FREQUENCY OF LARYNGOSPASM IN AWAKE VERSUS DEEP EXTUBATION AFTER INTRANASAL SURGERY

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ABSTRACT

Objective: To compare the frequency of laryngospasm in awake versus deep extubation after intranasal surgery.
Study Design: Randomized controlled trial.
Place and Duration of Study: The study was carried out at Combined Military Hospital Rawalpindi which is a tertiary care hospital, after seeking permission from Hospital Ethics Committee. Study was carried out for six months, from Feb 2013 till Aug 2013.
Material and Methods: Two hundred and fifty patients fulfilling the inclusion criteria were selected for this study and divided into two groups of 125 each. Patients of group A were extubated fully awake while the patients assigned to group B were extubated during deep anaesthesia. Patients were then monitored closely for 30 minutes to assess whether they developed laryngospasm or not.
Results: The mean age in group-A was 23.92 ± 5.01 years and in group-B was 24.16 ± 5.56 years. The mean height in group-A was 169.53 ± 4.74cm and in group-B was 170.42 ± 4.34 cm. The mean weight in group-A was 66.18 ± 6.31 kg and in group-B was 65.67 ± 6.00 kg. In group-A 72% patients were male and 28% were female while in group-B 76% patients were male and 24% patients were female. In group-A 9 (7.2%) patients developed laryngospasm and in group B 6 (4.8%) patients developed laryngospasm.
Conclusion: There is no difference in frequency of laryngospasm in awake versus deep extubation after intranasal surgery.

Keywords: Awake extubation, Deep extubation, Intranasal surgery, Laryngospasm.

INTRODUCTION

Laryngospasm is an abnormally sensitive reflex characterized by forceful involuntary spasm of the laryngeal musculature. Triggering stimuli include pharyngeal secretions or passing a tracheal tube through the larynx during extubation. Laryngospasm may occur at induction, emergence, or any time in between without an endotracheal tube. The development of laryngospasm was probably detected almost simultaneously with the discovery of anesthesia. In 1937, Guedel included laryngospasm, which is part of the phase II signs, characterized by excitement, in the description of anesthetic planes. Laryngospasm is the most common cause of airways obstruction after extubation and, currently, electronic simulators for the training of anesthetic complications include the management of laryngospasm. Despite developments in monitoring, ventilation failure resulting from complications of the upper airways continues to be a common and avoidable cause of cardiac arrest[1].

Judging when to remove a tracheal tube is part of anesthesiology that develops with experience. It is an extremely important part of the practice as more complications arise during extubation and immediately afterward than with intubation. A delay in the diagnosis or treatment and its evolution can lead to hypoxaemia, acute pulmonary oedema, and eventually, death of the patient[2].

The Fourth National Audit Project (NAP4) was set up by the Royal College of Anaesthetists and Difficult Airway Society to provide an insight into major complications of airway

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management in the United Kingdom keeping into account the importance and sensitivity of airway management during general anaesthesia. The NAP4 found that serious airway complications such as death, brain damage, the need for surgical airway or unexpected intensive care admission, were reported for every 5500 general anaesthetics. Out of all the recorded airway complications thirty percent of serious airway complications were associated with extubation or removal of laryngeal mask airway at the end of anaesthesia during the recovery phase[3].

Extubating an awake patient is usually associated with coughing (bucking) on the tracheal tube. This reaction increases the heart rate, central venous pressure, arterial blood pressure, intracranial pressure, and intraocular pressure. It may also cause wound dehiscence and bleeding therefore extubation during deep anaesthesia may be preferable in patients who cannot tolerate these effects. On the other hand, such extubation would be contraindicated in a patient at risk of aspiration or whose airway may be difficult to control after removal of tracheal tube[4].

In patients undergoing nasal or sinus surgery ideally extubation should be smooth, with a minimum of coughing or straining, as these will increase venous pressure and tend to increase postoperative bleeding. Unfortunately, strategies that accomplish this goal also tend to increase the risk of aspiration (eg deep extubation)[5].

In a study carried out by Webster *et al*, patients undergoing intranasal surgery, the incidence of laryngospasm in patients extubated deep was 19%, whereas in patients who had an awake extubation, it was 6%[6]. In anaesthesia local practice that is popular and considered safe, patients after intranasal surgery are preferred to be extubated fully awake. The rationale behind this study is to compare frequency of laryngospasm in deep and awake extubation and result of this study may help in recommending better extubation method after intranasal surgery.

