Ambulatory Surgery 1994; **2**: 193–204

Quality assurance in day case anaesthesia

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This paper outlines the implementation of a quality assurance initiative in a busy British day surgery unit (DSU) as this relates to day case anaesthesia. The indicators of quality day case anaesthesia and the appropriate standards of practice, are described. The methods utilized for the collection and analysis of data are described elsewhere, although this paper outlines the methods of scoring used in specific audits of postoperative morbidity. The results of the quality assurance initiative relating to anaesthesia are presented and discussed, and recommendations for future improvement made.

Key words: Quality assurance, day case anaesthesia, audit

Introduction

The importance of a comprehensive programme of quality assurance in day surgery has been alluded to in other papers[1]. Such a programme, specifically designed to scrutinize day case anaesthesia, has enormous potential, not only for improvement in the quality of patient care, but also as a powerful educational tool to highlight the effects various anaesthetic techniques have in a patient population that needs to be discharged within hours of the cessation of anaesthesia.

Minor morbidity assumes greater importance in day patients as discharge may be prevented or delayed, and yet the range of drugs and techniques available is more limited than in the inpatient setting. Also, any adjuvant therapy may cause morbidity of its own and may, in addition, affect admission rates. It is crucial therefore that those anaesthetic techniques unsuitable for the day case scenario are identified and eliminated from current practice. The investigation of morbidity post-discharge has tended to be overlooked. Even where incidences have been investigated, no measure of severity has been included. As minor morbidity may, if severe enough, delay return to normal function or work, data on severity is much needed. The influence exerted on the incidence and severity of post-discharge morbidity by anaesthetic techniques can be monitored using a comprehensive quality assurance programme.

Much work has been done to attempt to identify those factors that predict poor outcome in day surgery[2]. As the scope of day surgery increases, it will become vitally important that standards of patient care are not compromised by an increased throughput of more complex operative procedures. The continuous monitoring of modes of practice, especially those thought to include factors that may predict adverse outcome is therefore essential. Quality assurance programmes will also provide valuable information on cost. Although the cost of anaesthetic drugs comprises only a small proportion of the total cost of any day case operation[3], much attention has been focused on the cost benefit ratio of day case anaesthetic techniques. There is now a need to justify the cost of any anaesthetic technique utilized, and quality assurance programmes will go some way to provide data on both the direct and indirect costs of various anaesthetic techniques.

This paper will describe such a quality assurance programme. The results presented and discussed focus on those aspects of care under the control of the day case anaesthetist, but are part of an overall quality assurance initiative. This paper will describe how such a quality assurance programme was implemented, and will outline those factors which predict quality in day case anaesthesia. Specific audits of morbidity (e.g. pain and postoperative nausea and vomiting) were carried out, incorporating data from patients 48 hours post-discharge, however only the audit of postoperative nausea and vomiting will be described, as will the scoring method utilized. Finally, while the purpose of this study was not directly and accurately to compare different anaesthetic

Accepted: 1 August 1994
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0966-6532/94/040193-12

Table 1. Anaesthetics: quality indicators

ASA grading
Age including <13 yr and >65 yr
Quetelet indexes
Preoperative starvation times, for both fluids and solids
Past medical history, including diabetics, asthmatics, epileptics, hypertensives
Allergies
Drugs
Grade of anaesthetist
Presence of trainee
Type of anaesthetic GA/LA/RA/combination
Premedication
Induction agent
Maintenance
Analgesia, opioids and NSAI
Local anaesthesia including type of block, conc, vol, agent, pre- or postoperative insertion
Airway
Muscle relaxants and reversal agents
Monitoring used
Problems with the anaesthetic including: saturation falls, airway obstruction, arrhythmias, laryngo/bronschospasm, regurgitation and aspiration
Duration of surgery and anaesthesia
Duration of time to Stewards score six: recovery time
Duration of ward stay: time to discharge
Specific audits: pain, nausea and vomiting, bleeding, falls in O_2 saturation
Admission rates

NSAI, Non-steroidal anti-inflammatory.

techniques, some of the data collected relating to different anaesthetics will be presented and discussed. It is only by the assurance of the many facets of quality in the complex process that is day surgery that standards of care can be safeguarded.

Quality indicators

Table 1 describes those factors that were audited in the anaesthetic section of the complete quality assurance initiative and are thought to indicate quality anaesthetic care. Some quality indicators, e.g admission rates, are recorded by most day surgery units[4], but this paper will concentrate on those primarily relating to anaesthesia. Many have been extensively investigated in relation to the prediction of adverse outcome in day surgery[5], however many are unmonitored by the majority of day surgery units (DSUs). It can be seen that no attempt has been made to divide these quality indicators into those relating to structure, process, and outcome, as it was felt that little benefit accrues from such arbitrary division. It is important, however, that those indicators of quality relating to both process and structure are not overlooked, as both have potential for improvement of patient care and education. Specific outcome measures of quality, e.g. rates of postoperative pain and nausea and vomiting are included in this section of anaesthetic indicators, although many factors, surgical, anaesthetic, and others, are of relevance in the causation of these adverse outcomes.

Standards

Where published research has provided incidence rates of outcome quality indicators, these were adopted in this quality assurance initiative, however, in many instances, no standard could be derived from the published data. In these cases, standards were set on the basis of audits performed previously in the Addenbrooke's DSU, and also on a 'best-guess' basis, based on over 50 years' experience of day surgery.

