

อุบัติการณ์ที่เกี่ยวข้องกับการระงับความรู้สึกของโรงพยาบาลมหาวิทยาลัย ระดับตติยภูมิ

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Incident Related to Anesthesia at Tertiary Care University Hospital

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หลักการและวัตถุประสงค์: การศึกษานี้เป็นการหาอุบัติการณ์ที่เกี่ยวข้องกับการระงับความรู้สึกที่เกิดขึ้นในระยะเวลา 1 ปี เพื่อหาความสำคัญของแต่ละอุบัติการณ์ที่เกิดขึ้น ปัจจัยที่นำไปสู่เหตุการณ์ดังกล่าวและวิธีป้องกันการเกิดซ้ำ

วิธีการศึกษา: การศึกษาเชิงพรรณนา แบบไปข้างหน้าดำเนินการระหว่างเดือนกุมภาพันธ์ 2558 ถึงมกราคม 2560 โดยอุบัติการณ์ภาวะแทรกซ้อนที่เกิดขึ้นในผู้ป่วยที่เข้ารับการระงับความรู้สึก จะถูกรายงานในรูปแบบฟอร์มมาตรฐานที่ทางโรงพยาบาลกำหนด และรายงานนั้นจะได้รับการตรวจสอบโดยทีมงานบริหารความเสี่ยงของภาควิชาวิสัญญีวิทยา

ผลการศึกษา: มีจำนวนผู้ป่วยที่เข้ารับการการระงับความรู้สึก 19,163 ราย มีอุบัติการณ์เกิดขึ้น 236 ครั้ง (123: 10,000, 95% CI: 108.5-139.8) พบมากในผู้ป่วยที่มีอายุต่ำกว่า 1 ปี (120: 10,000) ส่วนใหญ่พบใน ASA II (ร้อยละ 38) ที่เข้ารับการผ่าตัดแบบไม่เร่งด่วน (ร้อยละ 71.4) และมักเกิดขึ้นในระหว่างการผ่าตัด (ร้อยละ 65.5) โดยพบอุบัติการณ์ที่เกี่ยวข้องกับระบบทางเดินหายใจมากที่สุด (ร้อยละ 27.5) จากการเกิดภาวะพร่องออกซิเจน (11.0:10,000) และการสำลักเศษอาหาร (6.3:10,000) อุบัติการณ์ชนิดที่พบเป็นอันดับสองคือระบบหัวใจและหลอดเลือด (ร้อยละ 24.6) พบภาวะหัวใจหยุดเต้น 25.6:10,000 เสียชีวิต 15:10,000 ปัจจัยที่น่าจะสามารถลดอุบัติการณ์ได้จากการวิเคราะห์โดยคณะกรรมการความเสี่ยงภาควิชา คือ ความระแวดระวังสูงในผู้ให้การระงับความรู้สึก (ร้อยละ 29.5) และประสบการณ์ของวิสัญญีผู้ดูแล (ร้อยละ 22.1) ส่วนวิธีการที่มีส่วนช่วยลด

Objectives: The purpose of this study was to detect critical incidents involving anesthesia over a one-year period. We identified the magnitude of each incident, factors leading to that incident, and how it could have been prevented.

Methods: A prospective, descriptive study was conducted between February 2015 and January 2016. A standard incident report form was completed for every critical anesthesia incident occurred; these reports were then audited.

Results: From among the 19,163 cases of anesthesia, there were 236 incidents (123:10,000, 95% CI 108.5-139.8). Most frequently, incidents involved patients under 1 year (approximately 120:10,000). Most commonly, incidents occurred among those with a classification of ASA II (38%), among those undergoing elective surgery (71.4%), and during the intraoperative period (65.5%). Incidents related to the airway (27.5%) were the most common; including desaturation (11.0:10,000) and aspiration (6.3:10,000). The second most common type of incident involved the cardiovascular system (24.6%). The rate of cardiac arrest was 25.6:10,000 with a respective mortality of 15:10,000. The factors associated with a lower number of incidents were vigilance (29.5%) and staff experience (22.1%). The corrective strategies suggested were used for quality assurance activities in 35.4% of cases, and practical guidelines were developed in 31.3% of cases.

Conclusion: Most common anesthesia incidents were incidents related to the airway and cardiovascular system.

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การเกิดอุบัติการณ์คือ ใช้แนวทางการแก้ไขปัญหามานกิจกรรมการประกันคุณภาพ (Morbidity & Mortality activities) ร้อยละ 35.4 และการพัฒนาแนวทางปฏิบัติร้อยละ 31.3

สรุป: พบภาวะแทรกซ้อนที่เกี่ยวข้องกับระบบทางเดินหายใจ และระบบหัวใจและหลอดเลือด มากที่สุดตามลำดับ การรายงานอุบัติการณ์ภาวะแทรกซ้อน เป็นเครื่องมือที่ดีช่วยให้บุคลากรมีความเข้าใจมากยิ่งขึ้นสิ่งที่จะช่วยลดภาวะแทรกซ้อนคือ การพัฒนามูลค่าการวิสัยทัศน์อย่างต่อเนื่อง

The critical anesthesia incident report is a useful tool for better understanding and prevention of perioperative events accompany with continue quality improvement.

