# Postoperative Reintubation after Planned Extubation in Thai Anesthesia Incidents Study (THAI Study)

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***Objective:*** *To analyze precipitating causes, outcomes and corrective strategies especially anesthetic related factors associated with reintubation after planned extubation in anesthetic technique of general anesthesia with endotracheal intubation.*
***Design:*** *Prospective observational study*
***Material and Method:*** *Incidents of reintubation after planned extubation were extracted from the Thai Anesthesia Incidents Study (THAI Study) database conducted between February 1, 2003, and January 31, 2004, and analyzed using descriptive statistics.*
***Results:*** *The total of two hundred and thirty four patients of reintubation after planned extubation (RAP) at the end of general anesthesia was reviewed in this study. The incidence of RAP was 27:10,000 and the incidence in the university hospital was similar to the tertiary and secondary care hospital. The incidence was increased in extreme age group (age < 1 and > 70 year). One hundred and fifty eight cases of RAP (67.5%) occurred in operating theater and recovery room which included 83 cases occurring within 10 minutes after extubation. The two most common primary diagnoses were upper airway obstruction and hypoventilation. Three main precipitating factors were residual effect of neuromuscular blocking and anesthetic agents (53-57%), upper airway obstruction (31%) and unstable hemodynamics (26.3%). Nearly half of RAP incidents occurring in the operating theater and recovery room were successful reextubation within six hours and 58-72 % of these two subgroups were complete recovery. The chance for prevention was more than 80% by additional training and supervision.*
***Conclusion:*** *More than 90% of RAP occurred in operating theater and recovery room were completely or partially related to anesthetic process. Incidence of RAP could be decreased by quality assurance process of recording, reporting and modeling care process together with increase individual experience.*

***Keywords:*** *Reintubation, Planned extubation, Complication*

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Medical care and medical procedures are not always free from adverse events, the incidence of perioperative adverse events or complication was reported in the range of 0.06 to 10.6 %[1-5]. Formative regular recording of unexpected anesthetic interventions such as delayed detection of esophageal intubation, cancellation of operation due to anesthetic reasons, reintubation, etc, are the quality key indicators of anesthetic care.

General anesthesia with endotracheal intubation and controlled ventilation is the most common anesthetic technique used in anesthetic services [1-4]. The endotracheal tubes are often extubated at the end of the operation. Five to fifteen percent of the patients

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who needed postoperative ventilatory support are transferred to intensive care units.

The reinsertion the endotracheal tube into the trachea after extubation at the end of anesthetic process or reintubation is an unexpected anesthesiologist s intervention. There is only one retrospective study at university of Michigan [6] that reviewed all reintubation and concluded that the respiratory problem was the most common cause which led to reintubation. Report of anesthesia adverse events at Siriraj Hospital was performed in 2002 which included incidence of reintubation in 35: 10,000 in the technique of general anesthesia with endotracheal tube [7]. Half of them were mainly related to action of neuromuscu-lar blocking agents. In this center, the incidence de-creased to 15: 10,000 in 2004 because of quality process and increased awareness in decision to extubation.

This study aimed to analyze precipitating causes, outcomes and preventive strategies especially anesthetic related factors associated with reintubation after planned extubation in anesthetic technique of general anesthesia with endotracheal intubation from the case series reported in Thai Anesthesia Incidents Study (THAI Study).

**Material and Method**

The Thai Anesthesia Incidents Study (THAI Study) is a multi-center study comprising 20 hospitals: 7 university, 5 tertiary, 4 secondary and 4 primary care. The incidence of adverse events was monitored between February 1, 2003 and January 31, 2004. The THAI Study was reviewed and approved by the Institutional Ethics Review Board at each of the involved institutions. Details of age, sex, preanesthetic conditions, anesthetic management, intraoperative events and perioperative complications within 24 hours,on consecutive patients, were recorded on a standardized form.

At the time of this analysis, there were 163,403 cases in the database. The total number of reintubation among patients who underwent general anesthesia was retrieved. The details of each event were immediately reviewed and reported in the same format by a principle investigator in each center coding by recorded number. Each record was sent to two reviewers for secondary analysis and comment. If agreement in every item was achieved, the details were record in SPSS 10.5. If any item was in doubt or disagreed, the third reviewer would eventually be responsible to complete the event-form.Then, data was analysed by using descriptive statistics.