The standards set and utilized were deliberately high, as befits a quality service, and may be modified over time in the light of experience gained in the sphere of quality assurance. All too often, however, the standards used in this section of the quality assurance initiative were thought to be both attainable and relatively modest, even when our practice fell short of the desired level of care. Such revelations are the essential benefit of any quality assurance initiative.

Methods

The quality assurance initiative described elsewhere incorporated the audits of anaesthetic practices described in this paper[1]. The study period was designated as one month, to include 80 clinical operating sessions. All patients were eligible for inclusion, irrespective of age and anaesthetic type. It was anticipated that this would provide a study group of up to 500 patients.

Data was collected initially using computer generated forms, long-hand, and entered manually. The burden of data collection fell on the anaesthetist and anaesthetic technician, although recovery data was collected by nursing staff. Subsequently data was collected using the Formic system. This speeded up both data entry and analysis, and reduced data transcription errors. The Formic forms utilized to collect some of the anaesthetic data are illustrated in Figures 1 and 2. At the end of the study period, all Formic forms were optically read, all data being entered into D base 4 software automatically, and returned to the patient notes.

Certain common types of minor morbidity following day case anaesthesia were investigated specifically. Such specific audits were planned to run for a finite period of time at set intervals, so that, for example, an audit of postoperative pain would be run for a period of a month and repeated annually to close the audit loop. Pain and nausea and vomiting were both scored using visual analogue scores, and the scoring chart utilized to score nausea and vomiting for 48 h post-discharge is illustrated in Figure 3. Patients were educated in its use while in the unit and were then given copies of the scoring charts to score their morbidity post-discharge. Such specific audits of post-discharge morbidity were run on a smaller scale, and included patient sample sizes of 100 patients. Follow-up data on these study groups was obtained by patient returned questionnaires, in addition to the anaesthetic information collected on a more routine basis by the quality assurance initiative. All data collection was in Formic form.

ANAESTHESIA

Name of Anaesthetist _____

Name of Surgeon _____

Name of O.D.A/Anaes. Assistant _____

Name:

No.

D.O.B.

PRE-OPERATIVE ASSESSMENT

Q.1 Previous general anaesthetic Yes ☐ No ☐

Significant Problems

Allergies

Drugs

Queletet _____ pulse _____ bpm

BP _____/_____ Hb _____

Q.2 ASA 1 ☐ 2 ☐ 3 ☐ 4 ☐

Q.3 *PREMEDICATION*

None ☐

Diclofenac ☐ Dose _____

EMLA ☐

Atropine ☐ Dose _____

Ibuprofen ☐ Dose _____

Temazepam ☐ Dose _____

Q.4 IV Canula Yes ☐ No ☐

Q.5 *INDUCTION* Dose

Propofol ☐ _____

Thio ☐ _____

Etom ☐ _____

Inhalational ☐ _____

Other ☐ _____

None ☐ _____

Q.6 *MAINTENANCE*

Propofol ☐

Enf ☐

Hal. ☐

Iso ☐

Nitrous ☐

O2 ☐

Air ☐

Q.7 *VENTILATION* SV ☐ IPPV ☐

Q.8 *AIRWAY* None ☐

Guedel ☐

LMA ☐

Facemask ☐

Oral ETT ☐ Size _____

Nasal ETT ☐ Size _____

Q.9 *MUSCLE RELAXANT*

None ☐

Sux ☐ Dose _____

Atracurium ☐ Dose _____

Vecuronium ☐ Dose _____

Mivacurium ☐ Dose _____

Alcuronium ☐ Dose _____

Figure 1. Formic form to collect data on anaesthetic agents T–IGA.

Q.10 *OTHER DRUGS USED*

		Which	Dose
Antiemetic	☐	_____	_____
Antibiotic	☐	_____	_____
Oxytocic	☐	_____	_____
Other	☐	_____	_____

Q.11 *ANALGESIA*

		Dose
Alfentanil	☐	_____
Fentanyl	☐	_____
Morphine	☐	_____
Pethidine	☐	_____
*Diclofenac	☐	_____
*Ketorolac	☐	_____
Other	☐	_____
None	☐	

Q.12 If DICLOFENAC – Route IM ☐ IV ☐ PR ☐

Q.13 If KETOROLAC – Route IM ☐ IV ☐ PR ☐

Q.14 *MONITORS*

ECG ☐
NIBP ☐
SpO2 ☐
FiO2 ☐
ETCO2 ☐
N. stim ☐
Other ☐ Specify _____
None ☐

LOCAL ANAESTHESIA

Drug

Q.15 Bupivacaine

0.25% ☐ 0.5% ☐ 0.75% ☐ Adrenal ☐

Q.16 Lignocaine

0.5% ☐ 1% ☐ 2% ☐ Adrenal ☐

Q.17 Prilocaine

0.5% ☐ 1% ☐ 2% ☐

Q.18 *INSERTION* Pre-incision ☐ Post-incision ☐

Q.19 *TYPE OF BLOCK* Regional ☐
Local infiltration ☐
Formal nerve block ☐

Q.20 *PROBLEMS*

Desaturation	☐	Arrhythmia	☐
Hypotension	☐	Laryngospasm	☐
Bronchospasm	☐	Aspiration	☐
Cardiac arrest	☐	Bleeding	☐
Other	☐	None	☐

(please specify) _____

POST-OPERATIVE INSTRUCTIONS

Q.21 Oxygen Yes ☐ No ☐

Q.22 Special Observations

Yes ☐ No ☐

Specify _____

Q.23 Patient's Hospital No.