Keywords: critical anesthesia incidents, morbidity, mortality, perioperative complications, risk management

ศรีนครินทร์เวชสาร 2561; 33(4): 308-13. • Srinagarind Med J 2018; 33(4): 308-13.

Introduction

Srinagarind hospital is a tertiary care university hospital, serving more than 18,000 surgical cases per year. The number of patients with complicated diseases is increasing year on year, including among both elderly and pediatric patients. Our anesthesiology department has developed a database for risk management where both incidents and near-misses are recorded. Critical incidents are discussed and the findings summarized in order to improve patient safety.

The purpose of the current study was to assess critical incidents involving anesthesia over a one-year period. We identified and analyzed the magnitude of each incident, the factors leading to that incident, and the ways in which it could have been prevented.

Materials and methods

After obtaining approval from the institutional Ethics Committee for Human Research (HE571499), prospective, descriptive data were collected for the period between February 2015 and January 2016.

The incidents are reported immediately in order to ensure accuracy and detail include: death, cardiac arrest, mismatched transfusion, malignant hyperthermia, cerebrovascular accident, aspiration, pulmonary embolism, and myocardial infarction. All of these must be reported to the department's risk committee and the hospital risk management committee within 24 hours. The report is first delivered to the department chair by telephone who in turn contacts the hospital risk team for early management and follow up. Other non-serious events are reported in writing within 1 week.

These anesthetic records and standard anesthesia risk forms were analyzed, and a summary of the problems and causes—based on a consensus from the department's risk committee—compiled for assessment by the Anesthesiology Risk Management Information System. In cases where serious incidents occurred, the patients were monitored by the Risk Management Committee.

The location of each incident was recorded; whether it occurred in the intra-operative, post-anesthesia care unit (PACU), or in the post-operative ward (whether an ordinary ward or intensive care). The cut-off for recording post-anesthesia related complications was 24-h after administration of anesthesia; albeit death incidents were followed beyond that time. The time of each incident occurred was recorded, as well as whether it was an elective or emergency case. The data recorded included sex, age, ASA physical status, and the type of complications. Transfusion errors regarding blood and blood components, drug-related errors and allergies, and anesthetic equipment malfunctions were recorded. The details of each incident were sent to the Risk Management Committee for consensus by 3 anesthesiologists on the causal factors, contributing factors, mitigating factors, and potential prevention strategies. All incidents that occurred during that time were analyzed separately and a consensus established. If there was not unanimity, as majority (2/3) decision was acceptable. If one of the reviewers was one of the anesthesia personnel involved, we retrieved all of the detail regarding the incident and deferred to the majority (the potentially biased vote censored).

Descriptive statistics were calculated and presented as numbers and percentages and Wilson score interval for the 95% CI. The proportion of incidents was reported as per 10,000.

Results

Among the total of 19,163 anesthesia cases, 236 incidents were reported (123:10,000, 95% CI: 108.5-139.8). A respective 15,063, 2,721, 1,101, and 278 of the cases

received general anesthesia, regional anesthesia, a combination of regional and general anesthesia, and monitored anesthesia care (MAC). More incidents occurred in cases involving male patients (64.9%). The prevalence of incidents occurred most frequently in patients under 1 year of age (approximately 120:10,000), followed by those over 65 (109:10,000), then by small children under 5 (108.3:10,000) (Table 1).

Table 1 Distribution of critical incidents by age

Age	Total number of case	Number of case	Prevalence of incidents (per 10,000)	95%CI
Newborn - 1 mo	166	2	120.5	(33.1,428.6)
> 1 mo - 1 year	579	7	120.9	(58.7,247.4)
> 1 year - 5 years	1108	12	108.3	(62.1,188.3)
6-10 years	956	5	52.3	(22.4,121.8)
11-20 years	1724	16	92.8	(57.2,150.2)
21-64 years	11142	91	81.7	(66.6,100.2)
≥ 65 years	3488	38	108.9	(79.5,149.2)
Total	19163	171	89.2	(76.9,103.6)

Incidents occurred most frequently in cases involving patients classified as ASA II (38.0%), ASA III (27.0%), and ASA I (18.7%). Of the total incidents, a respective 122 (71.3%) and 49 (28.7%) were cases of elective and emergency surgery. The descending rank of incidents was during the intraoperative period (65.5%), in the PACU (7.6%), and within 24 hours of entering the post-operative ward (27%), which included ordinary wards and the intensive care unit.

