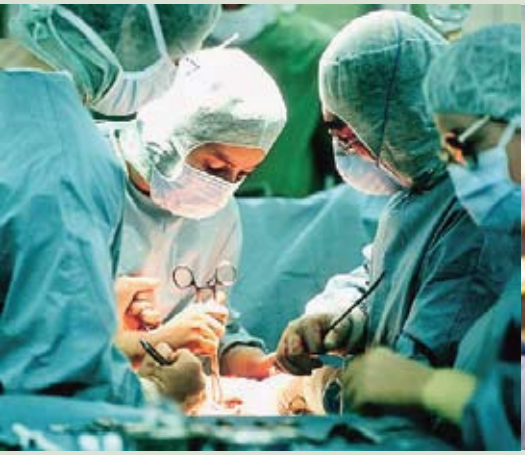
AMBULATORY SURGERY

International Journal covering Surgery, Anaesthesiology, Nursing and Management Issues in Day Surgery

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AMBULATORY SURGERY has changed, moving forward to the wider readership that is available by using web-based electronic publication.

AMBULATORY SURGERY will continue to be a peer-reviewed journal, disseminating knowledge in the field of day surgery with multidisciplinary reports covering surgery, anaesthesiology, nursing and management topics. AMBULATORY SURGERY will continue to be the official journal of the International Association for Ambulatory Surgery, and our new journal site will be linked to the IAAS site, www.iaas-med.com.

AMBULATORY SURGERY will also be a conduit for the announcement of all meetings related to ambulatory surgery, encompassing the areas of surgery, anaesthetics, nursing and management. The submission, for publication, of single-page meeting notices to attract the readership of this journal will be welcome.

In this first electronic edition (Volume 13, no. 1), we have research that covers the breadth and depth of ambulatory surgery, anaesthesia, nursing practice and management from around the world.

An updated survey of international day surgery activity by Toftgaard is the opening paper of this edition of Ambulatory Surgery. The remaining papers cover a variety of subjects.

Opioids are a well known contributor to the problem of postoperative nausea and vomiting; Habib et al. have investigated whether using the short acting opioid remifentanil instead of fentanyl as part of a balanced anaesthetic results in a reduction in PONV, and it did not. A study by Borges et al. suggests that routine dexamethasone may reduce PONV as well as the level of postoperative pain. Patient attitudes to the use of postoperative analgesics have been looked at by Older et al. Anatol and Harharan have evaluated the reasons for cancellations of paediatric ambulatory surgery in a Caribbean developing country and found that the majority of unplanned cancellations were by the hospital, due to operating theatre management and adminsitrative issues; only a quarter were due to a new patient illness. Soto gives us information presented at the last meeting of the Society for Ambulatory Anesthesia, on the clinical advantages of depth of consciousness monitoring in the ambulatory setting.

We welcome you to the new AMBULATORY SURGERY. We welcome your readership and your manuscripts about the state of Ambulatory Surgery worldwide.

World Wide Day Surgery Activity 2003 IAAS Survey of Ambulatory Surgery

Claus Toftgaard

Abstract

A survey has been conducted among the member countries of the International Association for Ambulatory Surgery (IAAS) and some other countries in order to elucidate the day surgery activity. 37 procedures were specified by surgical name and international coding. Of these, most are well established day surgery procedures, but a few are at the cutting edge of the move from inpatient to ambulatory surgery. As well as data on day surgery activity, data about total surgical activity, organisation and reimbursement was collected.
In comparison with former surveys from the end of the twentieth century, the percentage of day surgery has increased in all countries. The USA and Canada followed closely by the Scandinavian countries have the highest rate of day surgery. The reasons are discussed.

Keywords: Ambulatory surgery, surgical activity, basket of procedures, number of surgical procedures, percentage as day surgery.

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Introduction

Over several years there has been focus on the movement of surgical procedures from an inpatient setting to an ambulatory setting. The quality benefits for patients and the economic/efficiency benefits for the hospitals and society are the background for the movement towards ambulatory care.

This move has been facilitated by the introduction of minimally invasive procedures and new anaesthetic techniques.

However the attitude to ambulatory surgery varies greatly amongst healthcare professionals within and between countries. The expectations given to patients also vary and thus patient satisfaction with ambulatory surgery also varies. These are two of the reasons why ambulatory surgery rates differ between countries and between hospitals in the same country.

One of the goals of the IAAS is to encourage the development of day surgery all over the world. A way to achieve this is to periodically measure day surgery activity in as many countries as possible. This allows countries to benchmark their activity against other countries and to assess their absolute and comparative growth in ambulatory surgery activity over a period of time.

IAAS surveys have been conducted since 1994 [1,2]

The international surveys

Lathouwer and Poullier [1] started the international surveys as a collaboration between the IAAS (International Association for Ambulatory Surgery) and the OECD (Organization for Economic Cooperation and Development) and undertook two surveys in 1994-95 and 1996-97 using a basket of 20 surgical procedures. Since then the OECD has not found it worthwhile to investigate ambulatory activity within its member countries even though the increase in day surgery activity is still an important issue for the health authorities in the member countries (personal information).

It is a goal for the IAAS to measure and follow the development of ambulatory surgery worldwide [3]. However undertaking a large-scale international survey is very time and resource consuming and this is why erefore there has been a long gap between the last and the present survey.

Method

The original 20 procedures from the two first surveys have been supplemented by 17 more procedures. The reason for this is both to cover more surgical specialties (plastic surgery, vascular surgery, urology) than in the first surveys and also because there has been a development in procedures allowing surgery to be undertaken in an ambulatory setting, e.g. anti reflux surgery, laparoscopic assisted hysterectomy, TURP. The 37 procedures are shown in Table 1.

Each procedure is identified with its common professional name and with its code from both the ICD9CM classification system and the Nordic classification system NCSP.

The data relating to specific procedures should be interpreted taking into account general data about surgical activity, the data source and completeness, the organisation of day surgery facilities, the reimbursement system, and the coding system in each country or region. The datasheet to collect this supplementary data is seen in Table 2.

The survey was accepted at the General Assembly of the IAAS and sent to contact persons in all the IAAS member countries and also to some contact persons in other countries.

Results

18 Countries or regions answered the survey. Details from the supplementary datasheet are seen in Table 3.

From these observations it should be noticed that in most countries day surgery activity is within public hospitals. In USA where the activity is very high, the percentage of private freestanding units is also very high.

Reimbursement systems are very different. In Italy and Spain, as well

Table 1 The procedures identified with their common name, the ICD9CM code and the NSCP code.

Name of Procedure	ICD9CM Coding	NCSP Coding	Number of ambulatory cases	Number of inpatient cases
Cataract surgery	13.1 – 13.	CJB – CJE		
Squint correction	15.0 – 15.9	CEB – CEW		
Myringotomy with tube insertion	20.01	DCA 20		
Tonsillectomy	28.2 – 28.3	EMB 10 – 20		
Rhinoplasty	21.8	DJ, DL		
Broncho-Mediastinoscopy	33.22 – 33.24, 34.22	UGC, GEA		
Surgical removal of tooth	23.1	EBA 10		
Endoscopic female sterilisation	66.2	LGA		
Legal abortion	69.51, 69.01	LCH00, LCH03		
Dilatation and curettage of uterus	69.02, 69.09	LDA00, LDA10, LCA10, LCA13, MBA00,MBA03		
Hysterectomy (LAVH)	68.51	LCD11		
Repair of cysto/ recto cele	70.5	LEF		
Knee arthroscopy	80.26	NGA11		
Arthroscopic meniscectomy	80.6	NGD01, NGD11		
Removal of bone implants	78.6	NBU,NCU,NDU,NFU, NGU, NHU		
Repair of deform.of foot	77.51 – 77.59	NH		
Carpal tunnel release	04.43	NDM09,NDM19		
Baker cyst excision	83.39	NGM39		
Dupuytrens contracture correction	82.12	NDF02, NDF12		
Cruciate ligament repair	81.43, 81.45	NGE35, NGE36, NGE45,NGE46		
Disc operations	80.5	ABC		
Local excision of breast	85.12	HAB00,HAB10 HAB40,HAB99		
Mastectomy	85.4	HAC		
Laparoscopic cholecystectomy	51.23	JKA21		
Laparoscopic antireflux surgery	44.64 – 44.66	JBC01		
Haemorrhoidectomy	49.43 – 49.46	JHB		
Inguinal hernia repair	53.0 – 53.1	JAB		
Circumcision	64.0	KGH10, KGH80		
Orchidectomy + -pexy	62.3 – 62.5	KFH00, KFH10, KFC		
Male sterilisation	63.7	KFD43, KFD46		
TURP	60.2	KED22		
Colonoscopy w/wo biopsy	45.23, 45.25	UJF32, UJF35		
Removal of colon polyps	45.42	JFA15, JFA17		
Varicose veins surgey	38.5	PHB10 – PHB14, PHD10 – PHD15		
Bilat: breast reduction	85.32	HAD30, HAD35		
Abdominoplasty	86.83	QBE00, QBE99		
Pilonoidal cyst excision	86.21	JHW99		

Table 2 Supplementary datasheet.

Datasheet 1

IAAS Survey of Ambulatory Surgery in the World

Name of contributor:

Country or region:

Contact address:

Data source:

Completeness of data:

Total number of surgical procedures in your country/region:

Total number of planned surgical procedures in your country/region:

Total number of emergency surgical procedures in your country/region:

Total number of day surgery procedures in your country/region:

How is day surgery organised in your country/region:

How is day surgery reimbursed in your country/region:

Your coding system:

as in the Scandinavian countries, there is a fee per case that in many procedures will be the same for inpatients as for ambulatory treated patients. This is mentioned as a very potent incentive in order to move activity from inpatient to ambulatory treatment. There is little or no incentive for a move in Germany and Portugal where reimbursement is significantly less for ambulatory surgery.

There is no doubt that the organisational structure and reimbursement systems are of great importance for day surgery activity [4]. This item has only peripherally been investigated in this study and it should be studied further in the future.

The activity data is shown in Tables 4 to 9. In the first 5 tables the procedures from the respective surgical specialties are shown, and in Table 9 the overall activity data is listed.

It should be mentioned that for Belgium and Poland the total number of procedures are admissions and not procedures and therefore the number is relatively high.

US and Canada has a very high percentage of day surgery procedures followed closely by the Scandinavian countries. It is interesting to notice that countries having a very high rate of day surgery in some specialties may have significantly lower rates in other specialties.

Discussion

Data collection from many countries is very difficult. It is dependent more on dedicated professionals having an interest in the field than on a systematic follow up from the national or regional authorities. Therefore the data must be considered "the best possible" in many countries who do not have a national database covering all health activities. Such a national database has been implemented in Denmark since 1977 and this has covered all hospital based activity for over ten years. It is very valuable for statistical purposes [5].

However, data collected from the same source over consecutive years can give a very reliable picture of the development within a country.

In comparison to the former surveys in 1994-95 and 1996-97 [1,2] there has been is a marked increase in day surgery activity in most countries and most procedures. However, there are still great

Table 3 Details given in the supplementary datasheet.

Country / region. Year of data collection	Data source	Completeness	Organisation	Reimbursement	Coding system
Australia 2003	National Hospital Morbidity Database	Almost 100 %	www.racs.edu.au	Medicare and private	ICD-10-AM
Belgium 2004	Insurance companies	Almost 100 %	Only in hospitals	Insurance	ICD9CM
Canada (Alberta region) 2002	Alberta Health	100 %	Mostly public hospitals	Public tax	ICD9CM
Denmark 2004	National data register	100 % - public hospitals	Mostly public hospitals	Public tax	NCSP
England 2003	NHS	?	Mostly public hospitals	Public tax	ICD9CM
Finland 2003	Hospital files	Only public hospitals	10 % private. Public inside hospitals	Tax + pr. fee	NCSP
France 2003	Bases pmsi publiqeu et privee	?	Private and public	Tax and ?	ICD9CM
Germany 2003	Hospitals reports	Almost 100 %	Private 90 %	Insurance DRG	ICPM + DRG
Hong Kong 2003	CDARS from Hospital authority	Almost 100 %	Integrated in hospitals	Public tax	ICD9CM
Italy 2002	National ministry of health database	95 %	Mostly integrated in hospitals. Some private free standing	DRG	ICD9CM
Netherlands 2002	LMR database	100 % - public hospitals	Integrated in OR and dedicated units	Budget sytem	CvV (ICD9CM
Norway 2003	SAMDATA, Sintef	100 %	Integrated in hospitals and some private	Fee pr. case	NCSP
Poland 2003	Statistical bulletin				
Portugal 2003	III National Survey	99 %	Mostly integrated in public hospitals	55-60% of DRG	ICD9CM
Scotland 2003	Scottish Morbidity Records 1	100 %	OPCS4		
Spain (6 regions) 2003	CMBD, CMA	90 %	Integrated in public hospitals	DRG	ICD9CM
Sweden 2002	Socialstyrelsen	100 %	Integrated in OR and dedicated units	DRG	NCSP
US Medicare) 2003	Medicare	100 %	Most private free-standing units	DRG	ICD9CM

differences between countries. An example is illustrated in Fig. 1 where the data for a common procedure – inguinal hernia repair – is shown.

Organisational and reimbursement systems have a great impact on ambulatory surgery activity but also other factors like culture and tradition must be of importance.

Some new procedures in the armamentarium of day surgery are laparoscopic cholecystectomy, laparoscopic antireflux surgery and LAVH (laparoscopic assisted vaginal hysterectomy) where the differences also are big – from 0 % up to 50 % for cholecystectomy.

Even within individual countries the activity varies much [6,7]. It may also depend on the variation in organisation where some hospitals have dedicated units or even free standing units for day surgery while others have the day surgery activity integrated in inpatient wards and operating theatres.

