

Evaluation of Major Complications of Airway Management during Anaesthesia

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Abstract

Introduction: Respiratory complications are quite common occurrence during surgery. It can lead to sudden death during surgery and as it occurs due to anaesthesia, respiratory complication can occur in any surgery. Due to application of general anaesthesia, physiological or mechanical ventilation is disrupted which is the main cause of respiratory complications. The four major principles to be followed while managing the airway are to ensure that if the airway tract is patent, if any advanced management of the airway is indicated, confirm the device placement in the airway tube, if the tube is secure and the confirmation of the device placement is checked frequently.

Aims and Objectives: To evaluate the occurrence of airway complication during surgery and to find out the effective scoring system for assessment of airway complication.

Materials and Methods: This retrospective study was conducted with 90 patients who were evaluated demographic characteristics, characteristics of patients' general health, data regarding surgery, data regarding anaesthesia applied during surgery and data regarding management of patients with airway difficulty. The conditions that are considered to be the complication of airway are sudden need for airway device, hypoxemia, esophageal intubation, difficult airway management, ventilator associated complication, insufficient mouth opening, misposition of supraglottic airway devices, tachycardia and hypertension.

Results: The study found that most of the surgeries were general surgery constituting about 28.8% followed by ENT surgeries (27.77%). The main findings of this study were that the scoring systems Ventilation score and Cormack-Lehane, were found to be significant in assessing the probability of complication during surgery due to general anaesthesia.

Conclusion: The study concluded that there is significant airway associated complications during surgery and Cormack-Lehane and Ventilation score are the most effective scoring system.

Keywords: Airway complication, Surgery, Intubation, Airway

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Background

In the post-anesthetic period, respiratory complications are found to be the major cause of mortality even in healthy individuals. During the post-anesthetic

period, the pulmonary function is impaired even in normal individuals which results in decreased oxygen due to general anesthesia and impairment in mechanical

ventilation. In about 50 % of individuals, there is a reduction in the functional residual capacity. In anesthetized individuals, pulmonary atelectasis is known to be a common finding occurring in about 90% of healthy individuals [1,2].

Postoperative pulmonary problems are a significant determinant of patient prognosis and demand a significant amount of hospital resources, especially in critical care. Patient selection and, in some situations, informed patient consent need the prediction and anticipation of postoperative pulmonary problems. In addition to allowing research into techniques to prevent postoperative pulmonary problems, being able to assess the likelihood of them helps patients to be assigned to the proper arms of research studies. In some patients with obstructive sleep apnea and chronic obstructive pulmonary disease where evidence-based guidance is required for the reduction of post-operative anesthetic complications [3,4].

For the management of the airway during anesthesia, the surgeon must be aware of the anatomy, physiology, and pathology of the airway tract. The 4 major principles to be followed while managing the airway are to ensure that if the airway tract is patent, if any advanced management of the airway is indicated, confirm the device placement in the airway tube, if the tube is secure and the confirmation of the device placement is checked frequently. Change in the mental status of the patient, higher chances of aspiration or injury to the larynx (like penetrating injuries of abdomen, neck, or chest), decreased conscious levels (glass-gow coma scale less than or equal to 8), apnea, failure of the respiratory tract (hypercapnia, hypoxia) are the indications for airway management. Severe trauma or obstruction to the airway tube that does not allow for proper placement of endotracheal tube, so a surgical method is suggested for the maintenance of the airway. Cricothyrotomy or needle cricothyrotomy

is the method used for airway maintenance in adults in an emergency which is to be converted to formal tracheostomy after establishing the airway [5,6].

A prospective study was conducted on children for whom general anesthesia was given for conducting surgery. There are high chances of children suffering from laryngospasm, bronchospasm, desaturation, or airway obstruction. when were symptoms present 2 weeks before the surgery there was an increased risk of perioperative respiratory adverse events, whereas the upper respiratory tract symptoms were reduced the risk of perioperative respiratory adverse events 3 weeks before the surgery. The incidence of perioperative respiratory adverse events was raised when at least two family members had asthma, atopy, or smoked. Intravenous induction, inhalational versus injectable anesthetic management, and use of a face mask versus tracheal intubation all had lower risks than inhalational induction, inhalational versus intravenous maintenance of anesthesia, and use of a face mask versus tracheal intubation [7].

It has been observed that certain postoperative pulmonary complications (PPCs) and risk variables were in patients with severe chronic obstructive pulmonary disease (COPD) who had noncardiothoracic procedures. One or more PPCs (death, pneumonia, prolonged intubation, refractory bronchospasm, or prolonged intensive care unit (ICU) stay) affected 40 of 110 patients (38 percent). The anesthetic duration was more than 2 hours in 39 of 40 patients with a PPC. Patients in our study died at a rate of 45 percent after two years. By assessing potential preoperative and intraoperative risk factors, we were able to identify distinct risk variables for each PPC. In severe COPD patients, pulmonary variables alone do not predict the incidence of PPCs. Using tracheal intubation instead of general anesthesia during the intraoperative period may reduce the incidence of postoperative

bronchospasm. The risk of a prolonged ICU stay can be reduced by reducing the length of surgery and anesthesia [8].