MATERIAL AND METHODS

This randomized control trial study was carried out at department of Anesthesiology and Intensive Care Combined Military Hospital Rawalpindi, from 12th Feb 2013 to 11th Aug 2013. Two hundred and fifty patients fulfilling the inclusion/exclusion criteria were included in this study and they were divided into two groups of 125 each. The sample size was calculated by using WHO sample size calculator. Keeping Level of significance 5%, Power of the test 80%. Anticipated population proportion 1 (P1)=19%[6]. Anticipatied population proportion 2 (P2)=6%[6]. Non probability Consecutive sampling technique was used.

Inclusion criteria for sample selection was patients aged between 15-35 years of both genders, patients having American Society of Anaesthesiology (ASA) status-I and non-Smoker (as smokers have increased respiratory tract secretions and thus increased chances to develop laryngospasm). While the exclusion criteria was morbidly obese patients with BMI >34.9, patients with difficult airway diagnosed on clinical examination like prominent incisors, large tongue, short neck and maxillofacial abnormalities and patients who had upper respiratory tract infections within last two weeks (as it increases chances of laryngospasm).

After seeking permission from the hospital ethical committee, the purpose and procedure of the study of awake versus deep extubation was explained to the patients and an informed written consent was obtained. Demographic data like age and sex was taken, history and clinical examination was done to include a patient in inclusion and exclusion criteria. Those who were willing and were eligible for the study were divided into two groups (A & B) by using random tables. Throats of both groups were packed with sterile gauze after induction of anaesthesia to avoid contact with blood and secretions during surgery. Intranasal surgery was

done by consultant Otorhinolaryngologist and before extubation patients of both groups were placed in lateral decubitus position with head down, after suctioning of secretions and blood, throat packs were removed, an appropriate size Guedel airway was placed in the oral cavity and patients assigned to group-A were extubated fully awake while patients in group-B were extubated during deep anaesthesia by the researcher. Patient's output data was entered in the research proforma attached as Annex 'A' that whether they developed laryngospasm or not until 30 min of extubation.

Data was analyzed in the statistical package for social sciences (SPSS) version 16.0. Descriptive statistics were calculated for both qualitative and quantitative variables. Frequencies and percentages were calculated for qualitative variables like gender and laryngospasm. Mean and standard deviation were calculated for quantitative data like age, height and weight. Chi square test was used to compare the difference in laryngospasm between two groups. Level of significance was taken as $p<0.05$.

RESULTS

Two hundred and fifty patients with inclusive criteria were selected for this study and they were divided into two groups. In group-A, 125 patients were extubated awake after intranasal surgery and in group-B, 125 patients were extubated while under deep anaesthesia after intranasal surgery. Their age, height, weight and sex were recorded pre-operatively.

The mean age in group-A was 23.92 ± 5.01 years with minimum age of 16 years and maximum age of 35 years. In group-B, mean age was 24.16 ± 5.56 years with minimum age of 16 years and maximum age of 35 years (*p*-value =0.712).

The mean height in group-A was 169.53 ± 4.74cm with minimum height of 158 cm and maximum height of 180 cm. In group-B mean height was 170.42 ± 4.34 cm with minimum height of 158cm and maximum height of 183 cm (*p*-value =0.124).

The mean weight in group-A was 66.18 ± 6.31 Kg with minimum weight of 52 kg and maximum weight of 90 kg. In group-B mean weight was 65.67 ± 6.00Kg with minimum weight of 54 kg and maximum weight of 85 kg. (*p*-value=0.512).

In group-A 90 (72%) patients were male and 35 (28%) were female while in group-B 95 (76%) patients were male and 30 (24%) patients were female (*p*-value=0.471).

Table: Distribution of patients by Laryngospasm

Group		Frequency	Percentage (%)
Awake	Laryngospasm	9	7.2
	No Laryngospasm	116	92.8
Deep	Laryngospasm	6	4.8
	No Laryngospasm	119	95.2

In group-A, 9 (7.2%) patients out of 125 developed laryngospasm and in group-B, 6 (4.8%) patients out of 125 developed laryngospasm (table). Cross tabulation was done and chi square test was applied which resulted in *p*-value of 0.424 which is not significant.

