The Thai Anesthesia Incident Monitoring Study (Thai AIMS) of Oxygen Desaturation in the Post-Anesthetic Care Unit

Thanoo Hintong MD*, Sireeluck Klanarong MD**,
Sirilak Suksompong MD***, Waraporn Chua-in MD****,
Sunisa Chatmongkolchat MD*****, Thewarug Werawatganon MD******

** Department of Anesthesiology, Chiang Mai University, Chiang Mai*
*** Department of Anesthesiology, Buddhachinaraj Regional Hospital, Phitsanulok*
**** Department of Anesthesiology, Siriraj Hospital, Mahidol University, Bangkok*
***** Department of Anesthesiology, Srinakarind Hospital, Khon Kaen University, Khon Kaen*
****** Department of Anesthesiology, Songklanagarind Hospital, Prince of Songkla University, Songkhla*
******* Department of Anesthesiology, Chulalongkorn University, Bangkok*

Objective: *As part of the Thai Anesthesia Incident Monitoring Study (Thai AIMS), the present study was aimed to analyze the problems of oxygen desaturation in the post-anesthetic care unit in Thailand including clinical course, outcomes, contributing factors, and preventive strategies.*

Material and Method: *The authors prospectively collected incident reports of oxygen desaturation in the post-anesthetic care unit between January and June 2007 from 51 studied hospitals across Thailand. Clinical characteristics, outcomes, and contributing factors were recorded. All data were analyzed to identify contributing factors and preventive strategies.*

Results: *Eighty-six of post-anesthetic oxygen desaturation incidents were reported. Forty-six cases (53.5%) were diagnosed by pulse oximetry. Forty-eight cases (55.8%) were immediately detected within a minute upon arrival at the PACU. Thirty-one cases (36%) were caused by inadequate awakening. Eighty-two cases (95.3%) were anesthesia-related and preventable. The major clinical outcomes were re-intubation (51 cases; 59.3%), prolonged artificial ventilation (23 cases; 26.7%), unplanned ICU admission (16 cases; 18.6%), and prolonged hospital stay (3 cases; 3.5%). Sixty-three patients (73.3%) recovered completely within 24 hours but one died. Judgment error and lack of adequate patient evaluation were the two most common contributing factors that were minimized by high awareness and prior experience. Main strategies suggested to prevent the incidents included the development of specific guideline and quality assurance. These incidents did not effectively decrease when labor was increased.*

Conclusion: *Post-anesthetic oxygen desaturation was frequently found during the transport period. It can cause morbidity and mortality. Anesthesia providers should be aware of these potential incidents and strictly follow guidelines.*

Keywords: *Anesthesia, Oxygen desaturation, Hypoxia, Pulse oximetry, Post-Anesthetic, Incident report.*

J Med Assoc Thai 2008; 91 (10): 1531-8
Full text. e-Journal: *http://www.medassocthai.org/journal*

Oxygen desaturation in post-anesthetic period is one of the major complications in the post-anesthetic care unit (PACU). Many studies[1-6] have demonstrated a high incidence of oxygen desaturation (SpO_2 < 90%) which varied from 27.0% to 83.3%. Pulse oximetry has been confirmed to detect hypoxemia and related events during perioperative period[7-9] and has been used to determine the need for oxygen supplementation[10-12]. Several studies[2,6,13] have recommended the use of oxygen supplementation to patients in the

Correspondence to: Hintong T, Department of Anesthesiology, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand. Phone: 053-945-522, Fax: 053-945-526, E-mail: thintong@mail.med.cmu.ac.th

immediate post-anesthetic period, including during transport to the PACU. However, an episode of significant oxygen desaturation still occurred despite a routine administration of oxygen[14,15]. The development of oxygen desaturation in post-anesthetic period may be involved by many factors including surgical, patient and anesthesia related factors.

In addition to identify the mentioned involving factors, the present study was also aimed to determine the clinical courses, outcomes, contributing factors, factor minimizing incidence of oxygen desaturation in the PACU as well as the suggested corrective strategies.

Material and Method

The present prospective multi-centered study, a part of the Thai Anesthesia Incident Monitoring Study (Thai AIMS), was conducted by the Royal College of Anesthesiologists of Thailand between January and June 2007. Fifty-one hospitals ranging from primary to tertiary hospitals across Thailand were voluntarily included in the present study.

