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Anaesthetic clinical indicators in public hospitals providing anaesthetic care in Hong Kong: prospective study

香港提供麻醉服務的公立醫院的麻醉臨床指標：預期研究

Objectives. To assess the quality of anaesthetic services as defined in the six anaesthetic clinical indicators against preset standards and to identify risk factors for adverse events in the recovery room.

Design. Prospective study.

Setting. All public hospitals providing anaesthetic care in Hong Kong.

Patients. Eighteen thousand, seven hundred and fifty-nine patients receiving elective or emergency anaesthesia administered by anaesthetists from June 1998 to July 1998.

Main outcome measures. Patient demographics, American Society of Anesthesiologists status, category and nature of operation, presence of preoperative anaesthetic visit in ward, type of anaesthesia, reasons for a recovery room stay of more than a 2-hour duration, intubation to relieve respiratory distress in the recovery room, presence of hypothermia in the recovery room for operations lasting more than 2 hours, and dental or ocular injuries attributable to anaesthesia.

Results. There are two major findings from this study. Firstly, a high incidence of hypothermia in the recovery room was reported. Secondly, a greater risk of prolonged stay in the recovery room was identified for patients older than 65 years, major operations, and anaesthetic techniques using combined general and regional anaesthesia.

Conclusion. The six anaesthetic clinical indicators reflected the provision of anaesthetic care in public hospitals in Hong Kong. Good compliance to the preset standard of the anaesthetic clinical indicators was achieved during the study period.

目的：根據預定的六個麻醉臨床指標來評定麻醉服務的質素，確定在復原室中不利事件的危險因素。

設計：預期研究。

安排：香港所有提供麻醉服務的公立醫院。

患者：1998年6月至7月期間接受麻醉師選擇或緊急麻醉處理的18 759名病人。

主要結果測量：病人人口統計學數據，美國麻醉師學會身份，手術類別與屬性，在病人進行外科手術前是否有麻醉師進行探訪，麻醉類別，在復原室逗留兩小時以上的原因，是否在復原室中為減輕呼吸困難而有插管輸氧，當手術持續兩小時以上時病人在復原室內體溫有否降低，及因麻醉而導致對牙齒或眼睛的傷害。

結果：本研究有兩個主要發現，第一，大多數病人在復原室裡會有體溫降低的情況；其次，對於年齡超過65歲，做大手術且使用全身麻醉與局部麻醉的病人，逗留在復原室內的時間會延長。

結論：該六項麻醉臨床指標反映了香港的公立醫院中提供麻醉服務的質素。在研究期間，醫院符合麻醉臨床指標之預定標準。

Key words:
Anesthesia;
Anesthesia recovery period;
Quality assurance, health care;
Risk management

關鍵詞：
麻醉；
麻醉恢復期；
質素保證，醫護；
風險管理

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Introduction

Clinical indicators in anaesthesia were first drafted by the United States Joint Commission on Hospital Accreditation in 1992.[1] They were included as part of the accreditation process for hospitals in the Australian Council on Healthcare Standards in 1993.[2] In Hong Kong, anaesthetic clinical indicators were first introduced in public hospitals in 1994, closely modelled on the Australian experience. These indicators are used to monitor some of the processes or outcomes of anaesthetic care. Some of the initial indicators, such as perioperative cardiac arrest within 24 hours and unanticipated intensive care unit admission within 24 hours, were deleted because data collection was difficult and unreliable. The present set of six clinical indicators was adopted by the Hospital Authority Quality Assurance Subcommittee in Anaesthesiology (QASA) in 1996.

Although these indicators were reported quarterly to the Hospital Authority on a voluntary basis, there were doubts about the validity of the results. Different methods of data collection that could affect data accuracy and reliability were adopted by different hospitals. This prompted the QASA to conduct a study on the six anaesthetic clinical indicators for all patients undergoing operative procedures in public hospitals using a standard method of data collection.

The main objectives of this paper are to assess the quality of anaesthetic care as defined in the six anaesthetic clinical indicators against preset standards, and to identify risk factors for adverse events in the recovery room.

