Perioperative and Anesthetic Adverse Events in Thailand (PAAd THAI) Incident Reporting Study: Perioperative Oxygen Desaturation
Pathomporn Pin-on¹, Krit Panjasawatwong¹, Anantachote Vimuktanandana², Wimonrat Sriraj³, Chuthamat Somchat⁴, and Dujduen Sriramatr⁵

**Background:** The occurrence of hypoxemia in patients undergoing anesthesia is extremely varied. The objective of this study was to report the incidence, explore the causes, and report the outcomes of oxygen desaturation in a large surgical population.

**Methods:** We performed a retrospective study using electronically extracted anesthetic records obtained from 22 academic medical centers across Thailand. All surgical patients under anesthesia during a one-year period were included in the analysis. Hypoxemia was defined as oxygen saturation < 90% for 3 minutes. Any episode of oxygen saturation ≤ 85% was defined as severe hypoxemia. The contributory factors, the factors minimizing incidence and suggested corrective strategies were examined.

**Results:** There were 2,000 incident cases from all centers. Four hundred sixteen of these patients developed oxygen desaturation. The incidence of oxygen desaturation among all incident cases was 0.2. 50.2% of these patients experienced the episode of severe hypoxia. Oxygen desaturation occurred during the intubation period 26.7%. Upper airway obstruction was the leading cause of oxygen desaturation in the induction, intubation, and recovery periods. Circulatory failure concomitant with oxygen desaturation was found mainly during the maintenance period and at the ward. Haste, lack of knowledge, and inadequate patient preparation were considered as major contributory factors. Improved communication skill and more manpower were the most frequently suggested corrective strategies.

**Conclusion:** Hypoxemia is common during the perioperative period despite the widespread availability of oxygen saturation monitors. This study highlighted strategies that will help to reduce the clinical impact of oxygen desaturation. These strategies are improving communication skill and providing adequate manpower. (Funded by the Faculty of Medicine, Chiang Mai University.)

**Citation:** Pathomporn Pin-on, Krit Panjasawatwong, Anantachote Vimuktanandana, Wimonrat Sriraj, Chuthamat Somchat, Dujduen Sriramatr. Perioperative and Anesthetic Adverse Events in Thailand (PAAd THAI) Incident Reporting Study: Perioperative Oxygen Desaturation. *J Anesth Perioper Med* 2018;5:101-13. doi: 10.24015/JAPM.2018.0051
Oxygen desaturation is one of the most common "Perioperative Adverse Respiratory Events". It is considered a life-threatening condition if left untreated. The incidence reported by previous studies varies from 0.3% to 53% (1-4). Oxygen saturation can be measured by a pulse oximetry, a non-invasive, standard monitor used in all patients during anesthesia service. Normal pulse oximeter readings (SpO2) range from 95% to 100%. This range represents the normal oxygen partial pressure in arterial blood (PaO2) approximately 85 mmHg and above. Oxygen desaturation is defined as a pulse oximetry reading less than 90% (1, 2). When the value falls below 85%, it is referred to as severe desaturation (3, 4). PaO2 can also be measured from arterial blood gas analysis, which requires invasive arterial catheter insertion. A PaO2 level of 60 mmHg and below is called "hypoxemia" (1-4). The early detection of oxygen desaturation is a crucial warning sign indicating the potential subsequent progression to tissue hypoxia and functional organ damage in the patient. Therefore, prevention of severe oxygen desaturation and prompt treatment if it does occur are necessary.

We conducted this study as a part of the Perioperative and Anesthetic Adverse Events in Thailand (PAAd THAI) incident reporting study. Perioperative oxygen desaturation has been identified as a specific complication, a complication which needs clarification in terms of cause, severity, risk over time, and outcome. To comply with the quality assurance plan and anesthesia patient safety improvement, the contributory factors, factors minimizing the incidence and suggested corrective strategies are also reported.