After being approved by each institutional ethical committee, the specific anesthesia related adverse events detected during anesthesia and until 24 hours after the operation were registered in the data entry form. 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 arrhythmias requiring treatment. Oxygen desaturation in the present study was defined as SpO_2 below 90% for more than 3 minutes or once below 85% detected by pulse oximetry. The registered data of oxygen desaturation in patients who underwent cardiac or thoracic surgery were excluded. Only oxygen desaturation events occurred in the PACU were enrolled in the present study. All the details of study methodology and preliminary results were reported[16,17].

The descriptive statistics were applied to analyze the data by using SPSS f or Windows, version 12.

Results

After excluding oxygen desaturation associated with cardiothoracic surgery, 445 desaturation incidents occurred during anesthesia and until 24 hours after the operation. Only 86 cases (19.3%) of all desaturation incidents occurred in the PACU. Characteristics of the patients including gender, age, body mass index, ASA physical status, emergency state, type of surgery, anesthetic technique, and duration of anesthesia are summarized in Table 1.

Anesthesia procedures were administered by anesthesiologists in only 51 cases (59.3%), the other

Table 1. Patient characteristics, type of surgery and anesthetic technique in relation to number and percentage of incidents (n = 86)

Characteristics	Number of incidents (%)
Gender:	
Male	40 (46.5%)
Female	46 (53.5%)
Age range (years):	
< 5	7 (8.1%)
5-9	5 (5.8%)
10-19	10 (11.6%)
20-54	37 (43.0%)
55-65	11 (12.8%)
> 65	16 (18.6%)
Body mass index:	
< 25	61 (70.9%)
25-25.9	21 (24.4%)
≥ 30	4 (4.7%)
ASA physical status:	
ASA 1-2	63 (73.3%)
ASA 3-4	23 (26.7%)
ASA 5	0
Emergency state:	
Emergency case	22 (25.6%)
Elective case	64 (74.4%)
Type of surgery:	
Intra-abdominal	35 (40.7%)
Intra-oral/airway	19 (22.1%)
Orthopedic under general anesthesia	17 (19.8%)
Urological surgery	4 (4.7%)
Laparoscopic	3 (3.5%)
Ophthalmic	3 (3.5%)
Neurosurgery	2 (2.3%)
Orthopedic under spinal anesthesia	1 (1.2%)
Others	2 (2.3%)
Anesthetic technique:	
General	84 (97.7%)
Spinal	2 (2.3%)
Duration of anesthesia:	
< 30 minutes	11 (12.8%)
31-91 minutes	38 (44.2%)
91-150 minutes	20 (23.3%)
> 150 minutes	17 (19.8%)

35 cases (40.7%) were provided by nurse anesthetists. The experienced years of anesthesia providers varied from 1 to 33 years (mean 6.6 $\pm$ 7.2 years). The major clinical outcomes of oxygen desaturation in the PACU were re-insertion of endotracheal tube (51 cases or 59.3%), prolonged artificial ventilation (23 cases or 26.7%), unplanned ICU admission (16 cases or 18.6%), and prolonged hospital stay (3 cases or 3.5%). Sixty-three patients (73.3%) recovered completely within 24 hours. One case developed cardiac arrest in the PACU with death afterward.

Forty-six cases (53.5%) were diagnosed by pulse oximetry, the other 40 cases (46.5%) were detected by the clinical sign of central cyanosis. Most of events (48 cases or 55.8%) were immediately detected within a minute upon their arrival at the PACU. The causes of immediate hypoxia were inadequate awakening (31 cases or 36.0%), upper airway problems (10 cases), residual neuromuscular blockage (3 cases), lower airway problem (1 case) and others (3 cases). Only four cases (4.7%) had onset time after 30 minutes. Table 2 summarizes the onset time of oxygen desaturation in the PACU. The possible causes of this immediate oxygen desaturation are also described in Table 3.

Table 2 The onset time of oxygen desaturation in the PACU (n = 86)

Onset time (minutes)	Number of cases (%)
$\leq$ 1 (immediately)	48 (55.8%)
2-5	12 (13.9%)
6-15	13 (15.1%)
16-30	9 (10.5%)
> 30	4 (4.7%)
Total	86 (100.0%)

Table 3. Possible causes of immediate oxygen desaturation occurred within a minute after admission in the PACU (n = 48)

Possible causes	Number of cases (%)
Inadequate awakening	31 (64.6%)
Upper airway problems	10 (20.8%)
Residual neuromuscular blockage	3 (6.3%)
Lower airway problem	1 (2.1%)
Others	3 (6.3%)
Total	48 (100.0%)

Anesthesia factor was found to be the most involving cause of oxygen desaturation in the PACU. It was composed of 82 cases or 95.3%. Fifty cases of these were solely caused by anesthesia factor. The surgical and / or patient factors were also contributed to anesthesia factor in another 39 cases. The involving factors and their details are summarized in Table 4.

