# Postoperative Adverse Events in Morbidly Obese Patients Undergoing Anesthesia: A Retrospective Study

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***Objective:*** *To determine the incidence of postoperative respiratory complications among morbidly obese patients who had undergone anesthesia.*
***Material and Method:*** *This retrospective chart review was conducted at two centers, Siriraj Hospital and Buddhachinaraj Hospital. Adult in-patients aged greater than or equal to 18, with a body mass index (BMI) greater than or equal to 35 kg/m$^2$, and who had undergone non-cardiac surgery and anesthesia, were enrolled. The postoperative respiratory adverse events, such as pneumonia, pulmonary embolism, re-intubation, airway obstruction and airway trauma, were recorded.*
***Results:*** *A total of 830 medical records of morbidly obese patients who had been admitted at the two medical centers between October 2013 and December 2016 were retrieved. Around two-thirds of patients were female. The patients' mean age was 46.4 years old (the maximum was 98, and the minimum 18), with a mean BMI of 38.83 kg/m$^2$ (the maximum was 78.5 kg/m$^2$, and the minimum 35 kg/m$^2$). The overall perioperative respiratory adverse events numbered 37 (4.5%). The postoperative respiratory adverse event was re-intubation (0.5%); the remaining postoperative respiratory adverse events were pneumonia (0.1%) and upper airway obstruction (0.1%). All those cases had undergone general anesthesia, and their American Society of Anesthesiologists (ASA) Physical Status classification was greater than, or equal to, class 3.*
***Conclusion:*** *The incidence of postoperative respiratory adverse events was minimal; therefore, risk factors were unable to be identified.*

***Keywords:*** *Morbid obesity anesthesia, Postoperative pulmonary, Anesthesia adverse events*

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Morbid obesity is a medical condition that may have several adverse effects on health, leading to a reduced life expectancy and increased health problems[1]. From a surgical perspective, morbid obesity has long been considered a risk factor for adverse post-surgical outcomes. Morbid obesity is associated with pulmonary disorders, including Obesity Hypoventilation Syndrome (OHS), pneumonia, atelectasis, re-intubation and pulmonary embolism[2], as well as a risk of cardiovascular and wound-infection complications. From an anesthetic point of view, morbid obesity also seems to be related to a profound impact on anesthesia-related morbidity and mortality.

Morbid obesity is associated with an excess of metabolically-active adipose tissue and the consequent increased work load on the supportive muscles, which leads to higher oxygen consumption and carbon dioxide production. Other important effects are decreased myocardial compliance, increased work of breathing, and decreased efficiency as more work is spent on lung inflation. A reduction in respiratory system compliance and lung volumes is also evident among morbidly obese patients, who have higher respiratory rates to compensate for their lower tidal volumes. Their functional residual capacity may decline to less than the closing volume, and oxygenation may be affected. Patients may be hypoxemic post-induction, possibly due to ventilation-perfusion mismatching at the base of the lungs, where microatelectasis is likely to occur. Postoperatively, decreased lung capacities are expected for at least five days, but acute airway obstruction is more likely[3]. Morbid obesity is also associated with a decrease in vital capacity, functional residual capacity, forced expiratory volume in one second, and arterial oxygen tension[3,4]. Some studies have also identified overweight, obesity, and morbid

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obesity as risk factors for post-operative pneumonia[5].

From the database of the Department of Anesthesiology, Siriraj Hospital, approximately 1,000 cases of obese patients undergo anesthesia each year, and the number is increasing steadily. In Thailand, there is no report on the incidence of, and risk factors for, postoperative adverse events among morbidly obese patients who had received anesthesia. The main objective of this study was to evaluate the incidence of postoperative respiratory adverse events among morbidly obese patients.

## Material and Method

This was a retrospective chart review conducted at two centers: Siriraj Hospital and Buddhachinaraj Hospital. The study was approved by the Institutional Review Board (Si 562/2016).

