Multicentered Study of Model of Anesthesia Related Adverse Events in Thailand by Incident Report (The Thai Anesthesia Incidents Monitoring Study): Results

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Objective: *The Thai Anesthesia Incidents Monitoring Study (Thai AIMS) was aimed to identify and analyze anesthesia incidents in order to find out the frequency distribution, clinical courses, management of incidents, and investigation of model appropriate for possible corrective strategies*

Material and Method: *Fifty-one hospitals (comprising of university, military, regional, general, and district hospitals across Thailand) participated in the present study. Each hospital was invited to report, on an anonymous and voluntary basis, any unintended anesthesia incident during six months (January to June 2007). A standardized incident report form was developed in order to fill in what, where, when, how, and why it happened in both the close-end and open-end questionnaire. Each incident report was reviewed by three reviewers. Any disagreement was discussed and judged to achieve a consensus.*

Results: *Among 1996 incident reports and 2537 incidents, there were more male (55%) than female (45%) patients with ASA PS 1, 2, 3, 4, and 5 = 22%, 36%, 24%, 11%, and 7%, respectively. Surgical specialties that posed high risk of incidents were neurosurgical, otorhino-laryngological, urological, and cardiac surgery. Common places where incidents occurred were operating room (61%), ward (10%), and recovery room (9%). Common occurred incidents were arrhythmia needing treatment (25%), desaturation (24%), death within 24hr (20%), cardiac arrest (14%), reintubation (10%), difficult intubation (8%), esophageal intubation (5%), equipment failure (5%), and drug error (4%) etc. Monitors that first detected incidents were EKG (46%), Pulse oximeter (34%), noninvasive blood pressure (12%), capnometry (4%), and mean arterial pressure (1%).*

Conclusion: *Common factors related to incidents were inexperience, lack of vigilance, inadequate preanesthetic evaluation, inappropriate decision, emergency condition, haste, inadequate supervision, and ineffective communication. Suggested corrective strategies were quality assurance activity, clinical practice guideline, improvement of supervision, additional training, improvement of communication, and an increase in personnel.*

Keywords: *Anesthesia, Adverse events, Incidents, Incident report, Patient safety*

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Patient safety has received increased attention in recent years[1]. It is now widely accepted that incident monitoring in anesthesia is a useful tool for quality improvement and maintenance of high safety standards in anesthetic services[2-6]. It can be used to investigate latent and active errors and thus enable appropriate corrective action to be taken. In 2003, the Royal College of Anesthesiologists of Thailand initiated The Thai Anesthesia Incidents Study (THAI Study) of anesthetic adverse outcomes, as a registry of all consecutive anesthetics in 20 hospitals, to study incidences of anesthesia related complications[7,8]. During the 18 months period, analyses of parts of the database of 200,000 anesthetics led to 28 sub-studies. Therefore, the Thai Study provided the baseline incidences of adverse outcomes and some contributory factors for quality improvement. However, it was particularly limited to patients in teaching hospitals and general hospitals. Therefore, in collaboration with the National Research Council of Thailand and the Thai Joint Commission on Hospital Accreditation, the authors decided to use the method of incident reporting to identify and analyze anesthesia related incidents in more extensive levels of hospitals, from district (community) hospitals to tertiary hospitals across Thailand. The primary objective of The Thai Anesthesia Incident Monitoring Study (THAI AIMS) was to determine the frequency distribution, clinical courses, management, and outcomes of the adverse events. Furthermore, the present study investigated the active and latent errors of incidents and looked for possible corrective strategies in subsequent studies.

Material and Method

The present prospective multicentered study, a part of the Thai Anesthesia Incident Monitoring Study (Thai AIMS), was conducted by the Royal College of Anesthesiologists of Thailand from January to the end of June 2007. All anesthesiologists and nurse anesthetists in fifty-one hospitals ranging from district (community) hospitals to tertiary hospitals across Thailand, were invited to report the critical incidents on an anonymous and voluntary basis.