0	1	2	3	4	5	6	7	8	9	
										1000000
										100000
										10000
										1000
										100
										10
										1

Figure 2. Formic form to collect data on anaesthetic agents T–TLA.

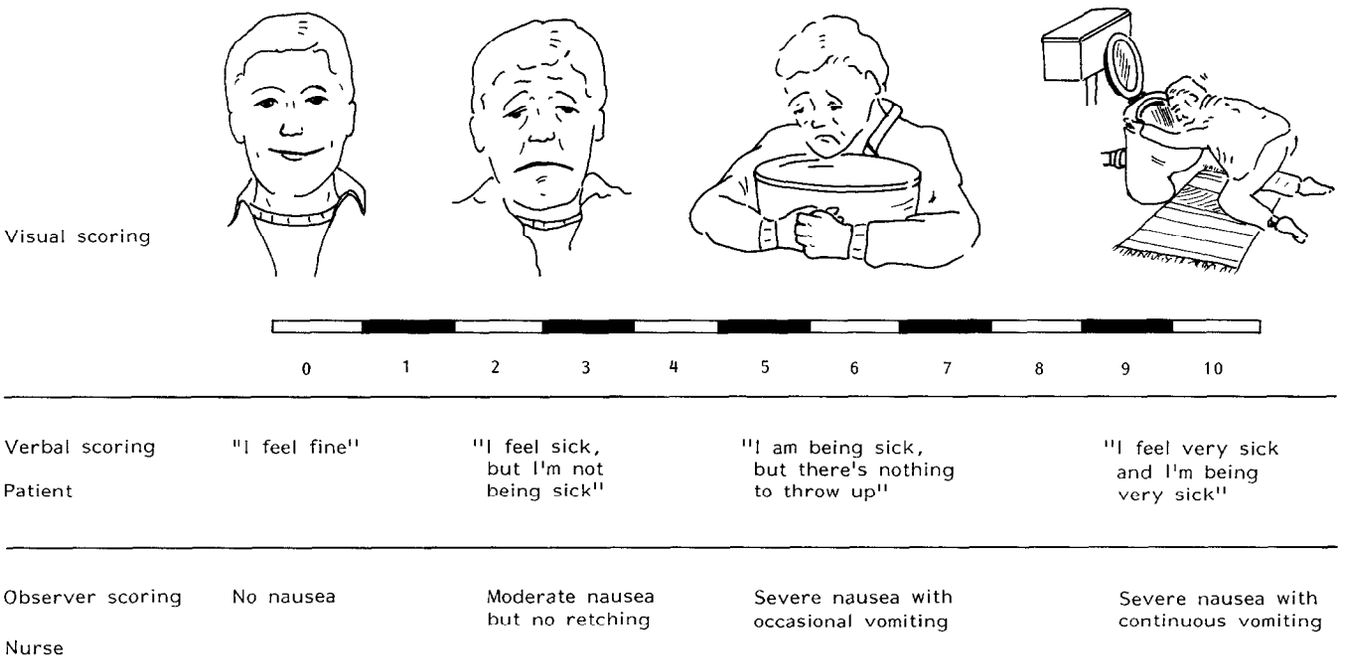

Figure 3. Formic form to collect data on post-discharge morbidity.

Table 2. Day case anaesthesia audit

Criteria	*Standard set*	*Outcome*
DSU patients should be fit	100% of DSU patients should be ASA I, II or III	100% of DSU patients were ASA I, II or III
DSU patients should be accompanied home	100% of DSU patients should be accompanied home	1.9% DSU patients were NOT accompanied home
DSU patients for GA should be starved preoperatively	100% of patients for GA should be starved of clear fluids for 3 h and solids for 6 h	0.005% of patients for GA were starved for less than 3 h
DSU patients should not be grossly obese	100% of patients should have a Quetelet index of less than 30	7.3% of patients did NOT have a Quetelet index of less than 30
Most DSU procedures should be performed under GA	80% or more of DSU procedures should be performed under GA	78.8% of DSU procedures were performed under GA
Propofol is the induction agent of choice	90% of inductions should be with propofol	95.3% of inductions were with propofol
Propofol is the maintenance agent of choice	75% of GAs should be maintained using propofol (TIVA)	36.4% of GAs were maintained using propofol (TIVA)
Endotracheal intubation is rarely required in the DSU	Less than 10% of DSU patients should be intubated	9.9% of DSU patients were intubated
Muscle relaxation is rarely required in the DSU	Less than 10% of DSU patients should receive muscle relaxants	8.8% of DSU patients received muscle relaxants
Opioid analgesics are required in DSU procedures under GA	90% of DSU patients receiving GA should receive opioid analgesics	87.2% of patients receiving GA were given opioid analgesics
NSAI analgesics are required in DSU procedures under GA	50% of DSU patients should be given NSAI analgesics during procedures under GA	40.7% of patients receiving GA were given NSAI analgesics
Pre-emptive use of local anaesthetics is important in patients undergoing procedures under GA	90% of patients receiving LA during procedures under GA should do so pre-incision	38.2% of patients receiving LA during procedures under GA did so pre-incision

NSAI, Non-steroidal anti-inflammatory.

The data collected was analysed in general terms to investigate any relationship between quality indicators, but was not subjected to formal statistical analysis. A general discussion of the findings of the quality assurance programme is provided.