The definition of obesity is classified by the World Health Organization (WHO) into classes I, II and III, based on the body mass index (BMI) of the patients. Patients are defined as overweight (pre-obese) if their BMI is between 25 and 29.9 kg/m$^2$, obese if it is greater than 30 kg/m$^2$, and morbidly obese if the BMI is greater than 35 kg/m$^2$[6]. Thus, inclusion criteria were the medical records of adult in-patients aged $\geq$18 with a BMI $\geq$35 kg/m$^2$ who had undergone non-cardiac surgery. Exclusion criteria were pregnancy, ambulatory surgery, and incomplete or missing data on the outcomes of interest.

Data sources for the perioperative period and the discharge summary reviews were obtained from Siriraj Hospital's electronic medical records, and from the departmental database and medical records at Buddhachinaraj Hospital. All adverse events of interest were defined by operational definitions (Table 1)[7-29], and definite diagnoses were retrieved from the discharge summary notes prepared by physicians either in long hand or using International Classification of Diseases (ICD) codes. The following were recorded: demographic data, surgical procedures, site of the operations, airway management, anesthetic management and surgical risks (low risk: dermatologic surgeries, endoscopic surgeries, cataract surgeries and breast surgeries; intermediate-risk: carotid end arterectomies, head and neck surgeries, gynecologic surgeries, gastrointestinal/intraabdominal surgeries, orthopedic surgeries, prostate surgeries and thoracic surgeries; and high-risk: emergency major surgeries, aortic or major vascular surgeries, and other major operations with anticipated large fluid shifts and/or blood losses).

### *Statistical analysis*

The primary objective of this study was to determine the incidence of postoperative respiratory adverse events among morbidly obese patients who had undergone anesthesia. The sample size was calculated on the assumption of a 2% incidence of pneumonia[30]. A sample size of 753 subjects was needed to achieve a 95% confidence interval (CI) with a 1% margin of error. However, the sample size was inflated by 10% due to incomplete information in records; therefore, 830 medical records were retrieved.

Descriptive statistics were used to examine the preoperative characteristics, the intraoperative and postoperative variables, and the incidence of the perioperative adverse events. Data are presented as mean $\pm$ standard deviation or number (percent), as appropriate. As for the possible risk factors of postoperative respiratory events, a univariate analysis and a multiple logistic regression analysis were used. Data were analyzed using PASW Statistics for Windows, 18.0 Chicago: SPSS Inc.

## Results

A total of 830 medical records of morbidly obese patients who had been admitted at the two medical centers between October 2014 and January 2016 were retrieved. Around two-thirds of the patients were female. The patients' mean age was 46.4 years old (the maximum was 98, and the minimum 18), with a mean BMI of 38.83 kg/m$^2$ (the maximum was 78.5 kg/m$^2$, and the minimum 35 kg/m$^2$). Most patients had at least one coexisting disease, and the most common were hypertension, diabetic mellitus and dyslipidemia. A prediction of difficult intubation was noted on the preanesthetic records of a quarter of the patients; however, the intraoperative anesthetic records documented difficult intubation and failed intubation for only 1.2% and 0.1% of the patients, respectively. Nearly all of the patients (94.4%) underwent low- to intermediate-risk surgery. General anesthesia was conducted for 78.1% of the patients. Other demographic data, the preoperative airway assessments and the intraoperative data are at Table 2 and 3.

Overall, 35 (4.2%) perioperative respiratory adverse events were documented. The respiratory adverse events occurred more frequently in the intraoperative period than in the postoperative period. The most common intraoperative respiratory adverse event was bronchospasm (14 patients; 1.7%), whereas the most frequent postoperative respiratory adverse event was re-intubation (2; 0.2%) (Table 4). The