METHODS

The study was multicenter and was of a retrospective nature. The data being collected from 22 hospitals across Thailand, during the period 1 January to 31 December 2015. Of the participating hospitals, 8 were university, academic service-directed institutions. The other 14 centers were community service-based hospital. The exclusion criterion was the medical records that deficient of important information to be analyzed. The Ethical Review Board approved the study protocol. An incident report form was standardized and approved by expert members of The Royal College of Anesthesiologists of Thailand (RCAT). A standardized form (Form I, in the Supplementary Appendix) was used to record the preoperative patient condition (including demographic data, such as age, sex, body weight, height, American Society of Anesthesiologists physical status), surgical factors (types of surgery, official hour, emergency or elective, duration), and anesthetic factors (choice of anesthesia, airway management, anesthetic drugs). Systematic factors, such as level and experience of anesthesia care providers, academic or non-academic medical service, surgical safety checklist and clinical details regarding oxygen desaturation were collected on a second record form (Form II, in the Supplementary Appendix). Other co-incidents, if any, were recorded on Form II. A list of contributory factors, factors minimizing the possibility of incident, suggested corrective strategies, and preventability, as well as outcomes (immediate and long-term) were recorded on the incident reporting form (Form III, in the Supplementary Appendix). Form I and Form II were distributed to participating hospitals. Anesthesiologists and anesthetist nurses were encouraged to discover all incident cases and complete these forms. These forms were deposited at the data management center in each hospital at regular intervals. The central data management was carried out at the Faculty of Medicine, Chulalongkorn University. Data from the total reported in the year, 2,206 incident cases were verified. Perioperative oxygen desaturation incidents were extracted. The Form I and II of all oxygen desaturation incidents were delivered to the authors.

Three independent peer reviewers assessed the details surrounding each event and identified the most likely cause or causes of perioperative oxygen desaturation. Each peer reviewer summarized the events on the incident report forms (Form III). A consensus was made case by case between the three reviewers. Any disagreement was discussed and concluded. Oxygen desaturation was defined as a pulse oximetry reading (SpO2) less than 90% for 3 minutes or any episode of an SpO2 reading less than 85% (1, 2).

Demographic data included age, sex, ASA physical status, weight, height, obesity (identified by body mass index, BMI, greater than 30),
pregnancy, pre-existing respiratory abnormalities, and expected difficult airway. Details of events included the lowest oxygen desaturation, duration of oxygen desaturation, type of operation, type of anesthesia, period of anesthesia (induction, intubation, maintenance, extubation, or recovery) in which the incident occurred, and most likely causes. The immediate outcome (within the first 24 hours) and long-term outcome (within 7 days after surgery) were recorded. Contributory factors, factors minimizing the possibility of incident and suggested corrective strategies were obtained by a consensus among the three peer reviewers. The descriptive statistics were used to summarize the data and were presented as frequency and percentage.

RESULTS

Of over 200,000 patients who underwent anesthesia from all 22 hospitals during the one-year period, 2,000 cases were identified where there was any incidence in line with the guidelines already given. Among these number, 465 records were the oxygen desaturation cases. Forty-nine patients were excluded because they did not meet the definition of perioperative oxygen desaturation. The incident rate of perioperative oxygen desaturation among all incident cases was 0.20%. The characteristics of the patients are presented in Table 1. Types of surgery are presented in Table 2.

Preoperative Airway Assessment

Over 60% of oxygen desaturation incidents were categorized as normal airway parameters indicated by Mallampati classification grade 1-2 and thyromental distance equal or greater than 5 cm. Laryngoscopic view grade 1-2 were identified in over 50% (Table 3).

Choice of Anesthesia and Type of Airway Management

Ninety percent of oxygen desaturation occurred during the patients were under general anesthesia as shown in table 3. Endotracheal tubes and a laryngeal mask airway (LMA) were used as the airway equipment in most incident cases. Among patients who developed oxygen desaturation during LMA placement, improper positioning (10 out of 14) and laryngospasm (8 out of 14) were
Table 3. Airway Parameters, Type of Anesthesia and Techniques and Duration of Anesthesia.