After being approved by each institutional ethical committee, the specific anesthesia related adverse events detected during anesthesia and during 24 hr postoperative period were reported by filling out a standardized incident reporting form[9] as soon as possible after occurring adverse or undesirable events. These included pulmonary aspiration, pulmonary embolism, esophageal intubation, endobronchial intubation, oxygen desaturation, re-intubation, difficult intubation, failed intubation, total spinal block, awareness during general anesthesia, coma/cerebro-vascular accident/convulsion, nerve injuries, transfusion mismatch, suspected myocardial infarction/ischemia, cardiac arrest, death, suspected malignant hyperthermia, anaphylaxis, drug error, equipment malfunction and cardiac arrhythmia requiring treatment. Oxygen desaturation in the present study was defined as SpO_2 below 90% for more than 3 min or once below 85% detected by pulse oximetry. The surgical profiles, anesthesia profiles and a narrative of incidents were also recorded. Details of the present study methodology have been described[9]. All forms were sent to data management unit at Chulalongkorn University. The descriptive statistics: (Frequency tables with number and percentage) were used to analyze data by using SPSS for Windows, version 12. Each critical incident was reviewed by a group of reviewers and presented in subsequent studies.

Results

After screening by the site manager, there were 1996 incident report forms with 2537 incidents sent to the data management unit. Fifty-one public hospitals from all regions of Thailand were registered as Thai AIMS participants.

Ages of patients varied from newborn to 96 years with a gender ratio of male: female equaled 1098 cases (55%): 898 (45%). Minimum, maximum, mean (standard deviation) of weight and height of patients were 1, 63, 52.9 (21.3) kg, and 30, 185, 150.7 (27.7) cm, respectively. Distribution of age and American Society of Anesthesiologists physical status (ASA PS) of patients are demonstrated in Fig. 1 and Fig. 2, respectively.

Among 1996 surgical procedures there were 754 cases (37.8%), 662 cases (33.2%), and 39 cases (2.0%) operated under emergency condition, during non-official time, and ambulatory (out-patient) setting, respectively. General surgery (34.9%), orthopedic surgery (13.7%), and neurosurgical surgery (11.5%) were the three most common surgeries that experienced adverse events in the database. Details of types of surgery or sites of operation are shown in Table 1.

Phase of anesthesia during which adverse events in 1996 incident reports occurred and locations at which incidents occurred are shown in Table 2. Performers of anesthesia in which incidents occurred were anesthesiologists (67.5%), nurse anesthetists (79.6%), anesthesia residents (24.3%), non-anesthesia

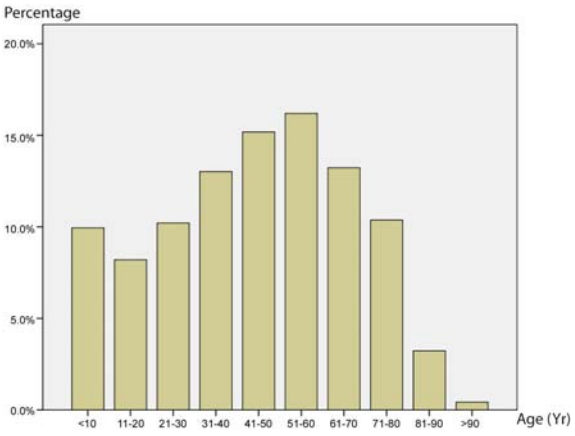

Fig. 1 Age distribution of patients in 1996 incident reports

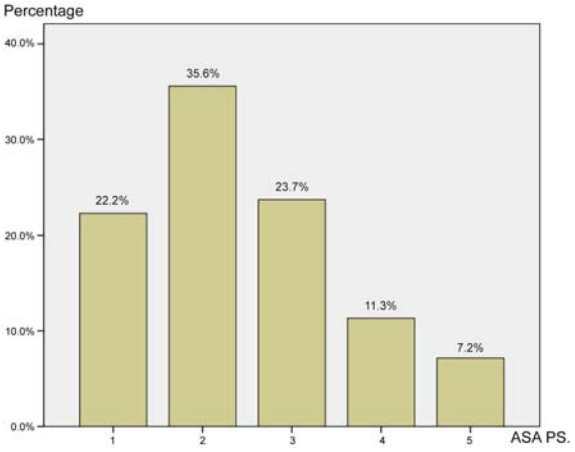

Fig. 2 ASA physical status classification of patients in 1996 incident reports

residents (1.8%), surgeons (1.5%), medical students (1.2%), and anesthesia nurse trainees (6.3%). Monitoring in the incident reports are shown in Table 3.