**Table 1.** Operational definitions of perioperative adverse events

| Adverse event | Definition |
|---|---|
| Acute myocardial infarction | Diagnosis by rising of Cardiac Enzyme (Trop-T) ≥50 to 100 or EKG-12 lead with ST-T change with signs or symptoms of angina pectoris[7]. |
| Bronchospasm | Is diagnosed when there is dyspnea, wheezing, chest tightness, tachypnea, small tidal volumes, a prolonged expiratory time, and hypercapnia are seen[8]. |
| Cardiac arrest | Sudden pulseless or sudden unexpected loss of heart function and breathing and consciousness[9]. |
| Cerebrovascular accident | New ischemic or hemorrhagic stroke[10]. |
| Death | Death within 24 hours after anesthesia, and cause of death related to anesthesia or other cause, such as patient condition, or related to surgery[11]. |
| Difficult intubation | An intubation is called difficult if a normally trained anesthesiologist needs more than 3 attempts or more than 10 minutes for a successful, endotracheal intubation[12]. |
| Esophageal intubation | Esophageal intubation event which was detected late until hypoxia, clinical cyanosis or pulse oximeter reading of less than 85%[13]. |
| Failed intubation | An inability to intubate the patient's trachea (even after only a single failed attempt), and an inability to ventilate the patient adequately with a bag and mask to maintain oxygen saturations above 90%[14]. |
| Hypertension | Blood pressure >160/90 mmHg[15]. |
| Hypotension | Blood pressure <80% control[16]. |
| Hypoxemia | Oxygen saturation below 90% for any condition[17]. |
| Oliguria | Defined as a urine output that is less than 1 mL/kg/h in infants, less than 0.5 mL/kg/h in children, and less than 400 mL or 500 mL per 24 h in adults[18]. |
| Peripheral nerve injury | Numbness or tingling if a nerve is being compressed due to factors such as a narrow passage way (including central nerve in spinal cord and cranial nerves). Diagnosis by Electromyography (EMG), nerve conduction study, CT scan, or MRI neurography with Sunderland Classification system[19]. |
| Pneumonia/Aspiration pneumonitis | An inflammatory condition of the lung affecting primarily the microscopic air sacs known as alveoli. Diagnosis by chest radiograph have new infiltrative lesion with at least 2/3rds of:1.Fever, which may be mild or high;2.Cough (greenish or yellow mucus, or even bloody mucus); and/or 3. Abnormal white blood cell count (>12,000/$mm^3$ or <4,000/$mm^3$ or >10% bands)[20]. |
| Post-dural-puncture headache | Is a complication of puncture of the dura mater, exacerbated by movement, and sitting or standing, and relieved by lying down. Nausea, vomiting, pain in arms and legs, hearing loss, tinnitus, vertigo, dizziness and paresthesia of the scalp are common[21]. |
| Pulmonary embolism | Is a blockage of the lung's main artery or one of its branches by a substance that has traveled from elsewhere in the body through the bloodstream. Diagnosis by pulmonary angiography, CT scan of the lungs, or VQ scan (Ventilation-Perfusion scan)[22]. |
| Re-intubation | The patient was intubated again within 24 hours of extubation at the end of anesthetic care[23,24]. |
| Severe arrhythmia | Cardiac dysrhythmia or irregular heartbeat. Is a group of conditions in which the heartbeat is irregular, too fast, or too slow, e.g.: -High-grade atrioventricular block; -Mobitz II atrioventricular block; -Third-degree atrioventricular heart block; -Symptomatic ventricular arrhythmias; -Supraventricular arrhythmias (including atrial fibrillation) with uncontrolled ventricular rate (HR >100 bpm at rest); -Symptomatic bradycardia; and -Newly recognized ventricular tachycardia[25]. |
| Suspected emergence delirium | Dissociated state of consciousness in which the patient is inconsolable, irritable, uncompromising or uncooperative, typically thrashing, crying, moaning, or incoherent[26]. |