Methods

This was a prospective observational study. All public hospitals providing anaesthetic care were invited to participate. The inclusion criteria were patients receiving elective or emergency anaesthesia administered by anaesthetists in the participating hospitals during the months of June 1998 and July 1998. The study did not include local anaesthesia administered by surgeons except when anaesthetists were involved in monitoring the patient. The following data were collected: patient demographics, American Society of Anesthesiologists (ASA) status, category and nature of operation, presence of preoperative anaesthetic visits in the ward, type of anaesthesia, reasons for a recovery room stay of more than 2 hours, intubation to relieve respiratory distress in the recovery room, presence of hypothermia (core temperature <35°C) in the recovery room for operations lasting more than 2 hours, and dental/ocular injuries attributable to anaesthesia. A common data collection sheet using an optical mark reader (OMR) form was employed (Box). The attending anaesthetist and recovery room nurse filled in the data where appropriate and the completed form was verified by the nurse specialist or the respective anaesthetic quality convenor. All the completed forms were collected and checked for omissions at individual hospitals. The data sheets were then read by an OMR scanner.

Statistical analysis

Sample size calculation depended on the precision required for the occurrence of different events. The incidence of intubation in the recovery room (<0.1%) and dental injury (<0.1%) are so rare that 96 000 patients have to be studied to generate a precision (margin of error) of 0.02% at a power of 0.8. For hypothermia, where the preset standard for occurrence is 0.5%, a sample size of 19 112 would be required for a precision of 0.1% at a power of 0.8. The estimated data volume in a 2-month period was approximately 20 000. This duration was chosen so that some of the adverse events in the recovery room could be studied with some degree of precision within the available resources. Univariate analysis using the Chi squared test or Fisher's exact test, where appropriate, were used to explore the association between adverse recovery events and patient characteristics. Multivariate analysis using stepwise logistic regression was then used to determine the relationships between different risk factors in the causation of (1) association between clinical characteristics (including demographic characteristics) and a stay of more than 2 hours in the recovery room, and (2) developing hypothermia (core temperature <35°C) in the recovery room following an operation of more than a 2-hour duration. The Statistical Package for the Social Sciences (Windows Version 9.0; SPSS Inc., Chicago, US) was used for the data analysis. The level of significance was set at 5% for all comparisons, and all statistical testing was two-tailed.

Results

All 23 public hospitals providing anaesthetic services agreed to participate in the study. These hospitals are randomly represented by codes from A to H, J to W, and Y in the Tables and Fig.

A total of 20 918 data sheets were collected during the study period. The number of forms collected from

Anaesthesiology Clinical Outcome Indicators
DATA COLLECTION SHEET

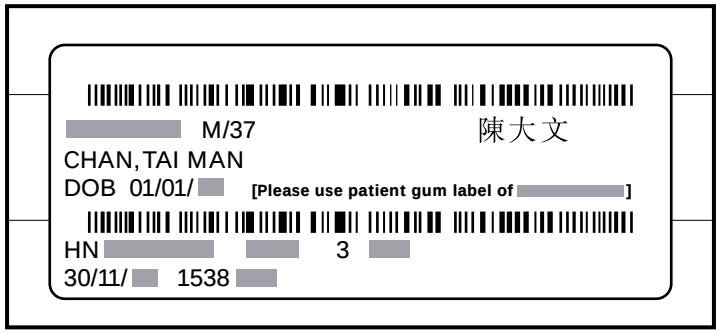
Please use pencil or black/blue ball pen to fill the oval. e.g. ●

A form must be filled in for every patient where the anaesthetist is in attendance.
Completed forms should be sent to HAHO for data entry and analysis.
Tick only one of the boxes for every question except Q.8.

1. Hospital			
1	AHNH	13	PYNEH
2	BH	14	QEH
3	CMC	15	QMH
4	DKH	16	RH
5	GH	17	TWEH
6	HKEH	18	TMH
7	KWH	19	TPH
8	NDH	20	TSK
9	OLM	21	TWH
10	PMH	22	TYH
11	POH	23	UCH
12	PWH	24	YCH

2. Date of Operation			
	○ Jan		
	○ Feb		
	○ Mar		
10	1 ○ Apr		
11	2 ○ May		
12	3 ○ Jun		
	4 ○ Jul		
	5 ○ Aug		
	6 ○ Sep		
	7 ○ Oct	98	
	8 ○ Nov	99	
	9 ○ Dec	200	

***Note** 1 Patient's personal information will be kept CONFIDENTIAL
2 Information will be used only for study and NOT for any other purpose
3 Please attach patient gum label with 2 barcodes on both forms