Critical incidents classified by perioperative period in the 1996 incident reported are shown in Table 4. Among 2537 incidents, 950 incidents (37.4%) and 900 incidents (35.5%) were diagnosed by clinical diagnosis before and after detection by monitoring, respectively. Monitoring could not detect the incidents in 804 incidents (31.7%) while monitoring could detect in 1733 incidents (68.3%). The most common monitoring that firstly detected the incidents were electrocardiography (46.4%), pulse oximeter (34.7%), noninvasive blood pressure (12.1%), capnometry (4.3%), and mean arterial pressure (1.2%).

Table 1. Operative site or surgery in 1996 incident reports

	n (%)
Cardiac	73 (3.7)
Thoracic	51 (2.6)
Cardioversion	2 (0.1)
Dental	11 (0.6)
Diagnosis	12 (0.6)
Intervention therapy	12 (0.6)
Radiotherapy	3 (0.2)
Electroconvulsive	-
Endoscopic	56 (2.8)
General surgery	697 (34.9)
Gynecological surgery	131 (6.6)
Hematological	-
Major multi-disciplinary	1 (0.1)
Neurosurgical	229 (11.5)
Obstetric	91 (4.6)
Ophthalmologic	45 (2.3)
Orthopedic	274 (13.7)
Otorhino-laryngological	108 (5.4)
Plastic	78 (3.9)
Urological	102 (5.1)
Major vascular	33 (1.7)

Data are expressed as number (%)

Table 2. Phase when the incidents were alerted and location where the incidents occurred (n = 1996)

	n (%)
Phase	
Preinduction	60 (3.0)
Induction	445 (22.3)
Maintenance	678 (34.0)
Emergence	111 (5.6)
Recovery	191 (9.6)
Post recovery (in 24 hr)	304 (15.2)
Location	
Induction room	7 (0.4)
Intensive care unit	91 (4.6)
Operating room	1220 (61.1)
Recovery room	188 (9.4)
Emergency unit	4 (0.2)
Delivery	1 (0.1)
Dental	1 (0.1)
Ward	216 (10.8)
Imaging	7 (0.4)
Transfer period	4 (0.2)
Other location	4 (0.2)

Data are expressed as number (%)

Table 3. Monitorings in incident reports (n = 1996)

	Yes / n (%)
NIBP	1971 (98.7)
Invasive BP	212 (10.6)
SpO_2	1985 (99.4)
EKG	1952 (97.8)
$ETCO_2$	913 (45.7)
ETGAS	237 (11.9)
CVP	231 (11.6)
Precardial stethoscope	79 (4.0)
Esophageal stethoscope	85 (4.3)
Temperature	252 (12.6)
Peripheral nerve stimulator	13 (0.7)
Airway Pressure	841 (42.1)
PAP	32 (1.6)
Cardiac output	3 (0.2)
EEG	3 (0.2)
BIS	-
Doppler	-
Oxygen analyzer	36 (1.8)

Data are expressed as number (%)

The immediate outcomes and long-term outcomes are shown in Table 5. According to the opinions of attending personnel and site managers, contributing factors, factors minimizing outcomes, and suggested corrective strategies in all incident reports are shown in Table 6, 7, and 8 respectively.

Discussion

Incident reporting has been more widely adopted as a tool for quality assurance program since the study of mishaps and near miss reported by Cooper[10,11]. In Thailand, The Thai Anesthesia Incidents Study (THAI Study) has provided many quality indicators that can be used as comparative data for benchmarking between different levels of hospitals. However, the system of incident reporting in anesthesia has not been standardized. Therefore, the present study provided model of anesthesia incident reporting in Thailand. The advantages of a structured incident reporting system include the ability to elicit contextual details about contributing factors, human error, factors minimizing adverse outcomes and suggested

Table 4. Critical incidents classified by the perioperative period (n = 1996)

