Original Article

Postoperative airway management after nasal endoscopic sinus surgery: A comparison of traditional nasal packing with nasal airway

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Abstract

**Background:** Nasal packing after the nasal surgery can be extremely hazardous and can lead to airway complications such as dyspnea and respiratory obstruction.

**Objective:** The present study aimed at comparing the traditional nasal packing with nasal airway during the immediate postoperative period in patients undergoing fibroptic endoscopic sinus surgery (FESS) under general anaesthesia (GA) with regards to airway management.

**Materials and Methods:** The study groups consisted of 90 ASA grade I and II patients aged 16 to 58 years who underwent FESS under GA. Patients were randomly assigned into three groups: Group NP, UA and Group BA of 30 patients each. At the end of surgery, Group NP patients were managed with traditional bilateral nasal packing while a presterilized 5 mm ID uncuffed ETT was cut to an appropriate size and inserted into one of the nostrils in UA and bilaterally in BA group patients. During postoperative period following parameters and variables were observed over the next 24 hours: Any respiratory distress or obstruction, pain and discomfort, oxygen saturation, heart rate, blood pressure, bleeding episode, ease of suctioning through nasal airway, anaesthesiologists and surgeons satisfaction during postoperative period, discomfort during removal of nasal airway and any fresh bleeding episode during removal of nasal airway. The data was compiled and analyzed using Chi-square test and ANOVA with post-hoc significance. Value of \( P < 0.05 \) was considered significant and \( P < 0.0001 \) as highly significant.

**Results:** The post-op mean cardio-respiratory parameters showed significant variations among NP group (\( P < 0.05 \)) and the patient of UA and BA groups while intergroup comparison between UA and BA was non-significant (\( P > 0.05 \)). Pain and discomfort, bleeding episode, ease of suctioning through nasal airway, anaesthesiologists and surgeons satisfaction during postoperative period, discomfort during removal of nasal airway and any fresh bleeding episode during removal of nasal airway. The low cost of the modified nasal airway and easily replicable design were the standout observations of the present study.

**Conclusion:** The present intervention to maintain airway patency can be termed as excellent with additional benefits like ease of suctioning; oxygen supplementation and a possible haemostatic effect due to pressure on the operated site. The key words: Airway obstruction, airway patency, fess, nasal airway, nasal packing
INTRODUCTION

Postoperative airway obstruction is a known complication of various head and neck procedures. For various nasal and nasal sinuses pathology, fiberoptic endoscopic sinus surgery (FESS) is a commonly performed procedure to widen the drainage pathways.[1,2] The basic principle of FESS has been adopted from the concept designed by Messerklinger and aims at postoperative normal ventilation and improved muco-ciliary clearance.[3,4] Apart from the common surgical complication such as bleeding, orbital trauma, intracranial injury and infection, various other complications like aspiration, embolism, nausea and vomiting, myocardial infarction, airway edema and obstruction can also arise.[5-11] The obstructive component can be severe at times leading to re-intubation for maintaining patency of airway. Normally the mechanism of breathing is a very complex phenomenon which is hardly perceived during the routine daily chores.[12,13] Any condition leading to a mild obstruction in breathing including therapeutic blockage of nasal cavity with nasal packing can elicit a sense of discomfort.[14] If the obstruction is not relieved immediately it can progress to a dyspnea, rapid hypoxemia and retention of carbon dioxide. As such it becomes very difficult to assess the recovery profile during postoperative period as all these resultant mechanisms can alter the sedation levels.[15,16]

The pre-operative counseling about breathing through mouth may sometimes do not produce desired results and anaesthesiologist faces a difficult situation in establishing a good breathing pattern as the patients are under the influence of anaesthetics. The use of costly nasal airway is also not feasible in low resource settings. Keeping these limitations and the potential complications in considerations we designed a novel intervention to maintain the patency of nasal airways during the immediate post-operative period in patients undergoing FESS under general anaesthesia. For prevention of airway obstruction and breathing discomfort, the intervention aimed at using low cost sterilized uncuffed endotracheal tube (ETT) which was cut to an appropriate size and inserted in the nasal cavity either unilaterally or bilaterally after the completion of surgical procedure.