| Category                        | n  | %  |
|---------------------------------|----|----|
| **Mallampati classification**   |    |    |
| Grade 1                         | 131| 31.5|
| Grade 2                         | 133| 32.0|
| Grade 3                         | 32 | 7.7 |
| Grade 4                         | 8  | 2.1 |
| Grade 5                         | 2  | 0.5 |
| Missing                         | 109| 26.2|
| **Thyromental distance**        |    |    |
| > 5 cm                          | 248| 59.6|
| ≤ 5 cm                          | 27 | 6.5 |
| Missing                         | 140| 33.9|
| **Laryngoscopic view**          |    |    |
| Grade 1                         | 197| 47.3|
| Grade 2                         | 53 | 12.7|
| Grade 3                         | 19 | 4.8 |
| Grade 4                         | 7  | 2.2 |
| Grade 5                         | 96 | 23.0|
| Missing                         | 42 | 10.0|
| **Type of anesthesia**          |    |    |
| General anesthesia (GA)         | 375| 90.1|
| Volatile-based GA               | 360|     |
| Total intravenous anesthesia (TIVA) | 15 |     |
| Spinal block                    | 2  | 0.5 |
| Epidural block                  | 1  | 0.2 |
| Monitor anesthesia care (MAC)   | 15 | 3.6 |
| Nerve block                     | 3  | 0.7 |
| Missing                         | 5  | 1.2 |
| **Airway equipment**            |    |    |
| Endotracheal intubation         | 242| 58.2|
| Nasotracheal intubation         | 7  | 1.7 |
| Tracheostomy                    | 18 | 4.3 |
| Laryngeal mask airway (LMA)     | 27 | 6.5 |
| Double lumen intubation         | 16 | 3.8 |
| Spontaneous mask ventilation    | 16 | 3.8 |
| Bronchoscope and jet ventilation| 3  | 0.7 |
| O2 supplement                   | 7  | 1.7 |
| Nasal airway                    | 7  | 1.7 |
| **Duration of anesthesia (min)** |    |    |
| < 30                            | 19 | 4.6 |
| 30-150                          | 269| 64.7|
| > 150                           | 125| 30  |
| Missing                         | 3  | 0.7 |

Missing indicates the data that were not recorded from the original case record form.

The airway-associated oxygen desaturation in the maintenance period came from improper positioning of the LMA and DLT and secretion obstruction. In cases of circulation-related oxygen desaturation, cardiac arrest was the major cause. During the Emergence and Recovery Period.

Upper airway obstruction, re-intubation, and lung pathology were the major causes of oxygen desaturation.

**Location of Oxygen Desaturation**

Oxygen desaturation occurred in the operating room in 62.7% of cases and in recovery 20.0%. The remainder of the cases occurred in the intensive care unit, ward, and radiologic suit in 5.0%, 2.4%, and 0.5% of cases respectively.

During Induction and Intubation

The most common causes of oxygen desaturation in the induction and intubation period were the improper intubation and ventilation problems including difficult/failed intubation, laryngospasm, tongue and soft tissue obstruction, and upper airway obstruction. Most of the events occurred under care of anesthesiologists, anesthetic nurses, and residents in training. (Table 4) The first-year anesthesiology resident in training, just graduated anesthetic nurse, and anesthesiologist who had working experience less than 2 years were confronted greater incident of oxygen desaturation.

During Maintenance of Anesthesia

The airway-associated oxygen desaturation in the maintenance period came from improper positioning of the LMA and DLT and secretion obstruction. In cases of circulation-related oxygen desaturation, cardiac arrest was the major cause. During the Emergence and Recovery Period.
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**During the Transfer Period**
Oxygen desaturation was suspected in the case of 4 patients diagnosed due to clinical manifestations. The condition was confirmed by pulse oximetry on arrival in the recovery room.

**Postoperative within 24 Hours**
Of the 27 patients who developed oxygen desaturation in the postoperative period, re-intubation from lung pathology and cardiac arrest were the concomitant events.

**Event Consequences**
Most incidences of perioperative oxygen desaturation were treatable without postoperative consequences. Three hundred and seventy patients (88.9%) out of the patients who suffered desaturation, had complete recovery after the oxygen desaturation event. In the patients who developed major physiologic derangement both the respiratory and cardiovascular system were usually involved. With regard to the consequences of oxygen desaturation within 24 hours, unplanned ICU admission occurred in 37 patients, unplanned hospital admission occurred in 3 patients, prolonged emergence occurred in 9 patients, and cancelled operations due to oxygen desaturation occurred in 5 patients.

