgeons belong to the staff of the hospital.

Materials and methods

The present study reports on the results of ambulatory surgery carried out between October 1990 and March 1994 on 552 general surgery patients regarding outcome, complications, patient acceptance and satisfaction, and effects on waiting lists. Surgeries were for: hernia, 233; pilonidal cyst, 176; proctology, 45; fibroadenomas, subcutaneous tumours and cysts and lymph node biopsy, 98.

Patients were selected in the Outpatient Clinic. Inclusion criteria included acceptance by the patient, ASA I, II or III status and access to a telephone, as shown in Table 1. Patients suitable for ambulatory surgery were informed and had to sign an acceptance

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form; they also received a simple booklet with information about ambulatory surgery and the hotline number open round the clock for any questions they may have had, pre- or postoperatively. Preoperative tests and evaluation were the same as those used for patients to be operated on as inpatients.

A preoperative evaluation by the anaesthetist was carried out on all patients. The main points of the preoperative information were reiterated and patients were provided with diazepam 10 mg p.o. and ranitidine 150 mg p.o. for the night before the operating day. On the operating day, patients came to the preoperative room after an overnight fast. Anaesthetic procedures and surgical techniques were based on preoperative diagnosis, independently of whether patients were under hospital or ambulatory surgery. Anaesthetic techniques used were: peridural 41%, local plus sedation 48%, general 7%, and intradural 4%. After the operation, patients spent 2–5 h in the recovery room and then returned home on their own. Postoperative discharge criteria are summarized in Table 2a. Failure to meet such criteria or presence of additional admission criteria shown in Table 2b resulted in hospital admission.

Postoperative analgesia was achieved with diazepam 5 mg h.s. and diclophenac 70–50 mg t.i.d. or dihydrocodeine 20 mg b.i.d. plus paracetamol 500 mg q.i.d. in patients with peptic ulcer disease. Ranitidine 150 mg b.i.d. was continued for 24 h postoperatively in all patients. The following day patients were seen or contacted by phone by a visiting nurse from the unit, and if they had a normal postoperative course, they came to the Outpatient Clinic a week after the operation. If any problem was observed during the postoperative period, patients could communicate with the nurse or the operating staff 24 h a day by telephone, and a hospital visit was arranged immediately if necessary. Patients always had hospital beds available should any complication have arisen during the postoperative period.

Table 1. Inclusion criteria for ambulatory surgery

Patient
Acceptance and understanding of the procedure
Reasonable degree of stress towards surgery and pain
Environment
Adult living with relatives
Telephone and apartment elevator
Maximum distance to hospital 10 km
Type of surgery
Minimal preoperative preparation
Able to tolerate liquids p.o. postoperatively
Antibiotics iv not necessary
Estimated duration general anaesthesia <60 min
Anaesthetic risk
ASA I and II*
ASA III if local or regional anaesthesia and minor surgery
Arterial hypertension if correctly treated
Non-insulin-dependent diabetes mellitus if local or regional anaesthesia
Respiratory diseases if local or regional anaesthesia
Exclusion criteria
Obesity >30% ideal body weight
Psychiatric and drug abuse patients
Patients under DVT† risk or an anticoagulation therapy
Insulin-dependent diabetes mellitus
Steroid-dependency for associated disease
Epilepsy

* ASA, American Society of Anesthesiology risk scoring system. †DVT, deep venous thrombosis.

Table 2a. Postoperative discharge criteria

Physiologic variables correct (Aldrete test score: 10)
Absence of orthostatic hypotension
Little or no pain
Correct oral intake
Spontaneous micturition
Absence of nausea and vomiting
Understanding of postoperative instructions

Table 2b. Postoperative admission criteria

Adverse reaction to any drug administered
Unexpected surgical complexity
Operative time (general anaesthesia) >60 min
Operation finished after 2 pm (general anaesthesia)
Anaesthetic administered after 2 pm (epidural anaesthesia)
Pain difficult to control without opiaceous analgesics
Lack of any of the discharge criteria after 5 pm

Results

Ninety-two per cent of patients to whom ambulatory surgery was proposed accepted the procedure. In approximately 4 yr since the unit opened 552 patients have undergone major surgical procedures. Preoperative diagnoses are shown in Table 3.

Mean operative time for general surgery patients was 33 min. Mean recovery time before discharge was 4 h 30 min. Nineteen patients (3%) could not be discharged on the operative day because of: unexpected surgical complexity, 7; pain not controlled with oral analgesia, 6; insufficient postoperative recovery by 4 pm, 4; accidental dural puncture, 1; social problems, 1. Interestingly, the non-discharge rate was 8% (11 out of 141 patients) during the first year and dropped to 2% (8 out of 411 patients) thereafter. This resulted from the exclusion of proctology patients, except for fissura-in-ano. Minor problems such as pain, small wound seroma or haematoma, nausea and vomiting, fever and questions about wound care or medication caused 66 patients (12%) to use the 24-h hotline. In 39 of them (7%), a visit to the Emergency Department was recommended. Ten patients (2%) were readmitted for local complications: unexplained fever, 3; headache as a result of accidental dural puncture during peridural anaesthesia, 1; wound haematoma or infection, 6. They were discharged 2–3 days later. One patient presented with a necrotizing fasciitis after hernia repair, that required local debridement and systemic antibiotics; he recovered uneventfully after 1 month of intensive treatment. This

Table 3. Preoperative diagnosis in general surgery patients

Hernia	
Inguinal	184
Femoral	18
Umbilical	24
Epigastric	7
Pilonidal cyst	176
Proctology*	45
Miscellaneous†	98
Total	552

*Proctology includes anal fissure and simple fistuli. Haemorrhoids are operated on on an inpatient basis. †Miscellaneous includes subcutaneous benign tumours such as lipomas, breast fibroadenomas and lymph node biopsy.

complication could not be attributed to the fact that surgery had been ambulatory. Postoperative satisfaction was complete in 98% of the patients, who affirmed they would accept an ambulatory procedure a second time. No claims have been filed by ambulatory patients.

Since 552 patients were operated on on an ambulatory basis but 29 were not discharged or readmitted, it is estimated that 523 hospital admissions were avoided in the General Surgery Department. Given that hospital stay for simple procedures such as hernia or pilonidal cyst is usually 3–5 days, over 2000 days of hospital care were saved. Bed occupancy rate in the department in the same period was 84% and mean hospital stay was 8 days. The general surgery waiting list was reduced from 13–3 months since the opening of the unit. The ambulatory surgery waiting list is 6 weeks.

Discussion

The growth in the demand for health services is associated with an increase in the resources needed to provide a continuing healthcare service with appropriate quality standards. Ambulatory surgery, recently introduced to Spain[3,4], has been proposed as a possible solution to the problem of increasing demand[1,2,5,6].

Simple surgeries have been performed under local anaesthesia for a long time. However, major surgery without hospital admission[7] is a more recent development. It consists of procedures of median complexity, performed under any anaesthetic technique, on patients that return home on the same day of the operation. Ambulatory surgery, also called day surgery, must be distinguished from short-admission surgery, where the patient is admitted at least overnight, and from minimally-invasive surgery, a concept that refers to the surgical technique but not to the length of hospital stay[8].

Ambulatory surgery includes a broad spectrum of techniques belonging to all surgical specialities that usually required a 2–8 day admission period in the past. It is often the case that the pathological conditions that are more common are the ones that can be operated on on an ambulatory basis (see Table 3).

To develop an ambulatory surgery programme, it is necessary to have[9]: (a) trained medical and administrative personnel; (b) hospital areas devoted to ambulatory surgery; (c) strict criteria on surgical and anaesthetic indications, patient acceptance, and postoperative admission or discharge[10]; and (d) postoperative home control[4].

The results obtained after 4 yr of ambulatory surgery at the Hospital de Viladecans were highly satisfactory. Admissions following surgery planned as ambulatory occurred in only 3% of the general surgical procedures, and these took place mostly during the first year. By making selection criteria stricter, particularly in proctology patients where postoperative pain is poorly tolerated[11], the number of unexpected admissions decreased during the second year.

Major concerns when practising ambulatory surgery are patient risk, and acceptance by both patients and medical personnel[12]. The present study suggests that patient risk is similar to inpatient surgery, provided a few precautions are taken. Acceptance by the patients was remarkably high and advantages for people involved were obvious. Waiting times for attendance were reduced, social and familiar impact of disease and surgery were minimalized and the risk of nosocomial infections were virtually absent. Surgeons appreciated the reductions in waiting lists that reduced pressure on them and the nursing staff involved in the unit was rewarded by not having to work night or weekend shifts.

Waiting lists, a common problem in public hospitals, were progressively reduced in all surgical specialities. However, demand for surgery within the hospital was not decreased to a point where bed occupancy fell, as shown by an 84% bed-occupancy rate, similar to that of other centres without an ambulatory surgical programme. This meant that the beds saved by ambulatory surgery were used to treat a remarkable number of additional patients who would otherwise still be on the waiting list. If healthcare for the population in the area had been saturated, occupancy would have fallen, and in this case the recommended action would have been to reduce the number of beds available.

The system by which health authorities finance the provision of hospital services is a critical factor for ASUs. Budgets must be planned according to the number and severity of patients operated on, as opposed to the number of beds in use and length of hospital stay. Ambulatory surgery is heavily penalized by the latter system, common in many countries, including Catalonia. Fortunately, there is now a trend towards adjusting funding to the real hospital costs of surgical treatment, that has partly been stimulated by the experience gained with the ASU.

In conclusion, ambulatory surgery is feasible and it has the same complication rate as inpatient surgery. It results in marked reductions in waiting lists and improves the use of available resources, with excellent acceptance by patients, medical personnel and healthcare administrators.

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Formulating an effective exposure control plan to deal with needlestick injuries in a free-standing surgical centre

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Needlestick injuries involving healthcare workers are not uncommon complications of surgical procedures. While much has been written about ways of addressing concerns of human immunodeficiency virus (HIV) and hepatitis B (HBV) infections in hospital settings, issues of significant exposures in an ambulatory surgical centre can present unique problems. In addition, regulations within a particular community may limit choices of protocol. A protocol is outlined in this article which maintains both patient and healthcare worker confidentiality, while answering questions that can relieve the anxiety associated with a significant exposure.

Key words: HIV, significant exposure, employee exposure, hepatitis B infections, universal precautions, ambulatory surgery exposure

One of the most anxiety producing problems facing a medical director in a modern outpatient surgical facility is the employee who has been stuck by a contaminated needle. The healthcare worker is faced with concerns about personal well-being and risks to family and friends that may not be answered for months. A medical director must balance the need to help his staff grapple with these issues and the personal privacy rights of his patients. While laws protecting patients and employees vary from country to country, this article will attempt to address the concerns of employees and the rights of patients in a systematic manner. Specifically, human immunodeficiency virus (HIV) and hepatitis B (HBV) infectious risks will be examined as they relate to needlestick incidents in a busy outpatient surgical practice.

Prevention

The most important method of preventing HIV and hepatitis B infections is to prevent them from ever happening. To this end, we have adopted universal precautions as outlined by the Centers for Disease Control (CDC) for all aspects of patient care in our facilities[1]. In addition, all our employees have been offered and have accepted HBV vaccine prophylaxis.