Results

The quality assurance initiative ran for a period of one month and covered 80 operating sessions and 493 patients. Tables 2, 3, and 4 outline the criteria, standards

Table 3. Day case anaesthesia audit

Criteria	*Standard set*	*Outcome*
The DSU should close on time	100% of DSU patients should be discharged from the ward before 6 pm	3.8% of DSU patients were discharged after 6 pm @ = 11
DSU patients should not suffer from nausea	95% of DSU patients should have no nausea in the recovery area	96.6% DSU patients suffered no nausea in the recovery area
DSU patients should not suffer from nausea	95% of DSU patients should have no nausea in the ward area	93.0% DSU patients suffered no nausea in the ward area
DSU patients should not suffer from vomiting	98% of DSU patients should not vomit in the recovery area	98.6% of DSU patients suffered no vomiting in the recovery area
DSU patients should not suffer from vomiting	98% of DSU patients should not vomit in the ward area	95.3% of DSU patients suffered no vomiting in the ward area
DSU patients should not bleed postoperatively	95% of patients should not bleed in the recovery area	98.6% of patients did not bleed in the recovery area
DSU patients should not bleed postoperatively	99% of patients should not bleed in the ward area	98.6% of patients did not bleed in the ward area
DSU patients should not desaturate in the recovery area	99% of patients should not desaturate in the recovery area	96.9% of patients did not desaturate in the recovery area

@ = % of non-respondents or N/A.

Table 4. Day case anaesthesia audit

Criteria	*Standard set*	*Outcome*
DSU patients should not be in pain postoperatively	95% of patients should have mild or no pain in the recovery area	88.1% of patients had mild or no pain in the recovery area
DSU patients should not be in pain postoperatively	No more than 4% of patients should have moderate pain in the recovery area	9.8% of patients had moderate pain in the recovery area
DSU patients should not be in pain postoperatively	No more than 1% of patients should have severe pain in the recovery area	2.1% of patients had severe pain in the recovery area
DSU patients should not be in pain postoperatively	98% of patients should have mild or no pain in the ward area	84.4% of patients had mild or no pain in the ward area
DSU patients should not be in pain postoperatively	No more than 2% of patients should have moderate pain in the ward area	13.3% of patients had moderate pain in the ward area
DSU patients should not be in pain postoperatively	No patients should have severe pain in the ward area	1.7% of patients had severe pain in the ward area
Patients thought to require admission after day surgery should be seen by a doctor	100% of patients thought to require admission after day surgery should be seen by a doctor	100% of patients thought to require admission after day surgery were seen by a doctor

and results for the quality assurance of anaesthetic practice. Three hundred and sixty-two patients (78.8%) were given general anaesthesia (GA), 92 patients (20%) were given local anaesthesia (LA) and five patients (1%) were given regional anaesthesia. No patients were given sedation. Twenty-two patients did not attend on the day of intended surgery, six patients were cancelled on the day of surgery by the surgeon and six patients were cancelled on the day of surgery by the anaesthetist.

ASA classification

ASA classifications[6] were recorded for 474 of the 493 patients undergoing surgery during the audit period. Of these 394 (83.1%) were classified as ASA I, 74 (15.6%) as ASA II, and six (1.2%) as ASA III. Although numbers were small, seven patients (1.2%) in ASA I were admitted compared to two (2.7%) in ASA II, however there was no relationship between anaesthetic-related admission and ASA status.

Preoperative starvation time (NPO time)

Preoperative starvation data was recorded for 420 patients, however the data did not differentiate between solids and liquids. Ten patients (2.3%) were starved for less than 3 h preoperatively, two undergoing GA and eight LA. Fifty-nine patients (14%) starved more than 3 h but less than 6 h; 120 patients (28.5%) starved for more than 6 h but less than 9 h; 63 patients (15%) starved for more than 9 h but less than 12 h and 168 patients (40%) starved for more than 12 h. Of these, 23 were aged 13 yr or less; 33.3% of children starved for more than 12 h preoperatively. No preoperative starvation time data was recorded for the single patient who was thought to have aspirated during the audit period. Of those patients starved for 6 h or less, two (2.2%) vomited, compared to eight (4.9%) who were starved for 12 h or more.

Quetelet index (body mass index)

A Quetelet index was recorded for 355 patients. Of these, 329 patients (92.6%) had a Quetelet index of less than 30;

Table 5. Maintenance of anaesthesia

Operation	*Laparoscopy*		*Removal 4 wisdom teeth*		*D&Cs*		*Vaginal termination of pregnancy*		*All operations*	
	TIVA	*Enflurane*	*TIVA*	*Enflurane*	*TIVA*	*Enflurane*	*TIVA*	*Enflurane*	*TIVA*	*Enflurane*
Number	20	20	14	38	27	37	14	33	104	240
Mean age	33		26		43		25		28	30
Mean BMI	26.6		23.1		25		24		24.5	23.8
Duration of surgery	22.3	28	23.9	27.1	13.5	15	12.7	16.2	24.6	25.3
Recovery 1 time (min)	6.1	4.5	8.7	5.1	4.8	4	5	4.9	6.5	6.0
Recovery 1 time (hr)	3 h 45 min	4 h 22 min	1 h 35 min	1 h 58 min	1 h 38 min	2 h 4 min	2 h 4 min	1 h 40 min	2 h 5 min	2 h 15 min
Recovery 1 nausea	5%	15%	0	2.6%	0	2.7%	0	3%	0.9%	4.1%
Recovery 1 vomiting	0	5%	0	2.6%	0	0	0	3%	0	1.6%
Recovery 2 nausea	15%	35%	0	2.6%	0	5.4%	0	21%	2.8%	9.1%
Recovery 1 vomiting	15%	30%	0	2.6%	0	2.7%	0	9%	2.8%	5.8%