3. Category of operation:

○ Major
○ Intermediate
○ Minor

4. Elective operation:

○ Yes
○ No

5. Preoperative anaesthetic visit in ward:

○ Yes
○ No

6. ASA:

○ 1
○ 1E
○ 2
○ 2E
○ 3
○ 3E
○ 4
○ 4E
○ 5E

7. Type of anaesthesia:

○ GA
○ SA
○ EA
○ Combination of GA + RA
○ Plexus
○ Other regional blocks
○ MAC
○ LA
○ Others

8. Please indicate the reasons for a recovery room stay of more than 2 hours:

○ Administrative reasons, e.g. portering
○ Clinical: Patient factors (problems, that existed before operation)
○ Clinical: Surgical factors, e.g. bleeding
○ Clinical:Anaesthetic factors, e.g. re-warming, pain control, delayed recovery
○ None. Recovery stay less than 2 hours

<Multiple entry accepted for Q.8 only>

9. Intubation to relieve respiratory distress in recovery room:

○ Yes
○ No

10. Did the patient develop hypothermia in recovery room with operations more than 2 hours duration?

○ Yes. Core Temp < 35 at any time during recovery room stay
○ No. Core Temp above 35 during recovery room stay
○ Operation shorter that 2 hours

11. Injuries attributable to anaesthetic:

○ Yes. Ocular injuries
○ Yes. Dental injuries
○ No

End of Questionnaire

Thank you

individual hospitals ranged from 1 to 2308. Two thousand, one hundred and fifty-nine data sheets were excluded from further data analysis because the date of operation was not marked. Null responses in the respective parts of the OMR form were treated as missing data and not counted towards the particular item involved. The final number of patients entered into the analysis was 18 759. There were more women than men in the study population (men, 9049; women, 9625) and the male to female ratio was 1:1.06. The majority of patients were adults in the age group 15 to 64 years (n=11 702), followed by elderly patients older than 65 years (n= 4472). Paediatric patients younger than 15 years accounted for 13.4% of the study population (n=2503). Most of these patients were undergoing major operations according to the Government Gazette (8350/18759, 44.5%), followed by intermediate operations (5379/18759, 28.7%) and minor operations (4853/18759, 25.9%)[Table 1].

Table 1. Distribution of case loads, sex, age, American Society of Anesthesiologists classification, and the types of anaesthesia administered in June and July 1998

	Patients, n=18 759 No. (%)
Month of study	
June	9162 (48.8)
July	9597 (51.2)
Sex	
male	9049 (48.2)
female	9625 (51.3)
unidentified	85 (0.5)
Age (years)	
0-14	2503 (13.3)
15-64	11 702 (62.4)
≥ 65	4472 (23.8)
Unidentified	82 (0.4)
Category of operation	
major	8350 (44.5)
intermediate	5379 (28.7)
minor	4853 (25.9)
unidentified	177 (0.9)
Type of operation	
elective	12 986 (69.2)
emergency	5761 (30.7)
unidentified	12 (0.1)
American Society of Anesthesiologists classification	
1+1E*	9773 (52.1)
2+2E	6212 (33.1)
3+3E	1528 (8.1)
4+4E	437 (2.3)
5+5E	47 (0.3)
unidentified	762 (4.1)
Type of anaesthesia	
general anaesthesia	13 543 (72.2)
major regional anaesthesia	3563 (19.0)
general anaesthesia and major regional anaesthesia	1320 (7.0)
monitored anaesthetic care	232 (1.2)
local analgesia and others	73 (0.4)
unidentified	28 (0.1)

*E Emergency

Results for individual anaesthetic clinical indicators

Tables 2 to 5 and the Fig summarise the results for the individual anaesthetic clinical indicator. Of the patients, 98.8% received a preoperative anaesthetic visit in the ward before an elective operation. While the preset standard is 98% and most of the hospitals achieved 100%, three (13%) hospitals did not achieve the 98% target.