The tradition and culture within a country may also have an influence on the rate of elective and emergency surgery. In some countries with long waiting lists procedures may become acute before surgery while in other countries with short waiting lists they are elective cases. Therefore, the percentage of total day surgery activity has been compiled from the total surgical activity and not from the number of planned procedures.

Attention should also be drawn to the fact that registrations of activity may be different in different countries and therefore the activity numbers are difficult to compare from one country to another.

Table 4 Percentage of day surgery procedures ENT, ophthalmic and oral surgery.

	Myringotomy	Tonsillectomy	Rhinoplasty	Broncho-mediastinoscopy	Cataract surgery	Squint correction	Tooth removal
Australia	82 %	4 %	22 %	48 %	89 %	80 %	92 %
Belgium	94.6 %	93.6 %	18 %	24.9 %	87 %	81 %	96.8 %
Canada	99 %	66.8 %	91.6 %	67.4 %	99.4 %	99.1%	94.8 %
Denmark	81 %	30 %	52.5 %	67 %	98 %	65 %	91.7 %
England	82 %	7 %	17 %	3.5 %	90 %	80 %	87 %
Finland	------	24 %	------	------	91.5 %	-----	-----
France	90 %	20 %	9 %	32 %	45 %	19 %	52 %
Germany	61.4 %	18 %	16.6 %	85.8 %	42 %	46 %	96 %
Hong Kong	60.7 %	0.7 %	------	14.5 %	53.5 %	31 %	-----
Italy	50 %	15.7 %	5.7 %	22 %	62 %	21 %	58 %
Nether-lands	98 %	64 %	56 %	92 %	90 %		
Norway	87 %	28 %	64 %	27 %	93 %	50 %	96 %
Poland		ENT 0.9 %	Eye 4.7 %				
Portugal	15 %	9.2 %	1.5 %	-------	31 %	29 %	44.8 %
Scotland	61.4 %	18 %	12.6 %	85.8 %	42 %	46 %	5.9%
Spain	0-78 %	1-42 %	-----	1-10 %	42-90%	2-69 %	------
Sweden	80 %	14.3 %	32.5 %	48 %	97 %	65 %	95 %
USA	98.6 %	89.2 %	94 %	34 %	99.7 %	85 %	----

Table 5 Gynaecology.

	Endoscopic Sterilisation	Legal abortion	Dilatation + curettage	LAVH	Cysto/recto cele
Australia	86 %	89 %	86.4 %	0.1 %	1.5 %
Belgium	67.2 %	----	79 %	0.2 %	5.1 %
Canada	99.3 %	99.8 %	80.6 %	0	3.7 %
Denmark	90 %	97 %	86.9 %	3.1 %	7.3 %
England	84 %	------	70 %	0.2 %	1 %
Finland	89 %	-----	------	------	------
France	5 %	87 %	45 %	0 %	0 %
Germany	41.5 %	5.1 %	40 %	1.3 %	19.1 %
Hong Kong	--------	51.8 %	14 %	0 %	-----
Italy	22 %	84 %	33.5 %	0.1 %	1 %
Netherlands	93 %	90 %	69 %	0 %	0.5 %
Norway	52 %	97 %	73 %	1 %	4 %
Poland		Gynaecology	0.8 %		
Portugal	23.5 %	Not legal	34.8 %	0 %	-------
Scotland	41.5 %	75 %	40 %	1.3 %	19.1 %
Spain	0-73 %	0-2 %	-------	------	6-50 %
Sweden	80.6 %	92 %	------	1.4 %	1.7 %
USA	90.2 %	82.5 %	85 %	19.5 %	20.5 %

Table 6 Orthopedics

	Knee arthroscopy	Arthroscopic menisciectomy	Removal Implants	Deformities of foot corrections	Carpal tunnel release	Baker cyst excision	Dupuytren contracture correction	Cruciate ligament repair	Disc surgery
Australia	63.2 %	81 %	61 %	19 %	86 %	34.8%	47.4 %	10.7 %	2.1 %
Belgium	69 %	79 %	75 %	41 %	93 %	37.8 %	84.5 %	14.7 %	1.9 %
Canada	94.9 %	97.7 %	85 %	72 %	99.5 %	87.6 %	94.4 %	62.7 %	10.2%
Denmark	92 %	91 %	83.5 %	72 %	78 %	76.4 %	86.6 %	55.7 %	1.6 %
England	65 %	70 %	------	28 %	88 %	-----	42 %	-----	1 %
Finland	74 %	------	-----	50.8 %	81 %	-----	------	------	------
France	29 %	36 %	40 %	2 %	79 %	15 %	54 %	1 %	0 %
Germany	17 %	32.5 %	33 %	42.5 %	62.5 %	19 %	60 %	46 %	4.2 %
Hong Kong	14.6 %	6.8 %	------	0 %	70.5 %	57.5 %	0 %	3.1 %	-----
Italy	32 %	28.7 %	35 %	20.5 %	73.5 %	52 %	48 %	2.2 %	2.5 %
Netherlands	93 %	92 %	64 %	27 %	95 %	57 %	81 %	5.1 %	0.4 %
Norway	76 %	88 %	60 %	61 %	83 %	79 %	42 %	22 %	6 %
Poland	Orthopedics	0.56 %							
Portugal	1.9 %	1.8 %	4.7 %	------	39 %	------	21 %	-------	0.8 %
Scotland	65.4 %	32.5 %	37 %	42.5 %	62.5 %	------	38 %	55 %	4.2 %
Spain	--------	6-53 %	-------	3-59 %	13-88%	-------	-------	--------	0-0.6%
Sweden	88 %	93 %	51 %	45 %	79 %	79 %	64 %	------	0.6 %
USA	93.9 %	96.7 %	75.9 %	95.2 %	97.3 %	84 %	97.6 %	82.1 %	5.7 %

Table 7 General surgery.

	Breast excision	Mastectomy	Lap. Chol.	Anti-reflux surgery	Haemorrhoidectomy	Hernia repair	Colonoscopy	Colon polyps removal	Pilonoidal cyst excision
Australia	65.1 %	8.6 %	2 %	0.3 %	62 %	22.6%	89.4	91.8%	29.7 %
Belgium	58 %	3 %	1.2%	0.1 %	29.1 %	19.9%	69 %	74.8%	33.6 %
Canada	92.6 %	8.8 %	43.9%	1.3 %	78 %	71.2%	92.8 %	97.6%	77.4 %
Denmark	45.3 %	7.2 %	18.8%	6.1 %	82 %	73 %	92.9 %	94.4%	91 %
England	------	2 %	3 %	------	18 %	42 %	86 %	-----	34 %
Finland	16.5 %	------	10.3%	------	14.7 %	46 %	-----	-----	-----
France	24 %	7 %	0 %	0 %	6 %	8 %	67 %	73 %	10 %
Germany	35 %	8.7 %	0.5 %	3.2 %	19.5 %	6 %	90 %	85 %	99 %
Hong Kong	58 %	0.2 %	5 %	0 %	38 %	24.6%	61 %	57 %	22 %
Italy	64 %	1.8 %	1.6 %	1 %	16.6 %	29.6%	26 %	39 %	64 %
Netherlands	41 %	0.4 %	2 %	0 %	53 %	38 %	-------	98 %	14 %
Norway	46 %	12 %	12%	6 %	73 %	63 %	78 %	85 %	87 %
Poland		General Surgery 2.2 %							
Portugal	28.7 %	1.1 %	1.2 %	------	12.5 %	14.9%	------	-----	28.8 %
Scotland	43 %	1.8 %	0.5 %	0 %	19.5 %	6 %	82 %	87 %	99 %
Spain	------	--------	0-10%	0-11 %	2-42 %	6-52%	----------	------	-------
Sweden	41 %	5.7 %	11 %	2.9 %	79.6 %	68.9%	80 %	87 %	92 %
USA	98.1 %	57.4 %	49.8 %	31 %	95.8 %	84.1%	86.3 %	77 &	91.6 %

Table 8 Urology, Plastic Surgery and Vascular Surgery.

	Circumcision	Testis surgery	Male sterilisation	TURP	Breast reduction	Abdominoplasty	Varicose veins surgery
Australia	87.1 %	44.7 %	95 %	1 %	8.8 %	9.8 %	20.5 %
Belgium	88 %	52 %	97 %	0.6 %	0.9 %	4 %	66 %
Canada	58.3 %	68.4 %	99.8 %	1.2 %	50.8 %	39.9 %	82 %
Denmark	92.9 %	63.7%	99.8 %	1.3 %	5.4 %	6.3 %	89.3 %
England	74 %	57.8 %	97 %	1 %	1 %	-----	54 %
Finland	75 %	-------	-----	1.9 %	------	------	56.7 %
France	82 %	29 %	0 %	0 %	1 %	1 %	17 %
Germany	53.6 %	39 %	84.8 %	3.2 %	3 %	40 %	30.5 %
Hong Kong	72 %	17.6 %	-------	0.3 %	----	-----	4.8 %
Italy	56 %	18.2 %	58 %	0.4 %	2.1 %	17.8 %	40 %
Netherlands	96 %	63.7 %	97.5 %	0.7 %	0.3 %	15 %	69 %
Norway	86 %	38 %	99 %	0 %	54 %	53 %	79 %
Poland		Urology 4.6 %					
Portugal	41.9 %	29.7 %	------	0 %	------	------	13.3 %
Scotland	53.6 %	46 %	84.8 %	3.2 %	3 %	40 %	30.5 %
Spain	34-94 %	---------	50-99 %	-------	0-1.8 %	0-15 %	19-52 %
Sweden	89 %	41 %	98.7 %	1.3 %	4.2 %	5.5 %	80.8 %
USA	88.5 %	67.2 %	94.8 %	23.1 %	80.6 %	24.1 %	88.2 %

Table 9 Day surgery as percentage of surgical procedures (overall) and of the procedures in the basket.

	Total number of procedures	Planned procedures	Emergency procedures	Day surgery procedures	Percentage of total surgery	Percentage of basket
Australia 2003	2.418.316	1.960.399	355.194	979.165	40.5 %	74 %
Belgium 2004	2.173.341 (admissions)			942.000	30 %	------
Canada 2002	747.849			654.901	87 %	84.4 %
Denmark 2004	1.357.914			749.375	55.2 %	79.3 %
England 2003						62.5 %
Finland 2003	381.486	302.574	78.912	132.508	37 %	62.4 %
France 2003						44.9 %
Germany 2003	13.000.000			4.800.000	37 %	60.7 %
Hong Kong 2003						42.5 %
Italy 2002	4.479.845			1.286.823	29 %	41 %
Netherlands 2002	1.593.000	1.344.000	249.000	790.000	49.6 %	69.8 %
Norway 2003	375.000	300.000	75.000	180.000	48 %	68 %
Poland 2003	3.351.877 (admissions)				2.4 %	
Portugal 2003	428.647	315.642	113.005	46.111	10.7 %	18.5 %
Scotland 2003	959.446	619.884	259.928	373.242	39 %	66 %
Spain 2003					28 – 44 %	54 %
Sweden 2002	426.570				50 %	66.7 %
USA 2003 (Medicare)						83.5 %

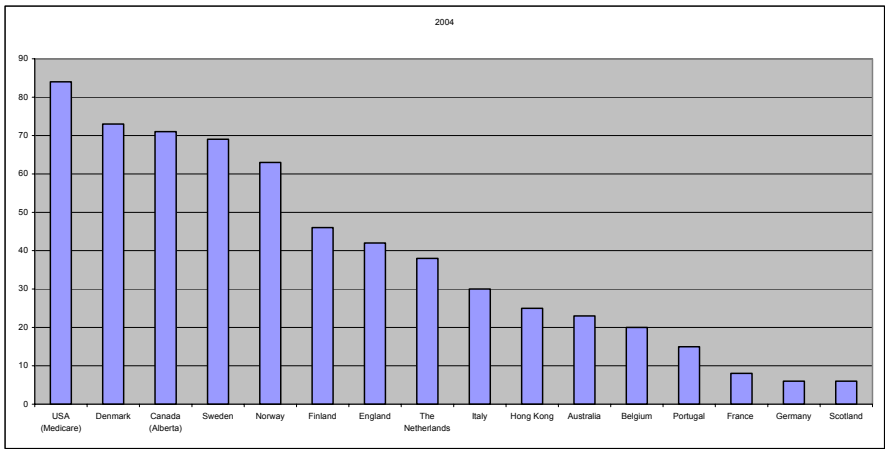

Figure 1 Inguinal hernia repair.

Conclusion

It is of importance to follow the development of day surgery activity in as many countries as possible. Day surgery can offer high quality care in most cost effective manner. It can maximise the potential of frequently sparse health service resources. The present survey shows that day surgery activity still varies enormously. Thus, there remains a potential for better utilisation of healthcare resources by encouraging all to reach the day surgery activity of the best performers.

The IAAS will conduct more surveys in the future and will try to get data from more countries than at present. Future surveys will also study more intensively why there are so great differences in day surgery activity and in particular the role organisation, reimbursement and culture plays in these.

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Routine Administration of Dexamethasone in a Day Surgery Protocol might decrease postoperative vomiting and pain

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Abstract

Background and Objectives: Postoperative vomiting (POV) remains a major problem after ambulatory anaesthesia. In randomised controlled trials dexamethasone has been shown to reduce POV. We have investigated whether the routine use of corticoid administration can decrease the incidence of POV in ambulatory patients.

Methods: We analysed retrospectively 2115 patients, divided in two groups: Group A (n = 737) surgery undertaken between January and August 2001, without the use of dexamethasone; Group B (n = 1378) surgery undertaken between September 2001 and November 2002 with the administration of dexamethasone.