	Operative period n (%)	PACU n (%)	Post-op 24 hr n (%)	Total (%)
Pulmonary aspiration	22 (1.1)	6 (0.3)	1 (0.1)	29 (1.5)
Pulmonary embolism	11 (0.6)	1 (0.1)	5 (0.3)	17 (0.9)
Esophageal intubation	104 (5.2)	2 (0.1)	-	106 (5.3)
Endobronchial intubation	37 (1.9)	2 (0.1)	-	39 (2.0)
Desaturation	364 (18.2)	95 (4.8)	32 (1.6)	487 (24.4)
Reintubation	55 (2.8)	113 (5.7)	48 (2.4)	214 (10.7)
Difficult intubation	172 (8.6)	2 (0.1)	-	174 (8.7)
Failed intubation	26 (1.3)	-	-	26 (1.3)
Total spinal block	7 (0.4)	1 (0.1)	-	7 (0.4)
Awareness during GA	-	-	25	25 (1.3)
Coma / CVA / Convulsion	11 (0.6)	5 (0.3)	14 (0.7)	27 (1.4)
Nerve injuries	6 (0.3)	1 (0.1)	15 (0.8)	22 (1.1)
Transfer mismatch	2 (0.1)	-	-	2 (0.1)
Suspected MI / Ischemia	13 (0.7)	7 (0.4)	10 (0.5)	28 (1.4)
Cardiac arrest	160 (8.0)	12 (0.6)	131 (6.6)	292 (14.6)
Death within 24 hr	68 (3.4)	4 (0.2)	329 (16.5)	400 (20.0)
Suspected malignant hyperthermia	-	-	-	-
Anaphylaxis / Anaphylactoid	43 (2.2)	3 (0.2)	2 (0.1)	45 (2.3)
Drug error	78 (3.9)	8 (0.4)	-	86 (4.3)
Equipment malfunction / failure	102 (5.1)	2 (0.1)	-	104 (5.2)
Arrhythmia need treatment	476 (23.8)	36 (1.8)	-	506 (25.4)

Data are expressed as number (%)

Table 5. Immediate outcome and long term outcomes after the incidents (n = 1996)

Outcome	n (%)
Immediate outcome (within 24 hr)	
Unplanned ICU Admission	204 (10.2)
Unplanned hospital admission	6 (0.3)
Prolonged emergence / apnea	28 (1.4)
Awareness	21 (1.1)
Cancellation / postponement of surgery	16 (0.8)
Minor physiological change	227 (11.4)
Major physiological change	
- Respiratory outcomes (Hypoxia, Pulmonary edema)	190 (9.5)
- Cardiovascular outcomes (Myocardium infarction)	56 (2.8)
- Neurological	42 (2.1)
Cardiac arrest	183 (9.2)
Death	521 (26.1)
Complete recovery	793 (39.7)
Others	68 (3.4)
Long term outcomes (within 7 days)	
Prolonged ventilatory support	123 (6.2)
Hospital stay after event	
< 7 days	59 (3.0)
> 7 days	43 (2.2)
Anesthesia reasons	3 (0.2)
Psychic trauma	2 (0.1)
Disability	4 (0.2)
Vegetative / Brain death	10 (0.5)
Death	141 (7.1)
Other morbidity	1 (0.1)
Complete recovery	337 (16.9)

Data are expressed as number (%)

Table 6. Contributing factors of the incident reports (n = 1996)

	n (%)
Inappropriate decision	405 (20.3)
Inexperience	510 (25.6)
Inadequate knowledge	69 (3.5)
Haste	330 (16.5)
Tiredness	32 (1.6)
Personnel's illness	4 (0.2)
Inadequate personnel	62 (3.1)
Communication defect	64 (3.2)
Unfamiliar to environment	14 (0.7)
Emergency condition	422 (21.1)
Inadequate preoperative evaluation	432 (21.6)
Inadequate preparation	243 (12.2)
Inadequate equipment	38 (1.9)
Ineffective equipment	71 (3.6)
No monitor	33 (1.7)
Ineffective monitor	36 (1.8)
Error in drug label	17 (0.9)
No recovery room	3 (0.2)
No bed in intensive care unit	59 (3.0)
Long waiting for blood transfusion	30 (1.5)
etc.	386 (19.3)

Data are expressed as number (%)

corrective strategies[12]. The greater likelihood of frank reporting of details because of guaranteed anonymity, the far more information because near-misses as well as adverse outcomes are reported.[12] Since the authors were able to enroll 1996 incident report forms with 2537 incidents during the 6-month period, the presented approach was successful in obtaining sufficient data for investigation. The Thai AIMS provided prospective data collection allowing retrospective analysis of risk factors related to anesthesia incidents.