Most of the oxygen desaturation events in the PACU (80 cases or 93.0%) were preventable whereas the rest were not. All these preventable cases were caused by human error such as skill-based, rule-based, and/ or knowledge-based error. Each case was associated with one to three types of human error. Knowledge-based, rule-based, and skill-based errors were involved in 75, 42, and 31 cases respectively. System error was also combined to human error in five cases. Table 5 summarizes the risk factors contributed to the cause of incidents and the lists of factors suggested to minimize the incident in each case. One to several factors was/ were reported to involve. Error

Table 4. Involving factors relating to oxygen desaturation (n = 86)

Involving factors	Number of incidents (%)*
Involving factors (n = 86):	
Anesthesia only	50 (58.1%)
Surgical only	3 (3.5%)
Patient only	1 (1.2%)
Combined anesthesia and surgical	7 (8.1%)
Combined anesthesia and patient	22 (25.6%)
Combined anesthesia, surgical and patient	3 (3.5%)
Anesthesia factor (82 cases or 95.3% involved):	
Too early extubation	42 (48.8%)
Over sedation	14 (16.3%)
Airway obstruction	11 (12.8%)
Volume overload	6 (6.9%)
Airway equipment	4 (4.7%)
Others	5 (5.8%)
Surgical factor (13 cases or 15.1% involved):	
Airway surgery	6 (6.9%)
Intra-oral surgery	5 (5.8%)
Improper chest drain	1 (1.2%)
Too tight chest bandage	1 (1.2%)
Patient factor (26 cases or 30.2% involved):	
Extreme age	11 (12.8%)
Airway problems	6 (6.9%)
Lung diseases	4 (4.6%)
Cardiovascular problems	3 (3.5%)
Metabolic and electrolyte disturbance	2 (2.4%)

* Not mutually exclusive

Table 5. Contributing factors and factors minimizing the incidents (n = 86)

Contributing factors*		Factors minimizing incidents*	
Categories of error	Number (%)	Categories of error	Number (%)
Skill-based:		Skill-based:	
Haste	31 (36.0%)	High awareness	81 (94.2%)
Rule-based:		Rule-based:	
Lack of adequate patient evaluation	42 (48.8%)	Guideline practice	9 (10.5%)
Poor preoperative preparation	3 (3.5%)		
Knowledge-based:		Knowledge-based:	
Inexperience	38 (44.2%)	Prior experience	51 (59.3%)
Lack of knowledge	19 (22.1%)	Additional training	2 (2.3%)
Error of judgement	65 (75.5%)		
System-based:		System-based:	
Communication problem	4 (4.7%)	Skilled assistant	34 (39.5%)
Inadequate staff	1 (1.2%)	Improved communication	4 (4.7%)
Inadequate equipment	1 (1.2%)	Improved supervision	8 (9.3%)
		Additional equipment	1 (1.2%)
Total	204	Total	190

* Not mutually exclusive

of judgment (65/204 or 32.0%) and lack of adequate patient evaluation prior to transfer from the operating room to the PACU (42/204 or 20.7%) were two most common contributing factors that were minimized by high awareness (81/190 or 42.6%) and prior experience (51/190 or 26.8%).

Preventive strategies were suggested and summarized in Table 6. Specific guideline development (64/210 or 30.5%) and quality assurance activity (60/210 or 28.6%) were two most suggested strategies for prevention of oxygen desaturation in the PACU, whereas the incidents did not effectively decrease by increasing labor.

Table 6. Suggested strategies for prevention of oxygen desaturation in the PACU (n = 86)

Suggested preventive strategies	Frequency (%)*
Rule-based:	
Specific guideline development	64 (74.4%)
Knowledge-based:	
Quality assurance activity	60 (69.7%)
Additional training	30 (34.9%)
System-based:	
Improved supervision	52 (60.5%)
Improved communication	3 (3.5%)
More manpower	1 (1.2%)
Total	210

* Not mutually exclusive

Discussion

From the previous THAI Study[18], oxygen desaturation during anesthesia and 24 hours after the operation was found to be the most common adverse event related to anesthesia with its incidence of 31.9: 10,000. The percentage of this event in the PACU in the THAI Study was 18.3%[19]. This proportion is comparable to 19.3% in the present study (Thai AIMS).