The majority of incidents were related to the airway and respiratory system (27.5%), followed by the cardiovascular system (24.6%), and the central and peripheral nervous system (9.0%). Oxygen desaturation in the present study was defined as SpO₂ below 90% for >3 min or once below 85% as detected by pulse oximetry. Twenty-one cases met the criteria for desaturation (11.0:10,000), among which 17 occurred intraoperatively: 1 in the PACU, and 3 within 24 hours of entering the ward. There were 12 incidents in which aspiration occurred (6.3:10,000), 11 of which occurred during induction and 1 in the PACU (5 of whom had to be moved to the intensive care unit for close monitoring where they all made a full recovery) (Table 2).

There were 49 critical incidents involving cardiac arrest (25.6:10,000). Death occurred in 29 of these cases (15:10,000); of which 13 occurred in the operating room, 12 within 24 hours after surgery, and 1 within 48 hours of surgery. Three deaths occurred after the patients had been taken home, but the other 20 patients survived (Table 3). Cardiac arrest occurred most frequently in patients categorized as ASA 4E (7.8:10,000) and 5E (7.3:10,000).

Thirteen procedures were postponed or cancelled after the anesthesia had been administered; 9 of which involved patients undergoing elective surgery. Among the 13 cases, the senior surgical resident had scheduled the operation and permitted the administration of anesthesia before the surgical staff had entered the operating room. The staff made the decision to cancel the operation due to assessment problems. Two incidents involved angiogram machine failure (1 after a peripheral nerve block when staffs were drawn away to deal with a serious problem with another operation; and, 1 involving a cardiac problem indicated by changes in ECG readings after induction).

Table 2 Details and incident rates of airway, cardiovascular, and central/peripheral nervous system complications (first 5 ranking)

Description of critical incidents	Intraoperative	PACU	24 h post-op	Total	Incidence (per 10,000)	95%CI
Airway and respiratory (n=65; 27.54%)					33.9	(26.6,43.2)
Desaturation	17	1	3	21	11.0	(7.17,16.75)
Aspiration	11	1		12	6.3	(3.58,10.94)
Reintubation	2	3	5	10	5.2	(2.84,9.61)
Difficult intubation	5			5	2.6	(1.12,6.11)
Pneumothorax	2		1	3	1.6	(0.53,4.61)
Cardiovascular (n=58; 24.58%)					30.3	(23.4,39.1)
Cardiac arrest	32		17	49	25.6	(19.35,33.79)
Arrhythmia	6		1	7	3.7	(1.77,7.54)
MI /Ischemia	1	1		2	1.0	(0.258,3.80)
CNS & PNS (n=21; 8.9%)					11.0	(7.2,16.7)
Nerve injury			4	4	2.1	(0.81,5.37)
PDPH			4	4	2.1	(0.81,5.37)
CVA			4	4	2.1	(0.81,5.37)
Convulsion	1	1	2	4	2.1	(0.81,5.37)
Coma			2	2	2.1	(0.81,5.37)

Table 3 Details and incident rates of ungrouped complications (first 5 ranking)

Others incidents (n=92; 38.98%)	Intra-operative	PACU	24 h post-op	Total	Incidence (per 10,000)	95%CI
Death	13		12	25	13.1	(8.8,19.3)
Unplanned ICU admission	25			25	13.1	(8.8,19.3)
Cancelled operation after administration of anesthesia	13			13	6.8	(4.0,11.6)
Wrong patient sticker identification	7			7	3.7	(1.8,7.5)
Drug error	5			5	2.6	(1.1,6.1)

Incidents usually arose from a combination of factors (i.e., via-à-vis the patient, surgery, or anesthesia). The 3 reviewers came to a consensus on which one of the four categories was the primary cause. Of the total incidents, 37.1% were related to the anesthesia, 37.1% to patient issues, 15.9% to surgical procedural issues, and 9.9% to the system. Contributing factors included inexperience (28.3%), pre-operative preparation problems (19.4%), and lack of vigilance (17.2%). Mitigating factors included vigilance on the part of the anesthesia personnel (29.5%), the staff's level of experience (22.1%) and following the guideline (18.8%). In order to reduce the risk of future incidents, incidence reports indicated (a) quality assurance activities

(35.4%), (b) development of practical guidelines (31.1%), and (c) increasing the amount of training for hospital staff (17.3%).

Discussion

Critical incidents in cases involving anesthesia can occur at any point in the process. There are human factors involved, as decisions must often be made quickly in the operating room^{1,2}. Analysis of critical incident reports is a useful tool for learning from, and preventing the recurrence of, these incidents³⁻⁶.

In response to a 2005 report on critical incidents involving anesthesia⁷, the frequency of quality assurance activities in the Anesthesiology Department was increased

from once to twice a month. This led to better understanding on the part of staff regarding cases in which incidents occurred. Twelve practical guidelines have been established in our department to further prevent hazard.