**Event Analysis**
The associated factors are summarized as shown in Table 7. More than one factor is involved in each analysed event. Human error was classified into three groups: rule-based, knowledge-based, and skill-based. Lack of skill was the main cause of human error (233 events out of 272, 85.6%). System (management) factor that was found to be related to desaturation event included anesthesiologist staff consultation after the office hour, unavailable of special airway equipment after the office hour, and very low rate of preoperative surgical safety checklist (13.2%). Table 8 summarizes the contributing factors, factors minimizing the possibility of incident, and suggested corrective strategies. Of all possible contributory factors, haste, lack of knowledge, and inadequate patient preparation were considered to be the most significant. Improved communication skills and increased manpower including more staff training were the corrective strategies most frequently suggested for enhancement.

**DISCUSSION**
Oxygen desaturation is a common adverse event which occurs during anesthesia. It arises from many causes including factors associated with anesthesia, the patients, and surgery. Pulse oximetry had been introduced for use as a standard monitor, and this relatively simple procedure facilitates early detection and correction of this potentially catastrophic event. The level of oxygen desaturation was derived using this monitor and the data used for this study, the defining parameters as de-
scribed above. The wide range of previously reported oxygen desaturation incidence came from different diagnostic criteria, different reported periods of the events, and differing age groups.

Comparison with Previous Studies
The incidence of perioperative oxygen desaturation among all incident cases in this study was 0.20%, which is lower than in comparison to that previously reported (1-5). Raksakietisak et al. showed an incidence of 0.37% (3). Uakritdathikarn et al. showed the incidence of 2.74% (2). Tamdee et al. reported the oxygen desaturation incidence of 0.236% in geriatric patients (5). Ehrenfeld et al. reported the incidence of hypoxemia at 6.8% (6). The reported incidence of oxygen desaturation varied depending on the definition and severity of hypoxemia in each study. Raksakietisak et al. defined desaturation as a $SpO_2 < 90\%$ which lasted longer than 3 minutes. Uakritdathikarn et al. defined desaturation $SpO_2 < 90\%$ for $> 10$ seconds. Ehrenfeld et al. used $SpO_2 < 90$ for hypoxemia and $SpO_2 < 85$ for severe hypoxemia. Furthermore, the choice of anesthesia and the period over which events occurred differed in previous studies.

| Associated Cause          | Induction | Maintenance | Emergence and Recovery | Ward | Total |
|---------------------------|-----------|-------------|-------------------------|------|-------|
| A = Airway                |           |             |                         |      |       |
| Difficult/ Failed intubation (22/7) | 21/6      | 0           | 1/1                     | 0    | 29    |
| Improper LMA/ DLT (14/14) | 10        | 18          | 0                       | 0    | 28    |
| Esophageal intubation     | 20        | 0           | 4                       | 0    | 24    |
| Re-intubation             | 0         | 0           | 61                      | 9    | 70    |
| Laryngospasm              | 32        | 8           | 7                       | 0    | 47    |
| Tongue and soft tissue obstruction | 24       | 0           | 19                      | 0    | 43    |
| Unable to ventilate       | 12        | 0           | 4                       | 0    | 16    |
| Accidental extubation     | 0         | 2           | 3                       | 0    | 5     |
| Secretion obstruction     | 2         | 12          | 19                      | 0    | 33    |
| B = Breathing             |           |             |                         |      |       |
| Pulmonary aspiration      | 5         | 0           | 0                       | 1    | 6     |
| Pulmonary embolism        | 0         | 2           | 0                       | 1    | 3     |
| Pulmonary edema           | 0         | 0           | 3                       | 1    | 4     |
| Hypoventilation           | 0         | 0           | 9                       | 0    | 9     |
| Pneumothorax              | 0         | 1           | 1                       | 0    | 2     |
| Atelectasis               | 0         | 0           | 5                       | 0    | 5     |
| C = Circulation           |           |             |                         |      |       |
| Myocardial infarction     | 0         | 1           | 0                       | 1    | 2     |
| Cardiac arrest            | 2         | 22          | 2                       | 14   | 40    |
| Death                     | 0         | 8           | 16                      | 0    | 24    |
| Artiopulmonary resuscitation from ER | 8 | 0 | 0 | 0 | 8 |
| D = Drugs                 |           |             |                         |      |       |
| Anaphylactic reaction, anaphylaxis | 3 | 0 | 0 | 0 | 3 |
| Residual anesthetic effect | 0       | 0           | 9                       | 0    | 9     |
| Drug error                | 0         | 1           | 0                       | 0    | 1     |
| E = Equipment malfunction | 2         | 0           | 0                       | 0    | 2     |