Over half of the patients (48/86 or 55.8%) in the present study developed oxygen desaturation immediately on their arrival at the PACU. This frequency is higher than those reported in several studies[1,2,4,5] but closed to the incidence reported in the study of Moller et al[3]. Pullerits et al[2] has demonstrated the pattern of arterial desaturation in healthy children during transport to the PACU. They found that the average arterial saturation values were significantly lower than the preoperative value from the one-minute point during the transport period. The authors finding also confirms that the risk of oxygen desaturation occurred within 30 minutes after arrival in the PACU and the evidence is obvious especially in the first minute (Table 2). Therefore, the most important critical period of high risk is the time between transport from the operating room to the PACU. Though the use of oxygen supplementation during transport and recovery was not 100% effective in preventing episodic oxygen

desaturation in a few studies[3,15], several studies still supported its benefit after general anesthesia[5,6], particularly in children[2], old age or obese patients[20,21]. From the details of events reported in the present study, the two most common causes of immediate post-anesthetic oxygen desaturation were inadequate awakening (31 out of 48 cases or 64.6%) and upper airway problems (10 out of 48 cases or 20.8%) respectively. Residual relaxation, lower airway problem, and airway equipment problems were less common. Types of surgery also play an important role in developing of desaturation. In the present study, the authors found a high frequency of the incidents in intra-abdominal, intra-oral/airway and orthopedic surgery that were performed under general anesthesia. Undoubtedly, respiratory function can deteriorate in both intra-abdominal and intra-oral/airway surgery. In addition, anesthetic technique also influences the incident. It has been widely accepted that general anesthesia has a more potential effect on the occurrence of perioperative oxygen desaturation when compared with spinal anesthesia[19,22,23]. This effect can also be demonstrated in the present study and its possible reasons are multifactorial including impaired respiratory function after general anesthesia, cardio-respiratory depression effects of anesthetic and sedative agents, diffusion hypoxia after N_2O administration or residual muscle relaxation. Only 2 cases or 2.3% of all incidents underwent spinal anesthesia. One case underwent cesarean delivery and developed hypervolemic pulmonary edema in the PACU, the other case with underlying renal insufficiency received heavy sedation resulting in hypoventilation and hypoxemia. The experience years of anesthesia providers, not only anesthesiologists but also nurse anesthetists, varied from 1 to 33 years and were not related to the frequency of oxygen desaturation in the present study. Factors other than experience such as haste, error of judgment, rule-based or system-based error, patient, and surgical factors may be contributing factors. The authors have not analyzed to find the potential risk factors of perioperative oxygen desaturation in the present study. However, the risk factors including ASA class 3-5, age < 10 or > 60 years, preoperative upper airway obstruction, preoperative upper and lower respiratory tract infection, history of asthma, preoperative difficult airway, intra-oral surgery, intra-thoracic surgery, general anesthesia and anesthesia duration of more than 30 minutes have been analyzed by the THAI Study[19,23]and supposed to be other significant risk factors. Therefore, anesthesia providers and post-anesthetic care staff should be aware of any potential risks of desaturation especially in these mentioned situations.

The main involving factors contributed to oxygen desaturation in the PACU in the present study were anesthesia related (82 out of 86 cases or 95.3%). Patient- and surgical- related factors were also involved but less common. Combinations of two or more involving factors were found in 32 cases or 37.2%. All of these anesthesia-related incidents were preventable and related to human error (skill-based, rule-based, knowledge-based) and/or system error. The authors found in the present study that human error was much more common than system error. More than one contributing factors were involved in nearly all of the cases. The two most common contributing factors in the present study were error of judgment and lack of adequate patient evaluation prior to transport from the operating room. Inexperience and haste were also common. Human error was found to be the main causes (83.0%) of overall adverse events reported in the Australian Incident Monitoring Study (AIMS)[24,25], which was comparable to the present study. In summary, the authors found that knowledge-based error was thought to have a potential impact on 60.1% of all contributing factors. Though risk factors of oxygen desaturation have been analyzed in several reports of the THAI Study[19,23,26] for a few years, the incidents still occur. Therefore, all anesthesia providers should fully realize the potential risk of oxygen desaturation throughout the anesthesia phase.