According to geographic distribution, the Thai AIMS could represent anesthetic incidents in the whole country. However, this did not include incidents that occurred in private hospitals. For demographic characteristics, the patients who experienced incidents were older than the average age of the Thai population and those of patients in registry of Thai Study[7,8]. In addition, 10 percentages of patients in the database were children less than 10 yrs old. Therefore, attending anesthesiologists and nurse anesthetists should be aware of incidents in both aging patients and children less than 10 yrs of age. Compared with gender ratio of female: male of 52.9%: 47.1% in THAI Study that represented patients undergoing surgery in Thailand, the gender ratio of female: male patients in the incident reports in Thai AIMS were 45%:55%. The more frequent adverse event that occurred in males was similar to previous studies[13-16]. The proportion of patients in Thai AIMS compared with the THAI Study[7] were higher in groups of ASA physical status III (23.7% vs. 10.7%), status IV (11.3% vs. 2.0%) and status V (7.2% vs. 0.2%) respectively because the present study was confined exclusively to patients who experienced incidents.

The five most common types of surgery or operative sites among 1996 incident reports were general (34.9%), orthopedic (13.7%), neurological (11.5%), obstetric & gynecological (11.2%), and otorhino-larygological surgery (5.4%), respectively.

Table 7. Factors minimizing the occurrence of adverse events (n = 1996)

	n (%)
Having experience	1194 (59.8)
Experienced assistant	681 (34.1)
Vigilance	1198 (60.0)
Adequate personnel	53 (2.7)
Good supervision	152 (7.6)
Effective communication	165 (8.3)
Training	65 (3.3)
Adequate equipment	149 (7.5)
Equipment maintenance	108 (5.4)
Equipment check up	122 (6.1)
Adequate monitoring equipment	187 (9.4)
Comply to guidelines	187 (9.4)

Data are expressed as number (%)

Table 8. Suggested corrective strategies (n = 1996)

	n (%)
Clinical practice guidelines	678 (34.0)
Additional training	447 (22.4)
More manpower	161 (8.1)
Improvement of supervision	598 (30.0)
Improvement of communication	160 (8.0)
More equipment	138 (7.0)
Equipment maintenance	109 (5.5)
Quality assurance activity	727 (36.4)
Good referral system	45 (2.3)

Compared to case load of anesthesia service in THAI Study[7], neurological, otorhino-laryngological, and cardiac posed a high risk to experience incidents. Critical incidents also occurred commonly in emergency conditions (37.8%). However, ambulatory or out-patient setting, which was considered as safe surgery, possibly experienced critical incidents with the percentage of two in the present study.

Among 1996 incident reports, common phases of anesthesia when critical incidents occurred were the induction phase (22.3%) and the maintenance phase (34.0%). The common locations where critical incidents occurred were the operating room (61.1%), ward (10.8%), and recovery room (9.4%). In the Australian Incident Monitoring Study, the common locations where incidents occurred were operating room (75%), induction room (10%), and recovery area (6%)[11]. The common performers of anesthesia to whom incidents occurred were anesthesiologists (67.5%), nurse anesthetists (79.6%), and anesthesia residents (24.3%), which were similar to the authors' previous study[8].

The two most common monitoring used in the present study were noninvasive blood pressure monitoring and pulse oximetry. Despite this, the use of electrocardiography, capnometry, and central venous pressure in the present study were more frequent than that in the previous THAI Study[8] (97.8% vs. 80.0%, 45.7% vs. 19.2%, and 11.6% vs. 4.7%, respectively). This could probably be due to a higher proportion of patients with higher ASA physical status who needed more intensive monitoring in this current study.

Anesthesia related complications occurred within 24 hr was particularly related to respiratory system such as oxygen desaturation, pulmonary aspiration, esophageal intubation, endobronchial intubation, re-intubation and difficult intubation etc. The five most common critical incidents that occurred in the present study that needed preventive strategies were arrhythmia requiring treatment (25.4%), oxygen desaturation (24.4%), death within 24 hr (20.0%), cardiac arrest (14.6%), and re-intubation (10.7%). Furthermore, the authors found that re-intubation and oxygen desaturation were the most frequent incidents in the postanesthesia care unit. Hence, compliance to guidelines might be considered as corrective strategy for these complications. After patients were discharged from the postanesthesia care unit, death within 24 hr was the most common complication reported to the data management unit. According to previous studies[17,18] the incidences of cardiac arrest within 24 hr in Thailand varied between 21 to 44 per 10000 anesthetics, while the previous THAI Study provided an incidence of death within 24 hr of 28 per 10000 anesthetics[19]. In this current study, the authors found 141 patients died and the incident occurred commonly during maintenance of anesthesia and 24 hr postoperative period. The finding was similar to the result from the authors' previous study[19].