The CDC recommends that certain blood and body fluids of all patients should be considered potentially infectious[1]. The term associated with the concept known as 'universal precautions' is used in reference to the management of all patients rather than all body fluids. Prevention of transmission of bloodborne pathogens is the ultimate purpose and goal of this technique. Those high-risk areas of concern apply to blood, blood-tinged fluids, semen, vaginal secretions, tissue, cerebrospinal fluid and synovial, pleural, peritoneal, pericardial and amniotic fluids. It does not include saliva, tears, nasal secretions, sputum, sweat, urine, faeces or vomit (unless visible blood is noted).

Universal precautions must be integrated into each and every procedure within the perioperative setting. To this end policies and procedures are formulated with the incorporation of universal precautions. All members of the health team are provided, at no cost to them, the necessary types of personal protective equipment for their respective jobs, in line with universal precautions. These items include protective eyewear, gloves, impervious operating-room attire, shoe, face and hair covers. Mandatory use of this protective equipment is the policy of our facility. Signs are posted throughout the facility as a constant reminder to all staff members to protect themselves and their patients. A mandatory inservice review by the Medical Director and the Nursing Director is provided to employees on an annual basis in order to review and update each individual staff member on Occupational Safety and Health Administration (OSHA) standards and universal precautions. In addition to our inservice programme we implement prevention techniques within the facility.

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They include the following:

1. A needleless system for iv therapy.
2. Ongoing communication among the perioperative team in order to implement individual patient care plans for the surgical procedure.
3. The importance of 'well choreographed movement' or being aware of your relationship to your immediate surroundings within the surgical setting, to avoid motions that may lead to unnecessary exposure.
4. The storage and placement of sharps (i.e. needles, surgical blades, etc.).
5. Correct fit of surgical gloves to avoid protrusion of fingertips which could be a potential interference in performance.
6. The use of forceps or needle holders to make adjustments to atraumatic needles, sutures or scalpel blades.
7. The proper use of instruments rather than the implementation of fingers to stabilize or retract tissue.
8. The use of the intermediate tray technique for passing sharps about the sterile field.
9. Not recapping, bending or breaking any needles prior to proper disposal.
10. Employing safety techniques in the decontamination area, i.e. specially designed processing gloves and a colander system to avoid immersing hands blindly into contaminated instruments sets.
11. Implementing capping techniques for all exposed intraoperative sharps, i.e. K-wires, external fixation devices, etc.

Developing a protocol

Despite these preventative measures and a careful staff, accidents occur on an infrequent basis and needlestick incidents must be addressed. Our first step is to reassure the employee that the risk of HIV infection is very low. In a recent study 0.36% of healthcare workers stuck with a needle from a known AIDS patient converted to being HIV positive[2]. Other studies of needlestick injuries suggest that the risk of seroconverting may be modified by several factors. For instance, blood volume transferred to a patient may be decreased more than 50% when the needle passes through a single latex or vinyl glove and double gloving may afford added protection[3]. Depth of needle puncture into the skin, the type of needle used (hollow bore vs. solid), size of inoculum and clinical stage of the patient's HIV infection may also modify risk factors in the setting of a needlestick injury[4]. Although the risk of HBV may be more than 10 times higher[5,6], all of our employees have received a complete series of the HBV vaccine. Their risk of infection is low as long as they have seroconverted.

Our next step is to assess the potential risk of HBV and HIV infection from the particular patient, We do not routinely screen for these infections preoperatively for several reasons. First we feel that the cost is prohibitively expensive. Each enzyme-linked immunosorbent assay (ELISA) screening test for HIV antibodies costs approximately $42. Since we perform over 3000 cases a year at our facility alone, it would cost over $120 000 just to test for HIV infections. In addition, it would create a false sense of security among employees who might not follow universal precautions with as much diligence. Patients who are in the window of infectivity might test negative for HIV antibodies while carrying the virus[7]. If the patient is known to be high-risk on the basis of history (iv drug use etc.), the employee is counselled on the advisability of undergoing prophylactic AZT therapy or HBV immunoglobulin therapy. On the basis of recent studies on the effectiveness of prophylactic AZT therapy coupled with side effects of the drug and the low incidence of seroconversion even if the patient is HIV positive, employees are advised against undergoing immediate AZT treatment[8]. However, in this case or in the case of a low-risk patient, the healthcare worker has the option of undergoing this treatment at the expense of the centre. None of our employees has chosen this option yet.

At this point in the counselling the employee is asked whether or not he or she wishes to pursue the additional testing opportunities available. For protocol purposes relative to future compensation concerns, the healthcare worker is strongly encouraged to follow up on obtaining antibody levels. If the employee agrees to testing, an HIV (enzyme immunoassay) test, HBV surface antigen, HBV surface antibody and HBV core antigen are obtained.

Next the patient is informed of the contaminated needlestick incident. The patient is reassured that there is no danger to them but that considerable anxiety has been created for the healthcare provider who has cared for them. They are then asked to provide a blood sample for the testing of HIV antibodies and HBV antibodies and antigens. Since most of our patients have received sedation, they cannot give informed consent for the performance of HIV testing during their same-day stay in the ambulatory surgical centre. Connecticut law and the law of many states requires the obtaining of an elaborate informed consent covering the reasons and implications for AIDS testing[9]. If the patient agrees to testing, the HBV screen is performed and the HIV test is run the following day after appropriate informed consent is obtained from the patient. Alternatively, blood for both HIV and HBV tests can be drawn on the day of surgery and a telephone consent for the HIV test can be obtained on the day after surgery. This latter option will be discussed further on in this paper.

Connecticut law realizes that the need may arise for a court order forcing a patient, who refuses voluntarily to undergo HIV testing, to be tested if a healthcare worker suffers exposure to a needle contaminated with that patient's blood. Since the law came into effect, however, we have had only five significant exposures and all patients have voluntarily undergone HIV testing. The law has been challenged in another ambulatory centre

in Connecticut and a court order was obtained to compel the patient to undergo HIV testing. In order to qualify for a court order, the affected employee must first agree to be tested and be found HIV negative.

All testing of employees and patients is done anonymously. The initials and date of birth of those to be tested are included on the requisition form. The results of the test are placed in a separate, confidential file and are not released to anyone other than the employee and patient. The test results are received, reviewed and filed by both the Medical Director and the Administrative Director who would inform the healthcare worker of the test results. Since the needlestick events discussed here do not put the patient at risk, we do not inform the patient of the healthcare worker's HIV status. The tests are paid for entirely by the surgical centre and no cost is incurred by patient or employee.

Of the five employees stuck by needles over a period of 36 months, none has been exposed to an HIV-antibody-positive patient. If patients had been positive, repeat tests on the healthcare worker would have been performed at 3 month intervals for a year, since there may be a delay in the appearance of antibodies for many months after a clinical infection[7]. Even if the results of the patient are negative for HIV, the healthcare worker has the option of having HIV testing every 3 months for 1 yr. All employees are counselled on the meaning of positive test results. All positive tests are confirmed by Western blot test for HIV antibodies. Employees with confirmed positive tests are given the option of treatment with AZT.

Interestingly, one of the five employees was exposed to a HBV carrier. Although this employee had received the HBV vaccine series and had shown evidence of seroconversion 2 yr before, her level of antibody was considered low at the time of her needlestick injury. She elected to undergo HBV immunoglobulin therapy at the recommendation of our consulting infectious disease physician. Current recommendations call for 0.06 ml kg^{-1} of HBV immunoglobulin (HBIG) to be given within 1 week of the needlestick injury and a repeat dose of 0.06 ml kg^{-1} HBIG to be administered within the next 7 days[10]. She also underwent a repeat series of HBV vaccine. She did not develop the virus after the known incubation period.

The patient who was a HBV antigen carrier was known to us prior to surgery. The knowledge of the patient's carrier status allowed us to address the exposure implications quickly to our employee. Most patients do not have a current assessment of HIV or HBV status and a means of obtaining this information quickly must be devised.

Special problems encountered in an ambulatory setting

There are some unique problems which may be encountered in obtaining informed consent in an outpatient surgical centre that are not found in the inpatient surgical population. First a greater percentage of patients are young and healthy and return to family and employment commitments as soon as a day after their surgery. As a result, it may be difficult to convince these individuals to return to the outpatient centre for a test which may not directly benefit them. Fortunately, when presented with the anxiety faced by a healthcare employee over a contaminated needlestick, to date all patients who have been involved in a significant exposure incident have returned for testing on the day following surgery.

The second problem concerns issues of informed consent in the recently anaesthetized patient. Since in most states informed consent must be obtained before an HIV test is performed, a patient must return the day following surgery to be briefed on the implications of this test. We initially delayed drawing a blood specimen until the following day, but have now simplified the process. We now draw a HBV screen on the day of exposure, which can be legally obtained without informed consent. In addition, we draw a second specimen of blood for possible HIV testing. This eliminates the need to have the patient return to have blood drawn on the day following surgery. We allow the patient to give witnessed verbal telephone consent for HIV testing on the day following surgery so that he or she does not have to be physically present. In the event a court order is needed for a patient who refuses testing, a vial of blood which can easily be tested for HIV, pending judicial approval is in the possession of the centre.

Patient confidentiality

Many patients are concerned that positive HIV information may be disclosed to their employer or insurance company. They may justifiably fear loss of work or employment benefits. We have addressed this anxiety by labelling all HIV tests in significant exposure situations anonymously. The patient or healthcare worker has only initials and date of birth attached to his or her sample of blood. When the results are returned to the centre, they are not included in the patient's or employee's encounter file, but are placed in a separate file maintained only for significant exposures. In this manner, a patient's confidentiality is maintained if an insurance company or employer subpoenas a copy of the chart; a situation which may occur in cases of litigation or worker's compensation.

In the event that HIV testing uncovers a patient who is antibody positive, we advise counselling for the exposed healthcare professional on the statistically small likelihood of conversion. We then recommend HIV testing in the employee for 1 yr at 3 month intervals. If an individual converts as a result of a needlestick injury, it is likely to occur during this period of time. The healthcare worker who has been exposed to an HIV-positive patient is offered immediate psychological counselling. Treatment options are discussed with employees who do convert to HIV-positive status. As discussed above, prophylactic options are offered to healthcare workers immediately following a significant exposure, but they are not encouraged since the results

of such studies are not promising and the side effects of AZT therapy are high.

Counselling the patient who has a positive antibody test is also challenging in the ambulatory surgical setting. Most of these individuals did not volunteer to be tested and many agree only reluctantly. When we contact the HIV-positive patient we inform them of the results of the test and its implications. We encourage them to come to the surgical centre for further counselling by the Medical Director. Patients are advised to consult with their family physician regarding follow-up therapy. If they do not have a personal physician, the name of an infectious disease physician is provided to them for further questions and potential treatment. Patients are assured that the results of their tests will remain confidential.