**Table 2.** Baseline characteristics and preoperative airway examination

| Variables | Total (n = 830) |
|---|---|
| Site | |
| Buddhachinaraj | 325 (39.5) |
| Siriraj | 505 (60.5) |
| Gender | |
| Male | 258 (31.0) |
| Female | 572 (69.0) |
| ASA classification | |
| 2 | 358 (43.3) |
| 3 | 465 (55.9) |
| 4 | 7 (0.8) |
| Mallampati classification | |
| 1 to 2 | 667 (80.5) |
| 3 to 4 | 163 (19.5) |
| Thyromental distance | |
| <6 cm | 149 (17.8) |
| ≥6 cm | 681 (82.2) |
| Coexisting disease | |
| None | 258 (31.2) |
| Hypertension | 443 (53.5) |
| Dyslipidemia | 205 (24.5) |
| Diabetes mellitus type 2 | 239 (28.5) |
| Obstructive sleep apnea | 30 (3.5) |
| Services | |
| General surgery | 183 (21.9) |
| Orthopedic | 198 (23.7) |
| Gynecology | 128 (15.4) |
| Eye & Ear-nose-throat | 73 (8.7) |
| Urology | 46 (5.5) |
| Neurosurgery | 35 (4.2) |
| Stomach-bowel surgery | 48 (5.7) |
| Others | 125 (14.9) |

Data presented as n (%)

**Table 3.** Intraoperative data and anesthesia management

| Variables | Total (n = 830) |
|---|---|
| Risk of surgery | |
| Low | 265 (31.9) |
| Intermediate | 519 (62.5) |
| High | 46 (5.6) |
| Position | |
| Supine | 671 (80.8) |
| Prone | 49 (5.9) |
| Lithotomy | 66 (7.9) |
| Type of anesthesia | |
| Total intravenous anesthesia | 46 (5.5) |
| Regional anesthesia | 136 (16.4) |
| General anesthesia | 604 (72.8) |
| Combined general and regional anesthesia | 44 (5.3) |
| Mask ventilation | |
| Difficult/easy | 36 (4.3)/ 482 (58.1) |
| Laryngeal mask airway | |
| Difficult/easy | 16 (1.9)/ 37 (4.4) |
| Intubation | |
| Difficult/easy | 63 (9.7)/ 587 (90.3) |
| Number of attempt for direct laryngoscopy | |
| 1 | 574 (69.1) |
| 2: >2 | 22 (2.6): 2 (0.2) |
| Laryngoscopic view | |
| Grade 1: 2 | 478 (57.6): 87 (10.5) |
| Grade 3: 4 | 23 (2.8): 1 (0.1) |
| Ventilator setting | |
| Modes of mechanical ventilation | |
| Volume control ventilation | 448 (53.9) |
| Pressure control ventilation | 168 (20.2) |
| Fractional inspired oxygen concentration | |
| 0.4 | 346 (41.7) |
| >0.4 | 264 (31.7) |
| Positive end expiratory pressure ($cmH_2O$) | |
| 4 to 10 | 285 (34.3) |
| >10 to 17 | 3 (0.4) |
| Peak inspiratory pressure ($cmH_2O$) | |
| 11 to 20 | 119 (14.3) |
| >21 to 40 | 49 (5.9) |

Data presented as n (%)

incidence of postoperative respiratory complication was very low; therefore, the risk factors could not be identified. The data of those patients who experienced respiratory complications are at Table 5. Six patients experienced postoperative respiratory complications; one patient was at Siriraj Hospital, and the five others were at Buddhachinaraj Hospital. None of those 6patients received intraoperative, lung-protective mechanical ventilation during general anesthesia, and the positive end-expiratory pressure (PEEP) was set at zero. Their American Society of Anesthesiologists (ASA) Physical Status classification was ≥3. As for the adverse events of other systems, intraoperative hypotension (279 patients; 33.6%) was the most common event. The other intraoperative complications were hypertension (61; 7.3%) and severe arrhythmia (22; 2.6%). There were no reports of pulmonary embolism, even though there was no standard protocol