Materials and Methods

This retrospective study was conducted between December 2017 to November 2018, in Shridev Suman subharti Medical College, Dehradun. The study considered 90 patients after applying inclusion and exclusion criteria. The patients who visited and received surgical intervention in our hospital, gave consent to use their records and those whom inhalational anaesthesia was given during surgery, were only included. The patients who had underlying chronic conditions, especially respiratory conditions were excluded. The patients who underwent emergency surgery or received regional form of anaesthesia were excluded from the study.

The patients data were evaluated thoroughly and analyzed statistically. The demographic characteristics, characteristics of patients' general health, data regarding surgery, data regarding anaesthesia applied during surgery and data regarding management of patients with airway difficulty, were obtained. Mask Ventilation (MV) score, physical status scoring by American Society of Anesthesiologists, Cormack-Lehane scores and type of devices which was used in the airway management and the complications that were observed. The authors of this study were present during the surgery till

the recovery time.

Complications of airway was evaluated in this study based on severity, namely, without any complication, mild complication (injury to teeth or buccal cavity or lips), moderate (obstruction of the airway or pulmonary aspiration) and severe form of complication (emergency surgical intervention for restoration of the airway, transferring the patient to Intensive Care unit or any form of brain damage or death of the patient during surgery). The conditions that are considered to be the complication of airway are sudden need for airway device, hypoxemia, esophageal intubation, difficult airway management, ventilator associated complication, insufficient mouth opening, misposition of supraglottic airway devices, tachycardia and hypertension.

Statistical analysis

The study conducted statistical analysis using SPSS 25. The descriptive data is expressed as mean±standard deviation and the variable data has been analyzed using Mann Whitney *U*-test. Fischer test and χ^2 test was used for qualitative data.

Results

The study considered 90 patients for this evaluation. The age of the patients was found to be 36.25±10.2 years old and there were 55 males (61.11%) and 35 females (38.88%). The demographic and general characteristics were considered for this study sample (Table 1).

Table 1: Demographic data and general characteristics of the study sample

Demographic characteristics	Value (Mean±SD)
Body Mass Index (kg/m ²)	24.25±4.2
Minimum age	26 years
Maximum age	47 years
Admission duration (days)	18±6
Patients who had complication during surgery	12 (13.33%)
Patients who had no complication during surgery	78 (86.66%)

The study found that most of the surgeries were general surgery constituting about 28.8% followed by ENT surgeries (27.77%). The other surgeries and their number of patients in each type of surgery have been listed in Table 2.

Table 2: The type of surgery underwent and the number of patients in each type

Type of surgery	Number
General surgery	26
ENT surgery	25
Gynecological surgery	22
Orthopedic surgery	17

The study considered several complications like difficult airway, Bronchospasm, Tachycardia, Excessive or bloody secretion and Esophageal intubation. It has been found that 12 (13.33%) patients had complications and 50% of them had difficult airway as complication. Table 3 shows all the complications and their number of patients in each complication.

Table 3: The complications that were recorded during surgery

Complication	Number of patients
Difficult airway	6 (50%)
Bronchospasm	2 (16.66%)
Tachycardia	2 (16.66%)
Excessive or bloody secretion	1 (8.33%)
Esophageal intubation	1 (8.33%)

The study has considered 3 scoring systems, namely, Ventilation score, Cormack-Lehane and Mallampati Classification, for effective analyses.

Table 4: The scores of airway assessments based on various scoring system

Scoring system	Scores	Number of patients
Ventilation score	I	35
	II	26
	III	18
	IV	11
Cormack-Lehane	I	36
	II	28
	III	13
	IV	13
Mallampati Classification	I	31
	II	30
	III	18
	IV	11

Several scoring systems were used for the evaluation of this study. The significance test was done for each parameters including demographic characteristics, surgeries that were done, various scoring systems and type of airway devices used. Table 5 shows the significance of each parameter including demographic, type of surgery, airway devices used and scoring system employed, for effective assessment of airway complication during anaesthesia.