Results: Both groups were similar in relation to age, gender, physical status (ASA), surgical and recovery times; surgical specialty and anaesthetic technique.

We found a lower incidence of POV with the administration of dexamethasone and also a statistical significant inverse relationship between dexamethasone use and the level of pain ($p<0.001$).

Conclusions: Our study suggests that 5 mg dexamethasone given to patients undergoing a wide spectrum of surgery might reduce the incidence of POV and the level of pain.

Keywords: Postoperative vomiting; dexamethasone; pain; day surgery.

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Introduction

Dexamethasone is a corticosteroid that can decrease postoperative vomiting after ambulatory surgery. It has been used since 1981 with good results in reducing the incidence of emesis in patients undergoing chemotherapy [1–5]. The proposed mechanism of dexamethasone's anti-emetic effect is related to the inhibition of prostaglandin synthesis and an increase in the release of endorphins, resulting in mood elevation, a sense of "well-being" and appetite stimulation [6–8]. Dexamethasone is effective in reducing the incidence of postoperative vomiting (POV) in patients undergoing different types of surgery by about 26 percent [6,9–13]. In order to obtain the highest efficacy against POV, prophylactic dexamethasone administration should be given during the induction of anaesthesia, because the onset time of dexamethasone on antiemesis is approximately 2 hours, and its biological half-life is 36 to 72 hours [14,15]. The commonly used dose for the prevention of POV is 8–10 mg i.v. but the minimum effective dose is suggested to be 5 mg in patients undergoing thyroidectomy and ambulatory laparoscopic surgery [10,16,17].

In this prospective analysis we tested the hypothesis that dexamethasone in the minimum effective dose can reduce the incidence of POV in the day surgery programme of our Institution.

Materials and Methods

We analysed our database that include 2115 patients, with data collected prospectively, between 1st January 2001 and 3rd December 2002, with physical status classification based on the American Society of Anesthesiologists scale (I to VI) and we accepted only patients between I and III. We divided the patients into two groups: Group A (n = 737) surgery undertaken between January and August 2001, without the use of dexamethasone; Group B (n = 1378) surgery performed between September 2001 and November 2002 with the administration of dexamethasone.

Patients were excluded from the study if they had active gastric pathology, hypersensitivity to corticoids or who had received antiemetics within 48 h before surgery.

All patients in the two groups received droperidol in anti-emetic doses (0.625 mg i.v.), based on our day surgery unit (DSU) protocol.

Patients in the dexamethasone group B received dexamethasone 5 mg i.v. Surgery time was determined from skin incision to completion of the procedure. Before leaving the operating room, fast-track eligibility (score > 12) was assessed using standardized criteria [18].

Vital signs were registered every 15 minutes in the post-anaesthetic care unit (PACU) and every 30 minutes in the intermediate post-anaesthetic recovery unit (phase II recovery room), till the discharge time. IV saline (0.9%) was given as maintenance fluid for each patient (minimum of 20 ml/kg). Analgesia was assessed by using a 10-cm linear visual analogue scale (VAS) with 0 corresponding to no pain and 10 to the worst pain and analgesics were given according to the DSU protocol. For the purpose of data collection, retching (same as vomiting but without expulsion of gastric content) was considered vomiting. Rescue anti-emetics (ondansetron 4 mg i.v.) were given if repeated vomiting occurred.

Data related to POV was collected (from 8:00 AM to 8:00 PM) by a team of nurses every 1 h, or by spontaneous complaint of the patients. Side effects if present were recorded.

Statistical analysis was performed, comparing discrete variables by using chi-square test. Metric variables were compared using

independent samples t-test. A p value less than 0.05 was considered statistically significant. All values were expressed as mean +/- SD or as percentages (%).

We compared statistically the 2 groups with cross-tables and verified both homogeneity to gender; ASA status; surgical and recovery times; surgical specialty and anaesthetic technique.

Results

Both baseline and operative characteristics were similar in both groups, except for age. (Table 1).

We found a lower incidence of POV in patients where dexamethasone was administered (p = 0,001) (Table 2.)

Moreover, we found an inverse relationship between the administration of dexamethasone and the level of pain ($p<0.001$) (Table 2)

The majority of patients reported low VAS pain scores (VAS < 3) in both groups: 95.2% in the dexamethasone group, 87.8% in the non-dexamethasone group. No significant side effects were found.

Discussion

Until 5 years ago, the incidence of POV at our DSU was similar to the 20% presented in the literature. It is one of the most annoying side effects after surgery performed under general anaesthesia [19,20]. Between 1998 and 2001 we were able to reduce this incidence to 8% owing to the introduction of low dose of intravenous droperidol (0,625 mg).

Table 1 Patient characteristic, anaesthetic and surgical data. Values are number of patients (%) except age, surgical time and recovery time, which are given in years and minutes; are presented as mean + standard deviation (SD), and with the 95% confidence interval (CI). ASA = American Society of Anesthesiologists.

Characteristic	A - without dexamethasone (n=737)	B - dexamethasone 5 mg (n=1378)	difference (95%CI)	t-test p-value
Age, yr	37.7 + 16.8	39.8 + 17.0	2,08 (0.56-3.59)	0.007
Surgical time, min	35.3 + 25.1	35.2 + 24,3	0.08 (-2.12-2.28)	0.945
Recovery time, min	364.8 + 115.5	365.8 + 120.1	1.02 (-9.65-11.69)	0.946
Characteristic	**A - without dexamethasone (n=737)**	**B - dexamethasone 5 mg (n=1378)**	**chi-square test p-value**	
Sex, No (%)			0.572	
Male	340 (46.1)	618 (44.8)		
Female	397 (53.9)	760 (55.2)		
ASA, No (%)			0.069	
I	407 (55.2)	692 (50.2)		
II	278 (37.7)	590 (42.8)		
III	52 (7.1)	96 (7.0)		
Surgical specialty, no (%)			0.349	
General Surgery	326 (44.2)	643 (46.6)		
Vascular Surgery	92 (12.5)	158 (11.5)		
Gynaecology	107 (14.5)	163 (11.8)		
Neurosurgery	25 (3.4)	37 (2.7)		
Neuropathology	35 (4.8)	58 (4.2)		
Orthopaedics	78 (10.6)	180 (13.1)		
Urology	74 (10.0)	139 (10.1)		
Anaesthetic technique, no (%)			0.163	
General anaesthesia	311 (42.2)	607 (44.1)		
Loco-regional anaesthesia	95 (12.9)	203 (14.7)		
Combined anaesthesia	215 (29.2)	342 (24.8)		
Sedation	116 (15.7)	226 (16.4)		

Table 2 The Evaluation of POV and Level of Pain. Values are number or proportion.

variable	A – without dexamethasone (n=737)	B - dexamethasone 5 mg (n=1378)	Chi-square test p-value
POV, No (%)			p = 0.001
No	699 (94.8)	1346 (97.7)	
Yes	38 (5.2)	32 (2.3)	
PAIN, No (%)			p < 0.001
Minimum (VAS 0-3)	647 (87.8)	1312 (95.2)	
Moderate (VAS 4-6)	88 (11.9)	65 (4.7)	
Severe (VAS 7-10)	2 (0.3)	1 (0.1)	

In this study, we found that dexamethasone in the minimum effective dose (5 mg i.v.), could reduce even more the POV incidence, reaching values below 3%.

All data related to POV was collected every 1 h, until the patient discharge. We had no possibility of obtaining information about the vomiting incidence in the first 24–48 hours after discharge, because only recently we have introduced a follow-up service by phone to all our patients, during the first 24 hours after operation.

The presence of risk factors such age, gender, physical status, history of motion sickness or postoperative nausea and vomiting, the duration of anaesthesia and type of surgery and anaesthetic technique, may contribute to the episodes of POV [21,22,24–26].

We found a small difference between the mean ages of both groups, yet this was statistically significant. However we doubt if this clinical difference could be strong enough to modify the results obtained, especially because this effect is small, the difference in POV due to an increase of 2 years of age is below 1%, and is not always detected [22,23,27].

Other patients' characteristics that may have modified the incidence of POV were well balanced between the two groups, so the differences found might be attributed to the use of dexamethasone. Nevertheless, we did not assess the history of POV or the non-smoking status, as this was a retrospective analysis and this data was not collected. These two factors if present in a higher percentage in one of the groups could influence the results obtained but given that the population was comparable in other aspects it is unlikely that an imbalance has caused this difference.

Another limitation of our study was the fact that it is a non-randomised design. However the effectiveness of dexamethasone in the prevention of POV is well proven [6,9–12] and thus the need for another placebo-controlled trial can be questioned from an ethical point of view. Moreover, the aim of this study was to see the impact of dexamethasone in our DSU clinical practice and if we could reduce even more the incidence of POV.

The dose often used is 8 to 10 mg and Lee at al. have demonstrated that the pre-induction administration of 8 mg i.v. was the smallest effective dose for the reduction of PCA (patient-controlled analgesia) morphine-related POV [28], but the minimal effective dose is 5 mg in patients undergoing thyroidectomy and ambulatory laparoscopic surgery [21,25,26]. Another study by Apfel et al. supports that at least 4 mg of dexamethasone i.v. is equally effective to 1,25 mg i.v. droperidol and to 4 mg i.v. ondansetron, all antiemetics can be freely combined, and that the type of surgery doesn't affect the efficacy of antiemetics [13]. In this study we wanted to use the minimum dose capable of lowering the incidence of POV with a minimum of side effects.

At the end we found that the dexamethasone group (5 mg) had a lower incidence of POV (p=0.001) and lower levels of post-operative pain (p<0.001). These results are similar to the ones found by Baxendale et al, who also reported decreased wound pain following extraction of third molar teeth after dexamethasone administration [29]. However, Liu et al. showed different results since the influence of dexamethasone on postoperative pain was minimal in patients undergoing major surgery [30,31], and by Lee at al. who reported that dexamethasone might not alter the intensity of pain after surgery, nor did it enhance the efficacy of PCA-morphine [28].

Probably, the different postoperative pain intensities and different degree of inflammation and oedema associated with different types of surgery can explain these differences, remembering that pain after tooth extraction might be related to swelling and that dexamethasone has a potent anti-inflammatory effect. This needs to be studied further.

The exact mechanism by which dexamethasone, a corticosteroid, exerts an anti-emetic action is not fully understood but there have been some suggestions, such as central [6–8] or peripheral mechanism [7,11,33]. It also has strong anti-inflammatory actions and may significantly reduce tissue inflammation around the surgical sites and thus reduce the ascending parasympathetic impulses (e.g., vagus) to the vomiting centre reducing POV. Finally, theoretically, as dexamethasone has a potent anti-inflammatory

effect, it probably also has the capacity to lower postoperative pain [30,32,33,34]. However these results are not conclusive and further investigations are needed.

Long-term corticosteroid therapy causes side effects such as an increased risk of infection, glucose intolerance, delayed wound healing, superficial ulceration of gastric mucosa, and adrenal suppression with significant morbidity [34]. However, side effects from short corticosteroid therapy (24–48 h), even in a high dose, have been rare. In the current study, no discernible side effect accompanying a single dose of dexamethasone 5 mg was found. Although a single dose of dexamethasone is considered safe [6,9,10,29,32], further studies are warranted.

As we used dexamethasone in all our patients in order to prevent POV, we can be criticized because of: i) promoting an increased rate of side effects owing to its corticosteroid properties; ii) giving it to patients who probably did not need it; iii) increasing costs related to the administration of this drug. Nevertheless, the authors are not aware of any important complication related to this low-dose corticosteroid administration. Moreover, the administration of 5 mg dexamethasone represented an increase in costs of around 0.7 € per patient and when associated with droperidol 0.625 mg an increase of 1.3 € per patient. Our results have proved that we have been able

to reduce POV incidence from around 20% without antiemetics to values lower than 3% when we gave a combination of dexamethasone and droperidol to all patients. The question is: Was this a price too high to pay for the advantages that we got? Gan et al in a way answered this question when they reported that patients are willing to pay between US$56 and US$100 for a completely effective antiemetic [35].

In conclusion, our study suggests that 5 mg dexamethasone given to patients undergoing a wide spectrum of surgery might reduce the incidence of POV and the level of pain.

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An Exploration of Patient Decision Making regarding the use of analgesics after Day Case Surgery

C Older, E Carr & J Warr

Abstract

Patients are experiencing unacceptable pain after day case surgery despite improvements in education and analgesia. It is proposed that pain may continue to prevail due to poor adherence by patients to analgesic regimens on return home. Twenty-one day case patients participated in telephone interviews exploring beliefs/attitudes regarding pain and analgesics. Themes identified were: 'Pushing the Limits', 'Monitoring the Limits' and 'Setting the Limits/Stopping the Pain'. These illustrate how patients' beliefs may lead them to endure pain, using analgesics as a last resort. Interventions are needed to tackle beliefs held by patients to help increase adherence and ultimately to reduce pain after surgery.

Keywords: Day case surgery; ambulatory surgery; postoperative pain management; patient barriers to pain management; analgesics.

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Introduction

In recent years day case surgery has grown rapidly and is driving the way forward for planned surgical procedures in the western world. In the United Kingdom the National Health Service Plan aims to achieve a target of three quarters of all operations to be carried out as day surgery by the year 2010 [1]. This growth comes as the result of improvements in technology and brings several benefits; it is cost effective as there is no overnight stay, waiting lists are reduced, and patients prefer day surgery as they receive treatment sooner, recover at home, and experience fewer cancellations than inpatient surgery [2, 3, 4].