MATERIALS AND METHODS

After obtaining permission from the appropriate authorities and ethical committee, an interventional study was undertaken in the department of anaesthesiology and ENT which included 90 patients who underwent FESS procedure under general anaesthesia (GA). Patients were randomly allocated to three groups with computer generated code: Group NP, UA and BA of 30 patients each. Sample population included patients between the ages of 16 to 58 years, of either gender, belonging to ASA grade I and II who received the planned therapeutic airway intervention and traditional nasal packing. Patients with heart disease, diabetes mellitus and history of central nervous system disorders were excluded from the study.

After thoroughly explaining to the patients about the type of surgery and the planned airway intervention to prevent any possible postoperative airway obstruction, a written consent was obtained. All patients were premedicated with tablet 0.25 mg alprazolam and 150 mg ranitidine at night before and in the morning of day of surgery. Besides, a thorough counseling of the patients was done to breathe through mouth during the postoperative period. In the operation theater, a large bore intravenous access was secured with 18G cannula and patients were administered dexmedetomidine 1 μg/kg over 20 minutes before induction of anaesthesia. Anaesthesia was induced with standard general anaesthetic technique using thiopentone, fentanyl, vecuronium, halothane and oxygen. Patients were intubated with an appropriate size endotracheal tube. A hypo pharyngeal pack, with anterior end knotted, was secured just around the ETT and anaesthesia was maintained with 40% oxygen in nitrous oxide and 0.2% to 1.5% of halothane concentration and 0.02 mg/kg of vecuronium as and when required to achieve an adequate depth of anaesthesia and muscle paralysis.

Throughout the operative procedure, vital parameters like heart rate, electrocardiograph (ECG), mean arterial pressure (MAP), end tidal carbon dioxide (EtCO₂) and oxygen saturation (SpO₂) were observed continuously and recorded at an interval of 10 minutes.

At the end of surgery and before nasal packing, a 5 mm ID uncuffed ETT was inserted into one of the nostrils in group UA [Figures 1 and 2]. The distal end was kept at the posterior aspect of choana and proximal to the posterior pharyngeal wall. The nasal tubes were inserted under the endoscopic guidance by the ENT surgeon in both the UA and BA groups. The proximal end of the tube was cut so as to keep a tube length of 1.5 to 2 cm projecting outside the nasal cavity. This proximal end was legated with cotton thread and was fixed with adhesive tape to the external part of the nose so as to prevent migration of the tube into the nasal cavity. Rest of the nostril was packed with cotton roll gauze after application of Soframycin ointment. Similar procedure was carried out in both the nostrils in patients belonging to Group BA [Figure 3]. Traditional nasal packing was carried out in the group NP patients [Figure 4]. Soframycin was used for lubrication of the roller gauze in all the groups. Neuro-muscular blockade was reversed with injection neostigmine and patients...
were extubated after they fully became conscious and able to sustain a normal breathing pattern.

Thereafter, patients were kept in the recovery room for 4 hours in a partial propped up position and vital parameters were monitored regularly with an emphasis on \( \text{SpO}_2 \) and respiratory mechanics. Patients were enquired about any breathing discomfort or difficulty with the nasal airway \textit{in situ}. The post operative observational parameters during the next 24 hours included:

- Any pain or discomfort
- Any bleeding episode
- Ease of suctioning through nasal airway
- Anaesthesiologists satisfaction during postoperative period
- Surgeons satisfaction during postoperative period
- Discomfort during removal of nasal airway
- Any fresh bleeding episode during removal of nasal airway.

At the end of study, data were entered and analyzed using SPSS version 15 for windows. Specific data which included surgeon satisfaction, anaesthesiologist satisfaction, complications, respiratory distress and discomfort, post-op bleeding from the nose, vital parameters, post-operative pain were observed and compared with Chi-square test and analysis of variance (ANOVA) with post hoc significance. Value of \( P < 0.05 \) was considered significant (S) and \( P < 0.0001 \) as highly significant (HS).