Conclusions

We have discussed some of the problems associated with incidents of significant exposure in the outpatient surgical setting. In dealing with this event, one must never underestimate the anxiety created for both patient and employee alike. However, if the simple protocol outlined in this article is followed, the patient's and the healthcare worker's confidentiality can be maintained and answers that can relieve your colleagues' fears can, in many cases, be provided. This plan will satisfy even the most stringent laws governing HIV testing which may be in place in your region. We strongly suggest, however, investigating the applicable regulations in effect in your community.

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Laparoscopic cholecystectomy in a surgical day unit setting: short term results

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Laparoscopic cholecystectomy (LC) is a safe alternative to open cholecystectomy (OC). A series of 285 patients with uncomplicated cholelithiasis were scheduled for LC in a day surgery unit (DSU) setting with overnight stay. Our objective was to facilitate the movement from inpatient to outpatient care for this group of patients, of whom 93.3% were discharged during the first 23 h. Overall morbidity was 4.25%; there was no mortality and the readmission rate was 1%. LC can therefore be performed with acceptable morbidity in the DSU setting and is now on the day-case schedule. Our programme offers the advantages of day-case surgery, namely, better operating room efficiency and a high patient satisfaction rate, while allowing for safe supervision during the first 24 h.

Key words: Laparoscopic cholecystectomy, ambulatory surgery

Introduction

Laparoscopic cholecystectomy (LC) is a safe alternative to conventional open cholecystectomy (OC), allowing a reduction in iatrogenic trauma, less postoperative pain and a more rapid return to normal activity. It therefore has the potential for being introduced into day-case surgery[1]. Outpatient LC has been performed by some authors[2–4] but it should not be forgotten that LC still represents major surgery and we were concerned with problems arising at home. The introduction of LC also brought about a re-examination of conventional practices, therefore we have developed an intermediate option to in-hospital surgical care: the 'first day' LC programme in a hospital-based day surgery unit (DSU).

Our objective was to separate the flow of LC patients and traditional inpatients to achieve increased operating efficiency without compromising the quality of patient care.

Patients and methods

Our Health Care District has two hospitals: the main Valme University Hospital and a dependent small Hospital El Tomillar, where, in February 1992, a DSU was opened. In March 1992 we began performing LCs in the DSU. We kept the patients overnight in a specific postsurgery recovery area, where they received the same level of nursing care as in a medical/surgical unit in an acute care hospital (laboratory services, x-ray, pharmacy).

Patients who met the following criteria were admitted to the programme: (a) symptomatic uncomplicated cholelithiasis; (b) patient acceptance; (c) anaesthetic risk (American Society of Anesthesiologists) ASA I, II or III with systemic diseases well controlled preoperatively. Patients with choledocholithiasis were accepted if the stones were removed preoperatively by endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy (EP). The study population comprised 335 patients attending the outpatient clinic of our DSU between March 1992 and September 1994, of whom 285 patients (85%) were included in the programme, 50 (15%) being excluded for the criteria (a), (b) or (c) and treated as inpatients. The results of the first 285 patients were analysed.

All of the outpatient evaluation was done the week prior to the procedure. All patients underwent preoperative ultrasound of the right upper quadrant and serum levels of liver enzymes were measured. Educational leaflets were prepared, including preoperative and follow-up care. These pamphlets provided an important source of information, including the telephone number of the DSU for the patient after discharge. The patients were admitted between 8 and 8.30 a.m., operated on during the morning and discharged the next morning. Orogastric tube and urinary catheter were not used routinely. We gave a single dose of a third generation

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cephalosporin (cefotaxim 1 g) and 2500 U of low weight molecular heparin. All patients received general anaesthesia with tracheal incubation. Anaesthetic techniques were planned with the avoidance of nausea as a high priority. Antiemetics were given intravenously at the end of surgery.

A portable C-arm image amplifier was used when intraoperative cholangiography (IOC) was performed. A four-puncture technique was used for LC[5]. At closure of the surgical wounds they were infiltrated with 0.25% bupivacaine hydrochloride. The operations were performed by a consultant and a senior surgical registrar. Oral fluids started 4–6 h after the end of the operation. Patients were encouraged to get out of bed as soon as they had recovered from the anaesthetic.

Patient follow-up was by telephone or domiciliary visit by nurses of our Home Hospitalization Service (specially trained nurses from the DSU). We assessed the efficacy of our programme by a postdischarge patient satisfaction questionnaire 2 months after surgery.

Of the 285 patients treated by laparoscopic cholecystectomy, 228 (80%) were women and 57 (20%) were men. The patients' ages ranged from 16–76 yr (mean 51 yr) and they weighed 39–115 kg (mean 72 kg). The anaesthetic ASA ratings were: 113 (39.7%) ASA I, 137 (48.1%) ASA II and 35 (12.2%) ASA III.

Results

There were no deaths. LC was converted to open cholecystectomy in 10 (3.5%) of the 285 patients because of dense adhesions or unclear anatomy (six patients), cholangiographic filling defects (common bile duct stones; two patients), common bile duct injury (one patient) and unsuspected hepatic adenoma (one patient). LC was performed successfully on the remaining 275 patients (96.5%). The duration of the laparoscopic operation ranged from 25–220 min (mean 50 min).

There were four (1.4%) postoperative bile leakages: slippage of metal clips (three patients); laceration of anomalus right hepatic duct (one patient). Selective IOC was performed in 29 patients (10.2%): choledocholithiasis was detected in three patients (two converted to OC and the other was removed by postoperative endoscopic pancreatography (EP)). Major morbidity occurred in five patients (1.8%): two common bile duct injuries (0.7%) and three biliary leaks (1.1%). Minor morbidity occurred in seven patients (2.4%): four wound seromas, two umbilical cellulitis and one patient with abdominal pain. The majority of patients experienced no pain or only a minimal degree of postoperative pain.

Two hundred and sixty-six patients (93.3%) were discharged on the first day postsurgery, 10 (3.5%) stayed in hospital for 48 h and nine (3.2%) more than 48 h (Figure 1).

The home management of the patients was by our home care service in 191 patients (67%) and by telephone in 94 (33%). Only three (1%) required readmission after discharge from hospital. Eighty per cent of questionnaires were returned 2 months after surgery. The degree of patient acceptance was 97%.

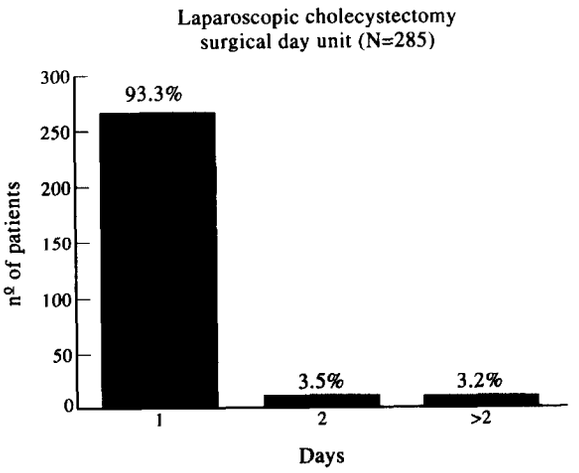

Figure 1. Times of discharge.

Discussion

Changes in surgery towards less invasive procedures, such as laparoscopic cholecystectomy, influence institutions to make major decisions involving same day surgery[6,7]. For cholecystectomy patients these changes have trimmed the usual hospital stay to 23 h following laparoscopic surgery, vs. up to a week following open surgery. Less psychological trauma is one of the proven benefits of day surgery, owing to the clear separation of inpatients and outpatients. Our purpose was to make the process of LC for uncomplicated cholelithiasis more convenient and more acceptable to the patients and their families. The hospital-based DSU is the ideal environment in which to reach this aim for several reasons: the DSU is less threatening than the traditional inpatient setting, scheduling is easier, turnover times are much faster and there is no risk of being cancelled when emergencies come in. The patient's recovery time after LC requires more than a few hours postoperative stay and they may qualify as an observational stay of less than 24 h. Our hospital-based unit has the advantage that bed availability is not an issue, making possible a 24-h service for LC patients. Our first day LC programme ensures that all patients receive the same standard of care that surgical patients currently receive and time spent in the sick role is minimized.

All patients in the current study were admitted the morning of the operation. The postoperative course in most patients was uneventful, with 93.3% of patients in our study being discharged from the hospital within 23 h of surgery.

The rate of conversion to OC of 3.5% is comparable to that reported by other authors in larger studies[8] that reported a conversion rate of 4.7%. Reasons for conversion to the open procedure were also consistent with other reports[9,10].

Postoperative complications were divided into minor and major categories. Patients with complications characterized as minor did not have prolonged periods of hospitalization. Major morbidity was 1.8%, which is comparable with, although slightly higher than, the rate reported in another series[10] of 1.6% in 647 patients. Neither of these complications is believed to be related to early discharge. Only three patients (1%) were readmitted for problems caused by the procedure: two patients were readmitted for bile leakage and one patient was readmitted for abdominal pain (but the cause of the pain was not discovered). Our readmission rate is comparable with other reports which range from 0.5–3.8%[11,12].

In our experience, the Home Hospitalization Service has been a valuable means of offering security to the patients and structuring a continuum of care. A visit once a day by a registered nurse to evaluate the patient's progress is important, particularly in the early detection of complications[13]. We believe that the programme has led to increased patient satisfaction.

Our results indicate that LC can be safely performed in a DSU setting if the patients are properly selected. Long experience with the laparoscopic approach will continue to shift most elective cholecystectomies from an inpatient to a day-case environment[4,13,14]. The next aim of our plan of early discharge will be outpatient LC. As more experience is gained with the technique and with the assurance of early access to the hospital, more patients should be able to spend their first night after the operation at home.

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Day-case adenoidectomy – safety and cost effectiveness

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In order to evaluate the safety, economics and cost effectiveness of performing adenoidectomy as a day-case surgical procedure, collected data from theatre register, medical and nursing case notes were analysed with the safety results and costings were detailed of day-care cases in relation to inpatient results. Over the 2 yr period between October 1991 and September 1993 out of 2229 ear, nose and throat (ENT) procedures, 993 were day cases under the care of one consultant surgeon where the procedures were carried out by senior house officers, staff grade, clinical assistant and the consultant. Of these, 332 intended day-case adenoidectomies were performed either as part of multiple day-case procedures, 310 cases; or adenoidectomy alone, 22 cases. The age range was 2–15 yr. A morbidity rate of 16.57% (55 cases) requiring overnight stay was recorded, mainly due to clinical or social reasons. No cases of bleeding requiring return to theatre and no mortalities were reported. The calculated cost of treating the 332 patients on an intended day-care basis, less 55 cases kept overnight, has shown that a saving of over £27 500 per annum over the cost of inpatient treatment is attainable by one surgical firm. It is concluded that performing adenoidectomy as a day-case compared with inpatient procedure is surgically and clinically safe with no mortality and minor morbidity and is also cost effective with an average saving of 43.6%.

Key words: Adenoidectomy, day-case, cost, safety

Introduction

Traditionally, over the decades adenoidectomy has been performed under general anaesthesia as part of multiple ear, nose and throat (ENT) procedures, in the majority of cases as adenotonsillectomy. In the latter half of this century it has been performed more in conjunction with myringotomy and/or grommet insertion or combined with examination under anaesthetic of the upper respiratory tract mainly in children, although in a relatively small number of cases adenoidectomy is performed as a lone procedure. This has always made it a reason for considering adenoidectomy as a procedure that justifies overnight admission.