**Table 4.** Perioperative adverse events and other outcomes

| | Number of events |
|---|---|
| Overall perioperative respiratory complications | 35 (4.2) |
| Intraoperative | |
| Bronchospasm | 14 (1.7) |
| Desaturation | 10 (1.2) |
| Difficult intubation | 5 (0.6) |
| Esophageal intubation | 1 (0.1) |
| Failed intubation | 1 (0.1) |
| Postoperative | |
| Re-intubation | 2 (0.2) |
| Pneumonia | 1 (0.1) |
| Upper airway obstruction | 1 (0.1) |
| Other adverse events | |
| Intraoperative | |
| Severe arrhythmia | 22 (2.6) |
| Hypertension | 61 (7.3) |
| Hypotension | 289 (34.8) |
| Postoperative | |
| Delay emergence | 1 (0.1) |
| Urinary retention | 5 (0.6) |
| Oliguria | 36 (4.3) |
| Wound infection | 7 (0.8) |
| Myocardial infarction | 2 (0.2) |
| Cardiac arrest | 1 (0.1) |
| Death | 2 (0.2) |
| Received pack red cell blood transfusion | |
| 1 to 5 unit: >5 unit | 36 (4.3): 3 (0.4) |
| Hospital length of stay (day) | 6.03±7.76 (1 to 67) |
| Intensive care unit length of stay | 0 to 34 |
| Ventilator days | 0 to 34 |

Data presented as mean±SD, (min, max) or n (%)

for venous thrombo embolism prevention for morbidly obese Thai patients.

## Discussion

Morbid obesity could have a profound impact on anesthesia-related morbidity and mortality due to changes in several pathophysiologies. The incidence of postoperative complications appears to be increasing, and this may be partly due to increasing surgical loads as well as a steady growth in elderly and obese populations. These factors are projected to lead to a 25% increase in the number of surgeries and a 100% increase in postoperative complications[31].

The incidence of postoperative respiratory adverse events among morbidly obese patients varies with different types of surgery[32]. Postoperative

**Table 5.** Characteristics of patients experiencing postoperative respiratory complications

| Gender/age | BMI ($kg/m^2$) | Coexisting disease | ASA | Diagnosis | Operation | Choice of anesthesia | Complication |
|---|---|---|---|---|---|---|---|
| F/33 | 35.9 | None | 3 | CA thyroid | Thyroid lobectomy | GA | Airway obstruction |
| F/58 | 38.3 | HT, valvular heart disease | 3 | Spondylolisthesis | Spinal instrumentation T12- L2 | GA | Pneumonia |
| M/54 | 40 | None | 4E | DM foot | Debridement | GA | Reintubation |
| M/55 | 40 | HT, CAD | 3 | Liver injury | Explore laparotomy | GA | Reintubation |
| F/55 | 40.6 | HT, DM, CAD, dyslipidemia | 3E | Rupture sigmoid colon | Debridement | GA | Reintubation |
| M/50 | 46 | None | 3 | CA nasopharynx | Gastrostomy | GA | Reintubation |

F = female; M = male; BMI = body mass index; ASA = The American Society of Anesthesiologists Physical Status classification; HT = hypertension; CAD = coronary artery disease; DM = diabetes mellitus; CA = cancer; GA = general anesthesia

respiratory adverse events were documented among 4.5% of patients (n = 993) who had undergone non-cardiac, moderate to major surgery;similarly, around 22.3% of patients (n = 207), especially patients with a BMI >43 kg/m$^2$ who had undergone gastric bypass surgery, experienced postoperative respiratory adverse events[2].

The impact of morbid obesity on the postoperative respiratory adverse outcomes produced questionable results. A study by Mendonca et al reported that morbidly obese patients with a BMI 38 to 44 kg/m$^2$ and residual neuromuscular blockade were independent risk factors for the occurrence of the immediate postoperative adverse respiratory events in Post Anesthesia Care Unit[33]. Another study by Lin et al proposed that morbid obesity (BMI >35 kg/m$^2$) was a risk factor for postoperative re-intubation and airway obstruction[34]. However, Lin's study did not report the number of morbidly obese patients, and the statistical association between morbid obesity and outcomes was not demonstrated in that study. In addition, a large, prospective study reported a comparable incidence of postoperative pneumonia and pulmonary embolism among underweight, normal weight and obese patients. Nevertheless, the authors demonstrated an advantage of obesity on long term survival after surgery[30].

