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EVALUATION OF RESPIRATORY PARAMETERS DURING EMERGENCE IN NEUROSURGICAL PATIENTS: EVALUATION OF CONVENTIONAL AWAKE EXTUBATION VERSUS ENDOTRACHEAL TUBE-LARYNGEAL MASK AIRWAY EXCHANGE EXTUBATION

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ABSTRACT

BACKGROUND: Emergence from general anesthesia and tracheal extubation may be associated with tremendous physiological and metabolic stress in patients which could be major concern for the anesthesiologist in patients especially with neurosurgical patients.

METHODOLOGY: A total of 60 patients of ASA physical status I and II between ages 18-60 years undergoing neurosurgery were evaluated for respiratory events like bucking, cough, desaturation, chin lift, jaw thrust and any complications that have occurred in two extubation methods.

RESULTS: In Group-A 86.67% patients have shown significant event of bucking and cough while desaturation events were comparable in two groups. Manipulation events i.e. Chin lift and jaw thrust had to perform in 66.67% and 21.67% respectively, in patients of Group-A compared to only 03.33% patients in Group-B ($p<0.05$). All the patients in Group-A have shown at least one complication while in Group-B only 33.33%.

CONCLUSION: ETT/LMA exchange is the most effective technique for achieving the clinical endpoint of the study, i.e., prevention of emergence respiratory complication compared to awake extubation method.

KEYWORDS : Respiratory Parameters, Emergence, Neurosurgical Patients

INTRODUCTION

Emergence from general anesthesia and tracheal extubation may be associated with tremendous physiological and metabolic stress in patients. These stress-induced alterations in physiological parameters may be harmful to patients as they can exacerbate preexisting disease or produce medical or surgical complications in the recovery period. It is important therefore, to implement measures that minimize these stress-induced changes during emergence from anesthesia, particularly in patients at higher risk or after procedures where complications may result in significant morbidity or even mortality.[1]

Preventing coughing at extubation is not always important but in certain types of surgery (eg, head & neck surgery, neurosurgery) both intubation and extubation are associated with various cardiovascular and airway responses leading to tachycardia, hypertension, arrhythmias, myocardial ischemia, coughing, agitation, bronch ospasm, increased bleeding, raised intracranial and intraocular pre ssure.[2] These transitory changes are of little consequences in American Society of Anesthesiologists (ASA) Grade I and II patients going for general surgical procedures, but could be of major concern for the anesthesiologist in patients especially with intracerebral space occupying lesions (ICSOL), where a sudden hypertension during or in immediate post-extubation phase could lead to raised cerebral blood flow (CBF), intracranial pressure (ICP) and decreased cerebral perfusion pressure (CPP) resulting into increased intracranial bleeding, high morbidity and mortality.[3,4] Up to 76-96% incidence of post-extubation bucking and coughing has been reported in the literature.[2,5,6]

Orotracheal intubation has been proven to be a reliable method for securing the airway and is considered to be the standard technique for intraoperative management of the airway during neurosurgery. However, endotracheal intubation induces more intense hemodynamic effects and physical stress than those caused by the use of a laryngeal mask airway (LMA). During emergence from anesthesia and extubation, these differences are even moreintense that can lead to increases in cerebral blood flow, intracranial pressure, and regional brain oxygen saturation.[7]

Awake extubation of an endotracheal tube (ETT) isassociated with complications such as bucking, coughing, bronchospasm, hypertension, tachycardia, myocardialischemia, arrhythmias, and increased intracranialpressure.[8] Deep extubation of ETT leads to upper airwayobstruction and hypoventilation. Replacing the ETT witha laryngeal mask airway (LMA) when the patient is deep and performing an awake extubation of the LMA was shown to decrease the above described respiratory and hemodynamic complications.[9]

The study was planned to find a novel method to achieve a smooth extubation in neurosurgery and compare the respiratory response and complications conventional awake extubation of a endotracheal tube (ETT) and that following exchange extubation of ETT by using a laryngeal mask airway (LMA) in neurosurgery.

MATERIALS & METHODS

After obtaining approval of institutional ethics committee, study was carried out in the Neurosurgery operation theatre, Department of Anesthesiology, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur (MP) from March 2016 to August 2017.