Over the past few years there has been repeated encouragement by the Audit Commission[1], King's Fund Centre for Health Service Development (personal communication) and NHS Management Executive[2] by building units dedicated to day-case surgery. The Royal College of Surgeons of England[3] has also recommended performing more day-case surgery, both as part of a cost-cutting exercise and to reduce waiting lists, as confirmed in later reports by Ahmed et al.[4]. The reduction in the psychological impact of hospital stay, especially on young age groups and their families, has been reported[4], in addition to the proof that day-case surgery is associated with less morbidity, as previously reported by Prugh et al.[5], Capper and Randall[6] and Shott et al.[7].

Material and methods

The indications for adenoidectomy are well established, namely: nasal obstruction, mouth breathing, snoring, nasal intonation, recurrent upper respiratory tract infections and eustachian dysfunction leading to otitis media, glue ears and their sequelae. However cleft palate or suspected submucus cleft are considered local contraindications for the procedure.

The decision to undertake adenoidectomy on a day-case basis was seriously considered after discussion with consultant anaesthetists who are well experienced in paediatric ENT surgery and who had worked with the author and the day-care unit nursing team for many years. This was followed by explanation and advice to individual parents to obtain their agreement.

The following criteria were laid down:

1. Patients should fulfil and pass health assessments and operative records, after the parents complete

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with a nurse the relevant record sheet that applies to children and adult day-care patients.
2. All patients are assessed on admission by the senior house officer (SHO) and the anaesthetist using a special admission form and preoperative routine observation recorded by day-care nursing staff.
3. Patients are admitted at least 1 h before the start of the morning operating list.
4. Operating lists start at 8.30 a.m. when the staffing level is high as recommended by Capper and Randall[6].
5. Children and their parents are encouraged to attend in groups 'The Saturday Club', where they are escorted by the nursing staff on a tour of the hospital departments and ENT unit, where details of what they should expect to see and what happens on admission are explained in clear terms and they are also encouraged to ask any questions while taking refreshments.
6. Parents are advised to stay with their children and encouraged to accompany them to the anaesthetic room on the day of surgery.
7. All the adenoids are done at the start of the operating list under a general anaesthetic.
8. No premedication is given.
9. The postoperative period is planned to expect postoperative discharge between 4–6 h after leaving theatre provided:
   (a) the patient is apyrexial;
   (b) no signs of revealed or concealed bleeding guided by half hourly standard observation for a minimum of 2 h;
   (c) no social or home reasons to delay discharge;
   (d) no signs of nausea, vomiting, irritability or sleeplessness and the child generally looks well;
   (e) patient had a light meal and drink when ready to eat.

If the patient does not fulfil any of the above criteria before discharge, they will be transferred to the inpatient ward for overnight observation and treatment then discharged when all the above criteria are fulfilled, usually within the next 24 h.

The following anaesthetic regime is usually applied with minor variations according to the preference of the consultant anaesthetist in charge of the list and the basic technique is as follows:

1. Preoperative:
   (a) no premedication;
   (b) Emla cream (Astra Pharmaceuticals) applied to the backs of both hands at least 1 h before transfer to theatre.
2. The anaesthetic procedure is carried out in the following order:
   (a) intravenous cannula;
   (b) thiopentone sodium (May and Baker) 4 mg kg^{-1} body weight;
   (c) suxamethonium chloride (Antigen Pharmaceuticals) 1.5 mg kg^{-1} body weight;
   (d) endotracheal intubation using plain oral tube of appropriate size;
   (e) immediately following the end of the procedure and before transfer to the recovery room the following medication is administered:
      (i) morphine sulphate 0.1–0.2 mg kg^{-1} or fentanyl citrate (David Bull Laboratories) 1 μg kg^{-1}.
      (ii) rectal diclofenac sodium (Voltarol) (Geigy Laboratories) 12.5–25 mg, one dose.
3. Surgery is performed by curettage using a very sharp adenoid curette and haemostasis is achieved by nasopharyngeal packing for a few minutes.
4. Postoperative medication:
   Mild postoperative analgesia in the form of paracetamol elixir 5–10 ml.

Results

Clinical details

The procedure was carried out on 332 cases fulfilling the above criteria and one or all of the indications for adenoidectomy as the sole procedure or as part of multiple day-case ENT procedures.

Table 1 shows a breakdown of adenoidectomy cases in this report and all other day-case ENT procedures as part of the ENT surgical load carried out under the care of one consultant surgeon.

The sex distribution in Table 2 shows that more male children undergo adenoid surgery, over 57% compared with 43% females. Analysis of age distribution in Table 3 shows that 75% of day-case adenoidectomy was carried out on children between the ages of 2 and 6 yr. Segal et al.[8] obtained similar figures when analysing 337 similar cases where the majority, 73.21% (276 cases) were in the 1–5 yr age group.

Mortality and morbidity breakdown from Table 4 showed at one end of the scale that nausea and vomiting are the main morbidity factor delaying discharge of 9.64% of all day-case adenoidectomy. At the other end of the scale there was no single case of bleeding either

Table 1. Summary of adenoidectomy as part of day-case ENT workload (October 1991 – September 1993)

	Total no. ENT cases: 2229	
	No.	*%*
Total no. day cases	993	44.64
Day-case adenoidectomy	332	33.43 (day cases) 14.89 (all ENT cases)

Table 2. Distribution by sex of 332 day-case adenoidectomies

	No.	*%*
Males	191	57.53
Females	141	42.47

Table 3. Age distribution of 332 day-case adenoidectomies

	No.	%
2–6 yr	249	75
7–11 yr	63	18.98
12–15 yr	20	6.02

Table 4. Morbidity and mortality analysis of 55 cases transferred to inpatient stay

Reason for transfer	*No.*	*%*
Nausea and vomiting	32	9.64
Pyrexia	10	3.01
Sleepy or irritable	8	2.41
Social reasons	5	1.51
Return to theatre	0	0.0
Bleeding after 6 h	0	0.0
Mortality	0	0.0

requiring return to theatre or more than 6 h observation, or a single mortality. This was confirmed in similar reports[8–10].

Other reasons for the delay of discharge were pyrexia over 37.5° C, sleeplessness or irritability and social reasons (transport and telephone availability or hospital-to-home distance was more than 15 min travel by car) which, together, made up 6.91% of all day-case adenoidectomy.

On discharge parents are given verbal and written advice regarding postoperative home-care and how to contact the doctor on-call through the ward if they are concerned and they are also handed a copy of their GP discharge letter.

Cost analysis

According to this hospital's costing and marketing department, adenoidectomy performed as an inpatient procedure before October 1991 was considered to have an average length of stay of 1.7 days at a cost of £173 per day and a total cost to the purchaser of £461 inclusive of accommodation, dressings, drugs and paramedical services, but excluding theatre and material costs. However according to the same source a day-case adenoidectomy will cost £260, a saving of £201 or 43.6% over the inpatient cost, which is comparable with other official government reports in this country from Welsh Office Statistics[11].

The total charge to the purchaser for 332 inpatient adenoidectomies at a rate of £461 per case will be £153 052, compared with a total cost of £86 320, if carried out on day-case basis at a cost of £260 per case for the same number of cases. This represents a total saving of £66 732 over a 2-yr period or £33 366 p.a. for one consultant's team, for the cases presented in this report.

However as the actual number of cases treated on a day-care basis was reduced by 55 to 277 at a total cost of £72 020, compared with £127 697 if treated on an inpatient basis, this would make a saving of £55 677 in 2 yr or £27 838.50 p.a. per consultant team or just over £11m (£11 135 400) if the day-care procedure is undertaken by only 400 consultant teams out of over 510 consultant members of the British Association of Otolaryngologists (BAOL) in the UK.

Discussion

The move to day-case surgery will depend on the surgeons' attempts to audit the results available from their own surgical practices and feedback from their patients, families and family practitioners. Stott[12] reported how popular day-case surgery is with doctors, nurses and patients.

The list of examples of appropriate ENT operations suitable for day-case surgery suggested in the guidelines for day-case surgery, published by the Royal College of Surgeons of England[3] did not include adenoidectomy, neither did the Audit Commission's[1] 'basket' of 20 procedures contain adenoidectomy as suitable for day-case surgery.

However the author found that day-case surgery is acceptable to parents, nursing staff, anaesthetists and family practitioners, as also reported by Garraway et al.[13], and in the author's opinion the formal inclusion of adenoidectomy in these lists following similar reports[14,15] will only be a matter of time, especially as both the Department of Health and Royal Colleges are aiming for day-care surgery to reach 50% of the total number of surgical procedures in the UK in the next few years; a figure that will be reasonably achievable in ENT surgery.

As from late 1991 the author began performing adenoidectomy as a single procedure and also as part of multiple ENT day-case procedures that included myringotomy, grommets, suction clearance and antrum washout on a day-case basis, but not adenotonsillectomy.

Clinical safety

Adenoidectomy and also tonsillectomy are safe, provided the patient has no significant systemic disease, a favourable social situation, parents with positive attitudes and a minimum of 6 h postoperative observation as reported by Lee[16].

The appreciation of GPs was evident in this series as they noted obvious increased access to shorter waiting lists as a result of quicker turnover in the use of beds. This was confirmed by Garraway et al.[13], where it was found that 75% of GPs appreciated quicker service, as well as patients, carers and district nurses, who were all in favour of day-care surgery for selected groups of surgical conditions.

The psychological impact on the parents of having their children stay overnight in hospital, in addition to the behavioural problems caused by the hospitalization of children and parental separation, is well documented in children under the age of 4[5,17]. This has been greatly

reduced in this series by the facilities offered to parents and carers to accompany and spend time with their children and then escort them home on the same day, a service that has been well recognized and appreciated by the families.

Postoperative bleeding as a major complication has a very low incidence in a published report by Leighton et al.[18], showing a rate of 0.34% of primary haemorrhage in a series of 20 000 cases and it was noticed to be nonexistent 6 h postoperatively, which encouraged others[4,5,19], including the author, to undertake day-care adenoidectomy on a large scale.

With the anaesthetic regime adopted in this series the author had minimal postoperative problems and it was found that endotracheal general anaesthesia for short-stay operative procedures had no increased morbidity over other reports[20].

Shott et al.[7] did not include complications studies of adenoidectomy performed as the main procedure in their series of tonsillectomy and adenoidectomy, as it was considered to have fewer potential complications. However pyrexia and nausea and vomiting have regularly been confirmed as minor complications. Mortality has never been reported in any of the series[4,7,19] including this report. The data in this series has shown that day-case adenoidectomy is safe provided 4–6 h of postoperative observation is adhered to.

Some clinical and social implications were learned from this study, namely:

1. Patients living more than 30 min drive from the hospital, or who have no private transport should be advised to have their children's operation performed on an inpatient basis.
2. If telephone communication is not available at home, day-care surgery should not be advised.
3. When adenoidectomy is carried out as part of an adenotonsillectomy procedure a minimum of 24 h postoperative stay should be mandatory.