DISCUSSION

Airways management is fundamental for anesthesiologists, especially during induction of anesthesia and after extubation, when laryngeal spasm is more common. The anesthesiologist should know pharyngeal-laryngeal physiology and the risk factors for airways obstruction, since this is a potentially severe complication with a multifactorial etiology that can develop during anesthesia and whose consequences can be catastrophic. A delay in the diagnosis or treatment and its evolution can lead to

hypoxemia, acute pulmonary edema, and, eventually, death of the patient[1].

Laryngospasm is a serious emergency which may be encountered in the perioperative period especially during extubation. It is characterized by prolong glottis closure reflex mediated by superior laryngeal nerve. The common triggering factors may include light anaesthesia, upper respiratory tract infection, blood, mucous and secretions. Laryngospasm is a serious complication which may result in cardiac arrest, brain anoxia and even death of the patient if it is not recognized well in time or if not managed adequately by the anaesthesiologist[7].

Negative pressure pulmonary oedema is a relatively rare but potentially dangerous form of non-cardiac pulmonary edema that results from vigorous patient inspiration against an obstructed upper airway[8]. Due to the generation of a large inspiratory force against an obstructed upper airway, triggers an accumulation of high negative intra-pleural pressure in the range of 50 to 100cm H2O. This high negative intra-pleural pressure creates a pressure gradient allowing for the extravasation of fluid from the pulmonary capillaries into the interstitial and alveolar spaces, and generates a large increase in venous return resulting in increased preload[9]. Concomitantly, hypoxia and sympathetic stimulation from laryngospasm increase mean arterial pressure and afterload causing decreased forward stroke volume[10].

Airway obstruction may occur after the stimulation of extubation is over. It can be diagnosed by paradoxical see-saw breathing pattern, intercostal indrawing, subcostal, sternal recession and tracheal tug. Some anaesthetists prefer to extubate at a deeper plane to prevent laryngospasm. This practice increases the incidence of tongue fall back which is the most common cause of airway obstruction in the immediate post operative period. Neck extension, mouth opening and jaw-thrust alone or together might be sufficient to correct obstruction. It can be prevented by nursing the patient in lateral position with neck extended[11].

It has been observed that many predictors of extubation failure can and should be identified before extubation. Extubation should always be an elective process. Strategies and tools are available to improve extubation outcomes in the presence of difficult airways and/or high risk of postextubation airway obstruction[12].

Laryngospasm, if not promptly managed effectively may lead to increased morbidity and mortality. Help should be sought early as these patients can deteriorate easily. If there is incomplete airway obstruction, remove irritant stimulus (eliminating surgical stimulation of visceral nerve endings), deepen anaesthetic plane, apply jaw thrust maneuver, insert an oral or a nasal airway and provide gentle continous positive airway pressure with 100% oxygen[13].

Pressing firmly at the 'laryngospasm notch' helps relieving the spasm partly because the forward displacement of the mandible prevents tongue fall. Much contrary to the recommendation that pain should be avoided, severe pain is an essential component of this maneuver. Most likely explanation being that the painful stimulus (periosteal pain caused by pressing on the styloid process) helps relaxing the vocal cords by the autonomic nervous systems[14].

Awareness about the various precipitating factors which increase the risk of laryngospasm is necessary. History of prior anaesthesia, complications, respiratory problems, surgeries should be noted. Patient should be intubated in deeper planes of anaesthesia. Extubation can be tried with various medications. If this finds no avail, resort to using suxamethonium should be made if not contraindicated. After laryngospasm, signs of aspiration, pulmonary edema must be sought and treated[15].

Management of tracheal extubation after nasal surgery is complicated by potential airway contamination from postsurgical bleeding. Bleeding may be aggravated by the venous congestion that accompanies coughing and bucking and by

upper airway obstruction from nasal packing. There is a controversy as to whether extubation should be carried out at a deep or light plane of anaesthesia in the attempt to minimize laryngospasm and there are several studies to compare both techniques[11].

There is controversy and a continuous debate as to whether extubation should be carried out at a deep or light plane of anaesthesia in the attempt to minimise laryngospasm. There are some studies that suggest a reduction in the incidence of laryngospasm if the patient is extubated at a deeper plane of anaesthesia as described by Hampson-Evans *et al*[16].