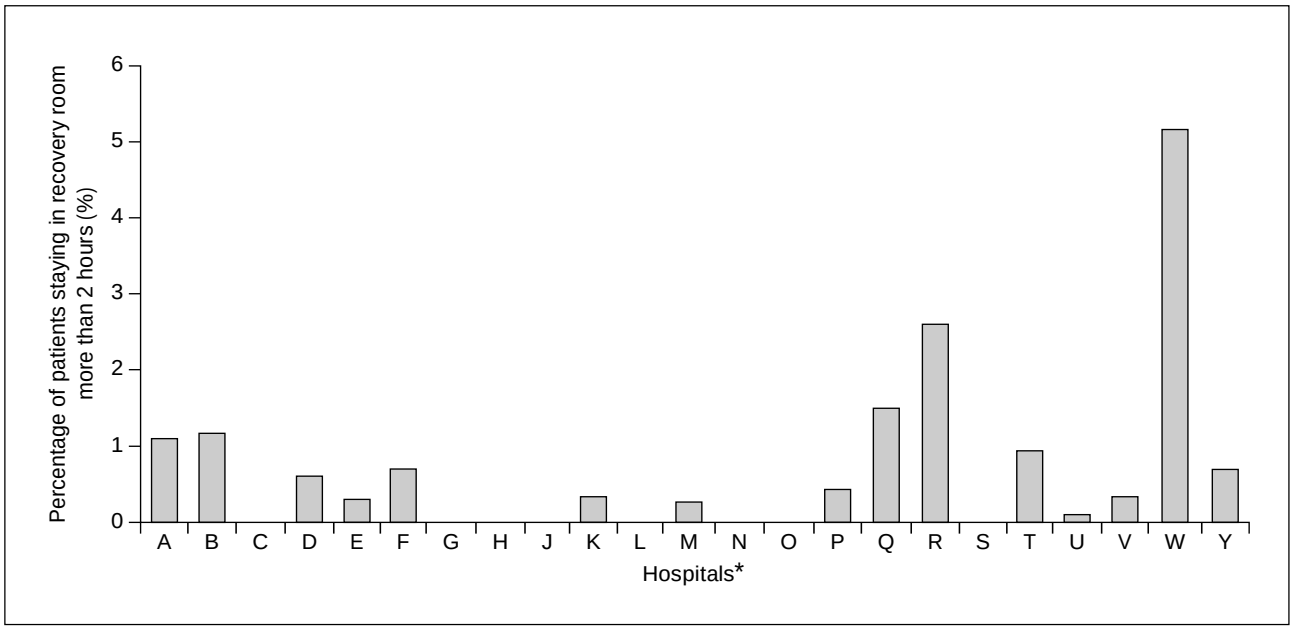
A preoperative anaesthetic visit in the ward was received by 96.2% of patients before an emergency operation. Most of the hospitals achieved 100%, but two (10%) hospitals did not achieve the 90% preset standard.

The average percentage for patients staying in the recovery room more than 2 hours was 1.04% (Fig). Statistical analysis showed that hospital, type of operation and anaesthesia, ASA status, and age were risk factors associated with prolonged stay in the recovery room (Table 3). Patients older than 15 years, with ASA status 2 or 3, and undergoing major operations using general anaesthesia in conjunction with regional anaesthesia were more likely to stay in the recovery room for more than 2 hours.

Eleven (0.06%) patients required intubation in the recovery room. Contributing causes included respiratory distress (2), deterioration in the recovery room due to ongoing bleeding (1), decreased level of

Table 2. Summary statistics for the six anaesthetic clinical indicators

Anaesthetic clinical indicators	No. of hospitals (mean [%])	95% CI
Elective surgery with a preoperative visit	23 (98.83)	94.24-99.42
Emergency surgery with a preoperative visit	20 (96.28)	94.60-97.96
Failure to be discharged from the recovery room due to clinical causes	23 (0.68)	0.21-1.15
Intubation in recovery room	23 (0.06)	0.02-0.14
Patients with a core temperature of <35ºC and undergoing operations lasting more than 2 hours	19 (3.22)	2.32-4.12
Injuries attributed to anaesthetic	23 (0.15)	0.04-0.18



* Codes A to H, J to W, and Y denote the different public hospitals in Hong Kong (no preset standard)

Fig. The distribution of percentage of patients who stayed in the recovery room more than two hours due to clinical causes in different hospitals

consciousness (2), aspiration (1), swollen neck with airway obstruction (1), and increasing desaturation (4). Significant risk factors for intubation in the recovery room included age, ASA status, and emergency operation (Table 4).

There were 111 (0.6%) patients with postoperative hypothermia. Risk factors for developing hypothermia included being treated at hospital Y, ASA status 2, 4, and 5, including emergency, an age of 65 years or older, and undergoing major operations using general anaesthesia in conjunction with regional anaesthesia (Table 5). Patients in hospital W (odds ratio [OR], 0.17; 95% confidence interval [CI], 0.06-0.48) and hospital C (OR, 0.26; 95% CI, 0.08-0.85) were least likely to develop hypothermia.