Table 5. Events-Related to Oxygen Desaturation: Number of Incidents by Cause and Phase of Anesthesia.
Oxygen desaturation was found during the intubation period in one fourth of all events (26.7%). This is consistent with the findings reported by Oofuvong et al. (7, 8). Szekely et al. suggested that difficult intubation, laryngospasm, and pulmonary aspiration occurring during intubation were the main causes of oxygen desaturation (9). In this study, the incidence of oxygen desaturation in patients aged less than 10 and over 60 years old were 27.8% and 21.8%, respectively. These findings were consistent with those reported by Charuluxananan et al. They found that an age less than 5 significantly predicted desaturation, OR 9.3 (95% CI 5.416.0) (4). Age was one of the patient-related factors reported to predict oxygen desaturation (4-8). Oxygen desaturation suspected during the transfer period and later confirmed in the recovery room was consistent with the results reported by Maity et al., emphasizing the importance of oxygen supplementation and continuous pulse oximetry monitoring during the transfer period (10, 11). A previous study mentioned that ventilation with 100% oxygen for 5 minutes before transport did not prevent desaturation during the transfer period. This event was closely related to the duration of anesthesia (12). Hypoventilation in the recovery period was caused by the residual anesthetic effect in all patients. This finding is consistent with the study of Misal et al. (11).

The association between airway equipment and oxygen desaturation has been studied. Interestingly, improper LMA positioning led to desaturation occurring in 10 out of 14 patients (71.4%). This finding was lower than those reported by Haynes et al (12). In that study, the authors reported 11 out of 12 patients developed desaturation during LMA insertion and all those patients did not receive supplementary oxygen prior to LMA insertion (12, 13). One of the limitations of this study is the type of LMA and the techniques used for LMA insertion were not recorded. Improper DLT positioning leading to desaturation during one-lung ventilation occurred in 9 out of 14 patients (64.3%). The safety margin of correct DLT positioning is very narrow. A change of more than 1 cm from the correct position confirmed by fiberoptic bronchoscope will necessitate immediate correction (14, 15). In 10 out of 14 patients DLT deviation was detected after positioning to lateral decubitus. In 4 cases it was difficult to adjust the DLT to the proper site during the intubation period.

Interestingly, desaturation occurred in 15 patients under monitored anesthesia care (MAC). Two of them developed desaturation in the radiologic suite. A previous study mentioned that the type of invasive procedure was an important factor in estimating the risk of hypoxemia in procedural sedation (16). We explored the possible causes of hypoxemia in these patients and found that extreme age, propofol sedation in combination with an opioid, and a pre-existing respiratory abnormality were the predictors of oxygen desaturation in MAC. These findings are consistent with previously reports (16-18).
Oxygen desaturation occurrence during the maintenance period was co-incident with circulatory failure and cardiac arrest. The degree of hypoxia during cardiac arrest was reported as a significant factor in the determination of the sequelae and outcomes (19). High oxygen concentration during cardiopulmonary resuscitation is recommended while hyperoxemia should be avoided in a post cardiac-arrest period (20).

In this study, the complete surgical safety checklist including sign-in, time-out, and sign-out, was done in 55 of 416 event cases (13.2%). This number demonstrated the inconsistency in compliance and attitudes of surgical team members, surgical circulators, scrub practitioners, and attending anesthetic team. The finding is consistent with previous reports (21, 22). The root-cause analysis of this study pointed out that improved communication among the working teams was highly recommended. More manpower was suggested to correct the most ranked contributing factors, which were haste and inadequate patient preparation. Additional training was suggested to correct the contributory factor of lack of knowledge.