Reintubation was defined as intubation after extubation in the case of initial endotracheal intubation with general anesthesia. All demographic data such as age, sex, body weight, site and type of operation, duration, ASA, emergency situation, official time, underlying disease or condition and technique of anesthesia were matched by record number and retrieved from main database.

All reintubations happened during operation, emergence and early (2 hours after operation) or late recovery period (within 24 hours after anesthesia) were collected and stratified into groups (Table 1) as follows:

1. Reintubation after planned extubation (RAP)

2. Reintubation after unplanned extubation (RUP) such as tube displacement, accidental extubation and other tube problems such as tube obstruction, esophageal intubation, etc.

3. Unplanned intubation (UI) in which endotracheal intubation was performed in anesthetic technique which endotracheal intubation was not expected such as spinal block, monitor anesthesia care, bronchoscopy, etc.

Details of place, time, clinical symptoms and sign before reintubation, decision to reintubation and consequence after reintubation were recorded (Table 1).

Due to our agreement at the beginning of this registry, the principle investigator in each center should contact the person who was in charge in each adverse event and asked them to write in every detail of the event in time frame format of what was happened, how they managed and what was the outcome of every step of management or we called it The event s story . We found that The event s story help us to complete the reviewed process and made conclusion of more than 80% of all adverse events.

In the group of RAP, inadequate reversal of muscle relaxants would be determined as the cause of reintubation only when hypoventilation was the main diagnostic medical problem before reintubation ($PaCO_2$ >55 mmHg, hypertension with/without conscious change) the clinical symptom could be easily resolved after reintubation and the tubes were successful removed within six hour later or ventilatory support was not longer than 24 hour.

If the reintubation was performed immediately after extubation with the significant signs of upper airway obstruction which included laryngospasm and no air entry, the cause of reintubation would be recorded as upper airway obstruction.

If the patient were fully awake with successful spontaneous respiration more than 2 hour after anes-

**Table 1.** Detail of reintubation episode

1. Grouping of reintubation
   - 1.1 Reintubation after planned extubation (RAP)
   - 1.2 Reintubation after unplanned extubation (RUP) such as tube displacement, accidental extubation, tube problems or esophageal intubation
   - 1.3 Unplanned intubation (UI) in which endotracheal tube was performed in anesthetic technique which endotracheal intubation was not expected such as spinal block, monitor anesthesia care, bronchoscopy.
2. Where the reintubation occur
   - 2.1 Operative theater
   - 2.2 Recovery room
   - 2.3 Ward
   - 2.4 Intensive care unit
   - 2.5 Other
3. Estimated time of reintubation after extubation
   - 3.1 Immediately after extubation or within 10 minutes after extubation
   - 3.2 More than 10 minutes until 60 minutes
   - 3.3 More than 60 minutes until 120 minutes
   - 3.4 More than 2 hour until 6 hour
   - 3.5 More than 6 hour until 24 hours
4. Clinical symptom at the time before reintubation
5. Main decision to reintubation
   - Hypoventilation
   - Upper airway obstruction
   - Hypoxia
   - Hypotensive
   - Conscious change
6. Consequence
   - Was the extubation success within next 6 hour?
   - Did the patient need ventilator support more than 24 hours?
   - Was the patient dead within 24 hours after reintubation?

thesia, all reintubation which happened after this time limit were not caused by muscle relaxant or anesthetic sedation.

## Results

In the database of 163,403 patients in Thai Anesthesia Incidents Study (THAI Study), there were 86,792 patients who received technique of general anesthesia with endotracheal intubation. The total of three hundred and twenty five cases were collected as reintubation case record form and reintubation together with other respiratory events. Seventeen cases were excluded from all analysis because of incomplete data and conclusion could not be made in more than five items of data management. Three hundred and eight cases were included in final analysis which divided in three groups of two hundred and thirty four cases of reintubation after planned extubation(RAP), forty three cases of reintubation after unplanned extubation(RUP) and thirty one cases of unplanned intubation(UI). The details of RUP and UI were not included in this report.