Table 3. Risk factors for staying in the recovery room more than 2 hours

Risk factor	Odds ratio (95% CI)
Hospital	
others (reference)	1.00
hospital A	6.61 (2.9-15.06*)
hospital W	29.29 (18.35-46.75*)
hospital Q	7.99 (4.36-14.66*)
hospital R	9.00 (3.75-21.6*)
hospital T	5.18 (2.81-9.56*)
hospital Y	3.81 (1.30-11.16*)
Type of operation	
minor (reference)	1.00
intermediate	1.46 (0.70-3.05)
major operation	5.05 (2.62-9.74*)
Type of anaesthesia	
general anaesthesia (reference)	1.00
regional anaesthesia and blocks	0.53 (0.33-0.86*)
general anaesthesia and regional anaesthesia	1.99 (1.23-3.23*)
Age (years)	
<15 (reference)	1.00
≥15 and <65	3.02 (1.31-6.99*)
≥65	5.06 (2.13-12.02*)

* P<0.05

The incidence of dental injury was 0.15% and only one patient was reported to have eye injury (incidence, 0.005%).

Discussion

General considerations

An indicator is defined by the Joint Commission on Accreditation of Healthcare Organisations as a quantitative performance measure used to monitor and improve the quality of important governance, management, and clinical and supportive services that affect patient outcomes.[3]

An indicator is not a direct measure of quality, but is a tool that provides performance data. The data can be used to direct attention to potential performance issues that may require intensive review in an organisation.[1] A process is the clinical path through which medical care is delivered. An outcome is a measure of total professional accountability.[4] The outcome for a patient after anaesthesia involves the joint effort of the team, comprising surgeons, anaesthetists, nurses,

Table 4. Risk factors for intubation in the recovery room

Risk factor	No. of patients (n=11)	P value
Age (years)		
< 15	0	0.01*
≥15 - <65	4	
≥65	7	
Sex		
male	7	0.31
female	4	
American Society of Anesthesiologists classification		
1	1	0.000*
2	3	
3	3	
4	4	
5	0	
Type of operation		
elective	4	0.02*
emergency	7	
Mode of anaesthesia		
general anaesthesia	11	0.15
regional anaesthesia	0	
general anaesthesia and regional anaesthesia	0	
others	0	

* P<0.05

Table 5. Risk factors for patients undergoing operations for more than 2 hours developing hypothermia in the recovery room

Risk factor	Odds ratio (95% CI)
American Society of Anesthesiologists classification	
1+1E* (reference)	1.00
2 and 2E	1.83 (1.04-3.19†)
3 and 3E	1.79 (0.94-3.40)
4 and 4E	3.22 (1.37-7.54†)
5E	19.91 (4.77-88.03†)
Type of anaesthesia	
general anaesthesia (reference)	1.00
regional anaesthesia and blocks	0.22 (0.07-0.70)
general anaesthesia and regional anaesthesia	2.77 (1.69-4.55†)
Age (years)	
<15 (reference)	1.00
≥15 and <65	1.67 (0.65-4.27)
≥65	2.62 (1.01-6.76†)
Hospital	
others (reference)	1.00
hospital Y	2.46 (1.08-5.61†)

*E Emergency
† P<0.05

physicians for preoperative optimisation of medical conditions, and intensivists for postoperative stabilisation, if required. In choosing the anaesthetic clinical indicators, the following criteria were considered: (1) the indicator can be strictly defined; (2) data can be easily available for collection; (3) data collected should be of appropriate size to permit adequate review; (4) the indicator should be applicable to all anaesthetic departments despite the different working environment; and (5) improved outcomes must be possible if appropriate measures are employed.

In the selection of clinical indicators, five dimensions should also be examined. These dimensions include process or outcome, sentinel event or rate-based dimensions, effectiveness and appropriateness, adverse event or desirable event, and practitioner-focused or system-focused dimensions.[4]

Individual anaesthetic clinical indicators

Anaesthetic clinical indicators 1 and 2: preoperative visit for elective and emergency surgery

Preoperative visits are an appropriate anaesthetic care process through which the anaesthetist performs preoperative assessment in the ward. The main purpose of the preoperative visit is to ensure that the patient is in an optimal condition for anaesthesia and operation. This is an important rate-based desirable system-focused process indicator. It is generally accepted that a preoperative visit conducted by anaesthetists is an essential part of good anaesthetic care.[5,6] There are high compliance rates, well above the preset standards (average 98.83% versus 98% preset standard for elective patients; average 96.28% versus 90% preset standard for emergency patients). The drawback for this indicator is the inability to monitor how the preoperative visit itself is conducted.