Cost factor

Concern over the rising cost of healthcare in North America, reported by Guida and Mattucci[14] and now in the UK, reported by Garraway et al.[13] and Stott[12], has created a trend towards outpatient surgery, especially with regard to frequently performed procedures such as adenoidectomy and adenotonsillectomy and other paediatric ENT procedures. Segal et al.[8], Shott et al.[7] and Helmus et al.[21] have shown that a saving of up to 50% can be made with day-case surgery compared with overnight admission.

The significant financial savings have been clearly shown by the NHS Management Executive[2]. It is also demonstrated in this report that savings of over £11m could be achieved annually if day-case adenoidectomy could be adopted by an average of 400 consultant teams nation-wide.

The 43.6% saving estimated to have been achieved in this report is comparable with the Welsh Office figures for Ysbyty Maeor Hospital in Wrexham achieved by the thoughtful use of available resources, as reported by Burn[22], where the cost of day-case paediatric procedures prior to 1990 was £53.21 compared with £93.44 for the overnight use of a paediatric bed in the same hospital, a saving of 43.5%. Similar figures were also reported by Sadler et al.[23], where in East Glamorgan Hospital the cost of an overnight stay was £73.16 compared with £41.61 for a day-case bed in the same hospital, a saving of 43.12%.

Conclusions

This article reviewed adenoidectomy cases performed under the care of one surgeon in the 2-yr period between October 1991 and September 1993 as a day-case procedure carried out by various grades of surgical staff.

The total number of ENT day cases (993), day-case adenoidectomy (332), their mortality, morbidity, number and reasons for transfer to inpatient stay (see Table 4) and the cost effectiveness of the operation compared with overnight stay is discussed. The criteria and preoperative preparation, operative and anaesthetic procedures, postoperative management and complications of such cases are illustrated. This report is meant not only to assess the cost-related savings which have been well documented in previous reports by Welsh Office Statistics[10] and Sadler et al.[23] but also to demonstrate the absence of mortality and the low morbidity rate attached to day-case adenoidectomy.

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The laryngeal mask in day surgery: a survey of current practices and usage

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A survey of 296 anaesthetists revealed the laryngeal mask airway (LMA) to be a valuable tool in anaesthetic practice for day surgery, used regularly by 88% of anaesthetists. The results show marked regional variation in the use of the laryngeal mask airway in more controversial areas such as anaesthesia for cataract extraction, tonsillectomy, the insertion of grommets, dental and laparoscopic procedures and surgery involving the prone position. Complications reported by anaesthetists using the laryngeal mask airway include dislodgement (69%), laryngospasm (62%), regurgitation and aspiration (22%) and pharyngeal trauma (22%). The most concerning of those reported was that of dislodgement when the airway was not easily accessible.

Key words: Laryngeal mask airway, day surgery, usage, complications

Introduction

The laryngeal mask was invented in 1981 by Brain[1], who described this revolutionary method of airway management in 1983[2] and subsequently in clinical settings[2-4]. It was first produced commercially in 1988 and since then has had a significant impact on the practice of anaesthesia and particularly for day cases because it avoids the need for endotracheal intubation and possible associated problems. Studies have shown that use of the laryngeal mask is associated with few complications[5-8]. Controversy exists over its use in some situations which involve a higher likelihood of problems occurring, although clinical trials have recommended its use in laparoscopic procedures[9-10], intraocular surgery[11], adenotonsillectomy[12], dental anaesthesia[13] and paediatric anaesthesia[8,14].

Complications occurring with use of the laryngeal mask airway (LMA) include dislodgement, regurgitation and aspiration, laryngospasm and pharyngeal trauma[1], hence use of the LMA in anaesthesia is dependent on the anaesthetist's preference and previous experience. This survey was conducted to audit current opinions and practice among anaesthetists of the use of the LMA in anaesthesia for day surgery.

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Methods

A postal questionnaire was sent to 386 anaesthetists from 15 different centres in the UK, which ranged from large teaching hospitals to smaller district general hospitals. Grades from registrar to consultant were included. The questionnaire included details about the number of years experience with the LMA, experience of use in children and adults, use for differing durations of anaesthesia, use in patients with physiological derangements (obesity, lung disease, gastric regurgitation) and use for different operative positioning (prone, Trendelenburg, lithotomy).

Current practice of the anaesthetist was assessed by asking whether the LMA would be used in the following circumstances: cataract extraction, dental surgery, tonsillectomy, insertion of grommets and laparoscopic work. The occurrence and details of complications experienced were sought in the questionnaire, specifically those of dislodgement, laryngospasm, regurgitation and aspiration and pharyngeal trauma. Finally, the questionnaire had a section asking if the anaesthetist had had any experience which led to a change of their practice with the LMA.

Results and discussion

The overall response rate to the questionnaire was 76%. Most anaesthetists had 3–4 yr experience of using the LMA and 88% of all anaesthetists used them regularly

in adult anaesthesia. There was no difference between consultants or trainees in their use of the LMA.

Paediatric anaesthesia

Seventy nine per cent of anaesthetists used the LMA for preschool children. Brain draws attention to the fact that the paediatric LMA has an advantage over the endotracheal tube since the diameter is larger and provides less resistance to gas flow for spontaneous respiration[1]. The LMA is less traumatic than the endotracheal tube which is also a great advantage for day-case surgery. Many anaesthetists reported that the incidence of laryngospasm and dislodgement in children was much higher than in adults and that they did not use the LMA in children for this reason. Fibreoptic assessment of the LMA showed partial obstruction in 10% of adults, compared with 25–50% of children[15]. Brain[1] recommends that only experienced anaesthetists use the LMA in children.

In a randomized comparison of the LMA with a face mask Johnston et al.[8] concluded that the LMA provides superior airway control with less hypoxia in 2–10 yr olds. An open study by Mason and Bingham[14] involving 200 children showed that the LMA can be used successfully in children of 6–30 kg, where only 2.5% of cases experienced problems with the LMA sufficient to necessitate its removal. The LMA is therefore of great value in paediatric day-case surgery.

Duration of anaesthesia

The percentage of anaesthetists who use the LMA for different durations of anaesthesia are shown in Figure 1. The most consistent response is where the duration of surgery is expected to be 10–60 min where 75–100% of anaesthetists would use the LMA. The popularity of the LMA for procedures under 10 min duration varied from 33–83% of anaesthetists in different centres. Although there are many day-case procedures under 10 min duration, the cost (up to £3 per use because of replacement and sterilizing costs) mitigates against its use where the use of the face mask is a reasonable alternative.

Patient physiology

Obesity. Ninety per cent of anaesthetists were happy to use the LMA in moderately obese patients, and 23% in very obese patients. These numbers may seem surprisingly high, but the alternative airway management may prove equally problematic. Difficulty with positioning of the LMA, regurgitation and later dislodgement were problems frequently encountered by anaesthetists. These difficulties highlight the potential unsuitability of very obese patients for treatment as day cases.

Lung characteristics. Patients with poor lung compliance present difficulties when using positive pressure ventilation through the LMA, since its use with pressures less than 20 cm water is recommended[1]. Forty per cent of the anaesthetists qualified their use of the LMA in this category of patient by only employing spontaneous ventilation. Eighty-two per cent of anaesthetists were happy to use the LMA in asthmatic patients, hence avoiding the stimulus to bronchospasm of tracheal intubation. Many day-case patients suffer with asthma and the LMA is valuable for this reason.

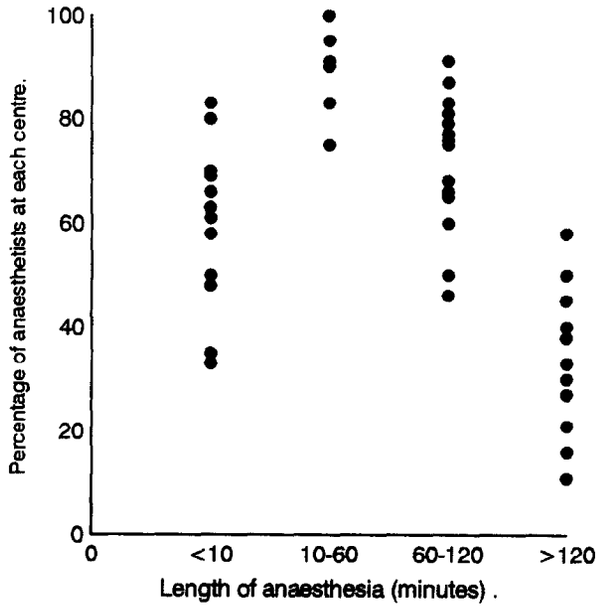

Figure 1. Percentage of anaesthetists at different centres using the laryngeal mask for different durations of anaesthesia. Each symbol represents a separate centre.

Gastric regurgitation. The LMA is not recommended for use in patients who are at risk of regurgitation, or who have full stomachs. Barker et al.[16] have considered whether the presence of the LMA may increase the incidence of reflux, possibly because of an effect on the lower oesophageal sphincter[17]. Therefore it is a surprise that in one hospital 37% of anaesthetists would consider using the LMA in these patients (although some stated that this would only be after prophylaxis with antacids and metoclopramide). At other centres only 15% of anaesthetists would use it in these patients. However, of the reports in the literature of regurgitation, many are unexpected or unpredictable[7,18,20,21]. Twenty-one per cent of anaesthetists reported further instances of regurgitation in this survey and it is important to be alert when this complication occurs, just as it is when a face mask anaesthetic is being given. Day-case patients are responsible for their preoperative starvation and there is obvious need to check that this has been adhered to before surgery.

Operative positioning

The LMA has been recommended for use in all positions including Trendelenburg and prone, if the anaesthetist is sufficiently experienced[1]. Figure 2 shows the percentage of anaesthetists in each centre who use the laryngeal mask in these operative positions. It can be

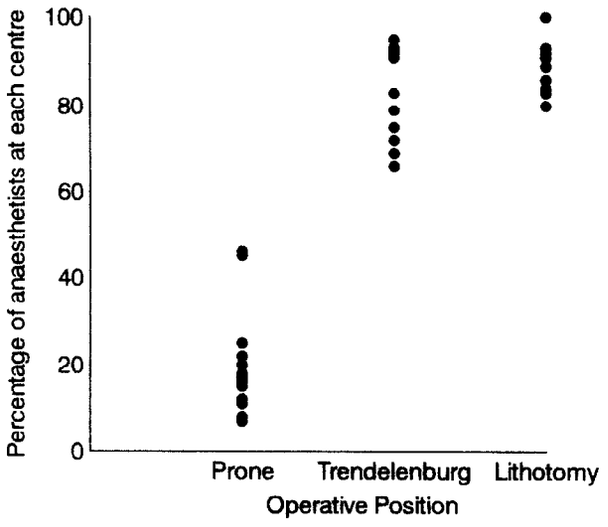

Figure 2. Percentage of anaesthetists in different centres using the laryngeal mask for different operative positions. Each symbol represents a different centre.