Some incident report forms contained more than one incident. Therefore, 2537 incidents were reported in this first step of the present study before gathering each specific adverse event for reviewing in a further step. Among 2537 incidents, it was noteworthy to know that 31.7% of critical incidents could be detected by monitoring equipment, while 37.4% and 35.5% of incidents were clinically diagnosed before and after detection by monitoring, respectively. Among 1733 incidents; electrocardiography, pulse oximetry, and

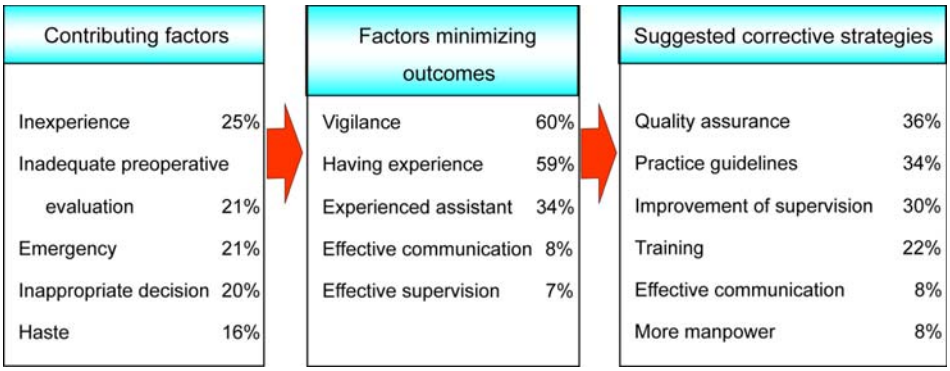

Fig. 3 Model of anesthesia related adverse events

capnometry firstly detected adverse events in 46.4%, 34.7%, and 4.3%, respectively.

For immediate outcome within 24 hrs, there were cardiac arrest (9.2%), death (26.1%), minor physiologic change (11.4%), and major physiologic changes such as respiratory problems (9.5%), cardiovascular problems (2.8%), and unplanned ICU admission (0.3%). However, about 40% of patients in the incident reports had complete recovery. For long-term outcome (within 7 days) after incidents, there were prolonged hospital stay (2.2%), vegetative state or brain death (0.5%), death (7.1%), and complete recovery (16.9%). Therefore, more than half of the patients who experienced incidents had a complete recovery while there were 33.2% of deaths within 7 days.

Among 1996 incident reports, inadequate preoperative evaluation and preparation (33.9%), inexperience (25.6%) emergency condition (21.1%), inappropriate decision (20.3%), and haste (16.5%) were common contributing factors of incident reports. Common factors minimizing the outcomes were having experience of incident (59.8%) experienced assistant (34.1%), adequate monitoring equipment (9.4%), clinical practice guidelines (9.4%), and effective communication (8.3%). Common suggested corrective strategies in viewpoint of attending anesthesiologists or nurse anesthetists and site managers were quality assurance activity (36.4%), practice guidelines (34.0%), improved supervision (30.0%), addition training (22.4%), and more labor (8.1%). Therefore, a model for prevention of anesthesia related adverse events is summarized in Fig. 3.

Conclusion

The Thai Anesthesia Incidents Monitoring Study (Thai AIMS) was the first national scale of incident reporting system in Thailand on the basis of voluntary and anonymity. Respiratory adverse events, cardiac arrest, and death within 24 hr were complications commonly reported. Model constructed from the present study revealed that quality assurance activity, clinical practice guidelines, improvement of supervision, addition training and increased number of personnel were suggested corrective strategies.

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การวิจัยสหสถาบันเพื่อศึกษาการเกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทยโครงการรายงานอุบัติการณ์ (THAI AIMS)

สมรัตน์ จารุลักษณานันท์, สุวรรณี สุรเศรณีวงศ์, ประสาทนีย์ จันทร, วิมลรัตน์ ศรีราช, ธวัช ชาญชญานนท์, สุรศักดิ์ ถนัดศีลธรรม, ชัยพฤกษ์ กุสุมาพรรณโญ, ธนารัตน์ สุรัตนสัญญา, สุรชาติ พจนสุภาวรรณ, ศิริลักษณ์ กล้าณรงค์, อักษร พูลนิติพร, ภูพิงค์ เอกะวิภาต, ยอดยิ่ง ปัญจสวัสดิ์วงศ์