**RESULTS**

A total of 90 patients were administered GA for FESS during the study period. The age ranged between 16 and 58 years and majority of the patients belonged to 23 to 32 years age group. No significant difference was observed on comparison of different demographic variables such as age, weight, height, gender distribution, ASA grade and mean duration of surgery [Table 1].

The values of mean heart rate, mean arterial pressure (MAP) and \( \text{SpO}_2 \) during the intra-operative and postoperative period are shown in Graph 1. Heart rate and mean arterial pressure were observed to be higher in the patients who were given traditional nasal packing while oxygen saturation was lowest though not

![Figure 1: Nasal airway placed in the right nostril](image1)

![Figure 2: Nasal airway placed in the left nostril](image2)

![Figure 3: Nasal airway placed in both the nostrils](image3)

![Figure 4: Traditional bilateral nasal packing](image4)
clinically significant in Group NP patients immediately postoperative in the recovery room.

Postoperative parameters and variables were measured during recovery period and later on in the ward also [Table 2]. The absence of pain and discomfort in majority of patients of group UA (66.67%) and BA (60%) to placed nasal airway during the postoperative period was a highly significant feature. ($P < 0.0001$) Nasal airway and packing was removed the next day in the ward in all the patients by the ENT surgeon and the presence of minimal pain and discomfort as well as dry postoperative wound site again in group UA and BA patients was a highly significant feature. ($P < 0.0001$) The overall satisfaction rate to the results of the present intervention in group UA and BA, related to unilateral and bilateral nasal airway insertion respectively as compared to traditional nasal packing in group NP patients was highly significant ($P < 0.0001$) among the anaesthesiologists and the operating surgeons [Table 2].

**DISCUSSION**

Various techniques and maneuvers have been used from time to time to prevent any airway obstruction and breathing discomfort after head, neck, nose, and throat surgeries with varying level of success.[13-19] However, the most important aspect during use of such interventions in developing nations like India includes the cost and availability of the necessary equipment. Though laryngeal mask airway has been used with some success, the nasopharyngeal airway can serve as an excellent conduit for maintaining nasal patency in the postoperative period following FESS but the high cost associated with it is a big limiting factor in a nation with more than one-third

| Table 1: Demographic profile of the patients who were administered GA for FESS procedure |
|---|---|---|
| Demographic variable | Group NP (n=30) | Group UA (n=30) | Group BA (n=30) |
| Age (in years) | 30.6 | 29.2 | 28.4 |
| Gender (male/female) | (18/12) | (14/16) | (21/9) |
| Weight (in kgs) | 61.84 | 56.28 | 64.32 |
| Height (in cms) | 166.4 | 163.5 | 170.2 |
| ASA Grade (I/II) | 23/7 | 21/9 | 18/12 |
| Duration of surgery (in minutes) | 106.54 | 111.46 | 118.26 |

FESS = Fibroptic endoscopic sinus surgery under; GA = General anaesthesia

| Table 2: Postoperative parameters and variables associated with nasal packing/airway in Groups NP, UA and BA |
|---|---|---|---|
| Post-operative Parameters/Variables | Group NP (n=30)/% | Group UA (n=30)/% | Group BA (n=30)/% | P value |
| Respiratory rate/ min (Mean) | 18.2± | 15.8 | 14.6 | 0.027 |
| Discomfort due to packing/nasal airway postoperatively | | | | |
| Pain | No pain | Discomfort-1 (26.6) | No pain | Discomfort-7 (23.3) | Pain-4 (13.3) | Pain-3 (10) |
| Discomfort during nasal packing/tube removal | No discomfort | Mild discomfort-8 (26.6) | No discomfort | Mild discomfort-8 (26.6) | No discomfort-7 (23.3) | No discomfort-11 (36.7) |
| Fresh bleeding from the nostril during removal of packing/nasal airway | No bleeding-20 (66.6) | Mild ooze-9 (30) | No bleeding-27 (90) | No bleeding-25 (83.3) | No bleeding-25 (83.3) |
| Overall satisfaction of the Anaesthesiologist during post-op period | Satisfied | Satisfied-21 (70) | Satisfied | Satisfied-26 (86.6) | Satisfied-26 (86.6) |
| Overall satisfaction of the surgeon during post-op period | Satisfied-10 (33.3) | Neutal response-13 (43.3) | Satisfied-18 (60) | Neutal response-7 (23.3) | Satisfied-22 * (73.3) |

*P<0.05, Significant +P<0.0001, Highly significant
population below the poverty line.\[26\] In the present study, we investigated the potential benefits of using low-cost sterilized uncuffed ETT in patients undergoing FESS under general anaesthesia over the traditional nasal packing.