Anaesthetic clinical indicator 3: staying in the recovery room more than 2 hours due to clinical causes

The first recorded description of the recovery room was made at Newcastle Infirmary in 1801.[7] In Hong Kong, recovery rooms were routinely included in the planning of new hospitals since complications frequently occur in the recovery period. A complication rate of 23.7% was reported in a prospective study of 18 473 patients entering the recovery area and 2.7% of patients required treatment.[8] In a recovery room setting, immediate postoperative complications can be managed effectively and efficiently.

This indicator is a rate-based, system-focused, and undesirable outcome flag reflecting total effectiveness of anaesthetic care. In recent years, incidents were analysed according to clinical and administrative causes. In this survey, only clinical causes were included since administrative causes were assumed to have been rectified.

The duration of stay in the recovery room is defined as prolonged when lasting more than 2 hours. A patient is expected to be ready for discharge from the recovery room well within this duration if a successful anaesthetic with an uneventful recovery has been administered. The average rate of prolonged recovery room stay in our study was 0.68%. No standard was set due to the high variation recorded in previous years. In a survey, an indicator rate of 2% is adopted as a threshold for review.[2]

There is some variation in the discharge criteria from the recovery room in the public hospitals studied. The patient and operation complexities are different between hospitals. Some hospitals employ discharge scoring systems. Others use level of consciousness, physical activity, oxygen saturation status, cardiopulmonary stability, minimal postoperative pain, or emetic symptoms as discharge criteria. Most anaesthetists oversee the discharge of the patient to the ward.

In this study, apart from clinical complications such as hypothermia requiring rewarming, increased postoperative bleeding, or desaturation requiring monitoring and supportive therapy, prolonged stay was due to the inadequate support of intensive care units (ICU) or high dependency units (HDU) in some hospitals. Prolonged stay is beneficial to high-risk patients if skilled support and monitoring is deemed necessary. This puts the validity of this indicator in question. A previous survey has shown that longer stay for pain management and research programmes has been observed.[9]

There is a significant proportion of patients with ASA status 2+2 Emergency (E) and 3+3E staying for more than 2 hours in the recovery room. It is highly likely that patients with ASA status 4+4E and 5E are transferred directly to an HDU or ICU, bypassing the recovery room in some hospitals. From our analysis, a greater risk of prolonged stay in the recovery room was found to be an age of 15 years or older, major operations, combined general anaesthesia, and regional anaesthesia. A high indicator rate may signal high complications or more complex surgery or more complex cases requiring special anaesthetic techniques. Nevertheless, the indicator helps to monitor the effectiveness and efficient management of the recovery room.

Anaesthetic clinical indicator 4: intubation required to relieve respiratory distress in the recovery room

Respiratory complications during the postanaesthesia period are an important area of concern for anaesthetists. Overseas studies show that critical respiratory complications occurred in 1.3% to 1.9% of patients who had undergone anaesthesia.[10,11] It has also been shown that approximately half of the major complications resulting in death or coma are associated with postoperative respiratory depression.[12]

Intubation required to relieve respiratory distress in the recovery room is a practitioner-focused adverse outcome indicator. The occurrence of this sentinel event reflects the appropriateness of anaesthetic planning and management for an individual patient. Less than optimal management may be due to error in judgement, premature extubation when the patient is still sedated or, when in combination with opioids, there is residual muscle relaxant effect.[13] Management of a recovering patient relies heavily on the vigilance of the recovery room staff since they are able to detect problems early and deal appropriately with them. In a study of recovery room incidents, a high rate of human (clinical) detection of catastrophic respiratory incidents was reported.[14]

In this study, the mean rate of reintubation was 0.06% (11 revalidated reports). In other studies, intubation rates in the recovery room ranged from 0.08% to 0.19% of patients undergoing general anaesthesia; two thirds of reintubations occurred within 1 hour of extubation and the majority (69%) were considered to be directly related to anaesthetic management.[13,15]

Six types of airway emergencies are encountered in the recovery room. Upper airway emergencies include soft tissue obstruction, laryngeal oedema, and laryngospasm. Lower-airway emergencies include bronchospasm, non-cardiogenic pulmonary oedema, and aspiration. In this study, intubation (27.2%) was performed to relieve upper respiratory obstruction. Another reason for intubation was related to aspiration occurring after the use of a laryngeal mask airway. Other patients required intubation to support ventilation due to deteriorating general condition. No explicit criteria are written for intubation in the recovery phase. Oxygen therapy, suction, and insertion of airway are the most common manoeuvres for less severe airway compromise. It is assumed to be a life-threatening complication if intubation is required.