A growing body of evidence suggests that intraoperative mechanical ventilation for surgery should consist of lung-protective mechanical ventilation using a low tidal volume in the range of 6 to 8 mL/kg of predicted body weight, a moderate level of PEEP of 6 to 8 cm $H_2O$, and periodic lung recruitment maneuvers (every 30 minutes to an hour). In the case of morbidly obese patients, lung function impairment is an important determinant of respiratory function before and during anesthesia. It can manifest as a reduced lung volume with increased atelectasis, a small airway closure, decreased chest wall compliance, increased resistance, and moderate to severe hypoxemia. These physiological alterations are more marked in OHS or obstructive sleep apnea (OSA). To reduce postoperative pulmonary complications, PEEP levels are recommended to be set higher for obese than for non-obese patients[35].

In our study, 6 patients experienced postoperative respiratory complications (Table 5); one patient was at a university hospital, and the remainders were at a regional hospital. None of the 6 patients had received intraoperative lung protective mechanical ventilation, and the PEEP had been set at zero. This might have been because of the utilization of an older generation of mechanical ventilator and a different style of ventilator setting by the anesthetic personnel involved. Nevertheless, the precise role of the lung protection strategies has been less clearly defined, and there is a large, randomized controlled trial (PROBESE) currently underway[35]. To date, however, there is no routine, practical guideline for supporting such an approach for intraoperative lung protective mechanical ventilation.

The effect of morbid obesity on severe cardiovascular adverse outcomes and deaths is also controversial. A large cohort study by Reeves et al followed 4,372 patients, of whom 156, morbidly obese patients underwent coronary artery bypass grafting (CABG).Reeves demonstrated that morbid obesity was not associated with either death (adjusted odds ratio [OR] 1.12; 95% confidence interval [CI] 0.39 to 3.20) or with myocardial infarction (OR 0.90; 95% CI 0.44 to 1.88), compared with normal weight and under weight patients[36]. On the other hand, Kuduvalli et al determined the primary outcome of their study was mid-term mortality. The study followed 4,713 patients who had undergone CABG, among which 1,284 obese patients were reviewed. An analysis of the adjusted freedom from death among the obese patients at 30 days, and 1, 2, 3 and 4 years concluded that the in-hospital mortality did not seem to be adversely affected by obesity, but there appeared to be a significant increase in mortality among obese patients during the 4-year follow-up period[37]. Our study found a few, severe, postoperative adverse events, such as myocardial infarction (0.2%), cardiac arrest (0.2%), and death (0.1%), and we did not have long-term, follow-up data.

Our study has some limitations. First, this was a retrospective study,which provides an inferior level of evidence compared to a prospective study. The chart abstraction and the management of conflicting data might not be totally systematic and reliable. However, we took action to circumvent the disadvantages by training two abstractors (NR, PC) and formulating operational definitions before study initiation. In addition, most patients had a relatively-low BMI (35 to 39.9 kg/m$^2$), and the study's population was lower than those of many previous studies. Finally, few postoperative respiratory events were found; this may be because we analyzed a database of postoperative complications among adult patients who had undergone a very wide variety of surgical procedures performed in a large teaching hospital and a tertiary referral center.

In summary, the postoperative respiratory adverse events were re-intubation, airway obstruction and pneumonia. As few incidents of postoperative respiratory adverse events were found, the risk factors could not be determined. We recommend using regional anesthesia or a low tidal volume, a moderate level of PEEP, and periodic lung recruitment maneuvers for intraoperative ventilator settings for those morbidly obese patients who need general anesthesia.

