Original Article

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Analysis of Clinical Indicators of Quality in Patients with Endotracheal intubation

Anaesthesia Section

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ABSTRACT

Introduction: Quality and safety in anaesthesia is usually monitored by analysis of perioperative mortality–morbidity and are influenced by anaesthetic and non-anaesthetic factors.

Aim: This study was conducted to analyse the incidence of clinical indicators of quality in endotracheally intubated patients undergoing general abdominal surgeries and obstetric and gynaecological procedures under general anaesthesia and to determine contributing factors for the same.

Materials and Methods: This retrospective study was conducted at our institute over a period of 12 months and 709 case records of patients were reviewed. Patients aged 14 years and more belonging to all ASA groups undergoing abdominal surgeries for general and obstetric and gynaecological causes under General Anaesthesia (GA) with endotracheal intubation posted for both elective and emergency surgeries were included in the study. Demographic details including name, age, sex, hospital number, height, weight, body mass index, type of surgery, nature of surgery, duration, American Society of Anaesthesiologists (ASA) physical status were recorded and presence or absence of clinical indicators of quality (presence of cannot intubate cannot ventilate scenario, occurrence of dental injury, episode of non cardiogenic pulmonary oedema, incidents of residual neuromuscular blockade, existence of aspiration pneumonia, unplanned ICU/HDU admissions, interventions for respiratory/cardiac arrest, occasions of respiratory distress in the recovery period, occurrence of respiratory arrest within 48 hours and re-intubation) were noted and analysed for all 709 patients.

Results: Total 709 patients were analysed in our study. We found that incidence of ICU admission was 1.83% and that of respiratory distress which needed intervention were 0.56%. A total of 0.28% patients needed reintubation. Residual neuromuscular blockade was seen in 0.28% patients. We did not find any case of respiratory and cardiac arrest and also there was no Cannot Ventilate and Cannot Intubate (CVCI) situation encountered in our study. SPSS for windows (version 17.0) was used as statistical software. Chi-square test was the statistical test for significance. A p-value < 0.05 was considered significant.

Conclusion: Proper optimization of patients prior to surgery and optimal perioperative care will result in better quality of care and safety in anaesthesia. Documentation of events and its management during perioperative period will help to know the fields of inappropriate management and thereby improve the quality of care and detect the incidence rates with accuracy and help to formulate protocol for institution.

Keywords: Neuromuscular blockade, Perioperative, Reintubation, Respiratory distress

INTRODUCTION

Anaesthetic practice can be associated with potential disasters [1]. Due to the skill acquired in the training period, the incidence of morbidity and mortality is low. However, both mortality and major morbidity after anaesthesia can occur and they are influenced by anaesthetic and non-anaesthetic factors. Presence or absence of complications reflects the quality of care provided to the patient. Indicators have been developed by organizations and societies to measure and improve the quality of medical care [2]. The word quality is used to describe the degree or grade of excellence of a trait or characteristic of a system. The intention of monitoring quality of care was, and still is, to learn and improve. With this realization, quality assurance became quality improvement [3]. Voluntary reporting systems are growing rapidly, most of the efforts have been focused on encouraging the actual reporting of events; even more important is the need to focus on learning from these events and reducing risks to patients [4]. Though there is a lot of emphasis in the recent past on quality of care, very few studies have been published in this regard [5-7].

This study was conducted to analyse the quality of clinical indicators in endotracheally intubated patients undergoing general abdominal surgeries and obstetric and gynaecological procedures under general anaesthesia and also to determine contributing factors for the same.

MATERIALS AND METHODS

This retrospective study was conducted over a period of 12 months from November 2014 to November 2015. Patients aged 14 years and more belonging to all ASA groups undergoing abdominal surgeries for surgical and obstetric and gynaecological (as these surgeries are of same invasiveness) under GA with endotracheal intubation posted for both elective and emergency surgeries were included in the study. Patients with age less than 14 years, undergoing surgery under general anaesthesia with Laryngeal Mask Airway (LMA) and other devices, surgical procedures under regional anaesthesia, undergoing other types of surgeries were excluded from the study. During our study period we could review a total of 709 case sheets which met the inclusion criteria.