16 patients (4.5%) had a Quetelet index of between 30 and 31.9; five (1.4%) between 32 and 33.9 and two (0.5%) 34–35.9. Three patients (0.8%) had a Quetelet index of greater than or equal to 36. Of the 26 patients with a Quetelet index of 30 or more, nine underwent LA and 17 GA. Of those undergoing GA, airway maintenance was using a laryngeal mask airway in six, a face mask in eight and endotracheal intubation in three. Of the 14 patients who desaturated to an SpO_2 of $<94\%$ for >2 min in the recovery area, despite oxygen therapy, two (14.2%) had a Quetelet index of 30 or more. Of the 12 patients who suffered from nausea in the recovery area, one (8.3%) had a Quetelet index greater than or equal to 30. Of the 25 patients who suffered from nausea in the ward area, one (4%) had a Quetelet index greater than or equal to 30. Of the five patients who vomited in the recovery area, none had a Quetelet index greater than or equal to 30. Of the 17 patients who vomited in the ward area, one (5.8%) had a Quetelet index greater than or equal to 30.

Anaesthetic induction and maintenance

Of those patients receiving GA, 345 patients (95.3%) were induced with propofol. No other intravenous (iv) induction agents were used. Seventeen patients (4.6%) were induced by inhalation. Seventy patients (19.3%) were maintained with propofol, nitrous oxide and oxygen; 34 patients (9.3%) were maintained with propofol, nitrous oxide and air; 28 patients (7.7%) were maintained with propofol, nitrous oxide, enflurane and oxygen; 132 patients (36.4%) received propofol for their anaesthetic maintenance; 212 patients (59.1%) were maintained with enflurane, nitrous oxide and oxygen; five patients (1.3%) were maintained with isoflurane, nitrous oxide and oxygen and 11 patients (3.0%) were maintained with halothane, nitrous oxide and oxygen. A comparison of recovery times, duration of ward stay (stage 2 recovery) and the incidences of nausea and vomiting between total intravenous anaesthesia (TIVA) using propofol and alfentanil and volatile anaesthesia using enflurane, nitrous oxide and oxygen is presented in Table 5.

Airway maintenance

In the 362 patients undergoing GA, the airway was maintained using the laryngeal mask in 158 patients (43.6%), a face mask in 168 patients (46.4%) and an endotracheal tube in 26 patients (9.9%). The laryngeal mask airway was utilized in all patients who underwent laparoscopy and 33 patients (62%) undergoing removal of wisdom teeth. The one patient who was thought to have aspirated during the audit period was in the face mask group.

Muscle relaxants

Of the 362 patients given GA, 330 (91.1%) did not receive any muscle relaxant; eight (2.2%) received suxamethonium alone; 21 (5.8%) received suxamethonium and alcuronium and three (0.8%) received atracurium alone. A total of 29 patients (8%) receiving GA were given suxamethonium.

Opioids

Of the 362 patients undergoing GA, 46 patients (12.7%) were given no opioid analgesia. Of this group 10.8% suffered moderate or severe pain in the recovery area and 17.3% in the ward area. One hundred and thirty-eight patients (38.1%) were given alfentanil, 165 (45.5%) fentanyl and 13 (3.5%) were given morphine. Of those given no opioid medication, five (10.8%) were nauseated and four (8.6%) vomited. This compares to 10 (7.2%) nauseated and six (4.3%) vomiting given alfentanil, 17 (10.3%) nauseated and nine (5.4%) vomiting given fentanyl and five (38.4%) nauseated and three (23%) vomiting given morphine.

Non-steroidal anti-inflammatory analgesics

Of the 362 patients given GA, 119 patients (32.9%) were given ketorolac and 28 patients (7.7%) were given diclofenac. Of the five patients who were recorded as suffering heavy bleeding in the recovery area, three of these patients (60%) had been given ketorolac; none had received diclofenac. Five patients bled in the ward area, four of these patients (80%) had been given ketorolac,

again none had received diclofenac. One patient was admitted due to excessive bleeding but required no further surgical intervention.

Local anaesthesia

Of the 459 patients undergoing surgery during the audit period, 92 (20.0%) received LA alone and five (1.0%) received regional anaesthesia alone. The mean age for patients receiving LA was 41 yr (SD 15.62) and this group included 28% (21) of those patients classified as ASA II and 83% (five) as ASA III. The mean duration of ward stay (phase 2 recovery time) for patients in this group was 56 min. No patient in this group suffered nausea or vomiting during their DSU stay, and only four patients suffered mild pain and one patient moderate pain in the postoperative period. The surgical specialities performing surgery under LA were urology (30 operations), general surgery (27 operations), orthopaedics (22 operations), plastic surgery (15 operations), ENT (six operations) and gynaecology (one operation).

Of the 362 patients receiving GA, 260 patients did not receive any supplementary LA. Of those that did, 39 patients (10.7%) received LA pre-incision, 63 (17.4%) received LA post-incision. Of those patients given LA pre-incision, 38% suffered moderate or severe pain during their DSU stay. Of those patients given LA post-incision, 23% suffered moderate or severe pain during their DSU stay.