It is clear that the advantages of day case surgery are vast. However, evidence continues to show that patients are experiencing unacceptable levels of pain after their surgery. A review by Coll et al [5] identified twenty four papers published since 1983 which assessed the duration and level of pain experienced after day case surgery. Coll et al [5] argued that inconsistencies between studies make it impossible to gauge an exact level of pain experienced within and between different operative procedures and specialities. However, they concluded that severe pain can continue into the third postoperative day and beyond. Another systematic review by Wu et al [6] concluded that on average 45% of day case patients experienced pain after surgery and that pain could continue for sometime interfering with normal activities for up to seven days postoperatively [7]. There are many unwanted consequences associated with this unmanaged postoperative pain for both the patient and health care provider that are well documented in previous research [8,9,10].

If the full potential of day case surgery is to be reached, issues surrounding adequate pain control after surgery need to be addressed. Past research indicates a number of barriers to pain relief after surgery which, in the main, include barriers posed by healthcare providers in terms of pain assessment [9,11,12], adequate analgesics (9,13,14), and patient education and information [9,12,15,16]. Despite information, education and appropriate analgesics, patients are continuing to report pain. Mackintosh and Bowles [17] created pre-assessment clinics, take home analgesic packs, and patient education regarding pain management, and were disappointed to find that the changes they made had little impact on patients reported pain levels. It has been proposed by Huang et al [14] that the lack of success found by Mackintosh and Bowles [17] may be due to patient non compliance with their analgesic regimen.

It is difficult to imagine that patients may willingly decide not to take their analgesics despite being in pain. However, research has shown that adherence to analgesic regimes after day case surgery may be problematic. Beauregard et al [7] argued that medication use was overall low among patients with 32% of them failing to take any medication during the first twenty-four hours after day surgery. Watt-Watson et al [18] found 50% of patients stopped taking analgesics at 72 hours after surgery despite moderate pain. Research by Watkins [19] illustrated that patients clearly have the knowledge regarding pain management strategies after their surgery but this did not increase their utilisation of analgesics and pain control. It appears that despite pain, and the provision of analgesics, education and information, some patients choose not to follow the advice they receive.

It is proposed that patients are not merely forgetful or ignorant but make rational decisions regarding whether or not to utilise their medication [20] , and key to this patient barrier appears to be the beliefs and attitudes they hold, particularly those surrounding their medication [21]. Relating this to pain and analgesics, previous research has shown that people hold a number of beliefs about pain and analgesics that may influence their adherence behaviour. Ward et al [22] identified patient related barriers to the management of cancer pain which included concerns about addiction, side effects, tolerance and fatalistic beliefs, and showed that increased concerns are related to an increase in pain and under medication. Members of the public also hold strong beliefs about pain and analgesics. For example, 66% of people surveyed in the USA stated that the last time they had severe pain they withstood it and did not take action [23]. They also hold beliefs regarding postoperative pain and its relief, with 39% of people surveyed in the UK believing that pain should not be taken away altogether after surgery, and 46% agreeing that you should put up with pain before complaining [24].

Such beliefs and barriers can be evidenced among day surgery patients. Beauregard et al [7] argued that day case patients who failed

to utilise their analgesics had concerns regarding addiction and side effects.

Watt-Watson et al [18] suggested that previous adverse events such as nausea might explain why some day case patients discontinued using analgesics. Dewar et al [25] followed up 238 patients after their surgery and identified 'beliefs and misconceptions' held by patients, including fears regarding side effects, concerns that they would 'overdo it' if their pain was reduced, and the belief that pain is to be endured, all of which led to a reluctance to use analgesics.

Due to fast turn around times associated with day case surgery, patients are becoming increasingly responsible for their own recovery and self-management of pain. With the introduction of new multimodal analgesic regimes for patients to take home, combining opioids and non-opioids resulting in reduced side effects and increased pain relief [26, 27, 28] it is more than ever imperative that patients utilise their analgesics as recommended. It is clear that lack of adherence by patients may be a major barrier to effective pain relief after day case surgery, and patients beliefs regarding pain and pain medication may play a vital role. Interventions to improve adherence to medication in other areas (adherence to medication for chronic illness), have had limited success as they do not address patients beliefs and perceptions that result in intentional non adherence [29]. We need to know more about patient beliefs and perceptions that stand in the way of effective pain relief after day case surgery in order to provide interventions to combat these barriers.

Aim

To gain an insight into the patient experience after day case surgery, particularly focusing on patients actual analgesic practice, and factors influencing the use of a multimodal analgesic regime.

Methods

As little research has been carried out in this area previously an inductive qualitative method was employed to explore the area further and get an in-depth insight into the patient's experience. The qualitative methodology of Interpretative Phenomenological Analysis (IPA) was used to guide and inform this research. First introduced by Smith [30] IPA is derived from two theoretical perspectives; phenomenology and symbolic interactionism, and has grown to become a distinctive approach popular in the field of Health Psychology. IPA aims to gain an insight into the participant's life world by looking at how it is experienced from the participant's point of view in terms of how they understand and give meaning to their experiences, and argues insights can only be achieved through interaction between researcher and participant, along with a process of interpretation.

Setting

This research took place in a day case unit, in a large district general hospital in the south of England. This unit provides patients with a multimodal analgesic regime comprising of oral morphine (6 vials of 10mg), ibuprofen (9 tablets of 400mg), and paracetamol (available at home) and gave patients a standard information sheet explaining how to use their analgesics additively. Despite these practices they continued to find, through clinical audit, that patients were not using their analgesics appropriately, and pain was a problem for some patients.

Sample and Recruitment

The study was successfully reviewed by a Local Research Ethics Committee and the associated hospital. Patients, whose surgical procedure was associated with moderate to severe pain and if they would receive a multimodal analgesic regime to take home with them, were invited to participate when they attended their preoperative assessment appointment. If patients were interested in taking part they left their telephone number with their assessment nurse. The main researcher then telephoned them to discuss the study and arrange an appropriate time on postoperative day four to carry out the interview. Written informed consent was obtained from all patients wanting to participate at the day case unit prior to their surgery.

Results

Thirteen women and eight men, aged between 23 and 67, were interviewed, eleven of whom underwent laparoscopy (gynaecological), nine hernia repair, one laparoscopic cholecystectomy and one removal of large metal work from the knee. Of these, for various reasons, 3 patients had an overnight stay and 2 were not provided with oral morphine to take home. Consequently these did not fulfil the recruitment criteria. However, they were included for a number of reasons : they were keen to participate, their experience of pain and feelings towards analgesics were consistent with those who fully met the inclusion criteria and they provided a good example of how day case surgery is not as straightforward as anticipated. There appears to be no such thing as a 'typical' day case patient.

Analysis revealed three main themes and eleven sub-themes that give an insight into factors influencing patients decisions about the analgesics they were prescribed (Table 1). Overarching this is the concept that patients seemed to want control over their own bodies and recovery, and felt that they knew what was best for themselves. Each theme and sub-theme will now be considered taking a narrative form.

Table 1 Themes and Sub-Themes from interviews following day case surgery.

Pushing the Limits	Monitoring the Limits	Setting the Limits/ Stopping the Pain
1. Stoicism and Pride	1. Pain as a measure	1. Type of Pain
2. Fitness	2. Contingency	2. Level of Pain
3. Individual Nature of Pain	3. Coping with Pain	
4. Importance		
5. Natural vs Unnatural		
6. Danger		

Pushing the limits

1. Stoicism and pride

Some patients were stoical in their response to pain and were willing to push their limit and endure as much pain as possible without complaining. They were also proud to tolerate their pain, and were pleased to get through their pain without using analgesics.

'I am very much sort of grin and bear it'

'It makes me feel like a bit of a warrior. It's maybe a sort of macho thing but I am pleased when I can say to people I don't need all these

things '

This is further evidenced by one patient who seemed somewhat ashamed of taking his analgesics when he said 'to be honest', it was as if he is telling me a secret or confessing a sin.

'I am still dosed up on plenty of painkillers to be honest'

Fitness

One reason some patients felt they were able to tolerate their pain and push their limits was because they thought they were physically fit and should feel less pain, and should therefore be able to endure more pain than the average person and need fewer analgesics.

'I pride myself in being able to tolerate things being a fairly fit person'

Interpreting this further, in society today fitness is something to be embraced and proud of, and if fitness is linked with feeling less pain then some patients may feel that by admitting that they have pain, and taking analgesics, that they are not as fit and healthy as they would like to be. Also analgesics may be seen as detrimental and something that diminishes their fitness and health and should therefore be avoided.

'I just don't like taking tablets. I try, and want to be, a fit and healthy man'

Individual nature of pain

It was also felt that pain is a very individual experience, and that some people could tolerate it more than others. If patients felt they had a 'high pain threshold' then they could tolerate more pain and take less pain relief.

'Well I know for a fact that I have got a fairly high pain threshold so maybe I can put up with a bit more than other people can'

Importance

The aim of IPA is not only to give an account of shared experiences but also give a closer insight into individual experiences. Consequently the concept of 'importance' of pain has been built around the narrative given by one patient. Here this patient argues that his operation and the pain that followed is insignificant, especially compared to those in a worse situation than himself. His pain should therefore be tolerated and endured, it is not worthy of fuss or treatment.

'I consider this a silly little operation I have had compared with what a lot of other people have got to go through.'

Pain is Natural and Medication Unnatural

Another reason why some patients wanted to tolerate their pain and push their limit was that they felt that pain was natural and something that should be embraced, and that medication is something unnatural and should be avoided.

'I like the body to heal itself naturally I suppose… this is part of the healing process'

'I just don't really feel that I want what I consider to be almost like pollutants in the body'

Some patients tried to alleviate their pain without taking analgesics prescribed to them. Again I feel this highlights the way in which it was felt that it is better to combat pain naturally rather than taking painkillers that are seen as unnatural.

'I don't like taking tablets and I would rather sort of sit and relax and see if it goes on its own'

Danger

Another reason why a number of patients may have wanted to avoid analgesics and endure as much pain as possible without resorting to them is that they were worried or concerned about using them. Many patients expressed that they did not use them in their everyday lives and may have been concerned about trying something new.

'I don't take them during my usual life. I very rarely have a headache tablet or anything like that so its not something I am used to taking. Some people take them for any sort of pain'

Patients were advised by the day case unit to use their analgesics additively, however some patients appeared to believe that this may be unsafe (particularly taking the ibuprofen and paracetamol together) as they had never been advised to do this before and the idea was unfamiliar to them. Consequently patients may have been reluctant to utilise their analgesics in this way.

'It does seem a lot of painkillers to take with ibuprofen and paracetamol and something else.You wouldn't normally dream of taking a mixture of pills like that if you just had a headache.You just go for the paracetamol - you don't take a bit of both do you?'

On the other hand, in some instances when patients were familiar with their painkillers and knew what to expect then they seemed to be happier following the analgesic regime.

'They gave me some in the hospital when I came around, so it isn't an unknown item, I would recognise them and know what to expect'

Some patients had negative perceptions of the painkillers they were prescribed. In particular the oral morphine evoked a number of negative views and concerns. It appears that these concerns may have been the result of past experiences, and the meaning morphine had for them. They also expressed fears regarding the possibility of addiction.

'Because my husband's grandfathers had some very bad experiences on morphine as a painkiller, I suppose in my mind I am aware of that'

'I do have a partner that took it when he came out of hospital after keyhole surgery. He took it for much longer then he was requested to and I just felt that it kind of got a hold of him…he didn't feel as though he could cope without it and that concerned me a little bit. When stuff like that happens I think its best to stay away from it'

However, patient concerns regarding addiction seem to be reduced if the patient trusts the healthcare provider that their analgesics are safe to take.

'There was always the thought in the back of my mind knowing what it is and knowing that it can be addictive and all that. But I was thinking I am sure whatever I have been given here is not going to be a problem'

Patients were also concerned about taking the morphine because of its side effects. The feeling of being out of control was a particular worry.

'The effects that morphine had on me … I would probably be less inclined to take it because it makes me really drowsy and sort of spaced out and not in control of anything'

As well as this some patients were worried about the volume of painkillers they were prescribed and this may have contributed to their willingness to endure their pain and push their limits.

'Well there were quite a lot of pills.When I saw them in front of me I thought I really don't want to take all of them because I will make myself ill'

'I guess you don't want the body to have to cope with too much'

A few patients felt that they did not have enough information to make an informed decision about their painkillers, and perhaps avoided taking them because they did not know what could happen and were frightened. It would appear that more detailed information about the mechanisms of analgesics may be appropriate for particular patients.

'You don't have enough information in your little booklet. It doesn't actually tell you what it actually does to the body.Yes it gives you the side effects but what about what is happening inside.That's what I would like to know…how does it actually reach the pain'

However, it was felt by the same individuals that although the use of multimodal analgesics were safe for others it may not be for them, which may render extra information useless. They believed that everyone is individual and they might react differently to the drugs than others. This fear that they may have a dangerous unpredictable reaction to their painkillers may have prevented these patients from taking them.

'I know obviously the people who have given it to me have said that it is going to be fine - absolutely no problems whatsoever. But everyone is different aren't they and you don't know how everyone is going to react so I would rather not have it if I don't need to'

Monitoring the Limits

1. Pain as a measure

Patients consistently monitored their pain which seemed to act as a coping strategy in order to allow them to push their limit and endure as much pain as possible, and resulted in patients reducing or avoiding their analgesics. For example, some patients did not like to take their painkillers as they block the pain and they could therefore do themselves further damage by overexerting themselves. This could be viewed as a coping strategy as these patients may have used pain to measure what activities may have been harmful and adjusted them accordingly, allowing them to endure as much pain as possible without using analgesics.

'So I have been using pain and twinges as a sort of measure. that allowed me to keep on going'

'If you dull the pain you might actually do yourself some more mischief'

Another coping strategy some patients used was to stop taking their painkillers or reduce their dose in order to see if they had pain, again using pain as a measure to find out if they were recovering well, and to monitor if their pain warranted taking analgesics.