In the present study, the common factors for minimization of incidents were high awareness (81 cases or 94.2%), prior experience (51 cases or 59.3%), and skilled assistant (34 cases or 39.5%). Many studies have been designed in order to reduce or prevent the incidence of post-anesthetic oxygen desaturation[1,2,4-6,13,21]. Chripko et al[1] demonstrated the significant reduction of post-anesthetic desaturation in pediatric outpatients if they met the criteria of "readiness for transport" from the operating room to the PACU. This criteria included 100% oxygen administration until SpO_2 > 98.0%, end tidal CO_2 < 45 mmHg and end-tidal N_2O < 10%. Pullerits et al[2] found that oxygen saturation in healthy children were significantly lower than preoperative value after a minute during the transport period and recommended to provide oxygen to these patients. Canet et al[4] demonstrated that administration of 35% oxygen for the first ten minutes in the PACU relieved oxygen desaturation. In addition, four studies[5,6,13,21] recommended oxygen administration during transport.

Detection of oxygen desaturation during transport to the PACU may be difficult. Several studies[7-10] have demonstrated the benefit of pulse oximetry for early detection of perioperative oxygen desaturation and related events though the monitor may fail to read accurately because of motion artifact in some patients.

In the present study, specific guideline development, quality assurance activity and improved supervision were the most frequent three recommendations for prevention of oxygen desaturation in the PACU. Additional training was also helpful especially in the new trainees. Interestingly, the incidents did not effectively decrease by increasing labor.

Conclusion

In conclusion, oxygen desaturation in the PACU was frequently found during the transport from the operating room to the first minute upon arrival at the PACU. It can cause related adverse events and change anesthetic outcomes. Human error plays an important role in development of this incident. Judgment error is the most common contributing factor and high awareness is recommended to minimize this incident. Oxygen supplementation and continuous oxygen saturation monitoring during transport from the operating room to the post-anesthetic care unit should be practiced in all patients with high-risk conditions.

Acknowledgements

The study was part of the Thai Anesthesia Incident Monitoring Study (Thai AIMS) of anesthetic adverse outcomes, which was financially supported by the Royal College of Anesthesiologists of Thailand and National Research Council. The authors wish to thank the following persons, Professor Pyatat Tatsanavivat, Khon Kaen University, head of Clinical Research Collaborative Network (CRCN) (for academic support), Mr. Wasan Punyasang and Mr. Nirun Intarut (for data management and analysis). We also wish to thank all attending anesthesiologists and nurse anesthetists together with the heads of all 51 departments of Anesthesia that participated in this study.

References

1. Chripko D, Bevan JC, Archer DP, Bherer N. Decreases in arterial oxygen saturation in paediatric outpatients during transfer to the postanaesthetic recovery room. Can J Anaesth 1989; 36: 128-32.
2. Pullerits J, Burrows FA, Roy WL. Arterial desaturation in healthy children during transfer to the recovery room. Can J Anaesth 1987; 34: 470-3.
3. Moller JT, Wittrup M, Johansen SH. Hypoxemia in the postanesthesia care unit: an observer study. Anesthesiology 1990; 73: 890-5.
4. Canet J, Ricos M, Vidal F. Early postoperative arterial oxygen desaturation. Determining factors and response to oxygen therapy. Anesth Analg 1989; 69: 207-12.
5. Tyler IL, Tantisira B, Winter PM, Motoyama EK. Continuous monitoring of arterial oxygen saturation with pulse oximetry during transfer to the recovery room. Anesth Analg 1985; 64: 1108-12.
6. Meiklejohn BH, Smith G, Elling AE, Hindocha N. Arterial oxygen desaturation during postoperative transportation: the influence of operation site. Anaesthesia 1987; 42: 1313-5.
7. Moller JT, Johannessen NW, Espersen K, Ravlo O, Pedersen BD, Jensen PF, et al. Randomized evaluation of pulse oximetry in 20,802 patients: II. Perioperative events and postoperative complications. Anesthesiology 1993; 78: 445-53.
8. Pedersen T, Moller AM, Pedersen BD. Pulse oximetry for perioperative monitoring: systematic review of randomized, controlled trials. Anesth Analg 2003; 96: 426-31.
9. Pedersen T, Dyrlund PB, Moller AM. Pulse oximetry for perioperative monitoring. Cochrane Database Syst Rev 2003; 3: CD002013.
10. McKenzie AJ. Perioperative hypoxaemia detected by intermittent pulse oximetry. Anaesth Intensive Care 1989; 17: 412-7.
11. DiBenedetto RJ, Graves SA, Gravenstein N, Konicek C. Pulse oximetry monitoring can change routine oxygen supplementation practices in the post-anesthesia care unit. Anesth Analg 1994; 78: 365-8.
12. Gift AG, Stanik J, Karpenick J, Whitmore K, Bolgiano CS. Oxygen saturation in postoperative patients at low risk for hypoxemia: is oxygen therapy needed? Anesth Analg 1995; 80: 368-72.
13. Smith DC, Crul JF. Early postoperative hypoxia during transport. Br J Anaesth 1988; 61: 625-7.
14. Russell GB, Graybeal JM. Hypoxemic episodes of patients in a postanesthesia care unit. Chest 1993; 104: 899-903.
15. Scuderi PE, Mims GR III, Weeks DB, Harris LC, Lipscomb L, James RL. Oxygen administration during transport and recovery after outpatient surgery does not prevent episodic arterial desaturation. J Clin Anesth 1996; 8: 294-300.
16. Punjasawadwong Y, Suraseranivongse S,