In majority of the patients, in spite of preoperative counseling, it is extremely difficult to maintain a normal breathing pattern through mouth breathing during the immediate postoperative period after bilateral nasal packing.\[14\] During the pilot study, bilateral nasal packing was compared with nasal airway in 10 patients. It was observed that the patients with nasal airway were managed comfortably in the postoperative period as compared to patients with nasal packing in whom a variable level of difficulty was encountered during establishment of postoperative breathing and suctioning. In the present study, patients were monitored for a minimum period of 4 hours in the recovery room after the completion of operative procedure with an emphasis on general consciousness, respiratory rate and pattern, pulse oximetry (SpO₂) and haemodynamic parameters besides observing for potential known complications. Haemodynamic variables such as mean HR and MAP were significantly higher while SpO₂ was significantly lower in the NP group patients [Graph 1]. This study establishes the potential benefits of nasal conduits in not only maintaining the normal breathing pattern and oxygen saturation but also highlight a possible role in maintaining stable cardiac parameters, most probably through avoidance of hypoxemia and respiratory obstruction.

The cost effectiveness of the uncuffed ETT was a big driving force in planning this interventional study for maintaining a smooth postoperative course and patent airway. However, during the study period besides maintenance of airway, other potential benefits of this intervention also came to the fore which included

- Haemostatic effect of the ETT as it pressed over the operated soft tissues of the nasal cavity.
- Ease of suctioning through nasal ETT.
- Ease of oxygen supplementation.
- A possible prevention of oedema and fibrosis in operative site.

Pain and discomfort due to placement of nasal airway during post-op period was one of the most important factors which were considered to be highly decisive in designing and conducting the present study. The response from the patients was excellent as only 10% and 23.3% in Group UA and 13.3% and 26.6% in Group BA felt mild pain and discomfort postoperatively as compared to 26.6% and 56.6% in Group NP patients. This mild pain and discomfort however, was completely relieved by the administration of routine analgesics. Contrary to our anticipation, the findings were clinically and statistically significant which clearly establishes the potential benefits of designing the present intervention.

The disadvantages of a poor nasal patency and airway can be seen at the earliest in patients with chronic obstructive pulmonary diseases (COPD), obstructive sleep apnea and cardiac diseases. The opening of nasal passages also improves the pulmonary mechanics in patients with COPD. The hazards of inadequate oxygenation can be extremely devastating in patients with limited cardio-respiratory reserve. The risks of such complications increase substantially in these patients if the level of anaesthesia and sedation are deep.\[21\] Without the availability of bispectral index system (BIS) monitoring, it is extremely difficult and challenging to titrate the anaesthetic and sedation requirements during surgery.\[22,23\] The postoperative period in these patients can be extremely stormy if they fail to breathe through mouth. The problem acquires significant dimensions in patients who are not habitual oral breather in the preoperative period.\[2,24\] In the present study we did not face any such difficulty among Group UA and BA patients. However, mean respiratory rate was little higher (18.2/min) and mean oxygen saturation (94.8%) was on the lower side in Group NP patients as compared to UA (98.8) and BA (99.2) patients which was not clinically significant but statistically significant. Ease of suctioning through nasal airway during the postoperative period was another added benefit of the present intervention as we were able to do suctioning with infant feeding tube no-5 or 6 especially in those patients which were sedated and had a little ooze during the postoperative period from the operated site.