Only reintubation after planned extubation (n = 234 cases) were reviewed in this report. The over all incidence of RAP was 27:10,000 (Table 2) in this data set which the incidence in university (24.60:10,000) and tertiary hospital (26.18:10,000) were in similar range. The incidence was highest in infant patient (age < 1 year) both in over all and subgroup analysis. The incidence also increased in patient older than 70 years.

One hundred and fifty eight cases of RAP (67.5%) took place in operating theater and recovery room. Among those, the reintubation process of 83 cases (35%) started immediately (within 10 minutes) after extubation (Table 3) mainly due to severe upper airway obstruction. There were eighteen cases (21.7%) in this group whose age were lower than six years and

**Table 2.** Patient characteristics, incidence of reintubation which stratified by age, ASA PS, hospital level and operation

| | All cases | RAP |
|---|---|---|
| **Total cases, n (ratio:10,000)** | 308 (35.5) | 234(27) |
| **Level of hospital,ratio:10,000** | | |
| University | 35.65 | 24.60 |
| Tertiary care | 30.99 | 26.18 |
| Secondary care | 161.29 | 161.29 |
| **Sex: Male/female (n)** | 178/ 130 | 135 / 99 |
| **BW(kg) mean ± SD** | 46.7 ± 22.7 | 49.5 ± 21.2 |
| **range** | 1.6-100 | 1.6-100 |
| **Ht(cm) mean ± SD** | 142.2 ± 36.7 | 148.05 ± 31.7 |
| **range** | 40-180 | 40-180 |
| **Age (yr)mean ± SD** | 43.3 ± 28.1 | 46.5 ± 26.4 |
| **Incidence in age(yr) group, n (ratio:10,000)** | | |
| < 1 | 31 (70.0) | 18 (39.8)* |
| >1-10 | 35 (23.0) | 19 (12.7) |
| >10-30 | 38 ( 8.2) | 29 ( 6.3) |
| >30-50 | 58 (10.9) | 46 ( 8.6) |
| >50-70 | 88 (24.7) | 75 (21.0) |
| >70 | 58 (41.3) | 47 (33.5)* |
| **Operation duration (min)** | 135.0 ± 95.4 | 142.6 ± 92.1 |
| **ASA PS,ratio:10,000** | | |
| Class 1 | 5.0 | 3.5 |
| Class 2 | 25.99 | 20.6 |
| Class 3 | 60.29 | 45.22 |
| Class 4 | 34.27 | 18.7 |
| **Emergence: Yes, (% )** | 32.5 | 33.3 |
| **Non-official time :Yes , (%)** | 25 | 26.5 |
| **Operation,ratio:10,000** | | |
| Airway scope | 116.48 | 46.60 |
| Head and neck | 56.83 | 42.00 |
| Others | 13.70 | 11.51 |
| **Place*( % with in group)** | | |
| Operative room | 31.2 | 26.5 |
| Recovery room | 38.3 | 41.0 |
| Ward | 18.2 | 19.7 |
| ICU | 12.0 | 12.8 |
| Other | 0.3 | 0 |

RAP= reintubation after planned extubation, ASA= ASA classification

Value shown as number, ratio per 10,000 , mean ± SD, range and percents
*Statistical significance

**Table 3.** Clinical course of reintubation after planned extubation ( RAP, n=234) stratified by place of event, ASA PS, time after extubation, initial diagnosis, clinical symptom and precipitating causes