There is a significantly higher risk of intubation with higher ASA status but no conclusive medical risk factor can be identified from the small sample of incidents reported. Two patients with chronic obstructive airway disease had reintubation after a

failed trial extubation. All 11 patients requiring reintubation in this study had operations performed under general anaesthetic—seven were emergency operations (P=0.021) with four patients diagnosed with peritonitis. Seven patients were older than 65 years (Table 4). It has been shown in other studies that patient factors (obesity, age 60 years or older, diabetes, male sex); surgical factors (abdominal surgery, emergency procedure, duration of operation of more than 4 hours)[16]; and anaesthetic factors (excessive sedative or residual muscle relaxant effect) increase the risk of respiratory complications in the postanaesthesia period.

Anaesthetic clinical indicator 5: core temperature of less than 35°C recorded in the recovery room for patients after operations lasting more than 2 hours

This is a rate-based, system-focused, undesirable outcome indicator. In the operating theatre, hypothermia is either induced or inadvertent.[17] Unless hypothermia is specifically indicated for protection of the brain, the intraoperative core temperature should be maintained above 36°C.[18] The immediate adverse effects of hypothermia are shivering, increased oxygen consumption, and cardiovascular and central nervous system changes. Whatever the cause, hypothermia increases the risk of temperature-related complications, including myocardial ischaemia[19], wound infection,[20] and prolonged drug actions. [21]

In this study, the mean rate for this indicator was 3.22%. This is the only indicator showing a higher average rate than the preset standard (0.5%). In one study, unintended perioperative hypothermia was reported to occur in approximately half of all surgical patients undergoing operations lasting more than 2 hours.[22] The findings in this study showed that a significantly higher incidence of hypothermia was detected in patients with ASA status 2, 4, and 5 (Table 5). Patients with ASA status 3 were also more likely to have hypothermia in the recovery period (OR, 1.79), but this is not significant at the 5% level. Hypothermia is more likely to be present with patients undergoing both general and regional anaesthesia. General anaesthesia removes a patient's ability to regulate body temperature through voluntary efforts, leaving the autonomic system alone to respond to changes in temperature. Regional anaesthesia further impairs both central and peripheral thermoregulation.[18] As a result, anaesthetised patients are poikilothermic, with body temperature determined by the environment. In addition, patients requiring combined techniques may have more extensive operations, longer duration of operation, high surface cooling with thoracic or abdominal exploration, and larger fluid shift. Patients older than 65 years were found to be more likely to develop hypothermia after an operation lasting more than 2 hours. Perioperative thermal care is needed as thermoregulation is impaired in elderly patients.[23]

In this study, the core temperature of 79.7% of patients undergoing operation for less than 2 hours were not measured so the true incidence of perioperative hypothermia during anaesthesia may be higher. Proper recognition of the problem helps to prevent the occurrence of hypothermia by providing perioperative thermal care to high-risk patients.

Anaesthetic clinical indicator 6: injuries attributable to anaesthetic—dental injuries

Twenty-eight (0.15%) dental injuries were reported during the study period. In a retrospective study of patients after general anaesthesia, the incidence of dental injuries was 0.1% (n=61 139).[24]

Careful examination of the dental state of the patient is an important aspect of the preoperative assessment.[25] Patients at risk should be informed of the possible damage and a preoperative dental check-up completed whenever possible.[26] Appropriate documentation of the patient's dental condition in the preoperative assessment record is recommended.