วัตถุประสงค์: *โครงการวิจัยสหสถาบันเพื่อศึกษาการเกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทยโดยการรายงานอุบัติการณ์มีจุดประสงค์เพื่อวิเคราะห์ความถี่และการกระจายของการเกิดอุบัติการณ์ อาการทางคลินิก การจัดการเพื่อหาแบบจำลองที่เหมาะสมในการลดปัญหาหรือบรรเทาความเสียหายจากการเกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทย*

วิธีการศึกษา: *โรงพยาบาล 51 แห่ง (ประกอบด้วย โรงเรียนแพทย์ โรงพยาบาลของกองทัพ โรงพยาบาลศูนย์ โรงพยาบาลทั่วไปและโรงพยาบาลชุมชน) ร่วมในโครงการโดยการกรอกข้อมูลซึ่งมีทั้งคำถามปลายปิดและปลายเปิดพร้อมข้อมูลทางวิสัญญี ศัลยกรรมและการเกิดอุบัติการณ์ ซึ่งได้รับการทบทวนโดยผู้เชี่ยวชาญ 3 คน ทำการรวบรวมข้อมูลช่วงระยะเวลา 6 เดือน (1 มกราคม 2550 – 30 มิถุนายน 2550)*

ผลการศึกษา: *จากรายงานอุบัติการณ์ 1996 ฉบับ และจำนวนอุบัติการณ์ในขั้นต้น 2537 อุบัติการณ์ พบว่า รายงานอุบัติการณ์เป็นของเพศชาย (55%) มากกว่าเพศหญิง (44%) ซึ่งมี ASA PS 1,2,3,4 และ 5 เท่ากับ 22%, 36%, 24%, 11% และ 7% ตามลำดับ พบว่าผู้ป่วยสาขาศัลยกรรมประสาท, หูคอจมูก, ศัลยศาสตร์ระบบปัสสาวะ และศัลยกรรมหัวใจหลอดเลือด มีโอกาสเสี่ยงค่อนข้างสูงในการเกิดอุบัติการณ์ในขณะที่ 61% ของรายงานอุบัติการณ์เกิดในห้องผ่าตัด, 10% เกิดที่ตึกผู้ป่วย และ 9% เกิดที่ห้องพักฟื้น อุบัติการณ์ภาวะแทรกซ้อนที่พบบ่อย ได้แก่ หัวใจเต้นผิดปกติ (25%), ความอิ่มตัวของออกซิเจนต่ำ (24%), เสียชีวิตภายใน 24 ชั่วโมง (20%), ภาวะหัวใจหยุดเต้น (14%), ใส่ท่อหายใจซ้ำ (10%), ใส่ท่อหายใจยาก (8%), ใส่ท่อหายใจเข้าหลอดอาหาร (5%), ความผิดปกติของเครื่องมือ (5%) และความผิดพลาดที่เกี่ยวกับการให้ยา (4%) ฯลฯ เครื่องเฝ้าระวังที่ช่วยวินิจฉัย การเกิดอุบัติการณ์ ได้แก่ เครื่องตรวจคลื่นไฟฟ้าหัวใจ (46%), เครื่องวัดระดับความอิ่มตัวของออกซิเจน (34%), เครื่องวัดความดันอัตโนมัติ (12%), เครื่องวัดระดับคาร์บอนไดออกไซด์ในลมหายใจออก (4%) และการวัดความดัน หลอดเลือดแดงโดยตรง (1%)*

สรุปและข้อเสนอแนะ: *ปัจจัยที่เกี่ยวข้องกับการเกิดอุบัติการณ์ที่พบบ่อย ได้แก่ ขาดประสบการณ์, ขาดความระแวดระวัง, การประเมินก่อนให้ยาระงับความรู้สึกไม่เพียงพอ, การตัดสินใจผิดพลาด, ภาวะฉุกเฉิน, ความรีบร้อน ขาดการให้คำปรึกษาหรือไม่เพียงพอ และปัญหาเกี่ยวกับการสื่อสารภายในองค์กร กลยุทธ์แนะนำ ได้แก่ กิจกรรมพัฒนาคุณภาพ การใช้แนวทางเวชปฏิบัติ ปรับปรุงระบบให้คำปรึกษาการฝึกอบรมเพิ่มเติม ปรับปรุงการสื่อสารและการเพิ่มบุคลากร*