Data of all the patients who underwent surgical procedures was entered in excel format. For analysis of indicators, completion of 48 hours was necessary and the folders from medical records department of 709 patients who underwent abdominal surgeries for general and obstetric and gynaecological causes in whom endotracheal intubation was done, were reviewed. Demographic details including

age, sex, hospital number, height, weight, body mass index, type of surgery, nature of surgery, duration, ASA physical status were noted and presence or absence of clinical indicators of quality were noted. The data collected were: Presence of CICV scenario (situation in which ventilation with non-invasive techniques fails to maintain oxygenation and tracheal intubation proves impossible), occurrence of dental injury, episode of non cardiogenic pulmonary oedema, incidents of residual neuromuscular blockade (Train of four ratio<0.8), existence of aspiration pneumonia, unplanned ICU/HDU admissions, interventions for respiratory/cardiac arrest, occasions of respiratory distress in the recovery period, occurrence of respiratory arrest within 48 hours requiring reintubation. All the data were recorded into a structured performa and it was used for the process of statistical analysis to find out the incidence of clinical indicators.

STATISTICAL ANALYSIS

The data was analysed using –SPSS for windows (version 17.0) statistical software. All continuous variables were described using descriptive statistics and dichotomous variables using proportions. Pearson's Chi-square test was the statistical test of significance. The p-value<0.05 was considered significant.

RESULTS

Demographic parameters like age, sex, body mass index, type of surgery, nature of surgery, duration, ASA physical status and presence or absence of clinical indicators of quality (pre-anaesthetic evaluation, CVCI, dental injury, non cardiogenic pulmonary oedema, residual neuromuscular blockade, aspiration pneumonia, unplanned ICU/HDU admission, intervention for respiratory/cardiac arrest, relieving respiratory distress, respiratory arrest within 48 hours, reintubation) were noted and tabulated.

Pre-anaesthetic evaluation was done in all patients in which detailed history, physical and systemic examination, review of investigations, ASA classification, plan of anaesthesia and postoperative care were recorded.

The age of the patients in our study ranged from 14 to 85 years, with 338 patients (47.67%) in age group of 21 to 40 years and 234 patients (33%) in age group of 41-60 years [Table/Fig-1]. A total of 507 patients were females (71.5%) and 202 were males (28.5%). Nearly, 58.9% of patients belonged to category of overweight or obese class I, II, III. The ASA physical status of the patients was tabulated [Table/Fig-2] and most of the patients belonged to ASA I (324 patients- 45.6%) followed by 284 patients (40%) in ASA II category. Elective surgeries were predominant in number (622 patients 87.7%), in comparison to emergency surgeries (87 patients 12.3%).

There were three cases of dental injury (0.42%) and it was significantly associated with age. Unplanned ICU admissions were needed for 13 patients (n=1.83%). There was statistically significant association with age, ASA physical status III, duration (p=0.006), general abdominal surgery (p<0.001) and elective surgeries (p=0.003).

Age group of patients	Number of patients
14-20 yrs	31 (4.37%)
21-30 yrs	183 (25.8%)
31-40 yrs	155 (21.8%)
41-50 yrs	143 (20.16%)
51-60 yrs	91 (12.83%)
61-70 yrs	66 (9.3%)
71-80 yrs	36 (5%)
>80 yrs	4 (0.5%)
Total	709

[Table/Fig-1]: Showing distribution of age.

There was a significant association between ages. Incidence of patients who were relieved for respiratory distress was 0.56% (n=4). Reintubation within 48 hours was required in two patients (0.28%) [Table/Fig-3]. There was significant association in patients presenting for emergency surgeries and ASA physical status IV (p=0.001). There were three patients with residual neuromuscular block (incidence 0.42%). The incidence of aspiration pneumonia was found to be 0.14% (n=1) and had no statistically significant associations with age, sex, type of surgery, duration, ASA physical status and nature of surgery. There were no patients with non-cardiogenic pulmonary oedema. No patients required intervention for respiratory/cardiac arrest and there was no CVCI situation encountered.

DISCUSSION

Quality and safety in anaesthesia is usually monitored by analysis of perioperative mortality, morbidity and incidents. But these methods have limited sensitivity and specificity for quality and safety issues. Donabedian was one of the masters of designing measures of health care improvement programs known as the Donabedian Quality-of-Care Framework [5]. In the 1980, he proposed that we measure the quality of health care by observing its structure (the attributes of the settings where care is delivered), process (whether good medical practices are being followed), and outcome (the impact of the care on health status). Indicators were first introduced into the healthcare industry in 1982 by the Federal government of the United States for Medicare beneficiaries, as part of its professional review organization program [6].