A total of 60 patients of ASA physical status I and II between ages 18-60 years undergoing neurosurgery who were satisfying and fulfill the inclusion criteria were included in this study. A written informed consent was taken from all the patients. Those patients who had difficult intubation, Aspiration risk, Glasgow coma score less than 8, ASA physical status III, IV and V, signs of raised intracranial pressure, significant midline shift (>5cm), congestive heart failure, Diabetes, hypertension, History of ARDS, COPD, bleeding disorder, hepatic and renal dysfunction and patients who may need elective mechanical ventilation or remain intubated post surgery were excluded from study. Study sample population was randomly divided into two groups (in each groups, n = 30) in which the observations were recorded and statistically evaluated. Patients in the either group were induced and maintained under anaesthesia using isoflurane (Etiso 0.5-0.6%) in oxygen and nitrous oxide. Relaxation was achieved using intermittent boluses of vecuronium. The observational period of the study was initiated at the end of surgery (EOS) when the two subsets of patient different method of emergence. In first group (n = 30) the awake extubation group (**Group-A**), at the end of the surgical procedure, isoflurane and nitrous oxide was discontinued. Reversing the effects of vecuronium. If the patients were resume spontaneous respiration with generating tidal volume of >4 ml/kg, EtCO2<45 mmHg and was responding to verbal commands, extubation was performed. In the other group (n = 30), ETT/LMA exchange extubation group (**Group-B**). The oropharynx was suctioned under direct vision. Before extubation a LMA was placed behind the tracheal tube, while the lungs were ventilated with the maintenance mixture, and end-tidal isoflurane concentration was maintained at 0.6-1.2%. The tracheal tube was removed, and muscle relaxation was reversed allowing the patient to breathe spontaneously through the LMA. When adequate spontaneous respiration generating tidal volume of >4 ml/kg, EtCO2<45 mmHg and was responding to verbal commands, fully awake, at that point LMA was removed.

Data was collected about demographic indices, preoperative vitals and respiratory events like bucking, cough, desaturation, chin lift, jaw thrust and any complications that have occurred.

The data of the present study was recorded / fed into the computers and after its proper validation, check for error, coding & decoding was compiled and analysed with the help of SPSS 20 software for windows.

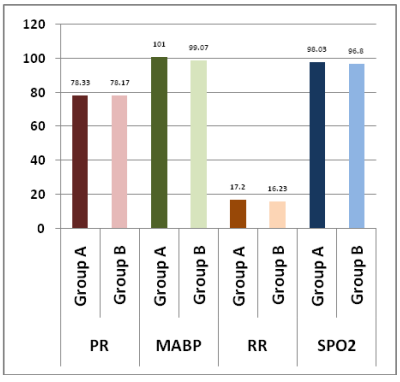
Student's t-test and 2 test for categorical data was applied to check the hypothesis according to the type of data i.e. continuous and categorical. The critical value for the significance of the results was considered at 0.05.

RESULTS

DEMOGRAPHIC AND PREOPERATIVE INDICES

A total 60 patients were included in the study with 30 patients each distributed between Group-A and Group-B. The mean age of patients in group-A and group-B was 42.83 years and 37.66 respectively with no statistical difference (p = 0.0751) between the groups.

There was also no statistically significant difference (p>0.05) between two groups according to mean preoperative vital as recorded in **Graph 1**.



Graph 1: Showing comparison of preoperative vitals between two groups.

RESPIRATORY INDICES

In Group-A 86.67% patients have shown significant event of bucking while in Group-B only 10% patients have shown event of bucking. Chi-square analysis showed a significantly higher (2=32.303 and p<0.0001) event of bucking in Group-A.

In Group-A 93.33% patients have shown significant event of cough compared to Group-B, only 23.33% patients have shown event of cough. Chi-square analysis showed a significantly higher (2=27.429 and p<0.0001) event of cough in Group-A.

In Group-A, 10% patients have shown desaturation and in Group-B 6.67% patients have shown event of desaturation. Chi-square analysis showed no significant difference (2=0.2182 and p>0.05) for event of desaturation between the study groups.

Graph 1: Respiratory parameters of Group-A vs. Group-B

Parameters	Group-A	Group-B	χ2 Analysis
BUCKING			
Present	26 (86.67%)	3 (10%)	**p<0.0001**
Absent	4 (13.33%)	27 (90%)	
COUGH			
Present	28 (93.33%)	7 (23.33%)	**p<0.0001**
Absent	2 (6.67%)	23 (76.67%)	
DESATURATION			
Present	3 (10%)	2 (6.67%)	p=0.6404
Absent	27 (90%)	28 (93.33%)	
CHIN LIFT			
Present	20 (66.67%)	1 (3.33%)	**p<0.0001**
Absent	10 (33.33%)	29 (96.67%)	
JAW THRUST			
Present	13 (21.67%)	13 (21.67%)	**p=0.0008**
Absent	17 (73.33%)	17 (73.33%)	
COMPLICATION			
Present	30 (100%)	10 (33.33%)	**p<0.0001**
Absent	0 (0%)	20 (96.67%)	

Chin lift had to perform in 66.67% patients of Group-A compared to only 03.33% patients in Group-B. Chi-square analysis showed a significantly higher (2=23.736 and p<0.0001) event of chin lift in Group-A.

In Group-A 21.67% patients have shown significant event of jaw thrust while in Group-B only 03.33% patients have shown event of jaw thrust. Chi-square analysis showed a significantly higher (2=11.273 and p=0.0008) event of jaw thrust in Group-A.

All the patients in Group-A have shown at least one complication while in Group-B only 33.33% patients have shown significant event of at least one. Chi-square analysis showed a significantly higher (2=27.075 and p<0.0001) event of complication in Group-A.