Charuluxananan S, Jantorn P, Thienthong S, Chanchayanon T, et al. Multicentered study of model of anesthesia related adverse events in Thailand by incident report (the Thai Anesthesia Incident Monitoring Study): methodology. J Med Assoc Thai 2007; 90: 2529-37.
17. Charuluxananan S, Suraseranivongse S, Jantorn P, Sriraj W, Chanchayanon T, Tanudsintum S, Kusumaphanyo C, et al. Multicentered study of model of anesthesia related adverse events in Thailand by incident report (The Thai Anesthesia Incidents Monitoring Study): Results. J Med Assoc Thai 2008; 91: 1011-9.
18. Charuluxananan S, Punjasawadwong Y, Suraseranivongse S, Srisawasdi S, Kyokong O, Chinachoti T, et al. The Thai Anesthesia Incidents Study (THAI Study) of anesthetic outcomes: II. Anesthetic profiles and adverse events. J Med Assoc Thai 2005; 88(Suppl 7): S14-29.
19. Punjasawadwong Y, Chinachoti T, Charuluxananan S, Pulnitiporn A, Klanarong S, Chau-in W, et al. The Thai Anesthesia Incidents Study (THAI Study) of oxygen desaturation. J Med Assoc Thai 2005; 88(Suppl 7): S41-53.
20. Daley MD, Norman PH, Colmenares ME, Sandler AN. Hypoxaemia in adults in the post-anaesthesia care unit. Can J Anaesth 1991; 38: 740-6.
21. Mathes DD, Conaway MR, Ross WT. Ambulatory surgery: room air versus nasal cannula oxygen during transport after general anesthesia. Anesth Analg 2001; 93: 917-21.
22. Brown AG, Visram AR, Jones RD, Irwin MG, Bacon-Shone J. Preoperative and postoperative oxygen saturation in the elderly following spinal or general anaesthesia - an audit of current practice. Anaesth Intensive Care 1994; 22: 150-4.
23. Charuluxananan S, Suraseranivongse S, Punjasawadwong Y, Somboonviboon W, Sriswasdi S, Pranootnarabhal T, et al. Risk factors of intraoperative oxygen desaturation: a case-control study of 152,314 anesthetics. J Med Assoc Thai 2007; 90: 2359-65.
24. Williamson JA, Webb RK, Sellen A, Runciman WB, Van der Walt JH. The Australian Incident Monitoring Study. Human failure: an analysis of 2000 incident reports. Anaesth Intensive Care 1993; 21: 678-83.
25. Webb RK, Currie M, Morgan CA, Williamson JA, Mackay P, Russell WJ, et al. The Australian Incident Monitoring Study: an analysis of 2000 incident reports. Anaesth Intensive Care 1993; 21: 520-8.
26. Bunchungmongkol N, Somboonviboon W, Suraseranivongse S, Vasinanukorn M, Chau-in W, Hintong T. Pediatric anesthesia adverse events: the Thai Anesthesia Incidents Study (THAI Study) database of 25,098 cases. J Med Assoc Thai 2007; 90: 2072-9.