Use of checklists, protocols and improved awareness of the relevance of critical incidents can improve the overall safety in anaesthesia [5]. Critical incident reporting should be introduced in all anaesthesia departments as part of quality assurance programs to ensure improved patient care [5]. A number of procedures done in modern anaesthetic era require endotracheal intubation with muscle relaxant, particularly in cases where regional technique is not feasible, contraindicated or failed. Endotracheal intubation was found without complications. They can arise when trying to intubate, while the tube is in situ and while extubation. It can be related to the tube, drugs and experience of the anaesthesiologist.

Unplanned ICU admission

ICU admission is not only a valid indicator of the severity of morbidity but the cost of ICU care is estimated to be three to five fold more

ASA physical status	No of patients
ASA I	324 (45.6%)
ASA II	284 (40%)
ASA III	79 (11.1%)
ASA IV	19 (2.6%)
ASA V	3 (0.4%)
Total	709

[Table/Fig-2]: ASA status.

SN	Quality indicators	Present	p-value
1	Cannot intubate cannot ventilate (CICV)	0%	p<0.001
2	Dental injury	3(0.42%)	p=0.021
3	Noncardiogenic pulmonary oedema	0%	p<0.001
4	Residual neuromuscular blockade	3(0.42%)	p<0.001
5	Aspiration pneumonia	1(0.14%)	p=0.48
6	Unplanned ICU admission	13(1.83%)	p=0.006
7	Intervention for respiratory/cardiac arrest	0%	p<0.001
8	Need for interventions for respiratory distress	4(0.56%)	p=0.049
9	Need for reintubation within 48 hours	2(0.28%)	p<0.001

[Table/Fig-3]: Showing outcome measures.

than conventional ward care [7]. Postoperative patients contribute to nearly 40% of intensive care unit admissions.

In our study, 13 (1.83%) patients required unplanned ICU admission compared to studies in literature (0.04%-0.58%) [8,9]. Since our institution was lacking an intermediate or high dependency unit, patients were shifted for not only ventilator and inotropic support but also those who required close monitoring, this could have increased incidence. Evidence [8-11] shows that major morbidity and mortality occur more frequently in elderly surgical patients than in younger counterparts undergoing comparable surgery as in our study (p<0.001) [8]. ASA physical status of III and IV contributed to 75% of the entire ICU admission group, which had a strong association (p<0.001) and was consistent with literature [8,9,11]. Respiratory support may therefore become necessary especially in those with poor preoperative physical status (ASA greater than III) [12]. Longer duration of anaesthesia would imply a greater physiologic trespass and hence greater likelihood of adverse outcome [11]. Duration of anaesthesia and ICU admission had a significant association (p=0.006) in patients undergoing surgery, which lasted for 180 minutes and more. Bhat SA et al., Rose DK et al., Manjula S et al., revealed that patients with emergency surgeries were more prone for unplanned ICU admissions because they have less time for optimization [8,9,11].

Dental Trauma

There were three patients (0.42%) of dental injury in our study. Even though the incidence is low, it is the most frequent cause of anaesthesia related medico-legal claims. In our study, there was statistically significant association of dental injury with patients above 50 years (p= 0.021) of age which is similar to the study by Givol N [13]. Givol N documented that dental injury occurred more in elective intubations and it occurred during laryngoscopy and use of airways, mouth openers and gags [13,14]. The risk factors for dental injury in this age group are pre-existing poor dentition, intubation difficulty and higher incidence of periodontal disease. Though dental injuries are more common in patients with difficult airway, our sample size did not allow us to find any significant association [13].