Of nine patients undergoing laparoscopic sterilization without the use of LA, 55% suffered moderate or severe pain in the recovery area and 33% in the ward area. Of the 12 patients undergoing laparoscopic sterilization with the use of LA, (10 ml of 0.75% plain Marcain), 28% suffered moderate to severe pain in the recovery area and 14% in the ward area.

Postoperative pain

Data concerning pain in the recovery area (phase 1) was available for 458 patients. Of these, 403 (88%) experienced either no or mild pain, 45 (9.8%) moderate pain and 10 (2.1%) severe pain. Data concerning pain in the ward area (phase 2) was available for 455 patients. Of these, 386 (85%) experienced either no or mild pain, 61 (13.4%) moderate pain, and eight (1.7%) severe pain. Of the 18 patients suffering severe pain, three patients experienced severe pain in both phase 1 and phase 2 recovery. Two of these patients had undergone gynaecological laparoscopic surgery, and the third the removal of wisdom teeth. Only this third patient was admitted due to pain in an operation that lasted 1 h 11 min.

Of the 15 patients suffering severe pain at some time during their DSU stay, six (40%) had undergone gynaecological laparoscopic surgery, and three (20%) had undergone inguinal hernia repair.

Postoperative nausea and vomiting (PONV)

The relationship between anaesthetic maintenance and the incidence of postoperative nausea and vomiting in the day unit is shown in Table 5. This data was obtained from the anaesthetic quality assurance data collected on all patients. Of the 22 patients who vomited postoperatively, 15 (68%) had undergone gynaecological surgery: seven underwent laparoscopic sterilization, four underwent VTOP, three underwent laparoscopy and one underwent D&C and hysteroscopy. Two patients vomited following ENT surgery, one after general surgery and one after plastic surgery. Twenty-nine per cent of patients who sufffered moderate or severe postoperative pain also suffered from PONV.

The specific audit of postoperative nausea and vomiting included data on 86 patients, 22 male and 64 female. Two patients were aged less than 13 yr and two aged over 65 yr. Eighteen (21%) gave a history of PONV with previous anaesthetics, and 26 (30%) of motion sickness. Despite this, only three patients (3.4%) were given preoperative antiemetics, seven (8%) intraoperative antiemetics, and two (2.3%) postoperative antiemetics. Induction of anaesthesia was performed using propofol in all patients. In 17 patients (19.7%) anaesthesia was maintained using propofol, and in 69 patients (80%) using a volatile agent. Only six patients (6.9%) were given muscle relaxants to aid tracheal intubation and only one patient (1.1%) was ventilated mechanically throughout surgery. No patient was given neostigmine. The laryngeal mask airway was used in 48 patients (55.8%) and a face mask in 32 patients (37.2%). Intraoperative opioid drugs were used in 85 patients (98.8%) (alfentanil 31 patients, fentanyl 52 patients and morphine one patient). No patient received postoperative opioid drugs. Non-steroidal anti-inflammatory analgesics were utilized intraoperatively in 18 patients (20.9%) and postoperatively in nine patients (10.4%). Intraoperative local anaesthetic was utilized in 29 patients (33.7%). Table 6 outlines the duration and severity of nausea and vomiting in the post-discharge period.

Discussion

The ease with which the data collection system described could be utilized to collect all the necessary information to ensure quality day case anaesthesia has been demonstrated. The indicators of quality we use have been outlined. The data collected permitted the investigation of a variety of relationships between quality indicators, anaesthetic practice, and outcome, although statistical analysis was not performed. It was never our intention to investigate such relationships formally, but to demonstrate that any DSU can collect relevant data in a meaningful and efficient way, to highlight areas where clinical practice is substandard and where formal investigation is needed. The continual auditing of such quality indicators as are felt to be relevant to a particular day unit will provide data to enable the prediction of adverse outcome. Such a predictive capability is feasible for any DSU using a comprehensive data collection system. The quality assurance programme highlighted areas where

Table 6. Postoperative nausea and vomiting – severity scores post-discharge

Time	*Scores = 0*	*Score 1–5*	*Score 6–10*
Preop	74 (86%)	12 (14%)	0
Recovery 1	82 (95.3%)	3 (3.4%)	1 (1.1%)
Recovery 2	71 (83.5%)	14 (16.5%)	0
Pre-discharge	75 (87.2%)	11 (12.8%)	0
On arrival home	68 (79%)	16 (18.6%)	2 (2.3%)
Before bed	66 (76.7%)	20 (23.3%)	0
On waking	68 (79%)	18 (21%)	0
Lunch time	71 (82.5%)	14 (16.2%)	1 (1.1%)
Before bed	73 (84.8%)	13 (15.2%)	0
On waking	76 (89.4%)	9 (10.6%)	0
Lunch time	75 (88.2%)	10 (11.8%)	0
Before bed	75 (88.2%)	10 (11.8%)	0

our standards of practice fell short of that desired or predicted and provided us with a focus for future research. It is hoped that such programmes could prove useful in providing similar areas for investigation in other DSUs.

ASA classification

The data confirms that the majority of patients undergoing day surgery in the UK are in ASA classes I and II. Despite a willingness to offer day surgery to stable patients in ASA III, at the present time few are receiving day surgical care and the majority that do undergo local anaesthesia. It is no surprise that the results demonstrate a positive relationship between age and increasing ASA classification. Although numbers are small there was an increased incidence of unanticipated admission in those patients in ASA II compared to ASA I, however it is of note that surgical factors were principally to blame and anaesthesia did not seem to contribute to this relationship. A quality assurance programme able to examine any possible link between ASA status and adverse outcome is of fundamental importance.