**What is already known on this topic?**

Morbidly obese patients are at risk of postoperative respiratory adverse events due to physiologic derangement. The adverse events vary with different surgical populations. Patients are also at risk of postoperative myocardial infarction, wound infection and nerve injury.

**What this study adds?**

Body mass index is an imperfect tool for predicting the occurrence of postoperative respiratory complications. In this study, the incidence of postoperative respiratory adverse events among the morbidly obese was minimal. General anesthesia without intraoperative lung protection strategies and severe co-existing disease may be risk factors for postoperative respiratory adverse events.

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**Potential conflicts of interest**

None.

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## การศึกษาย้อนหลังเรื่องภาวะแทรกซ้อนทางระบบหายใจหลังการระงับความรู้สึกในผู้ป่วยโรคอ้วนรุนแรง

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**วัตถุประสงค์:** เพื่อศึกษาอุบัติการณ์ของการเกิดภาวะแทรกซ้อนทางระบบหายใจที่เกิดขึ้นหลังการผ่าตัดในผู้ป่วย โรคอ้วนรุนแรงที่มารับการระงับความรู้สึก

**วัสดุและวิธีการ:** เป็นการศึกษาแบบย้อนหลังจากบันทึกเวชระเบียนของโรงพยาบาลศิริราชและโรงพยาบาลพุทธชินราช โดยทำการศึกษาในผู้ป่วยอายุมากกว่า 18 ปีที่มีดัชนีมวลกายมากกว่าหรือเท่ากับ 35 กิโลกรัม ต่อตารางเมตรที่มาผ่าตัดทุกชนิดยกเว้นการผ่าตัดหัวใจภายใต้การระงับความรู้สึก ผู้วิจัยได้ทบทวนวรรณกรรมและกำหนดคำจำกัดความของภาวะแทรกซ้อนทางระบบหายใจ เช่น ภาวะปอดติดเชื้อ ภาวะที่มีการอุดกั้นของหลอดเลือดแดงของปอด การใส่ท่อหายใจซ้ำ ภาวะอุดกั้นทางหายใจและการบาดเจ็บของทางหายใจ เป็นต้น

**ผลการศึกษา:** ผู้นิพนธ์เก็บข้อมูลของผู้ป่วยอ้วนรุนแรงที่เข้าได้กับการศึกษาตั้งแต่วันที่ 1 ตุลาคม พ.ศ. 2556 ถึง วันที่ 31 ธันวาคม พ.ศ. 2559 ทั้งหมด 830 รายผู้ป่วย 2 ใน 3 เป็นเพศหญิง มีอายุเฉลี่ย 46.4 ปี (18 ถึง 98) มีค่าดัชนีมวลกายเฉลี่ย 38.83 กิโลกรัมต่อตารางเมตร (35 ถึง 78.5) อุบัติการณ์ของการเกิดภาวะแทรกซ้อนทางระบบหายใจที่เกิดขึ้นตลอดช่วงการผ่าตัดเป็น 37 เหตุการณ์ (ร้อยละ 4.5) โดยเหตุการณ์ที่เกิดขึ้นหลังการผ่าตัด ได้แก่ การใส่ท่อ หายใจซ้ำ (ร้อยละ 0.5) ภาวะปอดติดเชื้อ (ร้อยละ 0.1) และภาวะอุดกั้นของทางหายใจ (ร้อยละ 0.1) ผู้ป่วยที่มีภาวะแทรกซ้อน ในระบบหายใจหลังผ่าตัดทุกรายมีพยาธิสภาพของร่างกายที่รุนแรงและเป็นอุปสรรคต่อการดำเนินชีวิต ร่วมกับได้รับการระงับความรู้สึกแบบทั่วตัว

**สรุป:** อุบัติการณ์ของการเกิดภาวะแทรกซ้อนทางระบบหายใจหลังการระงับความรู้สึกพบได้น้อยจึงไม่สามารถวิเคราะห์หาปัจจัยเสี่ยงต่อการเกิดภาวะดังกล่าวได้