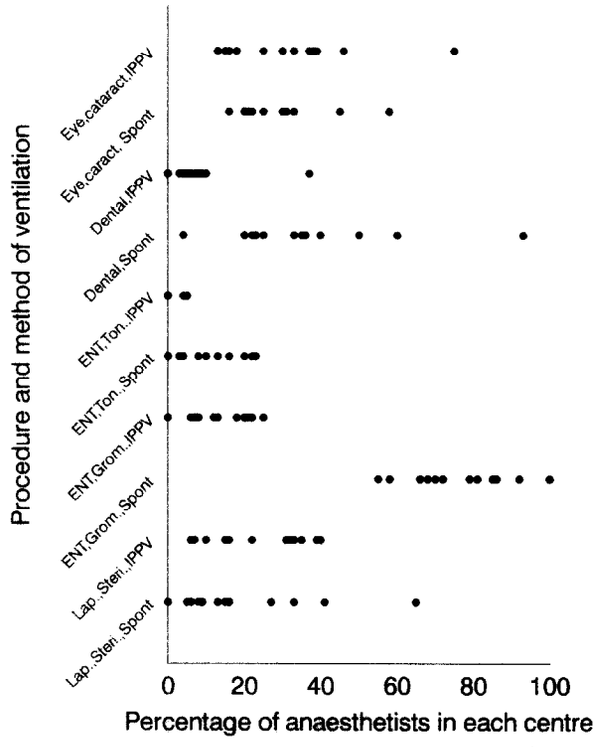

Figure 3. Percentage of anaesthetists in each centre who use the LMA for different procedures. IPPV, Intermittent positive pressure ventilation; Spont, spontaneous respiration; ENT, ear, nose and throat; Ton, tonsillectomy; Grom, grommets; Lap, laparoscopic; Steri, sterilization.

seen that few anaesthetists are willing to use the LMA if the patient is to be placed prone. Dislodgement during either positioning or intraoperatively may be difficult to correct due to the airway not being immediately accessible. This problem was reported by nine anaesthetists in the survey. The regional variation is interesting to note: in one hospital, 46% of anaesthetists used the LMA for prone positioning, compared with a mean of 19% of anaesthetists in all the other centres.

Practice in operative procedures

Figure 3 illustrates the percentage of anaesthetists in each centre who would use the LMA for a particular procedure and whether they would employ positive pressure ventilation or spontaneous breathing. It is interesting to note the large variation in practice between centres, which may be explained by the fact that anaesthetists are often influenced by their immediate colleagues' opinions and experience.

Eye surgery. Only 30% of anaesthetists use the LMA for cataract extraction, because of the risk of dislodgement. They would sympathize with Ripart et al. who write that, from their experiences with dislodgement during ophthalmic operations, they no longer employ the LMA for use in such circumstances[22]. Indeed eight anaesthetists reported similar experiences which had changed their practice. The LMA has been recommended for use by Brain in eye surgery[1], since it may induce less postoperative coughing and thus prevent an increase in intraocular pressure. Lamb et al. also showed that there was less increase in intraocular pressure when an LMA was used in preference to endotracheal intubation for the procedure[11]. Brain[1] does add a note of caution that spontaneous ventilation may be preferable to positive pressure ventilation when the presence of the surgeon and drapes make it difficult for the anaesthetist to assess the airway, although the use of a capnogram with graphical display gives an immediate warning of problems. From the survey results, approximately half of the anaesthetists use positive pressure ventilation enabling the arterial carbon dioxide tension to be controlled, avoiding an increase in intraocular pressure.

Dental surgery. The survey results show a wide discrepancy in practice between centres, from 0–37% for positive pressure ventilation and 4–93% for spontaneous ventilation. Eight anaesthetists have experienced problems with airway patency when the surgeon extends the head. Three anaesthetists recommend using the armoured LMA to avoid such problems. Brain suggests that the LMA is useful during short dental procedures, in conjunction with a throat pack[1]. Care must be taken by the surgeon to move the mask from side to side without dislodging the airway. The laryngeal mask has been shown to protect the airway from secretions from the oropharynx in a study by John et al.[23] and experience with its use in dental surgery is reported as successful[4,13].

Tonsillectomy. Although performing tonsillectomy as a day-case procedure is controversial, this was included because there is increasing pressure to perform such procedures on this basis. The use of the LMA for tonsillectomy is possible, although the large compressible tube can restrict surgical access. Fixation of the LMA is important and a throat pack can be used. The cuff of the LMA is below tonsillar level. Despite a study by Williams and Bailey[12], showing the LMA to be superior

to the use of an endotracheal tube for tonsillectomy in children, the number of anaesthetists using the LMA for this procedure is fewer than 20% in each centre. This is considerably less than the use of the LMA in children for other procedures and reflects the fear of airway contamination, dislodgement and laryngospasm.

Ear surgery. Fifty to one hundred per cent of anaesthetists used the LMA for insertion of grommets with spontaneous respiration since this enables the anaesthetist to stand clear from the area of surgery. Precautions must be taken in case of dislodgement, but at least access to the airway is possible. The study by Johnston et al.[8] on otological procedures in children aged 2–10 yr showed the LMA to be superior to using a face mask. The LMA is deservedly popular for this day-case procedure.

Laparoscopic surgery. The survey results show that at present 23% of anaesthetists use the LMA for laparoscopic work with positive pressure ventilation and 18% with spontaneous ventilation. The avoidance of the use of the LMA is attributable to the risk of regurgitation induced by the Trendelenburg position, higher abdominal pressures with intraperitoneal gas and gastric distention if positive pressure ventilation is used. Previous studies on techniques of anaesthesia for laparoscopy have shown no difference in outcome whether the patients were ventilated or breathing spontaneously[24,25]. Brain used the LMA for laparoscopy with positive pressure ventilation and found it to be satisfactory[2]. Goodwin et al. found the LMA to be excellent for day-case laparoscopy work, with the patients breathing spontaneously[9]. Swann et al. compared patients for laparoscopy who were either intubated and ventilated, or breathing spontaneously with assistance via the LMA[10]. They showed that both techniques were acceptable, although there was a higher incidence of nausea and vomiting in the LMA group, possibly due to gastric insufflation, but a lesser incidence of sore throat. A study by Malins et al. in which 150 patients were ventilated through an LMA for laparoscopy reported no complications, although obese patients were excluded[26].

Complications associated with the LMA

The aim of an anaesthetic technique for day-case surgery is safely and efficiently to produce adequate operating conditions with minimal complications and swift recovery. Complications of the use of the laryngeal mask may compromise safety and hence their occurrence was sought.

Dislodgement. From the survey results, 69% of all anaesthetists admitted to experiencing this complication. Dislodgement was said to occur more frequently during surgical repositioning of the head, application of drapes, repositioning of the patient, obese and edentulous patients and children. Dislodgement was also reported in two patients when facing prone, two patients during laparoscopy and four patients during eye operations. Reversal of muscle relaxant was also reported to precipitate airway obstruction in three cases, either due to laryngospasm or displacement of the LMA.

There are a number of reasons in addition to dislodgement why obstruction to the airway may occur during LMA anaesthesia. Brain describes how the tip of the LMA may penetrate the larynx on insertion and cause increasing obstruction as the cuff volume expands with diffusion of nitrous oxide intraoperatively[28]. Collier[29] found cuff pressures to be 11 kPa at the beginning of a procedure, increasing to 19 kPa at the end. This may explain the airway obstruction he experienced with three patients on induction, after 45 min and 110 min respectively. The obstruction was relieved in all cases by the aspiration of 10 ml of air from the cuff.

Downfolding of the epiglottis is said to occur in 60% of patients with partial airway obstruction in a fibreoptic study by Payne[30]. Brimacombe states, however, that only 5% of total airway obstruction is caused by epiglottic downfolding[31] and that the causes are more usually laryngospasm, closure of the laryngeal inlet by inward displacement of the aryepiglottic folds when the cuff is inflated, kinking of the tube, or cuff overinflation. Changes in practice reported by anaesthetists were to use the armoured LMA for ear, eye and dental procedures; reluctance to use the LMA in operative procedures near the airway, during eye surgery, or prone positioning; to check the position of the LMA with a laryngoscope before surgery; and to ensure good fixation of the LMA preoperatively. Three anaesthetists felt that insertion of the LMA was facilitated by partial inflation of the cuff, although Brimacombe and Berry did not conclude this in their study[32]. Seventy-seven per cent of anaesthetists were more reluctant to use the LMA in the obese patient and the need to keep the patient deeply anaesthetized when reversing muscle relaxation was emphasized.

Laryngospasm. Laryngospasm was reported by 62% of anaesthetists. It occurred more commonly in children, on induction when the patient was not anaesthetized deeply enough, and also in recovery. Patients who were smokers, asthmatics, unpremedicated day cases and patients who were induced with thiopentone rather than propofol also had a higher incidence of laryngospasm. Six of the cases reported were severe enough to warrant the use of suxamethonium. Studies in adults and children have estimated the incidence of laryngospasm associated with removal and insertion of the LMA to be 2%[14] and 4%[5]. The LMA manual recommends that the LMA remains *in situ* until the patient is fully awake and all pharyngeal reflexes are intact, however this seems to be a cause of laryngospasm and regurgitation in many cases, and many anaesthetists reported choosing to remove the LMA when the patient is still deeply anaesthetized.

Changes in practice to avoid laryngospasm include reluctance to use the LMA in children, to ensure that

the patient is deeply enough anaesthetized for insertion and removal of the mask, to use propofol as the induction agent of choice, or always to increase the depth of anaesthesia with a volatile agent before insertion of the mask. Two anaesthetists reported routine preoxygenation in case laryngospasm occurred.

Regurgitation and aspiration. This was experienced by 22% of all anaesthetists. All but one of the cases of aspiration were entirely unpredictable. This one patient had a history of gastric reflux. No longstanding morbidity subsequent to the aspiration was reported – some patients' lungs were ventilated postoperatively, but all recovered fully. These findings agreed with the literature which does not reveal to date a mortality from aspiration with the LMA. All five patients in the study by Verghese et al.[6] who regurgitated needed no postoperative intervention. The survey of Australian intensive care units by Brimacombe and Berry[7] showed the admission of one patient in 1990 and seven patients in 1991 for aspiration occurring with LMA usage, with no fatalities. Even in a study of the use of the LMA for cardiopulmonary resuscitation[27], where one might expect a high incidence of aspiration, although 20% of the patients regurgitated only one patient showed signs of clinical aspiration and recovered fully. Other case reports by Wilkinson et al.[20], Griffin and Hatcher[18] show aspiration to have occurred during recovery. This correlates with the results of the survey in which three of the patients aspirated postoperatively with the LMA still *in situ*. This brings into question once more whether the LMA should be removed earlier when the patients are still deeply enough anaesthetized. Changes in practice stated by the anaesthetists reveal a reluctance to use the LMA for positive pressure ventilation and laparoscopic work, and a lower threshold to intubate patients with a history of reflux.