These potential anticipated complications mandate a thorough pre-operative assessment and examination to measure the functional cardio-respiratory reserve. The history should elicit about any chronic steroid intake as these patients may require perioperative steroid supplementation for the underlying disease and prevention of stress response.\[25\]

Laryngospasm, bronchospasm and risk of blood aspiration are all potential complications of nasal packing and failure to breathe adequately through mouth. Literary evidence is available which suggests that even uvular edema can cause respiratory distress during postoperative period.\[26\] The most probable cause for such a phenomenon is the absorption of blood and fluids by the posterior nasal packs during the surgical period. These packs swell like a tampon and exert a downward pressure on the soft tissues of the pharynx thereby causing venous stasis and edema.\[27\]

The duration of nasal packing is also variable and is a subjective decision of the operating surgeon. However, it can be extremely uncomfortable and painful during postoperative period for the patient apart from the possible breathing difficulties. Besides airway obstruction, bradycardia due to vagal stimulation has also been
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observed in the immediate postoperative period with nasal packing while toxic shock syndrome is a reported complication during the late postoperative period.[14] The removal of nasal packs is very painful and sometimes it may require procedural sedation or short duration of anaesthesia in apprehensive patients. Approximately 5% of the patients are associated with Samster’s triad in whom FESS for removal of nasal polyps can result in bronchospasm in response to drugs like aspirin and non-steroidal anti-inflammatory drugs.[28] In the present study, no discomfort was felt by 36.6% and 23.3% of patients in group UA and BA patients as compared to only 10% patients in Group NP. Moderate discomfort was felt by 56.6% patients in Group NP as compared to 33.3% and 16.6% patients in Group UA and BA during removal of the packing/airway postoperatively. Further, in more than 80% of patients in Group UA and BA, there was no episode of fresh bleeding from the operated site during the removal of the nasal conduit as compared to 30% mild oozing from the operated site in Group NP patients which highly significant statistically. Only in 10% and 16.6% of the patients in Group UA and BA, mild ooze was observed which stopped spontaneously in the next 3 to 4 minutes, respectively.

The subjective assessment of the present intervention was carried out among the surgeons and anaesthesiologists based on the post-operative parameters and variables. The survey questionnaire contained various such as ease of breathing by the patient, cardio-respiratory parameters, pain and discomfort, ease of suctioning, pain during removal of the airway/packing and oozing from the operated site during removal of nasal packing and nasal airway. From the survey it was observed that the present airway intervention satisfied 60% and 73.3% of surgeons and 70% and 83.3% of anaesthesiologists in both the groups UA and BA respectively during the postoperative period. We used dexmedetomidine before induction of anaesthesia in the present study as it not only attenuates the stress response to laryngoscopy, intubation and surgery but also decreases the anaesthetic and analgesic requirements besides reducing the incidence of shivering and maintaining stable haemodynamic parameters in the perioperative and postoperative period.[29,30]

The hypo-pharyngeal packing has been shown to reduce the risk of aspiration of blood during the surgery on nasal sinuses.[13,31] We also used hypo pharyngeal pack during the present study. The distal end of the pack was knotted and was placed just inferior to the entry of the ETT into the glottis in all the patients. The rest of the portion was placed in a compact manner so as prevent aspiration of blood in the aero-digestive tract. During extubation, it was observed that the distal end of ETT was dry in majority of the patients while it was minimally soiled with blood stained secretions in minority of the patients.[22] The knotting of the distal end of the pack was a unique feature but we did not study its impact in the present study as it was targeted more on observing the patency of airway. All the patients were administered injection palonosetron 75 μg 20 minutes before the anticipated completion of the surgery. Palonosetron is 5HT3 antagonist and is very effective in prevention of nausea and vomiting for a prolonged period and is especially useful for day care surgery. In the present study, its use was mainly intended to minimize the risk of vomiting thereby preventing any incidence of aspiration.[23]

The concluding remarks can be summed up as excellent based on the observations of the present airway intervention. The additional benefits, besides patent airway, such as ease of suctioning, oxygen supplementation and a possible haemostatic effect due to pressure on the operated site were satisfactory to a great extent. The low cost of the modified nasal airway was the main motivating factor to undertake the present study. The study is simple and can be easily replicable in all type of surgical settings.

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