Dental injuries range from microfractures of natural tooth substances to avulsion of a tooth or teeth, damaging crowns and bridges. There are three categories of risk factors. Anaesthesia-related situations such as difficult intubations and emergency operations contribute to increased risk. Other contributing factors include skeletal deformities of the temporomandibular joint or decreased mandibular motility in osteoarthritis and poor dental conditions including dental caries, periodontal disease, and weakened upper anterior dentition.[26]

In previous surveys, a loose tooth combined with poor oral hygiene was the main contributing factor. General anaesthesia with endotracheal intubation, pre-existing poor dentition, and difficulty in intubation are identified as the main risk factors of perianaesthetic dental injuries.[27] The majority of incidents occurred during induction of anaesthesia. The anaesthetic plan may be modified to avoid intubation or airway insertion. A tooth protector or McCoy blade (Penlon Limited, Oxfordshire, UK) may be used to minimise dental trauma.[28]

Ocular injuries attributable to anaesthetic

In this study, one patient was reported to have ocular injury due to the anaesthetic. The patient had proptosis due to an eye tumour and the eyelid was found to be abraded although appropriate cover with adhesive tape was used. Appropriate closure of the eyes during anaesthesia is required. This includes simple manual closure of eyelids, taping the eyes closed, or the insertion of a hydrophilic contact lens. Eye protective cushions may be required to avoid direct pressure on the eyes when the patient is in the prone or lateral position. Measures are needed to protect eyes during head-and-neck surgery. Routine instillation of eye drops or ointment is not recommended.[29] The most reported ocular complication is corneal abrasion. The abrasions are mostly caused by lagophthalmos. Lying in the prone position and head-and-neck surgery for longer than 90 minutes are risk factors for corneal abrasions.[29,30] General anaesthesia reduces both the production and the stability of tears resulting in corneal drying.

Although eye injuries after anaesthesia are a rare occurrence, some result in visual impairment. In the ASA closed claims analysis, 35% of injuries were related to corneal abrasion, of which 16% resulted in permanent ocular injuries.[31]

Methodology

The OMR form provided a uniform method of data collection for each patient under anaesthetic care. The reliability of data was improved by reducing inter-hospital variations in data collection methods.

Although the OMR methodology is suitable for handling a large volume of data, filling errors did occur. The errors were small (0.17%) when compared with the number of forms completed (>20 000 forms), although they may still give rise to significant errors for incidents with low prevalence rates such as intubation in the recovery room (74 false-positive results compared with 11 true-positive incidents) and ocular injury (3 false-positive results to 1 true-positive sentinel event). Data validation is therefore essential to ensure accuracy.

Usefulness of the monitored anaesthetic clinical indicators

The indicators function as flags which identify a patient sample to be reviewed within the organisation.[2] Recently, the Australian Council on Healthcare Standards included additional information in the report containing a 99% CI, expected number of events, and excess events to assist health care organisations to decipher more accurately whether a rate is either similar or different to other organisations submitting data.[32]

The six selected indicators were filtered through 3 years of retrospective surveys. The achievements included the improved awareness of the need for quality management, the development of some threshold ranges, the implementation of quality improvement programmes and the trend for more hospitals to reach the targeted levels. It is important that the departments respond appropriately to the survey results. Additional insights into the aetiology of complications should be useful for developing strategies to reduce their incidence. The following programmes have been implemented: clinical training of anaesthetic staff, training programmes for recovery staff and anaesthetic assistants, development of guidelines and protocols, acquisition of forced air warming devices, temperature monitoring for high-risk patients, and the use of tooth protectors for high-risk patients.

There are two major findings from this study. Firstly, a surprisingly high incidence of hypothermia in the recovery room was reported. The definition of hypothermia in this study was set at <35°C, one degree lower than the recommended level of 36°C by Sessler.[18] In addition, no report of the body temperature was made for patients who underwent operations of less than a 2-hour duration. A similar surprise was noted in the Peskett report,[15] in which hypothermia was detected even when patients had had short and non-invasive otorhinolaryngology procedures. This finding may signal a greater problem awaiting further exploration, since evidence shows that mild hypothermia contributes to perioperative morbidity.[18-20] There is an emerging need to monitor the body temperature of anaesthetised patients and to prevent perioperative hypothermia.

Secondly, a greater risk of prolonged stay in the recovery room was identified for patients older than 15 years, major operations, and anaesthetic technique with both general and regional anaesthesia. Modification of the anaesthetic plan or measures to prevent complications or improve postoperative provision of intensive care are required for the better care of high-risk patients.

Conclusion

The six anaesthetic clinical indicators reflect the performance of local practice in public hospitals in the provision of anaesthetic care. Good compliance with the preset standard of the anaesthetic clinical indicators was achieved in this study.

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