Reintubation and Relieving Respiratory Distress

Incidence, causes and contributory factors of reintubation is being analysed as a part of quality assurance activities. Reintubation is defined as intubation from the time of extubation in the operating room, during their stay in the Post-Anaesthesia Care Unit (PACU) or in wards within 48 hours [15]. Two (0.28%) patients in our study required reintubation in the Operating Room (OR) in immediate postoperative period as observed in other comparable studies [15-17]. There was significant association between ASA IV patients and reintubation (p=0.009). Bunchungmongkol N et al., also observed the same and concluded that the poor cardiac and renal reserve handling fluid shifts could be the cause of increased incidence of reintubation in ASA IV group of patients [18]. Reintubations were more commonly present in patients undergoing emergency surgical procedures (p<0.001) which could be due to inadequate time for preoptimization and lesser experience of the anaesthesiologist [17]. Four (0.56%) patients required intervention for relieving respiratory distress in our study, the incidence of which is similar to that of critical respiratory events in many of the studies [7,19,20]. Respiratory distress was more common in elderly patients (p=0.049) in our study which is similar to that of Rose DK et al., study [19].

Residual Neuromuscular Blockade

There is increasing evidence that residual neuromuscular block is common, and also that it may adversely affect patient outcome [21]. Incidence of residual neuromuscular blockade worldwide is 0.348% to 0.544% [22]. Naguib M et al., have concluded that quantitative monitoring of neuromuscular function is required to minimize postoperative residual block [23]. In our study, all the patients received reversal agent at the end of procedure after confirming the presence of adequate twitches by Train of Four (TOF) and Double Burst Stimulation (DBS) using a neuromuscular monitor except patients who were shifted to ICU for postoperative ventilation. There was a statistically significant association with age (p=0.011) and residual neuromuscular blockade which was also observed in other similar studies [21,22,24,25]. We were unable to elicit any statistically significant associations between duration, type of surgery and ASA physical status in our study. Two patients with residual neuromuscular blockade in our study required re-intubation and ICU admission and two other patients needed oxygen supplementation and extended period of observation in the Post Anaesthesia Care Unit (PACU).

Aspiration Pneumonia

The incidence of aspiration pneumonia in literature varies between one in 2131 to one in 14150 [25,26]. The wide variation was probably due to methods used to select the patients as well as the measures used to prevent it from occurring. Incidence of aspiration pneumonia in our institute was one in 709 patients (0.14%) who required supplemental oxygen and observation. As described in some studies aspiration occurred in an elective patient with normal airway [27-31]. The relatively higher incidence of aspiration pneumonia in our study could be attributed to small sample size. In our institute, all patients who were at risk of developing aspiration were administered H_2 receptor blockers, prokinetic agents and rapid sequence intubation was done. This could probably be the cause for no documented incidents of aspiration during induction, which is the most common period [32,33]. All the patients were extubated in an awake state, after suctioning of pooled oral secretions.

Non-Cardiogenic Pulmonary Oedema

Laryngospasm induced pulmonary oedema after endotracheal extubation is an uncommon complication. Vigorous inspiratory effort against closed glottis or release of chronic obstruction creates more negative intrathoracic pressure which causes transudation of fluid from the pulmonary capillaries into the interstitium causing alveolar oedema. Patients who met inclusion criteria did not develop non cardiogenic pulmonary oedema. Laryngospasm induced pulmonary oedema is a self-limited condition with excellent prognosis and relatively simple management but it may also result in significant prolonged hospital stay and the necessity of intensive care unit.

Respiratory Arrests/Cardiac Arrests

In our study, we had no patients with respiratory arrests or cardiac arrest as it was a practice to monitor all the patients for airway obstruction after extubation in the operation theatre itself and then shift to PACU. Dorre Nicholau suggests that location of the PACU bordering operation theatres with adequate staffing will help in better management of critical incidents like respiratory/cardiac arrest in the recovery period [31].

CICV

Though CICV is rare, it is a life threatening condition [33]. There were no such scenarios reported in our study. Pre-oxygenation is recommended in all patients being intubated to create a potential reservoir of oxygen, which will prevent hypoxia for several minutes of apnea [34]. Protocols for difficult airway were followed when such situations were encountered.

LIMITATION

This was a retrospective study and patients undergoing abdominal surgeries were alone included. Sample size was low when few clinical indicators were analysed. Poor documentation in anaesthesia data base could be a reason for low incidence of few complications.

CONCLUSION

Proper optimization of patients prior to surgery, vigilant perioperative monitoring and optimal postoperative care will result in better quality of care and safety in anaesthesia practice. Documentation of all the events, which occur during the perioperative period and its management, will help to know the fields of inappropriate management and thereby improve the quality of care and detect the incidence rates with accuracy and help to formulate protocol for institution.

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