Preoperative starvation guidelines

Guidelines for preoperative starvation of day patients are currently changing[7]. At Addenbrooke's day unit, we permit patients to drink clear fluids up to 2 h preoperatively, although the data confirmed our suspicion that patients are still starved for excessive lengths of time. In particular, a third of our paediatric patients are starved for in excess of 12 h. The disadvantages of such preoperative starvation have been highlighted by a number of workers[8]. Our results have shown, in addition, that patients starved for longer than 12 h are more likely to vomit postoperatively than those patients starved for less than 6 h. No increased aspiration risk was demonstrated from this reduced period of preoperative starvation. The results of this quality assurance programme have led us to restate our preoperative guidelines to parents to instruct them to give their child a drink of clear fluid 2 h preoperatively. The continuation of the quality assurance programme will reveal the effect of such a change.

Quetelet index

Quetelet or body mass index guidelines have been used to restrict those patients offered day surgery[9]. Our unit has used a Quetelet index of below 30 as a guideline for patient selection, although the results illustrate that not only is this guideline often ignored, but little increased morbidity is associated with patients of increased Quetelet index. This has led us to revise the preoperative patient guidelines so that patients with a Quetelet index of up to 36 are now offered day surgery, although a Quetelet index of 34 is retained for patients undergoing laparoscopy using a technique of spontaneous respiration through a laryngeal mask. In such patients additional surgical restrictions also apply.

Anaesthetic induction and maintenance

It is apparent that the advantages of propofol for induction of day surgery patients are generally accepted by anaesthetists. The technique of total intravenous anaesthesia using propofol and alfentanil is also gaining more widespread acceptance, although this technique is still utilized by relatively few anaesthetists. The results of this audit highlight the low incidence of postoperative nausea and vomiting associated with TIVA, even in those patients and operation groups known to be associated with a high incidence of this form of morbidity. Of equal note was that, contrary to other published data[10], we found that recovery times (phase 1 recovery), as measured from the time the patient arrived in the recovery area to the attainment of a Steward score[11] of 6, was similar in both TIVA and volatile groups, as was the time spent in the ward area (phase 2 recovery). The data collection forms were, however, not designed to measure time to 'fit for discharge'. Our results suggest, however, that TIVA, with its lower incidence of PONV, may mean that patients are fit for discharge sooner. The true value of these results is that if one includes staffing costs in the overall cost of an anaesthetic technique, TIVA, by reducing time to fitness for discharge, may be cost effective[12]. Such cost benefits, however, will only be apparent if patients are discharged when fit to do so, necessitating a change in our discharge policy.

Airway maintenance and muscle relaxants

Endotracheal intubation is associated with significant morbidity[13] and yet the quality assurance initiative has confirmed work done previously[14–17] showing that alternative forms of airway management, in particular the laryngeal mask airway[18], is both safe and effective for a variety of day surgery operations. Although the audits performed do not demonstrate any increased morbidity associated with intubation, they do highlight the safety and effectiveness of the laryngeal mask airway.

The data collected did not permit us to link a patient's satisfaction questionnaire with the rest of the database, although this has been modified for future audits. The high incidence of muscle pains associated with the use of suxamethonium[19,20] as well as the increased morbidity due to intubation may well become evident from future data incorporating this link. The authors concede that suxamethonium may continue to have a place in future day care anaesthesia[21], although we favour mivacurium for muscle relaxation in those patients in whom we feel intubation is indicated, and regard the indications for suxamethonium to be few. Mivacurium has a duration suitable for most day surgery procedures[22], and has the additional advantage that reversal is not required, thereby avoiding the use of neostigmine with its associated incidence of nausea and vomiting[23]. The quality assurance data presented, however, leads us to conclude that endotracheal intubation and the use of muscle relaxants, in correctly selected day case patients, introduces a range of minor morbidity with little increase in patient safety. Quality assurance programmes of this sort, by forcing review of current practices and their benefits and drawbacks, are of excellent educational value.

Pain

Whilst the results of this quality assurance initiative demonstrated that the majority of day case patients experience little or no pain following surgery, more patients suffered moderate to severe pain than we would have hoped. The management of postoperative pain will thus continue to be the main limiting factor in the selection of suitable operations for future day surgery.

It is recognized that certain operations routinely performed on a day case basis are inherently more painful than others[24]. Certainly our results confirm the place of laparoscopic sterilization and inguinal hernia on the list of such operations. Such operations require the full range of analgesic techniques available to render patients comfortable postoperatively. We believe that the use of potent short-acting opioids intraoperatively, coupled with the use of long-acting local anaesthetic blocks wherever suitable, and the use of non-opioid analgesics preemptively and postoperatively, to be the best approach at the present time. This regime will still fail to control postoperative pain in some patients, and the judicious use of intravenous opioids in the immediate postoperative period may be the only effective method of bringing severe pain under rapid control. The development of treatment protocols for postoperative pain will ensure both safe and effective treatment.

Our unit uses the so called short-acting opioids fentanyl and alfentanil extensively and there is little to suggest that these drugs are major factors effecting the incidence of postoperative nausea and vomiting. Although the use of morphine in our unit is limited and the numbers small, this analgesic seems to confer little benefit in terms of analgesia while having a significant effect on nausea and vomiting. In the light of the work performed by Orkin[25], we recommend that morphine is no longer used and prefer instead to administer intravenous alfentanil to control severe pain.