'I like to know what's going on because if you dull the pain then sometimes its like false information. If you don't know whether you have got any pain then how are you supposed to know if you are actually getting better or worse'

2. Contingency

Some patients' coping strategy involved keeping a portion of analgesic aside as a contingency in case their pain worsened and they needed more painkillers or something stronger. These patients were not utilising all the analgesics prescribed. This exhibited a way in which some patients coped with their pain and perhaps helped them to push their limits further.

'I kept one just in case I did something stupid and hurt myself'

Setting the Limits Stopping the Pain

1.Type of pain

Patients will put up with their pain and push their limits as far as they can by monitoring their pain and coping with it. However, there comes a point when they give in or draw the line. There are a number of factors that determines when this happens. Firstly the type of pain they are experiencing influences whether the patient feels it is necessary to take analgesics. For example, one patient said that the pain he had following his surgery did not stop him functioning and therefore did not necessitate taking medication. However, a headache would stop him functioning so he would take analgesics for this. The type of pain experienced may also determine how long the patient feels their pain will last, which then influences whether analgesics are felt necessary. For example, because postoperative pain is acute and precipitated by tissue damage the patient may think that the pain experienced will soon decrease as the body heals. They may be prepared to endure pain avoiding analgesics as they believe their pain will not last forever.

'I just don't like headaches or anything that is going to actually stop me from functioning.You cannot think straight where you have got a cracking headache'

'It's just a case of I know this will be gone by tomorrow'

2. Level of pain

When pain reaches a certain level and it goes on for sometime patients will then draw the line and use their analgesics. Painkillers really were seen as the last resort. This attitude was adopted by many participants and goes directly against advice given to them in the hospital which encourages pre-emptive pain relief.

'I don't mind taking them if I feel that the time has come when I really want to be more comfortable but it's just a question of biding my time'

Morphine seemed to be a concern for some patients as they felt that their pain needed to be 'excruciating' for some period of time to necessitate taking it and putting a stop to their pain.

'I would say that I would have to be in tears and not be able to move before I would take it (morphine)'

3. Coping with pain

An important, and perhaps commonsense, factor that motivates patients to take their analgesics and stop their pain is to prevent or cope with their pain so that they can get on with their normal day to day activities. The extract below illustrates how one patient took painkillers in order to comfortably have a shower in the morning and sleep at night.It seems she was willing to endure pain for the rest of the day.

'I have been taking them first thing in the morning when I get up so I have no pain so I can have a shower and get dressed and do my stuff and then last thing at night'

Finally, as expected, some patients do not fit neatly into this model. These patients utilised their analgesics as prescribed and reported that they accurately followed the advice given to them. The patient provider relationship seemed to play a strong roll in this. A trusting relationship between the healthcare provider and the patient helped the patient to feel that the advice given to them was correct, and that it was safe to take the analgesics given.

'The nurses and the doctors told me - I trust what they have got to say'.

One patient said that both the surgeon and anaesthetist told him to take his analgesics regularly, and because of this he did. In this case it seems that the authority of the healthcare professional influenced the patients use of his analgesics, especially considering the extract below in which this patient states that he took his analgesics out of respect for those who helped him.

'Both the surgeon and the anaesthetist said it very definitely with conviction'

'I think it is respect for the people who have helped you through the operation'

Discussion

The findings suggest that the management of pain in day case surgery is not as straightforward as at first it might appear. Patients do not always follow their analgesic regime as provided and maximise their pain relief. The reasons for this have not previously been explored in detail with day case patients. This study illustrates that patients bring with them a number of beliefs surrounding pain and analgesics and make rational decisions as to whether they utilise their medication. This is consistent with previous research with other patient groups arguing that patients beliefs and attitudes may be one of the key factors contributing to medication adherence [29, 33, 34].

Pushing the Limits

Patients appeared to believe that pain is something to be endured and wanted to 'push their limits' withstanding as much pain as they could before resorting to analgesics, believing that pain should be endured without complaint. Such stoical beliefs have previously been identified among day case patients [25], and are reflected in the general public of the UK and USA [23, 24, 35]. Such beliefs have also been recognized in other patient groups; Ward et al [22] argued that not wanting to complain about pain was a significant barrier to pain management in cancer patients, and Townsend et al [36] found that patients with long term multiple morbidity struggled with the need to take drugs in order to be pain free, but also wanted to take as few as possible. Townsend et al [36] argued that research illustrates a common cultural belief that drugs should be used as little as possible which is something that definitely resonates among some of the day case patients interviewed in this study.

This research provides insight into what motivated these patients to tolerate their pain. Firstly patients gained a sense of pride and achievement when pain was successfully endured without using analgesics. If, as research suggests, stoical beliefs regarding pain, along with the attitude that drugs should be used as little as possible, are ingrained in our culture, then this may explain the sense of pride patients felt when carrying out a behaviour which is accepted and encouraged by society. This is supported by Scherman and Löwhagen [34] who argued that medication use is fraught with meaning for the patient which is context specific. 'Taking medicine is a social act, defining us not only in our immediate social world but giving us a role – perhaps unwanted – in a larger social context' [37]

Another reason patients may have wanted to, and thought they could, tolerate pain was that they saw themselves as physically fit and perhaps more capable of withstanding pain than the average person. Analgesics were seen as a weakness: something that threatened their sense of fitness and health. Similarly Scherman and Löwhagen [34] argued that one reason participants in their research did not adhere to a medication regime (for asthma/allergy) was because taking medication threatened their perception of themselves as healthy. The social context could also play a role here, as health and fitness are valued and encouraged in society.

Some patients felt that pain was natural and something to be embraced, and that the body should be left to heal by itself. This is consistent with other research that suggests some patients held the belief that pain serves a purpose for recovery and that patients avoided their medication in their research because they believed that by taking it the ability of the body to heal itself would be weakened [14,34].

This research also shows that medication was seen as unnatural and some patients sought alternatives in order to relieve their pain. This finding is reflected in previous research, where patients tried to minimise the use of drugs and maximise other strategies [36]. Members of the public also say they would prefer to use alternatives to medication in order to overcome pain. Fins [38] speculated that this may be because they want to maintain personal control and avoid giving control to practitioners. However, Horne [29] argued that the belief that medications are unnatural and made of harmful chemicals leads to the perception of medications as dangerous which then influences treatment decisions

Patients in this research also had worries about the dangers of analgesics. Some said that they did not use them in their day to day lives and thus were concerned about using them after surgery. The idea of taking analgesics additively was something unfamiliar which they were reluctant to try. Some patients were also concerned about addiction, particularly regarding the oral morphine; a barrier to pain management which has previously featured in a number of studies [22, 23, 38, 39, 40, 41]. They were also reluctant to use the oral morphine as it evoked a number of negative perceptions gleaned from past experiences. Side effects experienced after taking the oral morphine were also noted as a concern. 'Feeling out of control' was a particular worry especially for one patient who had young children to care for. Other research has argued that unwanted side effects influence analgesic use [7, 18, 22, 33, 35, 40] with patients in research by Donovan and Blake [20] stating that they would rather have pain than side effects.

All patients were given information about their analgesics. A few stated that they would like to know more about how the analgesics actually worked to stop pain in order to allay their fears. The importance of patient information is well documented (9,12,15,16), but giving information on the mechanisms of analgesics may be too complex and inappropriate for many patients. The participants who wanted further information later stated that they were concerned that although their analgesics had been tested and taken by others in the past, that everyone is individual and that they might react differently to them. Consequently, if they feel this way then would further information be redundant? Taking the concept of 'individuality' further, Horne [42] argued that some people feel they are more sensitive or susceptible to the adverse effects of medication than others, and such people may see medicines as harmful and over-prescribed.

Monitoring the Limits

Patients continually monitored their pain and used it as a guide telling them what activities they could perform, which in turn helped them to cope and perhaps endure their pain. Consequently patients were reluctant to utilise their analgesics as they would block their pain and it could no longer be used as a monitor. Other research has noted that fear of analgesics, because they impair the ability to monitor illness symptoms, is a significant barrier to pain management amongst cancer patients [43], that patients believed that medication may camouflage their bodies own signals [34], and that patients followed up after day case surgery felt worried that they may accidentally `over do it' if pain is reduced with analgesics [25].

Other coping strategies used were to keep some of the analgesics aside in case pain got worse and something stronger was needed. Similar beliefs are held by the general public, with people not wanting to take too many analgesics in case they are not effective with continued use [23]. Fear of tolerance is also an important barrier to pain management in patients with cancer [22, 39].

Setting the Limits/Stopping the Pain

The type of pain experienced, and how long they thought the pain would last, influenced when the patients felt their analgesics were necessary. Because their pain was precipitated by tissue damage patients thought that it would not last forever, and were prepared to endure pain. This is reflected by Fins [38] who argued that members of the public were willing to tolerate pain more if it was part of the

recovery process, and may crudely relate to three illness beliefs important in self regulatory theory [44] ; cause, consequence and timeline.

However,when pain reached a certain level or went on too long, patients drew the line and took their analgesics, using them to cope with their pain and get on with day to day activities. Likewise Scherman and Löwhagen [34] argued their patients waited until they absolutely had to before using their asthma / allergy medication. This may also relate to Horne et al [29] who suggested beliefs about medicines can be grouped under two core themes; necessity of prescribed medication and concerns about adverse effects. If necessity outweighs concerns, then patients will use their medication : if concerns are more important, then a lack of adherence will be seen.

Of those patients who utilised all their analgesics as prescribed the patient provider relationship played a strong role, with respectful and trusting relationships having an important influence. This reflects much previous research on the importance of building concordant relationships between the healthcare provider and patient [45].

Limitations

Participants in this research were all white with a European cultural background. Those from other cultural groups may report a different experience. For example, Horne [46] argued that those with an Asian cultural background are more likely to report medicines as being harmful, addictive substances that should be avoided, than those with a European cultural background. This research has also taken a rather broad snapshot of the patients experiences after day case surgery using 15-20 minute interviews with twenty-one patients, and further research is required in order to explore this area further and make more general claims [47].

Moving forward, it is proposed that subsequent research will be undertaken in order to investigate some of these findings in greater depth, and to consider further the source of patients beliefs and attitudes.

Conclusion

As the government pushes to increase day case surgery in order to reduce waiting lists and make savings, it is clear from a number of studies that the incidence of pain after day case surgery has also grown. Due to fast turn around times patients are becoming increasingly responsible for their own recovery and self management of pain. Many patients are failing to utilise their analgesics as prescribed. Findings from this study have illustrated that day case surgery is more complex than it may first appear, and that patients beliefs play an important role in the decisions they make about taking analgesics. Simple interventions such as 'patient information' often fail to take into account the complexity of decisions and further work is needed to understand this more fully. As this research progresses it is anticipated to provide further insight into patient beliefs and how these beliefs come to exist. This insight into this relatively unexplored area may provide foundations upon which future interventions aiming to increase patient analgesic use are based thus improving patient care and ultimately reducing the incidence of pain after day case surgery.

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Postoperative Nausea and Vomiting Following the Use of Fentanyl or Remifentanil in Ambulatory Gynecologic Laparoscopic Surgery: A Prospective Randomized Trial

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Abstract

Purpose: To test the hypothesis that using remifentanil during nitrous oxide-sevoflurane anesthetic would be associated with less postoperative nausea and vomiting (PONV) compared to a similar technique with fentanyl.

Scope: Sixty patients undergoing outpatient gynecologic laparoscopy were randomly assigned to remifentanil or fentanyl for intraoperative analgesia. The complete response rate (no PONV and no rescue) was 50% / 29 % in the remifentanil group and 37% / 12 % in the fentanyl group in the PACU and at 24 hours respectively (p=ns).

Conclusion: The use of remifentanil was not associated with a reduction in the incidence of PONV, compared with fentanyl, in patients undergoing ambulatory gynecologic laparoscopy.

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Keywords: postoperative nausea and vomiting, fentanyl, remifentanil, gynecologic laparoscopy, ambulatory surgery.

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Introduction

Postoperative nausea and vomiting (PONV) occur commonly after outpatient gynecologic laparoscopy with a reported incidence in the range of 56-95 % [1–3]. Short acting synthetic opioids are commonly used in ambulatory surgical patients. Opioid use is considered one of the major risk factors for PONV [4]. It is unclear if the choice of the opioid can influence the incidence of PONV. Alfentanil, a shorter acting opioid, has been associated with a lower incidence of PONV compared with fentanyl [5].

Remifentanil is a unique opioid. Its ester structure renders it susceptible to hydrolysis by blood and tissue non-specific esterases, resulting in very rapid degradation to essentially inactive metabolites. Its context-sensitive half time is rapid and relatively independent of the duration of infusion [6–8]. This rapid decline in drug effect may have advantage in being associated with a faster postoperative recovery and a lower incidence of opiate related side effects compared with other opiates.

Total intravenous anesthesia (TIVA) with propofol and remifentanil was found to result in a lower incidence of PONV compared with a technique using a propofol infusion, fentanyl, with or without nitrous oxide (N_2O) [9–11]. Similarly, TIVA with propofol and remifentanil was associated with less PONV compared to a balanced anesthesia technique with a volatile agent and fentanyl [12, 13]. The main focus of these studies was however to compare the effects of TIVA with propofol versus inhaled anesthetics on the incidence of PONV. Only one study compared PONV rates following the use of the two opiates during a volatile based technique. Apfel and colleagues reported that the use of remifentanil for intraoperative analgesia was not associated with a reduction in PONV compared to a technique using fentanyl during a volatile based anesthetic [14]. The administration of morphine at the end of surgery in the remifentanil group, however, confounded the analysis [15]. We therefore designed this study to test the hypothesis that the use of remifentanil as the intraoperative opioid during nitrous oxide-sevoflurane based anesthetic would be associated with less PONV compared to a similar technique with fentanyl.