| **Place** | Intraoperative room ( n=62) | Recovery room ( n=96) | Ward (n=46) | ICU ( n=30) | Total ( n=234) |
|---|---|---|---|---|---|
| **ASA PS*** Class 1 | 7 | 15 | 6 | 1 | 29 |
| Class 2 | 38 | 53 | 20 | 10 | 121 |
| Class 3 | 16 | 28 | 18 | 16 | 78 |
| Class 4 | 1 | 0 | 2 | 3 | 6 |
| **Time to event after extubation(% in group)** | | | | | |
| • Within 10 min | 100 | 21.9 | 0 | 0 | 35.5 |
| • >10 min to 60 min | 0 | 57.3 | 0 | 3.3 | 28.2 |
| • >60 min to 3 hr | 0 | 20.8 | 43.5 | 50 | 19.2 |
| • >3 — 24 hr | 0 | 0 | 56.5 | 46.7 | 17.1 |
| **Initial diagnosis ( % in group)** | | | | | |
| • Airway obstruction | 53.2 | 44.8 | 34 | 4 | 33.3 |
| • Hypoventilation/apnea | 46.8 | 42.7 | 32.6 | 43 | 44 |
| • Hypoxia | 0 | 12.5 | 6.6 | 6.7 | 8.1 |
| • Respiratory failure | 0 | 0 | 2.2 | .7 | 1.3 |
| • Unstable hemodynamic | 0 | 0 | 17.5 | 26 | 10.7 |
| • Conscious change | 0 | 0 | 8.7 | 3.3 | 2 |
| **Clinical symptom( % of cases)** † | | | | | |
| • Upper airway obstruction | 53.2 | 44.8 | 37.0 | 13.3 | 41.5 |
| • Dyspnea | 77.4 | 86.5 | 76.1 | 83.3 | 81.6 |
| • Desaturation | 62.9 | 74.0 | 58.7 | 66.7 | 67 |
| • Hypotension | 4.8 | 10.4 | 19.6 | 36.7 | 14 |
| • Conscious change | 37.1 | 40.6 | 50.0 | 30.0 | 40 |
| **Precipitating causes of reintubation (% of cases)** † | | | | | |
| • Muscle relaxant | 69.4 | 75 | 13 | 16.7 | 53.8 |
| • Level of sedation | 79.0 | 69.8 | 28.3 | 20.0 | 57.7 |
| • Severe metabolic acidosis | 3.2 | 12.5 | 17.4 | 6.7 | 10.3 |
| • Unstable hemodynamics | 11.3 | 20.8 | 43.2 | 50.0 | 26.3 |
| • Secretion in airway | 17.7 | 29.2 | 54.3 | 10 | 31.6 |

† **There might be more than one clinical symptom or precipitating cause in each patient**

Value shown as percent in group or percent of cases

only one case that prolonged intubation was needed due to surgical edema. The rest of them were successfully reextubated within six hours. It seemed that immediate reintubation caused by severe upper airway obstruction was commonly found in younger patients and the problems were easily resolved by delayed extubation.

One hundred and twenty one from 234 cases (51%) were classified in ASA class 3. Majority of patients with RAP in university hospital (60%) were clascsified of ASA 1 or 2 whereas majority of patients with RAP in tertiary and secondary care hospital (77%) were classified of ASA 3. All six cases in ASA class 4 which reintubation were performed within six hour after extubation, five died within 7 days after operation and one was in the stage of brain death.

**Table 4.** Level of anesthetic related, preventability,clinical course, outcome of reintubation after planned extubation ( RAP, n=234)