At emergence from anesthesia for intranasal surgery, the anesthesiologist is faced with a dilemma. Protection of the airway from aspiration of blood requires the return of active protective airway reflexes, with tracheal extubation when the patient is fully awake. However, this is usually accompanied by excessive coughing, which may increase the risk of postoperative bleeding. Coughing or straining during emergence from anesthesia and extubation should be avoided, as these events will increase venous pressure and increase postoperative bleeding. Unfortunately, relatively deep extubation strategies that are commonly and appropriately utilized to accomplish this goal also may increase the risk of aspiration[17].

Webster *et al* in their study compared awake versus deep extubation after intranasal surgery as a secondary objective of their study and their results showed no significant difference between frequency of laryngospasm between the two. In their study awake extubated group had 6% and deep extubated group had 19% laryngospasm, mean age was 41.94 ± 12.25 in awake and 42.77 ± 12.69 in deep group[6]. Mean weight in awake group was 77.27 ± 12.70 and 81.29 ± 13.62 in deep group. In awake group 62% were male and 38% were female while 66% were male and 34% were female in deep group[6].

In this study awake group had nine (7.2%) and deep group had six (4.8%) laryngospasms which is also not significantly different. Mean age was 23.92 ± 5.01 in awake group and 24.16 ± 5.56 in deep group. Mean weight in awake group was 66.18 ± 6.31 and 65.67 ± 6.00 in deep group. About 72% patients in awake group were male and 28% were female while in deep group 76% were male and 24% were female[6].

Von ungern-Sternbergs results were similar to this study and revealed that there was no difference in overall incidence of perioperative adverse respiratory events including post-operative laryngospasm after awake or deep extubation and that both techniques may be safely used provided proper precautionary measures are taken and anaesthesiologist is alert and vigilant[18].

Tsui *et al* in their case series have also suggested that the frequency of laryngospasm is minimal if the patient is extubated either fully awake or under a deep plane of anaesthesia and is not significantly different from each other[19]. They described studies done by Leicht *et al*, Lee *et al,* and Koc *et al*. who used awake tracheal extubations for their studies but all reported a frequent incidence of laryngospasm (between 21% and 27%)[19]. The aim of these three studies was to tracheally extubate all patients at the same depth of anesthesia using signs of swallowing as a clinical indicator for extubation. Consequently, their patients may have been extubated in a light plane of anesthesia because swallowing does not necessarily indicate consciousness but rather the return of laryngeal reflexes. Tsui *et al* attempted to avoid extubation under light anesthesia by avoiding patient stimulation during emergence and performing extubations only when the patients opened their eyes. They had no cases of laryngospasm, severe coughing, or desaturation when tracheally extubating of patients fully awake was made. Similarly in this study the frequency of laryngospasm was only 7.2% in awake group unlike 21% to 27% as the patients were extubated once fully conscious. As far as exxtubation under deep anaesthesia is concerned a potential advantage of deep tracheal extubation, as opposed to awake extubation, is that patients are less likely to cough and strain

afterward, thus avoiding the likelihood of laryngospasm and oxygen desaturation. However, this may increase the risk of aspiration but it can be easily avoided by carefully suctioning the blood and secretions from the pharynx and placing patient in left lateral position[19].

It is very important to mention that the patients from both the groups in this study were extubated in lateral decubitus position to avoid trickling of saliva, secretions or blood in the laryngeal area which could trigger laryngospasm. And in the group who is extubated while deeply anaesthetized, no risk was taken for aspiration of gastric contents by placing patients in lateral decubitus position and ensuring that patients were Nil per oral. In this study we had no case of severe laryngospasm, desaturation, and negative pressurepulmonary oedema and there was no case of aspiration. Slight desaturation that occurred in 7.2% of awake and 4.8% of deep group after extubation were managed promptly with simple maneuvers like chin lift and jaw thrust and was not for more than thirty seconds.

In comparing patients' extubated awake and deeply anesthetized, no difference in oxyhemoglobin saturation early after tracheal extubation or in the incidence of laryngospasm was detected.

These results indicate that awake as well as deep extubation after intranasal surgery is equally safe and there is no increased risk of laryngospasm provided that patient is either extubated fully awake when he or she opens eyes and follow commands or under deep anaesthesia when he or she has no coughing, swallowing or gag reflex. However, deep extubation definitely has the advantage over awake extubation in that there is less venous congestion because coughing and bucking is avoided.