Methods

Seventy two adult patients scheduled for outpatient gynecologic laparoscopy were enrolled in this study after obtaining institutional review board approval and written informed patient consent. Exclusion criteria were ASA physical status IV or V, antiemetic or glucocortiocosteroids use within 24 hours of surgery, allergy to ondansetron, pregnancy, breast feeding, obesity (body mass index more than 34), mental retardation, or psychiatric illness. For women of childbearing potential, a negative serum [beta]-hCG test was confirmed before enrollment.

Anesthetic technique was standardized. All patients received midazolam up to 2 mg IV as premedication. Anesthesia was induced using propofol 1.5–2.5 mg/kg and the trachea was intubated using succinylcholine 1 mg/kg. Anesthesia was maintained using 1-3 % inspired sevoflurane and 60 % nitrous oxide in oxygen. Inspired Sevoflurane was titrated to maintain a bispectral index (Aspect Medical System, Newton, MA) value between 45-60. Cisatracurium was used to maintain muscle relaxation at one twitch of the train-of-four.

Patients were randomly assigned to one of two treatment groups using a random-number table. Women were allocated using sealed opaque envelopes and randomization was grouped into blocks of 10 patients. The bolus dose of remifentanil and fentanyl was based on relative potency ratio of 1:1 [16]. In Group 1 (remifentanil group), remifentanil 1 mcg/kg was administered as a bolus at induction of anesthesia followed by an infusion at a rate of 0.05-0.3 mcg/kg/minute. The infusion was stopped at the start of skin closure. In Group 2 (fentanyl group), fentanyl 1 mcg/kg was given as a bolus at induction of anesthesia with further boluses of fentanyl 1 mcg/kg

given as needed. The opioids were given to maintain blood pressure and heart rate within 20 % of baseline. Within 20 minutes before the end of surgery, ondansetron 4 mg and ketorolac

30 mg IV were given. Local infiltration with 10-ml ropivacaine 0.5 % was administered around the trocar incision sites. Muscle relaxation was reversed with neostigmine 70 mcg/kg and glycopyrrolate 10 mcg/kg.

An independent research nurse unaware of the patients' randomization collected the data. The duration of surgery and the length of postanesthesia care unit (PACU) stay were recorded. Postoperative assessments were made at 0, 30, 60, 90,120 min, at PACU discharge, and at 24 h by telephone interview with a trained interviewer blinded to the patients' group. Nausea, emetic episodes, nausea score, sedation scores, and rescue antiemetic and analgesic use were recorded during these time intervals. The nausea score was measured as an 11 point scale ranging from 0–10 where "0" represents no nausea and "10" represents worst nausea, the concept was explained to patients preoperatively. Sedation was measured on a scale from 0-5 using the modified observer's assessment of alertness/sedation scale [7]. The time to readiness for PACU discharge, when patients were fully awake and oriented, with stable vital signs, minimal pain (<3 on a 0–10 scale) and were able to ambulate and not experiencing any side effects, was recorded. Patients rated their satisfaction with the control of PONV just before discharge from the hospital and at 24 hours, and with the control of pain at 24 h. At the 24 h follow up, patients were also asked to rate PONV control, and to indicate how well they slept. An 11 point linear numeric scale was used to rate the patients' satisfaction with the control of PONV and pain where "0" = very dissatisfied and "10" = very satisfied. A similar scale was used to rate PONV control where "0" = not effective and "10" = very effective, and to indicate how well they slept where "0" = did not sleep at all, and "10" = slept very well.

Nausea was defined as a feeling of the urge to vomit, as solicited by the investigators during assessments. Vomiting was defined as expulsion of stomach contents through the mouth. Retching was defined as an attempt to vomit, not productive of stomach contents. An emetic episode was defined as a single vomit or retch or any number of continuous vomits or retches. A complete response was defined as no PONV and no need for rescue antiemetics. In the PACU, ondansetron 4 mg was used as the initial rescue medication for PONV. This was given if nausea was intractable and lasted for at least 15 minutes, if three emetic episodes occurred within 15 minutes, or at any time at the patient's request. Postoperative pain in the PACU was treated with fentanyl IV doses of 25–50 mcg. After discharge, pain was treated with ibuprofen and oxycodone 5 mg/acetaminophen 325 mg combination.

Previous studies demonstrated an incidence of PONV of 59 % in this population using intraoperative fentanyl and PONV prophylaxis with ondansetron [17]. A sample size of 30 patients per group was determined to be adequate to demonstrate a 35% difference in the incidence of PONV (from 59 % to 24 %) with $\alpha = 0.05$ and $\beta = 0.8$. Descriptive statistics were used to summarize the demographic characteristics of patients. Fisher's exact test and chi-squared procedures for categorical data, and Wilcoxon rank sum test and the Kruskal-Wallis test for continuous variables were performed for comparisons among the treatment groups. Repeated measures analysis of the variance was used to analyze pain scores. $P < 0.05$ was accepted as statistically significant.

Results

One hundred and seventeen patients were assessed for eligibility. Eighteen patients had exclusion criteria and twenty seven refused to participate. Seventy two patients were enrolled in the study. Surgery was cancelled in five patients and was converted to an open procedure in 5 patients. Two patients were excluded from the analysis in the fentanyl randomization group due to protocol violations. Data from thirty patients in each group were analyzed.

The two groups were similar with respect to age, weight, height, ASA status, history of PONV or motion sickness, smoking history, and duration of surgery (Table 1). The mean (SD) dose of the intraoperative opioid was 420 (318) mcg in the remifentanil group and 168 (71) mcg in the fentanyl group.

Table 1 Patients' demographics, risk factors for PONV, and duration of surgery.

	Remifentanil Group (n=30)	Fentanyl Group (n=30)
Age, years	32 ± 5	32 ± 6
Height, cm	166 ± 6	165 ± 5
Weight, kg	73 ± 21	76 ±19
ASA Class, I/II	12/18	9/21
History of PONV	10 (33)	5 (17)
History of motion sickness	11 (37)	13 (43)
Smoker	5 (17)	6 (20)
Duration of surgery, min	56 ± 29	58 ± 27

Values are mean ± SD or number (%). PONV=postoperative nausea and vomiting.

The duration of PACU stay was not different between the two groups (Table 2). Efficacy data are summarized in Table 2. During the first 2-h postoperatively, there was no difference between the two groups in the incidence of PONV, nausea scores, sedation scores, vital signs, need for rescue antiemetics, or complete response rate. Twenty two patients in the remifentanil group and 13 patients in the fentanyl group needed analgesia with fentanyl boluses in PACU ($p=0.035$). Significantly more fentanyl was used in PACU in the remifentanil group compared with the fentanyl group ($p=0.002$). The repeated-measures ANOVA for the pain scores over time found no significant difference in treatment overall ($p=0.3674$). However, the interaction of treatment and time was non significant ($p=0.355$), indicating no significant difference between treatments in the effect of time on pain. A non-linear effect of time was also non-significant. In this repeated-measures analysis, time to measurement was treated numerically, preserving both its order and magnitude. Patient satisfaction with PONV control was not different between the groups.

Ten patients could not be reached at the telephone number that they supplied to the study personnel and were lost to follow up, with six and four patients in the remifentanil and fentanyl groups, respectively. At 24 h postoperatively, there was no difference between the two groups in the incidence of PONV, need for rescue antiemetics, complete response, pain scores, nausea scores, or in patient satisfaction with PONV or pain control (Table 3).

Table 2 Postanesthesia Care Unit (PACU) data.

	Remifentanil Group (n=30)	Fentanyl Group (n=30)
Nausea	10 (33)	12 (40)
Vomiting including retching	6 (20)	5 (17)
Need for rescue antiemetics	13 (43)	15 (50)
Complete response	15 (50)	11 (37)
Average nausea score	0.6 ± 1.2	0.6 ± 1.2
Worst nausea score	1.5 ± 2.8	2 ± 2.7
Pain scores		
At admission	3.3 ± 3.3	2.1 ± 2.8
30 min	3.7 ± 3.4	3.1 ± 3.4
60 min	2.4 ± 2	3.1 ± 2.9
90 min	1.9 ± 1.8	2.1 ± 2.5
120 min	2.1 ± 1.6	2.1 ± 2.2
Fentanyl use in PACU, mcg	88 ± 73*	35 ± 45
Duration of PACU stay, min	155 ± 48	159 ± 55
Satisfaction with PONV control	9.4 ± 1.5	9.3 ± 1.5

Values are mean ± SD or number (%). *p=0.002.
PONV=postoperative nausea and vomiting.

Table 3 24 hours data.

	Remifentanil Group (n=24)	Fentanyl Group (n=26)
Nausea	12 (50)	17 (65)
Vomiting including retching	3 (13)	5 (19)
Need for rescue antiemetic	2 (8)	2 (8)
Complete response (0-24 h)	7 (29)	3 (12)
Nausea score	1.3 ± 1.8	3.1 ± 3.6
Pain score	3.4 ± 2.6	4.2 ± 2.5
Satisfaction with PONV contro	19 ± 1.6	8.9 ± 1.6
Satisfaction with pain control	8.9 ± 1.2	8.5 ± 2.2
Rating of PONV control	9 ± 1.9	8.8 ± 1.7
Rating of sleep	8 ± 1.9	7.7 ± 2.5

Values are mean ± SD or number (%). Nausea and pain scores represent the worst scores since discharge. PONV=postoperative nausea and vomiting.

Discussion

In this study we found no difference in the incidence of PONV following the use of remifentanil or fentanyl as part of a sevoflurane-N_2O based anesthetic, in patients undergoing outpatient gynecologic laparoscopy.

Opioids are a major cause of PONV in ambulatory surgical patients. A previous study suggested that the selection of the opioid used intraoperatively can affect the incidence of PONV following ambulatory surgery. In that study, alfentanil compared with approximately equipotent doses of fentanyl and sufentanil, was associated with a lower incidence of PONV [5]. On the other hand, the incidence of PONV was not different following the use of either remifentanil or alfentanil as part of a TIVA technique with propofol [18–21].

A number of studies have compared the incidence of PONV following the use of anesthetic regimens involving remifentanil or fentanyl. However, no conclusions could be drawn regarding the effect of the two opioids on PONV since these studies were mainly comparing balanced anesthesia versus TIVA [13]. With a propofol based technique, the use of remifentanil was associated with a significantly lower incidence of PONV compared with fentanyl [9–11].

Only one recent study compared the two opiates when used as part of a volatile based technique. Apfel and colleagues found no reduction in the incidence of PONV with the use of remifentanil compared to fentanyl with a volatile based technique in inpatients undergoing a variety of surgical procedures [14]. An accompanying editorial suggested that the use of morphine at the end of surgery in patients receiving remifentanil, was the likely explanation for the failure of the shorter acting opioid to reduce the risk of PONV [15]. In our study, no other opioids were used intraoperatively in patients receiving remifentanil.

However, similar to Apfel's study, there was no difference in the incidence of PONV between the patients who received fentanyl and those who received remifentanil, both in PACU and at 24 hours.

A possible explanation for the failure of the short acting opioid remifentanil to reduce the risk of PONV is the greater fentanyl consumption in PACU by patients in the remifentanil group. Alternatively, it is likely that prior stimulation of the opioid receptors triggers PONV and that the occurrence of the latter is not linked to the opioid plasma concentrations at the time of the symptoms [5].

The ratio of the total doses of remifentanil versus fentanyl given intraoperatively in this study was 2.5:1. The relative potency ratio of remifentanil versus fentanyl was reported as being 2:1 or 1:1 [22]. The C50 for EEG depression for fentanyl and remifentanil was 6-10 and 10–15 ng/ml respectively [22] implying that the doses used intraoperatively in this study were comparable. Furthermore, the doses used for both agents are based on an algorithm to maintain a blood pressure within 20% of baseline and reflect the doses that are routinely used in our clinical practice.

This study has its limitations. Patients in both groups received a prophylactic antiemetic with ondansetron which might have obscured the effect of the opioid used. However, given the high incidence of PONV in this patient population, we felt it was unethical not to give an antiemetic prophylaxis. Also, despite our efforts to administer adequate analgesia using a NSAID and local anesthetic infiltration, patients in the remifentanil group required more fentanyl in PACU, which might have masked any difference in emetogenic effect between the two opioids. We used fentanyl as the rescue analgesic as remifentanil is very short acting and may cause undesirable side effects such as muscle rigidity when administered in awake patients

and hence was not a suitable rescue analgesic. A study in a patient population where postoperative opioid analgesia is unlikely to be required might be able to overcome this limitation. However, there appears to be a trend of higher complete response rates in the remifentanil group in the PACU as well as at

24 hours. It did not achieve statistical significance as our sample size calculation was based on a clinically significant difference of 35%. A larger sample size of 88 per group would be needed to test this hypothesis.

In summary, the use of remifentanil as the intraoperative opioid in patients undergoing ambulatory gynecologic laparoscopic procedures was not associated with a reduced incidence of PONV, compared with fentanyl, when used as part of a sevoflurane-nitrous oxide based anesthetic.

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Paediatric Ambulatory Surgery Cancellations in a Caribbean Developing Country

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Abstract

The reasons and impact of cancellations of paediatric ambulatory surgeries in developing countries may be distinctive and information regarding the same is sparse.

Methodology: Data on all patients scheduled to have elective surgeries during the period of two years from January 2002 to December 2004 were retrospectively collected. An audit form was used to determine scheduled surgical procedures, cancelled procedures, reasons for cancellations. Demographic data such as age, ethnicity, family composition, occupation of the parents and information regarding the inconvenience caused were also collected. Both chart review and telephonic interviews were conducted for data collection.