| Place | Operating theater ( 62) | Recovery room ( 96) | Ward (46) | ICU ( 30) | Total ( 234) |
|---|---|---|---|---|---|
| **Anesthetic related*** | 95.2 | 95.8 | 69.6 | 56.7 | 85.5 |
| **Level of anesthetic relate** | | | | | |
| Level 1 | 72.6 | 72.9 | 32.6 | 26.7 | |
| Level 2 | 17.7 | 12.5 | 21.7 | 23.3 | |
| Level 3 | 3.2 | 9.4 | 10.9 | 16.7 | |
| Level 4 | 4.8 | 4.2 | 15.2 | 6.7 | |
| Level 5 | 1.6 | 1 | 19.6 | 26.7 | |
| **Preventability(% in group)** | | | | | |
| Preventable | 88.7 | 87.5 | 65.2 | 70 | 81.2 |
| Partial preventable | 6.5 | 8.3 | 17.4 | 13.3 | 10.3 |
| Unpreventable | 4.8 | 2.1 | 17.4 | 16.7 | 7.7 |
| Inconclusive | 0 | 0 | 0 | 0 | 0.9 |
| **Clinical course (% of cases)** | | | | | |
| Successful reextubation within 6 hr | 50 | 46.8 | 8.7 | 16.7 | 36 |
| **Immediate outcome (% in group)** | | | | | |
| Complete recovery | 4.8 | 2.1 | 0 | 0 | 2.2 |
| Minor effect | 14.5 | 6.3 | 22 | 0 | 6.9 |
| Major effect | 77.4 | 86.3 | 84.8 | 100 | 85.4 |
| Cardiac arrest | 3.2 | 5.3 | 13.0 | 0 | 5.5 |
| **Long term outcome, n (% in group)** | | | | | |
| Complete recovery | 45(72.9) | 57(58.7) | 11(23.9) | 9(30) | 122(51.5) |
| Prolonged respiratory support | 11(18.6) | 33(34.8) | 20(43.5) | 16(53.3) | 80(34.8) |
| Vegetative/brain death | 0 | 0 | 5(10.9) | 2(6.7) | 7(3.1) |
| Death | 4(6.8) | 5(5.4) | 9(19.6) | 3(10) | 21(9.3) |
| Others | 2(1.7) | 1(1.1) | 2(2.2) | 0 | 4(1.3) |

Value shown as percent in group or percent of cases

The two most common primary clinical diagnoses which led to reintubation in operative theater and recovery room were upper airway obstruction and hypoventilation. While hypoventilation and unstable hemodynamics were common in intensive care unit. Respiratory insufficiency was predominant clinical symptoms which included dyspnea (81.6 %), desaturation(67 %)and upper airway obstruction (41.5%) . Alteration of consciousness, ranging from confusion to deep coma, was reported in 40 % of RAP and most events were rapidly changed after a short period of dyspnea. Fourteen percent of the reintubation was performed for the treatment of unstable hemodynamics usually in patients with severe metabolic acidosis from infectious process. The two most common infectious process were empyema gall bladder and pyelonephrosis.

Precipitating causes could be concluded in eighty five percents by three experts agreement after reviewing of all medical process, document and anesthetic record. Three main groups of precipitating factors were 53-57 % from residual effect of neuromuscular blocking and anesthetic agents, 31.6% from upper airway obstruction and 26.3% from unstable hemo-

**Table 5.** Contributing factors and suggested corrective strategies of reintubation after planned extubation (RAP, n=234) stratified by place of event

| Place | Inoperative room (n= 62) | Recovery room (n= 96) | Ward (n=46) | ICU (n=30) | Total (n=234) |
|---|---|---|---|---|---|
| **Contributing factors** | | | | | |
| Human factors | | | | | |
| Lack of knowledge | 58.1 | 55.2 | 47.8 | 33.3 | 51.7 |
| Inexperience | 93.5 | 91.7 | 67.4 | 80.1 | 85.9 |
| Improper performance | 61.3 | 77.1 | 60.9 | 53.3 | 66.7 |
| Communication | 22.6 | 20.8 | 37.0 | 23.3 | 24.8 |
| Lack of supervision | 74.2 | 82.3 | 63.0 | 56.7 | 73.1 |
| Equipment | | | | | |
| Not available | 1.6 | 0 | 0 | 0 | 0.4 |
| Poor function | 3.2 | 0 | 0 | 3.3 | 1.3 |
| **Corrective strategies** | | | | | |
| Quality assurance | 96.8 | 94.8 | 73.9 | 80.0 | 89.3 |
| Additional training | 91.9 | 91.7 | 69.6 | 73.3 | 85.0 |
| Improved supervision | 95.2 | 89.6 | 71.7 | 76.7 | 85.9 |
| Guideline practice | 29.0 | 52.1 | 54.3 | 33.3 | 44.0 |
| More communication | 29.0 | 40.6 | 53.4 | 40.0 | 40.2 |
| More manpower | 33.9 | 33.3 | 45.7 | 13.3 | 33.3 |
| Good referral system | 3.2 | 6.3 | 13.0 | 13.3 | 7.7 |
| More equipment | 0 | 0 | 2.2 | 0 | 0.4 |

Value shown as percentage of cases

dynamic.