DISCUSSION

The respiratory responses and complications associated with extubationis often overlooked during the conduct of general anesthesia.[5,6] The neurosurgical patients are subset of patients in which extubation and emergence from anaesthesia may lead to disastrous complication. In the face of a poorly autoregulating cerebral vasculature, hypertension also has the potential to an increase in ICP. Much of the concern with coughing and straining has a similar basis. The sudden increases in intrathoracic pressure are transmitted to both arteries and veins, producing transient increases in both cerebral arterial and venous pressure, with the same potential consequences: edema formation, bleeding, and elevation of ICP. Thus smooth emergence is essential in neuro-surgeries.

Two controversial thoughts exist for emergence and extubation neurosurgical patient. One is wake-up from anesthesia although presence of an ET tube in the trachea and the larynx may invariably causes a cough as well as a gag reflex, but in case of neurosurgeries it may lead to disastrous complication such as formation of intracranial haematoma. Another is 'deep' extubation, the ET tube is removed before wake-up, but it has theoretical risk of losing the airway, before the patient is fully conscious and requires airway manipulations.

Nair and Bailey, Costa e Silva and Brimacombe and Glaisyer et al [7-9] had suggested that the use of the laryngeal mask after tracheal extubation may minimize the stress response while providing a patent airway during emergence from anesthesia. **Asai et al.**[10] **and Dob et al.**[11] improvised on this method by inserting the LMA behind the ETT and then removing the ETT, thereby avoiding the loss of airway. This study was planned to evaluate to compare the respiratory complications between conventional awake extubation of a endotracheal tube (ETT) and that following exchange extubation of ETT by using a laryngeal mask airway (LMA) in neurosurgeries.

It was concluded in his study by **Ma HN et al.**[12] that exchange of tracheal tube for LMA under deep anesthesia during recovery stage can decrease the stress response during the recovery stage and attenuate the harmful response of respiratory tract. It was suitable for the elderly patient with hypertension. It was also mentioned by **Bailey et al.(1998)**[11] that the LMA provides easier airway maintenance,less cough and initially higher median SpO_2. The results of the study of **Saad A Sheta, et al (2011)**[13] showed that awake "no touch" technique for tracheal extubation produces less airway-related complications during emergence from general anesthesia. **Popat M, Mitchell V, et al.(2012)**[14] said that the emergence profile of LMA/ETT exchange was superior to either awake or deep extubation , and was useful in cases where there was a risk of disruption of the surgical repair due to the cardiovascular stimulation resulting from the presence of a tracheal tube.

In our study the similar concept is applied in neurosurgical patient where the emergence stress may lead to Systemic and cerebral hemodynamic changes that increase the multiple risk in post-operative period. **Irene P. Osborn, MD , et al.(2016)**[15],concluded that SGA devices can be a useful airway alternative for neurosurgical patients, provided there is appropriate patient selection and careful management. **Perelló-Cerdà et al (2015)**[16] study had been concluded that replacing the ETT with the LMA before neurosurgical patients emerge from anesthesia results in a lower incidence of cough.

The HR and MBP in both Group-A and B at the end of surgery (EOS) was nearly identical (p-value >.05). At the end of surgery LMA was placed in Group-B under deep anesthesia. Post extubation HR and MAP significantly (p value < 0.05) increased in awake extubation group (Group-A) in compare to ETT/LMA exchange extubation group (Group-B).

In study of **Takita et al**[17] the incidence of cough and bucking was 33.3% in classical LMA group. It was 25% in study done by **Rajan et**

al.[74] Similarly it was comparable to this study in which 23.33% patient were shown cough in Group-B (LMA/ETT exchange) and 93.33% in Group-A. These value are significant with p-value <0.05. Similarly the incidence of bucking was 10% in Group-A and 86.67% in Group-B.

This trend was in agreement with other respiratory parameter like need chin lift in Group-B was 01.33% in compare to Group-A 63.33% and the need of jaw thrust in Group-B was 03.33%in compare to Group-A 21.67%. At last but not least Group-A 100% patient had one or other unwonted respiratory event compare to the Group-B only 33.33% patient .That was a significant difference with p-value <0.05 .

CONCLUSIONS

Neurosurgical patients are subset of patients in which extubation and emergence from anaesthesia is met with haemodynamic perturbation which in turn may lead to disastrous complication such as intracranial haematoma.

Cconventional awake extubation of a endotracheal tube (ETT) lead to respiratory complication this may lead to formation of intracranial haematoma and increased edema formation and poor prognosis. The present study concluded that exchange of ETT with LMA in deeper plane of anesthesia significantly reduces emergence related the respiratory unwanted events. Comparing the two different procedures for emergence, it seems reasonable to infer that ETT/LMA exchange is the most effective technique for achieving the clinical endpoint of the study, i.e., prevention of emergence respiratory complication.

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