CONCLUSION

It is concluded from this study that there is no significant difference in frequency of laryngospasm in awake versus deep extubation after intranasal surgery. In this study 9 (7.2%) out of 125 patients from awake group developed laryngospasm and in comparison, 6 (4.8%) out of 125 patients from deep group developed laryngospasm (p=0.424). This indicates that the complications associated with awake extubation can be prevented by preferring deep extubation which is equally safe procedure.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

1. Safavi M, Honarmand A, Khazaei M. The effects of propofol, ketamine and combination of them in prevention of coughing and laryngospasm in patients awakening from general anesthesia A randomized, placebo-controlled, double bind clinical trial. Adv Biomed Res 2016 22; (5): 64-72.
2. Alalami AA, Ayoub CM, Baraka AS.Laryngospasm. Review of different prevention and treatment modalities.PaediatrAnaesth 2008; 18(4): 281-88.
3. Hodzovic I. Airway management disasters--lessons from the United Kingdom. Acta Clin Croat 2012; 51(3): 525-37.
4. Bhattacharya M, Kallet RH, Ware LB, Matthay MA. Negative-Pressure Pulmonary Edema.J Chest Surg 2016; 150(4): 927-33.
5. Sheta SA, Abdelhalim AA, Nada E. Evaluation of "no touch" extubation technique on airway-related complications during emergence from general anesthesia. Saudi J Anaesth 2011; 5(2): 125-31.
6. Webster AC , Morley-Forster PK, Janzen V, Watson J, Dain SL, Taves D et al. Anesthesia for Intranasal Surgery: A Comparison Bet-ween Tracheal Intubation and the Flexible Reinforced Laryngeal Mask Airway. AnesthAnalg 1999; 88(2): 421-35.
7. Gavel G, Walker R. Extubation guidelines: management of laryngospasm. Anaesthesia 2012; 67(8): 920-23.
8. Siddiqui R, Khalique K, Khan MA, Amin MU. Pulmonary edema and lung injury after severe laryngospasm. J Coll Physicians Surg Pak 2006; 16(12): 777-89.
9. Mehta KK, Ahmad SQ, Shah V, Lee H. Postobstuctive pulmonary edema after biopsy of a nasopharyngeal mass. Respir Med Case Rep 2015; 16: 166-78.
10. Mulkey Z, Yarbrough S, Guerra D, Roongsritong C, Nugent K, Phy MP. Postextubation pulmonary edema: a case series and review. Respir Med 2008; 102(11): 1659-62.
11. Pawar D. Common post-operative complications in children. Indian J Anaesth 2012; 56(5): 496-01.
12. Cavallone LF, Vannucci A. Review article: Extubation of the difficult airway and extubation failure. Anesth Analg 2013; 116(2): 368-83.
13. Harrison HC. An approach to the management of paroxysmal laryngospasm. J Laryngol Otol 2009; 123(8): 937-48.
14. Shinjo T, Inoue S, Egawa J, Kawaguchi M, Furuya H. Two cases in which the effectiveness of "laryngospasm notch" pressure against laryngospasm was confirmed by imaging examinations. J Anesth 2013; 27(5): 761-73.
15. Paratz JD, Thomas PJ. A case of near fatal laryngospasm. Aust J Physiother 2008; 54(4): 291-02.
16. Hampson-Evans D, Morgan P, Farrar M. Pediatric laryngospasm. Pediatr Anesth 2008; 18: 303-17.

17. John F. Butterworth, David C. Mackey, John D. Wasnick, Morgan & Mikhail's Clinical Anesthesiology, 5th Edition, 2013; 78.
18. Von Ungern-Sternberg BS, Davies K, Hegarty M, Erb TO, Habre W. The effect of deep vs awake extubation on respiratory complications in high-risk children under going adenotonsillectomy: a rando-mised controlled trial. Eur J Anaesthesiol 2013; 30(9): 529-36.
19. Tsui BC, Wagner A, Cave D, Elliott C, El-Hakim H, Malherbe S. The incidence of laryngospasm with a 'no touch' extubation technique after tonsillectomy and adenoidectomy. Anesth Analg 2004; 98: 327–3.