Over the study period, 236 incidents were reported among 19,163 cases in which anesthesia was administered (123:10,000). The previous study reported 268 incidents in 10,607 cases (252:10,000). The incidence rate found in the current study was, thus, less than half of that reported in the previous study. The dramatically decreased incidence is likely the result of continuous quality improvement. Moreover, similar to our study, Munting et al. reported the incidence rate for anesthesia administration was 354:10,000 and the most common complications were airway and respiratory incidents⁸⁻¹⁰.

Critical incidents in our study occurred in adult to elderly patients with mild systemic diseases (ASA II) more than in patients with severe systemic disease with functional limitations (ASA III). A possible explanation is that anesthesia personnel were being more watchful of adverse events in patients with severe systemic disease.

The majority of cardiovascular incidents in our study involved cardiac arrest (25.6:10,000). Thirty-three of the 49 incidents occurred in cases of emergency surgery and 16 in cases of elective surgery. Twenty-nine of the cases resulted in death (15:10,000). The rates of both cardiac arrest and death have decreased since our previous study (44.3:10,000 and 34.9:10,000, respectively). The incidence rates of cardiac arrest and death in cases of cardiac arrest found in the current study were similar to those reported by Gupta et al. in a university hospital (29:10,000 and 22.6:10,000, respectively); of which 5.6:10,000 was anesthesia-related¹¹.

Massive and rapid blood loss was the primary cause of cardiac arrest both intra-operatively and 24 hours post-operatively. The Massive Transfusion Protocol (MTP) was developed in cooperation with our blood bank so that the anesthesia and OR personnel team could respond rapidly once the code was activated. The use of the MTP code helped us to quickly receive large amounts of blood for resuscitation. The effectiveness of the CPR team also contributed to these results. After

the incident report that came out 12 years ago, our Department formed a well-trained support team, which would be able to reach a cardiac arrest in the OR as soon as possible. These factors may be the reason for the increase in the incidence survival rate

The rate of airway and respiratory complications in our study was similar to that found in a study by Gupta et al¹¹ (34.0:10,000). Desaturation was the most common incident (11.0:10,000): the rate of which was significantly lower than in the previous study discussed above (95.2:10,000). We developed oxygen transfer guidelines which were implemented in all cases in which the patient received general anesthesia and underwent extubation or sedation during transport from the operating room to the post-anesthesia care unit (PACU). This eliminated the problem of desaturation during transportation. The second kind of incident involving airway and respiration was aspiration. In our study, aspiration occurred in 12 patients (6.3:10,000). In 11 of these cases, aspiration occurred during induction and in 1 case, it occurred at the PACU. This is similar to the results from the study by Gupta et al¹¹. (6.6:10,000), albeit the affected patient group differed. While in the study by Gupta et al¹¹, aspiration most commonly occurred in small children, we found that aspiration mostly occurred among adults anaesthetized using the total intravenous anesthesia technique (TIVA) or a laryngeal airway device.

Mismatched transfusions occurred in 2 cases. Even though practical guidelines have been established to verify and cross-check, complacency and the rush of emergency situations can lead to poor adherence. We re-emphasized this risk at the morbidity and mortality conference and introduced a coaching system for all new trainees.

In addition to a lack of technical skills, one of the problems we discovered was insufficient communication between team members. There were 13 cases in which surgery was postponed or even canceled after anesthesia had been administered. A lack of communication between the surgical staff and surgical residents was found to be involved in 70% of these cases. This problem was solved by not allowing anesthesia to be

administered until the surgical staff signs-in with the team.

Some of the incidents were preventable. Ninety percent of incidents involve human factors such as lack of knowledge, lack of vigilance, inadequate patient assessment, and inappropriate decision-making^{12,13}. Our department used morbidity and mortality information as a tool to learn from mistakes and to minimize the amount of preventable incidents¹⁴⁻¹⁶. Practicing non-technical skills (i.e., communication skills, decision-making, and situation awareness, team work, leadership, and stress management) may help to reduce human error and enhance patient safety. Implementing a “no blame, no shame” workplace environment may encourage our team to learn from other people’s mistakes, realizing that human error is a reality^{17,18} and that safety of the patient must be our first priority¹⁹.

Conclusion

Most common anesthesia incidents were incidents related to the airway and cardiovascular system. The critical anesthesia incident report is a useful tool for better understanding and prevention of perioperative events accompany with continue quality improvement.

Acknowledgements

We would like to thank the (a) invitation research grants (IN58153) from Faculty of Medicine, Khon Kean University for financial support (b) Mr. Saksin Sinsin for assistance with statistical analysis (c) Mr. Bryan Roderick Hamman for assistance with the English-language presentation of the manuscript under aegis of the publication clinic, Research Affairs.

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