Pharyngeal trauma. This was reported by 22% of anaesthetists. Most of the reports were of small amounts of blood seen on the mask at the end of the procedure. However reports were made of pharyngeal haematoma, severe bruising to the pharynx and soft palate laceration. One anaesthetist discovered from postoperative questioning that more patients complained of sore throat than did patients who had conventional mask anaesthesia. Comments were made that care should be taken in children to avoid trauma to the epiglottis and enlarged tonsils and that the LMA should not be used in patients with bleeding problems. Incidence of sore throat postoperatively in the literature varies from 3.9%[2] to 12%[5]. Severe bruising has been reported by Lee[33]. Brain[34] stresses that the technique of insertion is important to avoid this complication: the tip of the LMA should always remain flat and never kinked. Thompsett and Cundy report the occurrence of a haematoma above the right vocal cord in a patient with a bleeding diathesis[35] but Brain emphasizes the need for cautious insertion to avoid misplacement of the tip into the laryngeal aperture, stressing that the LMA need not be considered any more traumatic than either a conventional mask or endotracheal intubation[28]. The occurrence of pharyngeal trauma therefore seems to be negligible and avoidable with correct technique of insertion, and the incidence of sore throat after LMA insertion was only small, suggesting suitability for day-case anaesthesia.

Conclusion

This survey was conducted to see how anaesthetists use the LMA in their practice for day surgery today and what problems they have encountered. It is of interest to report the complications revealed in the survey, although an accurate estimation of the incidence of complications is not possible because of the reliance on memory. Many anaesthetists show considerable caution, avoiding its use in situations where problems may arise. The incidence of serious complications is low, the most worrying one being displacement or obstruction of the LMA in situations where the airway is not accessible.

In a recent Editorial[36], Asai and Vaughan warn of the danger of misusing the LMA and the need for trials to establish its place in anaesthetic practice. This survey illustrates the differences between anaesthetists in their use of the LMA and emphasizes the need for recommendations for safe practice. This is all the more necessary in day-case anaesthesia where safety and the avoidance of complications are of prime importance if the patient is to be allowed home.

Acknowledgements

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The real cost of total intravenous anaesthesia: cost versus price

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This paper outlines the comparative cost analysis performed on three types of day case general anaesthetic maintenance techniques, namely total intravenous anaesthesia (TIVA) using propofol, and volatile anaesthesia, using oxygen, nitrous oxide and either enflurane or isoflurane. The general anaesthetics studied were administered to patients undergoing oral surgery, minor gynaecological surgery, ear nose and throat (ENT) surgery and knee arthroscopy as day cases in a busy teaching hospital day surgery unit (DSU). Both direct and indirect costs were included in the overall costing, including follow-up data concerning the use of medical resources in the post discharge period. The results suggest that total intravenous anaesthesia is comparable in cost to more traditional volatile anaesthesia, especially for day case operations of less than 30 min duration. TIVA was also associated with less negative outcomes at 24 h follow up and may thus be associated with greater patient satisfaction.

Key words: Day surgery, total intravenous anaesthesia, propofol, cost

Introduction

Total intravenous anaesthesia (TIVA), involving induction and maintenance with an infusion of propofol, is widely used in the day surgery setting. The technique offers many advantages of particular relevance to the anaesthetic management of the day case patient, including rapid, high quality induction and recovery[1], coupled with a low incidence of postoperative nausea and vomiting[2]. In the current financial climate, however, where there is increasing pressure on healthcare systems to rationalize costs, total intravenous anaesthesia is often regarded as expensive and not significantly superior to cheaper forms of anaesthetic maintenance to warrant the increased cost incurred.

When considering the cost of any day case anaesthetic technique, Wetchler has urged that all costs, both direct and indirect, be taken into account[3]. Not only must the price or acquisition cost of anaesthetic drugs be considered, but so too should other direct costs, including drug wastage, adjuvant therapy and equipment costs. Indirect costs are less obviously associated with the anaesthetic technique utilized, yet the clinical events that precipitate them may have a large effect on overall outcome and on patient satisfaction. Indirect costs, including the cost of nursing, admission, duration of day unit stay, complication rates and their treatment, constitute a large proportion of the total anaesthetic cost, yet are seldom included in the overall cost analysis.

Several studies have highlighted the cost implications arising when all costs are considered, rather than simply the price of the anaesthetic drugs utilized[4,5], but none have included the cost implications of follow up and post-discharge complications. This study attempts to compare the costs of TIVA and volatile anaesthesia used over a 4 yr period in a major South Australian teaching hospital day surgery unit (DSU), including in that costing those indirect costs incurred in the post-discharge period.

Method

The study involved the retrospective analysis of our day surgery database, containing data on the 10 000 patients who have received day surgery in our day unit between 1990 and 1994. Data is collected routinely on all patients, information being entered long hand onto appropriately designed forms by both the anaesthetist and nursing staff and entered by hand into a computerized database. The data collected and analysed in this study included follow-up information at 24 h collected using telephone follow up, and is listed in Table 1.

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Table 1. Parameters measured

Duration of surgery
Duration of unconsciousness in stage 1 recovery
Duration of stage 1 recovery stay after return of consciousness
Duration of stage 2 recovery stay
Incidence of postoperative nausea and vomiting in stage 1 recovery
Treatment of postoperative nausea and vomiting in stage 1 recovery
Incidence of postoperative nausea and vomiting in stage 2 recovery
Treatment of postoperative nausea and vomiting in stage 2 recovery
Incidence of unanticipated hospital admission
Incidence of follow up by GP for anaesthetic-related reasons
Incidence of follow up by hospital A&E Department for anaesthetic-related reasons
Incidence of anaesthetic-related complications during DSU stay

The patient database was analysed, grouping together data concerning each operative group and anaesthetic maintenance technique. Four operative groups were found to be suitable for study and included oral surgery, minor gynaecological surgery, ear, nose and throat (ENT) surgery and knee arthroscopy. Three anaesthetic maintenance regimes were identified for comparison, namely: propofol, air and oxygen; enflurane, nitrous oxide and oxygen and finally, isoflurane, nitrous oxide and oxygen.

Mean values for the parameters listed in Table 2 were calculated. The hospital pharmacy and finance departments were consulted regarding drug prices and staffing rates. Fees for general practitioner and hospital follow up were obtained from the regulatory authorities.

The acquisition costing of the propofol used for anaesthetic maintenance was performed by analysing 100 randomly selected day surgical procedures undertaken in our unit. The mean value for the amount of propofol infused per min of surgical time was calculated from the total amount of propofol infused and the duration of surgery. This rate of propofol consumption was then applied to all the operations studied and the total amount used was costed accordingly. The quantities of medical air and oxygen used during TIVA were based on routinely used fresh gas flows (FGF) of 2 l min^{-1} of air and 1 l min^{-1} of oxygen into a circle system.

Table 2. Parameters calculated

Cost of the propofol, air and oxygen utilized during surgery
Cost of the enflurane, nitrous oxide and oxygen utilized during surgery
Cost of the isoflurane, nitrous oxide and oxygen utilized during surgery
Staffing costs
Postoperative nausea and vomiting costs
Admission costs
GP follow up costs
A&E Department follow up costs
Complication costs

As circle systems and relatively low flow fresh gas regimes are routinely utilized in our unit, the estimation of the quantities of enflurane or isoflurane used during volatile anaesthetic maintenance was also based on these fresh gas flow rates. Standardized vaporizer settings were also used so that the amount of enflurane consumed was based on a vaporizer setting of 3% in 6 l FGF for the first 5 min of surgery (4 l min^{-1} nitrous oxide and 2 l min^{-1} oxygen), followed by a setting of 2% in 3 l FGF for each remaining min of surgery (2 l min^{-1} nitrous oxide and 1 l min^{-1} oxygen). Similarly the amount of isoflurane consumed was based on a vaporizer setting of 2% in 6 l FGF for the first 5 min of surgery (4 l min^{-1} nitrous oxide and 2 l min^{-1} oxygen), followed by a setting of 1% in 3 l FGF for each remaining min of surgery (2 l min^{-1} nitrous oxide and 1 l min^{-1} oxygen).

Nursing costs were evaluated as follows: in stage 1 recovery ('time to wake'), while each patient was still unconscious and where each patient was nursed by a single nurse throughout, staffing costs were calculated based on the nurse's hourly rate of pay multiplied by the fraction of an hour the patient remained unconscious. Thereafter in stage 1 recovery ('time to sit'), staffing costs were calculated at half the nurse's hourly rate of pay multiplied by the fraction of an hour the patient remained in that clinical area. Stage 2 recovery time (time to 'fit for discharge'), where five patients were potentially nursed by one nurse throughout, was costed at a fifth of the nurse's hourly rate of pay multiplied by the fraction of an hour the patient remained in that clinical area.

The cost implications of pre- and intraoperative antiemetic prophylaxis were calculated. The staffing costs of treating postoperative nausea and vomiting (PONV) were also included, based on both the price of the drugs concerned and staffing time involved. Similarly, the drug costs and staffing time involved in the treatment of intra- and postoperative complications relating to anaesthesia were included in the final total costings.

The cost of both general practitioner (GP) consultation and unplanned Accident and Emergency (A&E) Department visits were incorporated into the overall cost for each anaesthetic maintenance technique, the costs involved being based on the published fees. Such information was only available for the first 24 h post discharge. Only those consultations precipitated by anaesthetic-related problems or symptoms were included.

Finally, the mean costs of unanticipated hospital admission were included in the final cost of each anaesthetic maintenance technique. Only those admissions precipitated by anaesthetic-related problems or symptoms were included.

The analysis of cost for the three anaesthetic maintenance techniques studied was intended to be comparative, focusing on those costs unique to each anaesthetic

technique. Therefore those costs incurred during all three types of anaesthetic, such as the cost of propofol for induction of anaesthesia, were not included in the final overall costing. The results concerning the incidence of negative outcomes were not subjected to statistical analysis.

Results

The four operative groups and three anaesthetic maintenance regimes studied comprised a total of 3750 patients. The demographic variables, including the mean duration of each operation and number of patients in each group are shown in Table 3. Table 4 illustrates the acquisition and total costs associated with each anaesthetic maintenance regime, for each type of operation. Table 5 illustrates the differences in cost between TIVA and both enflurane- and isoflurane-based anaesthesia, in relation to the duration of each operative group.

Tables 6 and 7 illustrate the outcome data relevant to each operative type and anaesthetic maintenance regime, including recovery times, PONV incidence rates and the incidence of unanticipated admission and anaesthetic-related complications occurring during the patients' stay in the DSU, and general practitioner and A&E department follow up in the first 24 h post discharge.

Discussion

This study was undertaken by the retrospective analysis of our database. Patients were not formally randomized to receive a particular anaesthetic maintenance technique. We believe that a retrospective analysis is valid for the comparison of costs, however, the potential for bias with regard to some outcome measures cannot be overlooked. Furthermore, the small number of TIVA anaesthetics relative to the use of volatile maintenance makes statistical comparison difficult and no analysis of outcome data was undertaken. While we have tried to cost as many related costs as possible, many indirect costs were not evaluated which may have had a bearing on the final costs. It is our belief that the cost implications of patient satisfaction cannot be overlooked, despite the obvious difficulty in costing such an outcome measure. Similarly, while it proved impossible to provide more than an estimate of the cost of drug wastage, Hitchcock et al.[6] have shown the potential costs involved.