**Clinical Implications**

Preoperative airway assessment, which indicates that easy airway management does not guarantee the safety of patients as regards oxygen desaturation, should be a high priority. Intravenous sedation MAC should be conducted under supervision by senior anesthesiologist or attending staff, and end-tidal CO2 and oxygen saturation monitoring should be carried out. Level of sedation should be closely monitored to avoid loss of airway control. Upper airway obstruction during the induction period arises from improper ventilation. This was considered to be a resident-training risk. Staff training and supervision needs to be improved to address this. During the transfer period, all patients should receive oxygen supplementation via nasal cannula or face mask. Surgical team members, surgical circulators, scrub practitioners, and the attending anesthetic team should be encouraged to complete the surgical safety checklist. The suggested corrective strategies should be implemented in clinical practice to reduce the number of critical incidents and increase perioperative safety for the patients.

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This work was supported by a grant (059/2558) from the Faculty of Medicine, Chiang Mai University (CMU).

The authors declare no other conflicts of competing interest for this work.
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Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Pathomporn Pin-on, Krit Panjasawatwong, Anantachote Vimuktanandana, Wimonrat Sriraj, Chuthamat Somechat, Dujduen Sriramatr. Perioperative and Anesthetic Adverse Events in Thailand (PAAd THAI) Incident Reporting Study: Perioperative Oxygen Desaturation. J Anesth Perioper Med 2018;5:101-13. doi: 10.24015/JAPM.2018.0051
Form I

**PAAd THAI Study: Perioperative Oxygen Desaturation**

### Procedure Information

**Operation**

- **Type**: [ ] Cardiac
- **Site**: [ ] Thoracic
- [ ] C-section
- [ ] Dental
- [ ] Diagnostic (Image, biopsy)
- [ ] Intervention Rx
- [ ] Radiotherapy
- [ ] Other

**Technique**

- **Main**: [ ] GA
- [ ] GA(TMA)
- [ ] MAC
- [ ] Spinal
- [ ] Epidural
- [ ] CSE
- [ ] Caudal
- [ ] Brachial block
- [ ] Nerve block
- [ ] Bier block

**Monitor**

- **NIBP**: [ ] Invasive BP
- [ ] SpO2
- [ ] EKG
- [ ] EtCO2
- [ ] Et gas
- [ ] CVP
- [ ] Chest piece
- [ ] Esophageal stethoscope
- [ ] Temperature
- [ ] Other

**Anesthetic Agents**

- **Propofol**: [ ] Ketamine
- [ ] Midazolam
- [ ] Propofol
- [ ] Vecuronium
- [ ] Rocuronium
- [ ] Fentanyl
- [ ] Lidocaine
- [ ] Bupivacaine
- [ ] Levobupivacaine
- [ ] Prostigmine
- [ ] Atropine
- [ ] Glycopyrrolate
- [ ] Other

**麻醉**

- **Distance**: [ ] > 5 cm
- [ ] > 3 finger breath

**Laryngoscopic view (Conventional)**

- [ ] < 15 cm
- [ ] > 15 cm

### Safety Checklists

**Surgical Safety Checklists** *(Accredited by the 1st Cohort)*

**Sign in** *(Preoperative Check)*

- [ ] Patient identification (by patient)
- [ ] Mark site (as shown)
- [ ] Mineshare with difficult airway
- [ ] Anticipate pulmonary aspiration (NPO...)
- [ ] Anticipate blood loss > 500cc (adult) or > 7cc/kg (child)
- [ ] Anticipate fluid allergy
- [ ] Anticipate pulse oximeter dysfunction
- [ ] Complete anesthesia checklists (when applicable: anesthesiology, thoracic, neurology, radiotherapy, surgery...)