การศึกษาการเกิดภาวะความอิ่มตัวของออกซิเจนต่ำจากการให้ยาระงับความรู้สึกในห้องพักฟื้นในประเทศไทย โดยการรายงานอุบัติการณ์

ธนู หินทอง, ศิริลักษณ์ กล้าณรงค์, ศิริลักษณ์ สุขสมปอง, วราภรณ์ เชื้ออินทร์, สุนิสา ฉัตรมงคลชาติ, เทวารักษ์ วีระวัฒกานนท์

***ที่มาและเหตุผล**: การศึกษานี้เป็นส่วนหนึ่งของโครงการเฝ้าระวังภาวะแทรกซ้อนทางวิสัญญีในประเทศไทยโดยการรายงานอุบัติการณ์มีจุดประสงค์เพื่อวิเคราะห์ปัญหาการเกิดภาวะความอิ่มตัวของออกซิเจนต่ำจากการให้ยาระงับความรู้สึกในห้องพักฟื้นในประเทศไทย ในด้านลักษณะของปัญหา ปัจจัยเสี่ยง และการป้องกันเชิงระบบ*

***วิธีการศึกษา**: เป็นการศึกษาเชิงพรรณนาชนิดไปข้างหน้า แบบรายงานอุบัติการณ์ในผู้ป่วยที่ได้รับยาระงับความรู้สึกในโรงพยาบาล 51 แห่งในประเทศไทย ช่วงตั้งแต่เดือนมกราคมถึงมิถุนายน พ.ศ. 2550 และนำอุบัติการณ์ของการเกิดภาวะความอิ่มตัวของออกซิเจนต่ำ ที่เกิดขึ้นในห้องพักฟื้นมาศึกษาปัจจัยเกี่ยวข้อง และหาแนวทางป้องกัน*

***ผลการศึกษา**: พบภาวะความอิ่มตัวของออกซิเจนต่ำในห้องพักฟื้นจำนวน 86 อุบัติการณ์ คิดเป็นร้อยละ 19.3 ของอุบัติการณ์ภาวะความอิ่มตัวของออกซิเจนต่ำทั้งหมด 46 ราย (ร้อยละ 53.5) สามารถวินิจฉัยโดย pulse oximetry ส่วนใหญ่ 48 ราย (ร้อยละ 55.8) เกิดขึ้นในระหว่างย้ายผู้ป่วยมาที่ห้องพักฟื้น โดย 35 ราย (ร้อยละ 36) เกิดจากผู้ป่วยยังฟื้นไม่เต็มที่ 82 ราย (ร้อยละ 95.3) มีสาเหตุเกี่ยวข้องกับวิสัญญีและสามารถป้องกันได้ ผลที่เกิดขึ้น ได้แก่ 51 ราย (ร้อยละ 59.3) ต้องได้รับการใส่ท่อหลอดลมใหม่ 23 ราย (ร้อยละ 26.7) ต้องใช้เครื่องช่วยหายใจเป็นเวลานาน 16 ราย (ร้อยละ 18.6) ต้องนอนในหออภิบาลผู้ป่วยวิกฤติ 63 ราย (ร้อยละ 73.3) สามารถกลับมาสู่ภาวะปกติ ภายใน 24 ชั่วโมง แต่มี 1 รายที่เสียชีวิต ปัจจัยสำคัญที่ทำให้เกิดภาวะความอิ่มตัวของออกซิเจนต่ำในห้องพักฟื้น ได้แก่ การตัดสินใจไม่เหมาะสม และขาดการประเมินผู้ป่วยอย่างเพียงพอ การให้ความระมัดระวังและประสบการณ์จะช่วยลดปัญหาได้ นอกจากนี้การปฏิบัติตามแนวทางที่กำหนดร่วมกับกระบวนการคุณภาพจะช่วยป้องกันอุบัติการณ์ได้ โดยไม่พบว่าการเพิ่มจำนวนบุคลากรจะลดอุบัติการณ์ เกิดภาวะแทรกซ้อนนี้ได้*

***สรุป**: ภาวะความอิ่มตัวของออกซิเจนต่ำในห้องพักฟื้น ส่วนใหญ่เกิดขึ้นในระหว่างย้ายผู้ป่วยมาที่ห้องพักฟื้น ภาวะดังกล่าวอาจเป็นสาเหตุของภาวะแทรกซ้อนหรือการตาย ดังนั้น จึงควรให้ความระมัดระวัง และปฏิบัติตามแนวทางเวชปฏิบัติอย่างเคร่งครัด*