Table 5: The findings of the significance tests for each characteristic or scoring system between patients who had complication and who did not

Parameter (characteristic or scoring system)		Patients without complication N = 78 (86.66%)	Patients with complication N = 12 (13.33%)	p-value*
Age		n/a	n/a	0.195
Gender	Male	50	5	0.554
	Female	28	7	
Body Mass Index				0.012
Surgery	Abdominal site (n=55)	47	8	0.071
	Extra-abdominal site (n=35)	31	4	
Ventilation score		n/a	n/a	0.000
Cormack-Lehane		n/a	n/a	0.001
Mallampati Classification		n/a	n/a	0.015
Airway Devices	Clasic Laryngeal Mask Airway	35	3	0.326
	Tracheal tube	29	7	0.255
	Others	14	2	0.025

* $\alpha = 0.005$; n/a = not applicable

Discussion

The most common causes of respiratory problems postoperatively include general anesthesia and surgery. A common respiratory consequence, atelectasis, can cause pneumonia and abrupt respiratory failure. It has recently been discovered that activating abdominal muscles during anesthetic induction reduces lung capacity, resulting in an increased prevalence of atelectasis. Furthermore, long-term mortality in patients with respiratory difficulties has recently been demonstrated to be considerably higher at 5 and 10 years. As a result, preventing or treating respiratory problems early may be advantageous in improving postoperative patient outcomes. The study concluded that respiratory problems following surgery can have serious repercussions. Improved outcomes are likely to result from a better knowledge of the underlying causes of respiratory problems and the development of early treatment techniques. Early treatment with preventive or therapeutic continuous positive airway

pressure has been shown to be effective in an abdominal surgical patient population; however, its usefulness in the general population is unknown [9].

During the perioperative period, asthmatic patients are believed to be at increased risk for developing pulmonary complications, which may result in serious morbidity. Medical records of the patients with asthma were studied in Minnesota between the years 1964 and 1983. The study concluded that in this group of asthmatics, the incidence of laryngospasm and bronchospasm was remarkably low perioperatively. The majority of individuals did not experience significant respiratory difficulties as a result of these issues. Complications were more common in elderly patients and those who had active asthma [10].

Obesity has been linked to respiratory issues, with the bulk of these issues occurring in the Post-Anesthesia Care Unit (PACU). The goal of this study was to see

how obese patients fared in the PACU and how often they had adverse respiratory events (AREs). A prospective study was conducted on 30 obese patients with the same number of non-obese patients which stated that the obese patients have a risk of undergoing surgery. In the PACU, obese patients had a higher rate of AREs. Obesity and residual neuromuscular inhibition were revealed as independent risk variables for the incidence of AREs in multivariate analysis. Obese patients spent more time in the PACU. In the PACU, obesity was deemed as a major risk factor for AREs. Patients who were obese spent more time in the PACU, but not in the hospital. Obese patients have prompted a sharp focus on clinical management strategy and the peri-operative pathway development, such as pre-operative risk assessment, the position of the patient during induction and anesthesia, modified intraoperative ventilation, and peri-operative use of continuous positive airway and non-invasive ventilation (NIV) [11,12].

The most common pulmonary consequences include pneumonia, respiratory failure, lobar atelectasis, bronchitis, and extended mechanical ventilation. The likelihood of these problems is determined by a number of risk variables, which can be split into two categories: procedure and patient-related factors. Preventing postoperative complications has the potential to reduce morbidity and mortality while also improving resource utilization. Patients who are undergoing elective surgery have been assigned preoperative risk using pulmonary risk indices, lung function tests, climbing stairs, and exercise tests of cardiopulmonary functions. Preoperatively identifying the high-risk patients has the benefit of focusing more attention on preoperative preparation, with the ultimate goal of lowering the rate of postoperative pulmonary problems [13].

Postoperative pulmonary complications (PPCs) are prevalent, expensive, and have

a high mortality rate. Upon the introduction of general anesthesia, changes to the respiratory system begin immediately: muscular functioning and respiratory drive, lung capacities are lowered, and atelectasis develops in more patients who are under therapy of neuromuscular blocking agents. During a major surgery after giving general anesthesia, the respiratory system may take up to 6 weeks to restore to its preoperative state. There are various risk factors for PPC development, and doctors should be aware of both the factors that can be modified or not in the patients at risk and provide the best possible therapy. There are numerous risk prediction models which have been validated. These have been helpful in enhancing our knowledge development of PPC but there is still insufficient unanimity to make them therapeutically relevant. Preoperative comorbidity optimization, smoking reduction, and anemia correction, as well as intraoperative protective breathing methods and adequate managing of the neuromuscular blocking medicines, are all examples of preventative approaches. The low levels of tidal volumes are to be determined according to the patient's optimal body weight, which is part of protective ventilation. More research is needed to determine the most effective level of PEEP, and ongoing randomized trials should offer that knowledge [4,14,15].

Conclusion

This current study has concluded that there is significant airway associated complications during surgery. The study further concludes that difficult airway is the most common complication. In our study, Cormack-Lehane and Ventilation score are the most effective scoring system to assess the airway complication of the patients during anaesthesia.

This study includes patients who are adult and specifically mid-aged and hence, the findings cannot be considered to be

appropriate for pediatric patients. There is a need to conduct more studies with varied population.

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