**Time out** *(Intraoperative Check)*

- [ ] Confirm
- [ ] Patient identification
- [ ] Operation / Site
- [ ] Anticipate
- [ ] Anesthesia critical incident
- [ ] Surgical critical incident
- [ ] Duration of surgery
- [ ] Anticipate intravenous
- [ ] Antibiotics

- [ ] Inadequate
- [ ] Unusual
- [ ] Other

**Sign out** *(Postoperative Check)*

- [ ] Patient identification
- [ ] Thoracic critical incident
- [ ] Surgical critical incident
- [ ] Duration of surgery
- [ ] Anticipate intravenous
- [ ] Antibiotics

- [ ] DMU Code (If not applicable)

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**Table with Numbers**

- **ASA**: 1 2 3 4 5 6
- **E**: Invasive BP
- **ANES DURATION**: *

**Operation**

- **Room**: [ ] 1

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### Form II

| Incidents (What happened) | s
| --- | --- |
| Disconnect infrar | CO₂ Absorber |
| Leak pneumo | Common gas outlet |
| Misconnect circuit | Endotracheal tube or equivalent (LMA) |
| Overpressure | Flowmeter |
| Rebreathing | Gas supply |
| Dilution of gas | Humidifier |
| อื้อมะวอสูง | Oxygen bypass |
| Oxygen-related | Inspire or expire valve |
| Pressure relief valve | Scavenging system |
| Scavenging system | Tubing or connection |
| Vapizer | Other complications |
| Ventilator | Other complications |

| Airway Incidents | s
| --- | --- |
| Endobronchial Intubation (male/male type) | Ulnar nerve |
| Extubation (male/male type) | Brachial plexus |
| Failed intubation | Lumbosacral root |
| Cant not ventilate | Spinal cord |
| Obstruction | Other |
| Laryngospasm | Conventional |
| bronchospasm | |
| Esophageal Intubation (early, late) | |
| Airway trauma | |

| Incident alerted * (เรื่องทางการ) | Si
| --- | --- |
| Phase when alerted | Location |
| Preinduction | Induction room |
| Induction | Delivery |
| Maintenance | Dental |
| Emergence | Ward |
| Recovery | Imaging |
| Emergency | Other |
| Post recovery (24 hr) | Day surgery |

| Drug Incident | Syringe swap | wrong ampule / vial | Allergic Incident |
| --- | --- | --- | --- |
| Wrong incident | Overdose | CVS rash |
| Wrong drug | Underdose | Other rash |
| Wrong route | | |
| Wrong label | | |
| Other | | |

| Awareness | Cardiac arrest/ Death |
| --- | --- |
| แก้ได้ | ไม่สามารถทำได้ |
| sound | temporary stress |
| pain | PTSD (posttraumatic) |
| paralysis | sleep disturbance |
| Intubation | dream |
| surgery without pain | anxiety |
| panic | flash back |
| other | other |

| Initial condition | possible causes | treatment |
| --- | --- | --- |
| conscious | drug, lungs | cardiac massage |
| breathing | | atropine |
| pulse | | adrenaline |
| hypoventilation | | CPR |
| anaphylaxis | | bicarbonate |
| direct cardiac arrest | | adrenaline |
| other cause | | |

**Management & Results (การจัดการและผลที่เกิดขึ้น)***

**Detail of event ผู้ป่วยได้รับการดูแลอย่างไร (เรื่องทางการ)***

**DMU Code (ที่แนะนำมานี้)***

112
### Form III

| Incident code | Specific code |
|---------------|---------------|
|               |               |

#### Contributing Factors (ปัจจัยผิดพลาด)

| Factor | Description |
|--------|-------------|
|        |             |

#### Factors minimizing incident (ปัจจัยลดผลลัพธ์การณ์)

| Factor | Description |
|--------|-------------|
|        |             |

#### Suggested Corrective Stategies

| Strategy | Description |
|----------|-------------|
|          |             |

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**Immediate Outcome (ภายใน 24 ชม.)**

- Unplanned ICU Admission
- Unplanned hospital admission
- Prolonged emergence / apnea
- Awareness
- Cancellation / postponement of surgery
- Minor physiological change
- Others

**Long term Outcome (7 วัน)**

- Extended ventilator support
- Hospital stay after event
- Death
- Other Morbidity
- Complete recovery
- None
- Others

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**Monitor**

1. ระบุ
2. ระบุ
3. ระบุ

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**Other factors**

1. ระบุ
2. ระบุ
3. ระบุ

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**Original Article**

PAAd THAI Study: Perioperative Oxygen Desaturation

Pathomporn Pin-on et al.

**Visited from**

Data Code

สายบัน วันที่ เดือน พ.ศ.