Results: Of 3048 procedures scheduled during the study period, 917 (30.1 %) were cancelled. 174 cancellations were analysed in detail after power analysis. Common causes of cancellations were problems with supplies or staffing of the operating theatres (22.9%), administrative issues, being found medically unfit on the morning of surgery (21.7% each), unavailability of surgeon or anaesthetist (13.7%). Other reasons were patients not showing up (14%) due to concurrent medical illness, confusion about the date of surgery, withdrawal of parental consent, and a decision to have the surgery done elsewhere.

Discussion and conclusion: Inappropriate management of operating rooms and inadequate communication are the major issues causing cancellations of paediatric day-care surgery in our setting.

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Introduction

The frequent last-minute cancellation of cases scheduled for non-urgent surgery implies a serious deficiency in the quality of the clinical services, and gives rise to significant emotional and economic challenges to affected patients and their families [1]. The attendant wastage of limited resources, including manpower hours and preparations made for the conduct of these routine cases, may also erode the enthusiasm and work ethic of personnel providing these services. Where minors are the beneficiaries of these services, parents or guardians frequently take time off work to accompany children, and may suffer unexpected financial hardships as a result [2]. These considerations are of even greater importance to institutions in developing countries such as ours, subsisting largely on limited government subventions, striving to provide services for disadvantaged people with restricted earning power.

Yet many of the cancellations that affect outpatient clinics and surgical lists have been shown to be preventable by proper planning [3]. Since one cannot assume a universal explanation for this problem, the foundation of such planning requires knowledge of the reasons for such cancellations in every locality.

With this background, this study attempts to investigate the reasons for the cancellation of paediatric cases listed for surgery in the Same Day Surgery (SDS) unit of a tertiary care teaching hospital in Trinidad and Tobago and try and assess the impact of this turn of events on patients and guardians. The data hopefully would enable to formulate a policy for minimizing this occurrence in the future.

Hospital Setting

Eric Williams Medical Sciences Complex (EWMSC) is a teaching hospital which provides centralized paediatric surgical services for Trinidad and Tobago. The hospital is a public institution and no fee is charged for the services provided.

Children with non-acute surgical complaints are referred by their doctors, or from the Priority Care Facility (Casualty) of the hospital, which is a "walk-in" area, to the out-patient surgical clinics. After evaluation by the consultant surgeon, patients are given a date on the waiting list for surgery. Routine blood investigations are carried out within four weeks of the date scheduled for surgery. Pre-operative assessment to confirm fitness for surgery is done by the Anaesthetic Department at a designated clinic, the week before the scheduled date of surgery. A printed list of instructions is given to a responsible adult by the nursing personnel followed by discussion and explanation of the instructions. These instructions include specific details about the required duration of fasting, any specific preparations necessary and eventualities which should lead to the postponement of surgery for the child (usually unexpected illness).

The patients are admitted to the SDS unit on the morning of surgery, again assessed by the anaesthetist, and after the surgical procedure all (except who require unplanned admission to hospital) patients are discharged home on the same day from the SDS unit.

Methods

Approval to conduct the study was obtained from the Ethics Committees of the University of the West Indies and the hospital. All patients scheduled for elective surgery during the two-year period from 2002 through 2004 were included for the retrospective analysis.

For detailed evaluation of the cancellations, a sample size was determined to give adequate power to the findings of the study, based on median figures for percentage cancellations derived from previous studies. A projected percentage of 13% was used for the calculation based on the formula:

$$No\ of\ subjects = t2\ \frac{(p)\ (1\text{-}p)}{d2}$$

where t is a constant (= 1.96 at the 95% confidence interval), p is the expected percentage of cancellations derived from the literature search (13%), and d is another constant defining the precision level or range within which the true value of the study population was estimated to lie. Thus, for a precision level of 5% (and d=0.05), the sample size was derived as 174 patients.

175 patients were randomly chosen from the total number of patients who were cancelled and after explanation of the purpose and format of the project, informed consent was sought from all responsible adults by phone. Consent forms were also posted out to the 175 candidates enrolled to the study which were signed and returned. Patient anonymity was preserved by excluding patient identification and contact information from the forms subjected to analysis.

An audit form was developed for the detailed assessment of the children who had cancellation of scheduled surgery in the SDS unit of the hospital. The audit form sought to identify data from all the 175 entrants to the study. Demographic and clinical data and reasons for cancellation were derived from chart review. Where further information was required, such as information regarding family composition, how the cancellations impacted the parent/guardian, data were collected by telephone interviews of the relevant parents or guardians.

Demographic features such as age, gender, ethnicity, social class (based on parents' occupations), and family structure, as well as the clinical diagnosis and time spent on the waiting list were recorded. The reasons for the cancellations were grouped into two – one group where parents/guardian were responsible for the cancellation and the second group where factors within the hospital were responsible for the cancellation.

Descriptive analyses and ANOVA analysis were done to infer the statistical significance of the various factors involved in cancellations.

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 12 (Chicago IL, USA) software.

Results

During the three-year period of study from 2002 to 2004, a total of 3048 cases were scheduled for surgery, out of which 917 surgical procedures were cancelled; overall cancellation rate being 30.1%.

The majority of the affected children (46.3 %) were between one and five years old, just under two-thirds (65.7%) were male. A little more than half (54.5%) were of African ethnicity. More than one third (35.1%) were from single parent homes, most of the fathers (70.3%) were skilled or semi-skilled tradesmen and almost half of the mothers (45.5%) were homemakers. The demographic features of the children whose surgeries were cancelled are depicted in Table 1.

Analysis of the distribution of all the cancellations according to the surgical specialty involved revealed that the majority of cancellations occurred in the children scheduled for General surgical procedures 482 (52.6%), followed by Orthopaedic and Plastic Surgery cohorts (8.3 and 9.3% respectively) and the least in the ENT (4.6%) (Figure 1).

Although the overall cancellations were less when the parent's occupation was professional/managerial (Table 1), patients whose parent's occupation was professional/ managerial, the median waiting time was 166 days when compared to patients who had unskilled parents, which was 26 days.

Table 1 Demographic features of cancelled patients.

Variable		n (%)
Age	<1 year	20 (11.4)
	1-5	81 (46.3)
	6-10	59 (33.7)
	11-16	15 (8.6)
Gender	Male	115 (65.7)
	Female	60 (34.3)
Ethnicity	African descent	96 (54.9)
	East Indian descent	35 (20.0)
	Other	44 (25.1)
Family composition	Single parent	99 (57.9)
	Both parents	60 (35.1)
	Guardian	12 (7.0)
Occupation of father	Professional & Managerial	5 (3.4)
	Skilled	102 (70.3)
	Semi- or Unskilled	28 (19.3)
	Unemployed/Retired	7 (4.8)
Occupation of mother	Professional & Managerial	2 (1.2)
	Skilled	61 (36.6)
	Semi- or Unskilled	23 (13.8)
	Unemployed/Retired	76 (45.5)

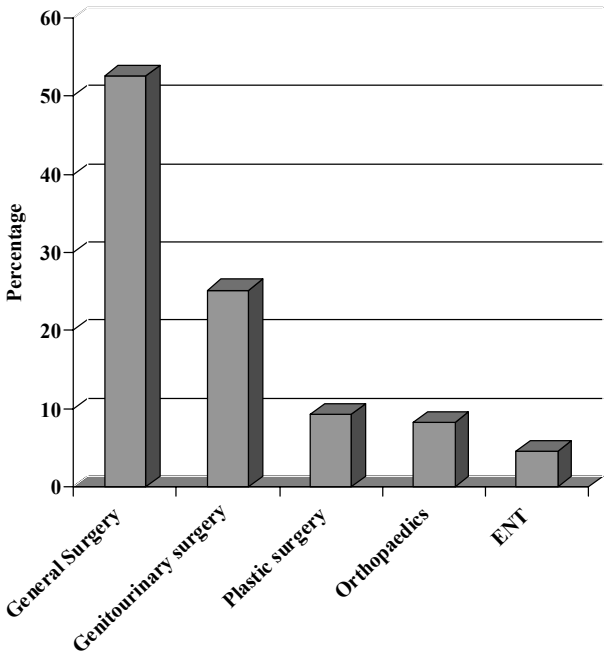

Figure 1 Distribution of cancelled cases by Specialty.

Twenty-five children (14.3%) were not brought to the SDS unit on the scheduled date, nine because of concurrent medical illness, and the remainder for a variety of reasons, including confusion about the date scheduled for surgery, withdrawal of parental consent, and a decision to have the surgery done elsewhere. Of this 25, six parents/ guardians had informed the hospital of the changed circumstances.

The remaining 150 children (85.7%) were cancelled by the hospital, most frequently because of problems with supplies or staffing of the operating theatres (22.9%), administrative issues, or being found medically unfit on the morning of surgery (21.7% each). There was a problem with surgeon or anaesthetist availability in 24 cases (13.7%) (Table 2). Thus, only 47 cancellations (26.9%) could be categorized as unavoidable (due to patient illness).

Table 2 Overall reasons for cancellation.

Reason for cancellation	Frequency of cancellation (%)
Self-cancellations:	25 (14.3)
Child ill	9 (5.1)
Miscellaneous	16 (9. 2)
Hospital Cancellations:	150 (85.7)
Operating room problems	40 (22.9)
Administrative problems	38 (21.7)
Child unfit	38 (21.7)
Surgeon/anaesthetist unavailable	24 (13.7)
Miscellaneous	10 (5.7)

The vast majority (74.9%) of the children had been on the waiting list for less than three months before the cancellation, 30 (17.1%) had been waiting between three and six months, and 14 (8%) had been waiting for more than six months. The overall median waiting duration was 41 days (interquartile range: 15, 138). The duration of waiting was not significantly different between the demographic features and occupation of the parents (Table.3) (ANOVA, F= 0.529, p=0.59).

Of the 150 patients cancelled by the hospital, nearly two-thirds of the parents or guardians (98, 65.3%) had taken a day off work to accompany the child to the hospital.

Table 3 Waiting time for surgery related to demographic variables.

VARIABLE		Median duration (days)
Ethnicity	African descent	40
	East Indian descent	42
	Mixed	51
Family composition	Single parent	33
	Both parents	44
	Guardian	34.5
Occupation of parent	Professional & Managerial	166
	Skilled	23
	Semi- or Unskilled	26.5
	Unemployed/Retired	43

Discussion

Ambulatory surgery and its benefits have grown steadily, and more than 50 to 60% of all elective surgical cases are done by this approach even a decade ago [4]. The list of advantages in the paediatric setting is impressive, which includes early ambulation, less likelihood of nosocomial infections, psychological benefits like decreased separation anxiety, less emotional stress for children and reduced disruption of the family unit, as well as economic and cost-effective returns [3, 4].

Well-defined quality indicators are required to define the standards and improve the results of ambulatory surgery. These may be unique to every setting, although some reported common indicators are unplanned admissions, emergency department consultations, postoperative pain, length of time spent on the waiting list and unexpected cancellations [5]. Hence our study sought to elucidate the reasons for cancellations, duration of waiting and their impact on parents in our setting.

Our study revealed an unexpectedly high incidence of cancellations of paediatric surgical day-cases. A wide range of unplanned cancellations has been reported in literature varying between 4.5% and 33% [3, 6 – 9]. Pollard observed that studies reporting cancellations due to "no shows" and those due to administrative reasons reported rates of 13% to 20% [7]. A previous study from Barbados reported a rate of 9% cancellation due to "no show" [10]. Also, rates quoted in prospective studies are about twice reported by retrospective studies (13% versus 6.6%). Although we opted to use a median rate (13%) from previous reports to calculate the sample size for the present study [6, 11, 12], and retrospectively studied our patients, we eventually found an exceedingly high cancellation rate in our setting.

The majority of cancellations in this report, as in most others, was hospital initiated, and mainly due to problems with administration and supplies, staff availability and time over-runs (Table 3). Administrative problems have previously been recognized to be responsible for the largest single group of cancellations, with rates of 43% to 45% occurring in a Community Hospital and in a University Hospital respectively [11, 12]. Our hospital is a hybrid that provides services by hospital appointed surgeons alongside a smaller number of University appointed consultants.

Other cancellation rates reported vary widely from 3.3% to 23.1% [3, 5-15]. Underlying reasons are multifarious, but appear to include the type of clientele served, financing, the level of development of the hospital, and issues of access and staffing. Our figure is far in excess of these values for reasons that are not quite obvious from the present study.

Another suggested influence on cancellation rates is the specialty involved. A lower cancellation rates in Orthopaedic and Plastic surgery in the present study may be perhaps due to the reason that some day-case procedures such as fixation of fractures and burn dressings, which belong to these units, might be expected to be given priority over other elective General surgical problems in the face of pressure for operating time. A previous study showed that cancellations in out-patient Urological surgery were significantly more compared to Orthopaedic and General surgery [6], while in our situation, General surgery surpassed Urology (Figure 1).

A previous study reported that 38.5 % to 50% of either parent of the patient had to take time off work, compared to 65 % in the present study [16]. This may be perhaps another reason for the longer waiting duration for children who had parents with professional/ managerial occupation. Additionally, in the present study, telephonic interviews revealed that there were considerable expenditures incurred by the parents such as the cost of transportation to hospital, babysitting

expenses and overnight lodging expenses for children coming from the sister isle of Tobago. The issue of the emotional and economic effect of cancellations on the involved families has been recognized to be of importance in a previous report [16].