More than 90% of reintubation which occurred in operating theater and recovery room were related to anesthetic process (Table 4) and mostly categorized in level one of anesthetic relation or totally related to adverse outcome. The chance for prevention was more than 80 %. Nearly fifty percent of events occurred in the operative theater and recovery room, the endotracheal tube were successfully reextubated within six hours and 58-72% of these two subgroups completely recovered.

Reintubation which happened in ordinary ward and intensive care unit were less related to anesthetic process. The clinical outcome, both immediate and long term were worse than the previous two subgroups. Patients were classified in higher ASA classification, older and some were suffering with severe infection, head injury and end stage organ dysfunction.

Considering system analysis, Major important factors contributing to the occurrence of RAP included 1) human error: inexperience (85.9%), improper performance(66.7%), lack of knowledge(51.7%) and 2) lack of supervision (73.1%, see Table 5). Patient s condition and Organization factors were less contributing to RAP.

Suggested corrective strategies included three most importance activities included quality assurance (89.3%), improve supervision (85.9%) and additional training (85 %). Guideline practices, improvement of supervision and more manpower were also suggested, but in less frequency than the previous three activities.

## Discussion

This is the second large-scale database study of reintubation in perioperative periods. The first study from University of Michigan Health Center[6], it was a retrospective reviewed of quality assurance database and medical records for five years, they concluded that the incidence of reintubation was 12.5:10,000 of all anesthetic technique and the respiratory problems was the most common cause (58.64%) which led to reintubation. Adverse outcome involving the respiratory system comprised the single largest class of injury reported in the ASA Closed Claims Study[8]. Obvious adverse events related to tracheal extubation accounted

for 35 of the 522 or 7% of the respiratory related claims. Other documented a 4-9 % incidence of serious adverse respiratory events in the immediate postextubation period .[9, 10] Preventable anesthesia-related etiologies were noted as important[9] and majority of tracheal reintubations were due to preventable anesthetic-related factors[10]. The consequences of reintubation are significant, including increased duration of total ventilatory support, prolonged recovery room stay, unexpected intensive care admission and increase adverse cardiac events[12, 13]. Our goals in this descriptive analysis were to identify incidence of reintubation, precipitating causes, patient at risk and preventable factors. Our discussion is focusing only in the group of reintubation after planned extubation (RAP) or extubation failure after technique of endotracheal anesthesia.

The incidence of extubation failure in this study was 27:10,000 or 2.7% and was lower than the extubation failure in surgical intensive care[14]. The incidence of 2.7% was decreased to 1.9% if all anesthetic techniques were used as reference (308 from 163,403 cases) and was higher than the report from Michigan Health System[6]. Two main reasons could be explained. First, our database came from twenty hospitals across Thailand and approximated seventy percents of case load came from university hospitals. Even the incidents of reintubation from university and tertiary care hospital were in similar range but patients characteristics were different. Most of reintubation cases from university hospitals (60%) were classified in ASA class 1-2, endotracheal intubation was needed in a short period after reintubation with complete recovery. This may reflect of teaching process which regularly occurred in university hospital. But most of the reintubation cases in secondary and tertiary care hospital (77%) were classified in ASA 3, emergency operation, severe head injury or severe metabolic acidosis with the limitation or less availability of post surgical intensive care unit.

The second reason was the study method especially in data collection. This study prospectively registered every anesthetic case and our teams were actively reviewed of every adverse events as soon as possible. We were able to recruit nearly all reintubation which happened immediately in operating theater and recovery room or delayed in ward and intensive care unit. Details of sequences and consequences of each reintubation and all medical documents led to analytic process including precipitating factors, level of anesthetic-related process and preventability.

The majority of RAP (67.5%) happened in operating theaters and recovery room. The common initial diagnoses (upper airway obstruction and hypoventilation) and major clinical symptoms (dyspnea, desaturation and upper airway obstruction) were refered to respiratory problems which were precipitated by residual effect of neuromuscular blocking and anesthetic agents. Improve competency in decision of extubation would decrease the occurrence of reintubation. Developing appropriated algorithms that indicate readiness for extubation in the operating theater could not only decrease reintubation but also provide an initiated more objective tools. The extubation criteria and algorithm could help trainee to form their decision pattern for extubation and modify for other circumstance such as extubation during deep anesthesia and extubation after prolong ventilatory support .