The costing of TIVA maintenance based on a sample of 100 TIVA anaesthetics, to generate an amount of propofol utilized per min of surgery is a new idea and one which removes the necessity to collect data about the weight of each patient. Those regularly using TIVA in the day surgery setting will appreciate that unpremedicated, anxious day case patients often require

Table 3. Demographic data

Surgery type		*TIVA*	*Enflurane*	*Isoflurane*
Oral Surgery	Age (yr) mean (SD)	27.25 (12.04)	23.33 (8.53)	23.65 (7.82)
	ASA class	1 = 45 2 = 11	1 = 988 2 = 168 3 = 11	1 = 325 2 = 88 3 = 5
	Duration (min)	51.53	53.36	53.17
	No.	56	1167	418
Minor gynaecological	Age (yr) mean (SD)	31.48 (13.10)	36.40 (15.05)	39.95 (15.38)
	ASA class	1 = 118 2 = 19 3 = 2	1 = 633 2 = 178 3 = 15	1 = 26 2 = 17
	Duration (min)	23.50	25.97	26.81
	No.	139	826	43
Ear, nose and throat surgery	Age (yr) mean (SD)	36.28 (16.51)	34.12 (16.73)	32.74 (15.29)
	ASA class	1 = 31 2 = 15 3 = 1	1 = 278 2 = 69 3 = 12 4 = 1	1 = 25 2 = 10
	Duration (min)	29.90	33.77	31.09
	No.	47	360	35
Knee arthroscopy	Age (yr) mean (SD)	35.18 (16.68)	35.93 (15.54)	42.92 (16.68)
	ASA class	1 = 132 2 = 48 3 = 3	1 = 295 2 = 98 3 = 4	1 = 50 2 = 26 3 = 3
	Duration (min)	37.98	46.66	36.68
	No.	183	397	79

Table 4. Acquisition cost and total cost (in Australian dollars)

Operation		*TIVA* A$	*Enflurane* A$	*Isoflurane* A$
Oral surgery	Acquisition cost	34.50	12.64	10.60
	Total cost	51.34	37.12	32.78
Minor gynaecological surgery	Acquisition cost	15.70	7.18	9.90
	Total cost	30.74	31.75	27.82
Ear, nose and throat surgery	Acquisition cost	20.01	8.71	7.17
	Total cost	35.32	35.61	22.45
Knee arthroscopy	Acquisition cost	25.42	11.31	8.04
	Total cost	42.25	33.24	31.08

higher infusion rates than one would predict from the work of Roberts et al.[7]. In this study, often quoted when infusion rates for TIVA are discussed, all patients received temazepam premedication, followed by 3 μg kg^{-1} of fentanyl immediately prior to induction. This is not consistent with the practice of the majority of day case anaesthetists. Also with regard to weight, Sear has shown that adequate TIVA, again in premedicated patients could be delivered to patients within the weight range 60–90 kg using an infusion regime based on a weight of 70 kg[8]. The use of a fixed amount of propofol per min of anaesthesia to cost TIVA in day surgery therefore provides a reasonable estimate of the actual amount of propofol used, especially for shorter procedures. Unlike most previous assessments of anaesthetic costs[9], the amount of volatile anaesthetic used was based on fresh gas flows of 6 and then 3 l min^{-1}, as is the most common practice in our unit. Circle systems are used in every day case anaesthetic, although truly low fresh gas flows are seldom if ever used. It is our belief that in reality most anaesthetists practising in our unit utilize higher flows for longer periods than those used for costing purposes in this study. We believe that the manner in which the acquisition costs of the anaesthetics used were obtained is representative of the everyday practice in our DSU.

In day case anaesthesia while major morbidity and mortality are extremely rare, minor morbidity is common[10]. In addition, not only is there a definite morbidity associated with surgery and anaesthesia, but also the side effects of drugs used to treat or prevent that morbidity can cause further problems[11]. Anaesthetic techniques associated with intrinsically lower morbidity are therefore highly advantageous in the day surgery setting and the cost savings associated with such decreased morbidity may be used to offset the price of the drugs concerned. Our results suggest that TIVA is associated with a lower incidence of PONV and general practitioner and A&E department consultation post discharge than volatile anaesthesia with enflurane or isoflurane. In the light of work done by Orkin showing the importance to patients of avoiding nausea and vomiting[12], and the concerns expressed by Jackson et al.[13] over the increased workload imposed on general practitioners by the expansion of day surgery, such findings merit further more controlled investigation.

Table 5. Duration of surgery and cost differences between TIVA and enflurane (TIVA-E), between TIVA and isoflurane (TIVA-I) (in Australian dollars)

Operation	*Mean duration (min)*	*Cost difference TIVA-E A$*	*Cost difference TIVA-I A$*
Oral surgery	52.7	14.22	18.56
Minor gynaecological surgery	25.4	−1.01	2.92
Ear, nose and throat surgery	31.6	−0.29	12.87
Knee arthroscopy	40.4	9.01	11.17

This study illustrates the importance of considering all costs, both direct and indirect, when examining the cost of an anaesthetic procedure or technique. Lethbridge has pointed out that although anaesthetic costs contribute relatively little to the overall cost of any day surgery procedure, being only 6–10% of the total cost[14], indirect costs have a very marked effect on the overall cost of anaesthesia. While TIVA with propofol is widely regarded as an expensive form of anaesthetic maintenance, the results from this study would seem to suggest that the more anaesthetic-dependent costs are included in the overall cost analysis, the more comparable the cost of TIVA becomes relative to volatile anaesthesia. Morgan and Beech have stated that the costing of day surgery can vary depending on the manner in which that costing is performed and it seems that this also applies to the costing of anaesthetic techniques[15].

When examining the cost benefit ratio of any anaesthetic technique, several parameters have to be defined. As already stated, the potential benefits associated with the use of TIVA are particularly relevant in the day surgery setting. Also, the duration of anaesthesia may have some bearing on the cost benefit profile of TIVA. Our study suggests that TIVA is very cost effective,

Table 6. Outcome data: recovery times and incidence of postoperative nausea and vomiting (PONV)

Operation		*TIVA*	*Enflurane*	*Isoflurane*
Oral surgery	Recovery time 1	2 min	1.5 min	1.5 min
	Recovery time 2	56.8 min	56.9 min	57.5 min
	Recovery time 3	77.2 min	81.5 min	83.2 min
	PONV 1	8.9%	17.4%	18.1%
	PONV 2	7.1%	9.7%	13.8%
Minor gynaecological surgery	Recovery time 1	3.9 min	2.1 min	3.9 min
	Recovery time 2	46.7 min	60.4 min	51.7 min
	Recovery time 3	79.6 min	78.4 min	73 min
	PONV 1	10%	16.5%	2.3%
	PONV 2	2.1%	3%	0%
Ear, nose and throat surgery	Recovery time 1	3 min	1.3 min	1.6 min
	Recovery time 2	50.6 min	52.4 min	46.4 min
	Recovery time 3	83.2 min	79.9 min	73.6 min
	PONV 1	2.1%	6.3%	2.8%
	PONV 2	4.2%	1.6%	0%
Knee arthroscopy	Recovery time 1	4.8 min	1.7 min	2.9 min
	Recovery time 2	56.4 min	61.1 min	55.3 min
	Recovery time 3	77.0 min	82.6 min	82.3 min
	PONV 1	7.1%	16.3%	14%
	PONV 2	3.8%	2.5%	6.3%

relative to the use of volatile anaesthesia, for day case operations of less than 30 min duration. This needs further investigation. It may be that once the duration of surgery exceeds a certain length, the benefits of TIVA are no longer evident in the day case patient, due to the increased morbidity associated with prolonged surgery. Operation types, in which the use of TIVA may be advantageous, also need to be defined. TIVA may be more cost effective in operations associated with a high incidence of nausea and vomiting. The complete picture regarding the cost of any anaesthetic technique will need the investigation of all these factors.

Several studies have highlighted the potential savings associated with the shorter recovery period or time to 'fit for discharge' required following TIVA[16], although in our study recovery times were, if anything, more prolonged than with volatile anaesthesia. The informal manner in which such times were measured in our unit, as compared to formal studies of recovery time could explain this. However, while nursing staff time is undoubtedly an expensive commodity and the intensity of nursing is strongly correlated with postoperative morbidity, the potential cost reductions described are not readily achievable in practice. Even in a well organized day surgery facility using TIVA exclusively, recovery times and times to 'fit for discharge' are dependent on several factors, in addition to recovery from the effects from anaesthesia alone. For example,

Table 7. Outcome data: anaesthetic complications, admissions, GP follow up and A&E Department follow up

Operation		*TIVA*	*Enflurane*	*Isoflurane*
Oral surgery	Complications	1 (1.7%)	30 (2.6%)	10 (2.3%)
	Admission	0 (0%)	6 (0.5%)	1 (0.2%)
	GP follow up	0 (0%)	51 (4.3%)	15 (3.5%)
	A&E follow up	1 (1.7%)	42 (3.5%)	11 (2.6%)
Minor gynaecological surgery	Complications	2 (1.4%)	19 (2.3%)	2 (4.7%)
	Admission	0 (0%)	13 (1.5%)	0 (0%)
	GP follow up	1 (0.7%)	24 (2.9%)	2 (4.6%)
	A&E follow up	1 (0.7%)	14 (1.6%)	0 (0%)
Ear, nose and throat surgery	Complications	0 (0%)	16 (4.4%)	0 (0%)
	Admission	0 (0%)	11 (3%)	0 (0%)
	GP follow up	0 (0%)	4 (1.1%)	0 (0%)
	A&E follow up	0 (0%)	12 (3.3%)	1 (2.8%)
Knee arthroscopy	Complications	2 (1%)	12 (3%)	4 (5%)
	Admission	0 (0%)	1 (0.2%)	1 (1.2%)
	GP follow up	1 (0.5%)	3 (0.7%)	2 (2.5%)
	A&E follow up	0 (0%)	13 (3.2%)	1 (1.2%)

following laparoscopic cholecystectomy or gynaecological laparoscopy, a period of observation is frequently required independent of recovery from anaesthesia. Also, the only practical way to capitalize on the cost savings associated with shorter recovery times would be to reduce the number of nurses employed, which could reduce the potential throughput at busy times, thus increasing rather than reducing unit costs. Our study seems to show that the use of TIVA imposes less of a burden on general practitioners and hospital A&E departments. While this may seem unimportant to hospital-based budget holders, the potential savings in overall costs are both real and achievable. While the importance to patients of this decreased need for follow up is impossible to cost with any degree of accuracy, it constitutes the basis of a high quality day surgery service.

In future there will be increased pressure on anaesthetists, and indeed all healthcare workers, to justify the cost of the drugs they use. Already a prime determinant of whether or not a new drug is widely used is the acquisition cost or price of that drug. It is hoped that this paper will highlight how misguided such an approach can be. While it is appreciated that drug price will inevitably be a factor in determining the indications for the use of a particular drug, healthcare workers should concern themselves with cost-benefit profiles. The real issue is one of cost-effective quality care; the cost of overall care rather than simply the price of drugs used. It would seem sensible therefore to develop a costing system to enable such a process to be undertaken fairly and accurately. There is a need to appreciate that the choice of drugs used in day case anaesthesia can influence far more than the intraoperative period alone, and the subsequent outcomes can have enormous cost ramifications.

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