The non-steroidal anti-inflammatory analgesics, ketorolac and diclofenac, are used extensively in our day surgical practice. Our data does not allow firm conclusions to be reached on the efficacy of these drugs, as where they are used for a particular type of operation, they are used in the majority of patients and comparative groups are very small indeed. Similarly, firm conclusions could not be reached on the benefit of giving these drugs pre-emptively[26]. Of greater concern, however, is the safety of this class of drugs. While postoperative bleeding occurred in more patients receiving these drugs than those that did not, only one patient was admitted due to bleeding and required no further surgical intervention. The bleeding in the remaining patients stopped spontaneously and did not delay discharge. It cannot be stated, on the basis of our results, that these drugs were either the main cause, or a contributory factor to the incidence of postoperative bleeding in our patients. Indeed the available evidence to date would not support such a claim[27–29]. The quality assurance initiative has drawn our attention to an area where close monitoring of practice and outcome will provide essential information. In time this will enable us to make an informed and logical decision on the place of these analgesics in our day surgery practice. No other problems arose from the use of these drugs, and thus we conclude at the present time that the judicious use of these useful analgesics should continue to supplement other analgesic interventions in the day surgical setting.

It is important also to consider pain following discharge after day surgery. This quality assurance initiative also contains a specific audit of both day unit pain management and post-discharge pain scores and analgesic use. Aspects of such a quality assurance programme, targeting specific day surgery problems will thus enable rational treatment protocols to be monitored for efficacy and compared both with other treatments and indeed other day surgery units.

Local anaesthesia and laparoscopic sterilization

Laparoscopic sterilizations are among the routine day case operations that are most often associated with moderate to severe pain. We have found, like others[30], that injecting 10 ml of plain marcain (0.5–0.75%) onto the fallopian tubes prior to clipping to be an effective supplementary measure in reducing the incidence of

moderate to severe pain in this patient group. We are not aware that the efficacy of this procedure has not been previously documented using 0.75% plain marcain. Study groups in this area of the quality assurance data are small but have confirmed our impression that this simple and safe therapeutic intervention is worthwhile, and is an area of our clinical practice that will receive further investigation.

Local anaesthesia

The average age of this group of patients was greater than others in the quality assurance initiative. In addition, this group of patients included most of those classified as ASA II or III. It thus seems that despite our willingness to undertake GA where required, in the more elderly and infirm, referral patterns are still directing only those suitable for operation under LA to our DSU. This raises the question of developing a separate clinical area for day case operations under LA, as a more cost efficient use of anaesthetic time. Our result also confirm the safety and minimal morbidity associated with this form of anaesthesia.

We were unable to demonstrate any benefit from the pre-emptive use of local anaesthetic measures in those patients receiving LA supplementation in addition to GA. We feel that the concept of pre-emptive use of analgesics and LA is of value, and will investigate this issue in forthcoming studies.

Postoperative nausea and vomiting

Our results confirm previous research demonstrating that certain operations are associated with a higher incidence of nausea and vomiting than others[31]. While the number of patients vomiting postoperatively was small, the majority (68%), had undergone gynaecological surgery. Many factors are implicated in the cause of the morbidity and so meaningful analysis becomes difficult. Certain aspects of our practice, e.g. preoperative starvation times, have already been discussed. Our results support no firm conclusions on concomitant pain[32] or the use of nitrous oxide[33]. It would appear, however, that the technique of TIVA, using propofol and alfentanil, is associated with a lower incidence of nausea and vomiting both in phase 1 and 2 recovery and up to 48 h post-discharge. This is surprising in view of the transient nature of the antiemetic effect documented by Borgeat[34].

The scoring method utilized in the specific nausea and vomiting audit provided visual analogue data, as has been performed by Cohen[35]. We felt that rather than try to differentiate between patients vomiting and retching, or simple nausea, what was most important was some measure of how ill the patients felt. This form of measurement lends itself very well to visual analogue scoring. The logical development of such a scoring system is the implementation of a treatment protocol and its assessment.

Conclusions

It is apparent that it is relatively easy to collect sufficient data concerning day care anaesthesia not only to assure quality but also to investigate the relationships between many of the patient, anaesthetic and surgical factors that are thought to be associated with adverse outcome. The quality assurance indicators utilized in a day unit just starting such a programme will necessarily have to be more limited than those listed and discussed here. Different day units will regard different quality indicators as more important and will audit accordingly. This paper highlights what is achievable with simple data collection techniques.

The facility to audit such factors continually will ensure that the planned expansion of day surgery does not compromise quality of care and will permit the development of anaesthetic techniques appropriate to day surgery. The extension of audit programmes into the post-discharge period is much needed, as at the present time relatively little is known of patient outcome on return to the community, and the burden placed on carers by seemingly minor factors such as muscle pains caused by the use of suxamethonium. Rational development of day surgery techniques and methods of care can only occur in the light of such information.

In the future, quality assurance programmes will enable the development of a 'weighting system', for patient, surgical and anaesthetic factors, so that for a given operation, in a patient with any given characteristics, and using a given anaesthetic technique, the risk of adverse outcome can be accurately assessed. It can only be on the basis of such a system that the range of operations performed in day units on a potentially increasing patient population can be sensibly controlled in the face of increasing economic pressure for more day surgery.

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