Seventy percent of RAP cases were primary due to upper airway obstruction after operation in airway, head and neck regions. Signs of upper airway obstruction occurred immediately or within 10 minutes after extubation. Reintubation were performed in operating theater together with steroid administration.We suggested that patients with airway and head and neck procedures should be extubated with fulfill criteria for extubation. The patients needed closed observation of respiratory pattern for at least 10 minutes in operating theater and also in recovery room. The further study of steroid for reducing edematous process is needed.

Twenty percents of RAP (18 cases) from upper airway obstruction occurred in patient age less than 6 years. The sign of upper airway obstruction happened immediately after extubation. Only three patients were documented of sudden laryngospasm after extubation. The residual effect of neuromuscular blocking and anesthetic agents were concluded as precipitating factors. Most of them were operated in tertiary and secondary care hospital for minor operation. There was low percentage of pediatric patients in this group of hospital, both nurse anesthetists and anesthesiologists needed to have continuous education program such as short course for pediatric anesthesia. The program could improve quality of anesthetic care for pediatric patients, not only for reduction the incidence of rein-tubation but also reduction of all adverse events in pe-diatric patient as a whole.

Reintubation at ward and intensive care were initiated by dyspnea, unstable hemodynamics and alteration of conscious in patients who mostly were not suitable for ordinary postoperative care. In university hospital, these groups of patients were always transferred to postoperative intensive care unit and the endotracheal tubes were used for mechanical ventila-

tory support. The incidence of reintubation in patient with ASA 3-4 was lower in university hospital than tertiary and secondary hospitals. We suggested that if these groups of patients (severe head injury, severe sepsis, old age and multiple end organ dysfunction) had to be operated in tertiary and secondary care hospitals, high quality of postoperative critical care units were needed to improve the outcome. Investments of medical equipments and qualified personnel may cost more than good referral system.

We agreed with Lee [6] that respiratory complications were the most common cause of reintubation in perioperative period. But respiratory complications were the results from other precipitating factors including residual drug effect, primary upper airway obstruction and unstable hemodynamics. In this study, we could identify more details of precipitating causes of respiratory insufficiency. Some suggestion could be confidentially introduced for improvement process of anesthetic care in the global picture of the whole country.

From our data, we could not clearly discriminate residual effect of neuromuscular blocking from anesthetic agents. In real clinical situation, both always happened together such as not fully alert with rapid shallow respiration . We concluded that residual effect of neuromuscular blocking and anesthetic agents were the main precip-itating factors of reintubation after planned extubation in perioperative period and were preventable by appropriate decision.

The major limitation of this study was that not all twenty hospitals were equally active collecting data in details.We estimated five percents of all primary data loss and ten percents for incomplete report of adverse events. True incidence was expected higher. In addition, the monitoring of neuromuscular function via periph-eral nerve stimulator was not routinely performed in Thailand. Some clinical evaluation of neuromuscular function (hand grip, head lift, effective cough) and conscious stage (full alert, easily follow command, har-dy follow command, deep sleep, not follow command) were neither routinely recorded in anesthetic document. We suggested the regular monitor and document in both anesthetic document and postoperative database system.

Our data demonstrated relatively high inci-dence of reintubation in Thailand. We suggested the regular event collection of reintubation as one of the Key Performance Index as anesthesia quality indicator for improvement quality assurance.

In conclusion, high incidence of reintubation after planned extubation was reported in Thai Anesthesia Incidents Study (THAI Study). Three main precipitating causes of reintubation were residual effect of neuromuscular blocking and anesthetic agents, inap-propriated extubation in high risk patients and upper airway obstruction. Most incidents were preventable. Implementation of extubation algorithm and extubation criteria might reduce incidence in university hospital. Increase anesthetic competency for pediatric patient by training of anesthesia personnel and improvement of postoperative care are suggested in tertiary and secondary care hospitals.