The problem of self-cancellation has been addressed by many studies. Certain demographic factors have been reported to have influenced this factor, such as belonging to an ethnic minority group, possessing a lower educational and economic background, or being members of a younger age group [3, 8, 17]. Our study also suggests a parallel effect of ethnicity, family structure and socio-economic status on the cancellation rate. However, the proportion of cancellations in East Indian ethnic composition (20%) falls well short of the representation of this group in the population as a whole (40.3%) [18]. This may reflect an advantage in economic circumstances, or a cultural preference by this group to seek private medical care.

Many cancellations in the present study were due to upper respiratory infections (URI), of the patient. Even among those children who unexpectedly developed intercurrent illness, majority of the cancellations were initiated by the hospital and only few were by the parents or guardians. There has been controversy whether childhood URI-like symptoms, not accompanied by fever or pulmonary signs, should lead to automatic deferral of surgery. A tendency has been described for more recently qualified anaesthetists to desist from routinely canceling patients with URI-like symptoms [19, 20]. Also, a recent review has found that blanket cancellation for this reason is no more in vogue [21]. Educating parents to contact the hospital when they first note URI-like symptoms in the child is an obvious method of allowing last-minute cancellation and re-organization of the operating room schedule [3].

One method of curtailment in cancellation rate may be improved pre-operative evaluation. The introduction of hospital pre-operative clinics has been shown to reduce inadequate preoperative preparation [3]. Earlier evaluation might allow more time for addressing identified problems and give an opportunity for rescheduling, perhaps from a pool of easily contactable patients on stand-by [7]. In our hospital, despite having a designated Pre-anaesthetic Clinic, there have been many last-minute cancellations. Cancellation rates have been found to be similar whether these assessments are done within 24 hours or up to one month prior to surgery [3, 7, 22–24]. An earlier study in our setting showed that the Pre-anaesthetic Clinic has probably contributed to the low rate of unplanned admissions following day-care surgery [25].

Many interventions are likely to help in reducing unplanned cancellations in time to allow rescheduling of procedures. Strategies such as pre-admission testing visit by nursing staff in the same day surgery unit led to a reduction in delays and cancellations and increased nursing job satisfaction [20]. Preoperative telephone screening is another overture shown to be useful [13, 22]. In fact, a telephone call by the nurse the day before surgery to determine changes in the child's health status has become a mandatory part of the protocol of several units [26].

In our situation, many parents could not be contacted by telephone, which is again the limitation unique to the developing world. There are problems with communication, both with respect of the actual number of accessible working phones and the administrative and economic challenge of making contact with guardians. A similar situation has been previously described [27].

There were some limitations to the present study. The absence of a control group due to the retrospective nature of the study, did not allow valid comparisons. Also because of administrative reasons, constant staff shortage as well as motivation, no interventions could be made to see whether this has made any improvement. Nevertheless, it is possible to propose suggestions when the problems are known to avoid cancellations in future, as has been done in a recent study [28]. In a similar vein, it could be reasonably concluded from the results of the present study that in our setting, administrative efforts might be usefully directed to attention basic issues of adequate staffing and supplies, the formulation of an improved schedule design which could accommodate these shortcomings at short notice when they do occur, and more effective communication with parents and children.

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Clinical Advantages of Depth of Consciousness Monitoring in the Ambulatory Setting

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Abstract

Purpose: Consciousness monitors allow for intraoperative titration of hypnotic depth. This review examines the efficacy and advantages of these monitors in the ambulatory setting.

Scope: This review summarizes the possible clinical advantages of consciousness monitors in the ambulatory setting. Included in the discussion are potential savings of time and cost, avoidance of intraoperative recall, and improvement in clinical outcomes.

Conclusions: Monitoring consciousness in the ambulatory population may result in earlier recovery, reduced PACU stay, and a reduction in the incidence of intraoperative recall. Use of consciousness monitoring may aid in providing a safer and more efficient anesthetic, allowing for adjustment of dosing of hypnotics to individual patient needs.

Note: This work was presented, in part, at the 2005 meeting of the Society of Ambulatory Anesthesia, Scottsdale, AZ.

Keywords: Apnea, Depth of Consciousness, Monitored Anesthesia Care.

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Introduction

For over 150 years, physicians have used surrogate measures of consciousness (such as respiratory pattern, pulse, blood pressure, and exhaled anesthetic concentration) to determine and adjust anesthetic depth. With the advent of inexpensive and rapid computing power over the past thirty years, the ability to readily measure the effects of anesthetics on the brain (which is, afterall, the target organ for the hypnotic effects of anesthetics) has become possible. Modern processed EEG technology allows a more direct assessment of the brain's response to these medications and presumably a more accurate estimate of the level of sedation.

The primary goal of ambulatory surgery is to provide safe healthcare to patients in a way that is both time and cost effective. Consciousness monitors have been touted as a means to trim perioperative costs, improve anesthetic technique, and enhance patient safety. The purpose of this discussion, therefore, is to review the clinical advantages that these monitors can deliver in the ambulatory and office based settings.

Although frequently referred to as "depth of anesthesia" monitors, it is important to point out that of the components of anesthesia, these devices only monitor consciousness (or hypnosis, which is synonymous). Experiments that have examined the correlation between consciousness and movement during various anesthetic regimens have not shown a predictable correlation between the two [1]. MAC does not equate with consciousness, as shown in animal experiments revealing that MAC does not change despite forebrain removal [2].

Many attempts have been made to identify a single ideal value for interpretation of the EEG for perioperative use. 95% spectral edge and median frequency were among the first derivatives used in clinical practice with varying degrees of success. Following a series of experiments that confirmed the utility of a proprietary algorithm for EEG processing in the early 1980s, Aspect Medical Systems was formed in 1987. The first literature detailing the Bispectral Index® (BIS®) was published in the early1990s, with over 12 million patients monitored by 20053. Physiometrix and General Electric followed suit, and there are currently three primary monitoring choices available:

The Bispectral Index® (BIS®) reports a number between 100 (fully-awake) and zero (isoelectric EEG) to predict level of hypnosis, with values under 60 generally correlating with anesthetic level indicating loss of consciousness and absence of recall. Similarly the PSA-4000 monitor (and the soon-to-be-released "SEDLine"), initially developed by Physiometrix and now manufactured by Hospira, reports a number (known as Patient State Index, or PSI) between 100 and zero, with 50 generally representing appropriate surgical anesthetic depth [4]. The Entropy monitor (General Electric) translates the disorder in both EEG and EMG into two separate measures of consciousness: State Entropy (SE) which reflects cortical activity of the brain, and Response Entropy (RE) which reflects both cortical activity and frontalis EMG activity [5]. Technologies utilizing audio evoked potentials have also been introduced, but are no longer available for sale in the United States.

A plethora of studies have explored the ability of these monitors of consciousness to reduce drug use, speed recovery time, aid in anesthetic titration, and potentially reduce morbidity and mortality. In effect, an attempt has been made to show that these monitors allow for delivery of an anesthetic that is cheaper, faster, and better.

Do consciousness monitors save time/ money?

Drug use

A number of well designed studies have shown that patients receiving an anesthetic titrated with a consciousness monitor received less drug without untoward consequences. In a study examining recovery in ambulatory patients, anesthesia providers titrating anesthetic without a BIS monitor used 38% more volatile anesthetic and had significantly slower recovery times than providers that titrated to BIS [6]. Similarly, in a study of propofol consumption, patients with anesthetic titrated to BIS required less propofol, were extubated sooner, were more likely to be oriented in the PACU, and were eligible for discharge sooner [7].

Advantages of reduced drug use include the possibility for reduction of anesthetic related side effects. For instance, the incidence of

postoperative nausea and vomiting is reduced when anesthetic is titrated to level of consciousness [8,9]. Furthermore, an enhanced ability to titrate drug allows for potentially safer titration in patients that have altered pharmacodynamic profiles, such as the obese and elderly, that make up more and more of our ambulatory surgical population .

Recovery

Many studies have examined the effect of consciousness monitors on time to awakening, orientation upon arrival in the PACU, length of PACU stay, and time to PACU discharge with both positive and negative results. In a meta-analysis of healthy ambulatory patients, Liu showed that although recovery room time was slightly reduced in patients monitored with BIS (as was anesthetic consumption and risk of PONV), their overall time spent in the ambulatory surgical unit was not [10]. Wong and colleagues found that anesthetic titrated to BIS in the elderly population resulted in a nearly four minute faster time to orientation in the PACU as well as a more rapid time to achieve an Aldrete score >9 (16.9 vs. 19.1 minutes), suggesting the potential for earlier discharge in this vulnerable population [11]. However, earlier discharge was not demonstrated.

Sedation

Apnea during monitored anesthesia care is common, and has been reported to occur between 25-50%. Furthermore, it is more likely to occur as level of consciousness is progressively depressed [12,13]. In a recent study of MAC sedation, BIS prior to apnea was frequently in the range of general anesthesia (i.e. <60) [13]. Monitoring depth of consciousness and preventing unwanted oversedation with processed EEG may result in an improvement in patient safety during procedural sedation, especially when sedation is administered by non-anesthesia providers with limited training in resuscitation and airway management.

Do consciousness monitors prevent recall of intraoperative events?

A number of studies have sought to determine the incidence of explicit recall following general anesthesia. Using well constructed questionnaires and statistical methodology, the incidence has been determined to be somewhere between 1 in 500 and 1 in 1000 cases [14, 15]. Although most subjects recall only auditory stimuli (rather than pain), a significant subset of patients (50%) have been found to have evidence of post-traumatic stress two years after the event [16]. As a result of this disturbing data, attempts were made to determine whether consciousness monitors could potentially reduce or eliminate this risk.

Ekman and colleagues examined the incidence of recall in patients receiving a balanced anesthetic in a large medical center before and after introduction of BIS technology [17]. Although their initial incidence of recall was 0.18% (similar to what was previously published) they found a 77% reduction to 0.04% in this incidence when BIS technology was introduced. Myles and colleagues randomized nearly 2500 patients at high risk for recall (including those with hypovolemia, chronic benzodiazepine or opiate use, those undergoing high-risk cardiac surgery, rigid bronchoscopy, etc.) to receive anesthesia titrated with either BIS or with standard practice monitoring (heart rate, end-tidal gas concentration, etc) [18]. Similar to Ekman's findings, patients monitored with BIS had an 82% reduction in recall to 0.16% versus the 0.9% incidence in the standard practice group.

As is evident from the literature, recall does occur regularly, the incidence is higher with certain patient populations and anesthetic tehniques, and consciousness monitoring can help reduce this incidence. In part due to the findings of these studies, the FDA approved a new indication for the BIS monitor: "Use of BIS monitoring to help guide anesthetic administration may be associated with the reduction of the incidence of awareness with recall in adults during general anesthesia and sedation." . In 2004, the Joint Commission on Accreditation of Healthcare Organizations issued a 'sentinel alert' warning of the risk, requiring accredited organizations to develop a comprehensive recall awareness policy at all locations performing general anesthetics (Table 1) [19].

Table 1 JCAHO recommendations to help prevent and manage awareness.

Develop and implement an anesthesia awareness policy that addresses the following:

- Education of clinical staff about anesthesia awareness and how to manage patients who have experienced awareness.
- Identification of patients at proportionately higher risk for an awareness experience, and discussion with such patients, before surgery, of the potential for anesthesia awareness.
- The effective application of available anesthesia monitoring techniques, including the timely maintenance of anesthesia equipment.
- Appropriate post-operative follow-up of all patients who have undergone general anesthesia, including children.
- The identification, management and, if appropriate, referral of patients who have experienced awareness.

Assure access to necessary counseling or other support for patients who are experiencing post-traumatic stress syndrome or other mental distress.

Do consciousness monitors improve clinical outcomes?

A retrospective chart review by Monk and colleagues examined the incidence of mortality at one year following major non-cardiac surgery under general anesthesia [20]. The mortality rate of the 1064 patients reviewed was approximately 5% at one year, and slightly higher in the elderly subset. Independent predictors of increase mortality were coexisting disease, intraoperative hypotension (<80 BPS), and cumulative time of BIS <45. It was found that every hour a patient was kept below this level resulted in a 24% increased chance of mortality at one year. It has long been known that mediators of inflammation increase in the perioperative period, and it has been suggested that depth of anesthetic state may alter the inflammatory cascade, affecting survival. However, the low BIS values may also simply be a marker of underlying disease. Multicenter randomized prospective trials are needed to determine the impact of anesthetic depth on long-term outcomes, and no conclusions can be made at this time regarding the phenomenology described, especially in the

younger/healthier population usually treated in the ambulatory setting.

Cost analysis

A recent meta-analysis examining the issues of drug/time savings vs. device costs found that use of consciousness monitors would increase costs by approximately five dollars per patient [10]. Cost analysis of consciousness monitoring technology, however, must take into consideration not only the expense of the device, but also the potential benefits in terms of patient safety. The price of avoiding a single case of awareness and its sequelae (both medical and legal) is unclear. An intriguing analysis published by Gan and colleagues in 2003 suggested that patients assign a very high intrinsic value to the prevention of awareness, and that they would be willing to pay up to $34 for a monitor that would aid in preventing this complication [21]. Similarly a study by Macario and colleagues from 1999 found that patients would assign approximately $14 out of $100 to prevent recall without pain [22].

Summary

It is evident that consciousness monitors can aid in anesthetic titration. Monitors of consciousness give a glimpse into the effects of anesthetic on the brain, which is, after all, the end-organ of consciousness, and as such provide insights beyond that given by hemodynamics alone.

Monitoring consciousness in the general population results in earlier recovery, reduced PACU stay, and a reduction in the incidence of intraoperative recall. Incorporating consciousness monitoring into standard practice in the ambulatory setting may aid in providing a safer and more efficient anesthetic, allowing for adjustment of dosing of hypnotics to individual patient needs.

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