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## *การใส่ท่อหายใจซ้ำหลังการถอดท่อหายใจเมื่อสิ้นสุดการให้ยาระงับความรู้สึก : รายงานจากฐานข้อมูลการศึกษาอุบัติการณ์เกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทย (THAI Study), 163,403 ราย*

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***วัตถุประสงค์:*** *เพื่อค้นหาสาเหตุนำที่ทำให้ผู้ป่วยต้องได้รับการใส่ท่อหายใจซ้ำหลังการถอดท่อหายใจเมื่อสิ้นสุดการให้ยาระงับความรู้สึก ผลกระทบและผลลัพธ์ โอกาสที่จะป้องกัน แนวทางแก้ไขโดยเฉพาะที่เกี่ยวข้องกับ กระบวนการการให้ยาระงับความรู้สึก*

***วัสดุและวิธีการ:*** *ทำการศึกษาจากรายงานผู้ป่วยที่รายงานว่าได้ทำการใส่ท่อหายใจซ้ำ ในฐานข้อมูลการศึกษาอุบัติการณ์เกิดภาวะแทรกซ้อนทางวิสัญญีในประเทศไทย (THAI Study) จากจำนวนผู้ป่วยทั้งหมด 163,403 ราย*

***ผลการศึกษา:*** *จากรายงานผู้ป่วยที่ได้ทำการใส่ท่อหายใจซ้ำจำนวนทั้งหมด 234 ราย เป็นอุบัติการณ์ 27 ราย จาก 10,000 รายของผู้ป่วยที่ได้รับการให้ยาระงับความรู้สึกโดยใส่ท่อหายใจ ซึ่งอุบัติการณ์ที่เกิดในโรงพยาบาลโรงเรียนแพทย์เท่ากับโรงพยาบาลศูนย์ และโรงพยาบาลทั่วไปของกระทรวงสาธารณสุข อุบัติการณ์สูงขึ้นในเด็กอายุน้อยกว่า 1 ปี และ ผู้สูงอายุมากกว่า 70 ปี ผู้ป่วย 158 ราย (67.5%) ได้รับการใส่ท่อหายใจซ้ำในห้องผ่าตัด หรือห้องพักฟื้น และ 83 รายของผู้ป่วยกลุ่มนี้ การใส่ท่อหายใจเกิดในเวลาเพียง 10 นาทีหลังจากการถอดท่อหายใจ การวินิจฉัยเบื้องต้นที่พบบ่อยที่สุดคือภาวะการหายใจน้อย ไม่เพียงพอ และ ภาวะการอุดกั้นของทางเดินหายใจส่วนบน สาเหตุนำสามประการที่พบบ่อยที่สุดคือ ฤทธิ์ที่หลงเหลืออยู่ของยาหย่อนกล้ามเนื้อและยาสลบ (53-57%) ภาวะการอุดกั้นของทางเดินอากาศส่วนบน (31%) และระบบไหลเวียนเลือดไม่คงที่ (26.3%) ผู้ป่วยครึ่งหนึ่งที่ได้รับการใส่ท่อหายใจซ้ำในห้องผ่าตัดและห้องพักฟื้นสามารถถอดท่อหายใจได้ในเวลา 6 ชั่วโมง และ 58-72 % ของผู้ป่วยกลุ่มนี้หายเป็นปกติ โอกาสป้องกันภาวะแทรกซ้อนนี้มีมากถึง 80% โดยการเพิ่มการฝึกอบรม และการควบคุมการทำงาน*

***สรุป:*** *มากกว่า90 % ของการใส่ท่อหายใจซ้ำที่เกิดในห้องผ่าตัดและห้องพักฟื้น เกี่ยวข้องกับกระบวนการทางการให้ยาระงับความรู้สึก การลดอุบัติการณ์สามารถทำได้โดยผ่านทางกระบวนการประกันคุณภาพในการให้บริการพร้อมกับการเพิ่มประสบการณ์ผู้ให้บริการโดยการให้ความรู้และการฝึกอบรม*