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# Clinico-Radiological Assesment of Nasal Morphological Parameters in Determining Choice of Nostril Side to Achieve Unhindered Nasal Passage in Nasoendotracheal Intubation of Maxillofacial Surgical Patients: A Randomized Control Trial

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**KEYWORDS**

nasotracheal intubation, nasal examination, nasal abnormalities.

**ABSTRACT:**

**Background**: A significant number of patients undergoing maxillofacial surgery need naso-endotracheal intubation. However, in many patients who are in need of oral and maxillofacial surgical procedures under general anesthesia have nasal obstructions undiagnosed, which render airway selection and management difficult. Hence role of nasal morphological parameters to select nostril side is essential for selection of nostril side for an unhindered nasal passage in naso-endotracheal intubation.

**Material and methods**: A total of 50 patients, aged between 18-60 years, requiring naso-endotracheal intubation for maxillofacial surgery were included in the study. Two groups of 25 each were made, group A: Pre anesthetic nasal evaluation with blinding and group B: Pre anesthetic nasal evaluation without blinding. Patients were evaluated clinically and radiologically for the presence of septal deviations, septal spurs, epistaxis, nasal polyps and enlarged adenoids in nasal passage both pre and intra operatively. Pre-op and intra-op assessment was done and evaluated on basis of the XIII examinations and results obtained after the nasal intubation, the intubation was done in the chosen nostril in group B patients and in the nostril chosen by the anesthesiologist in the group A patient and the obstructions and timing with the manipulation required were checked by the anesthesiologist.

**Results**: The bleeding or epistaxis was found to be more among the subjects with group A -blinding compared to group B- non blinding. This difference was found to be statistically significant ($p = 0.031$). Also,the group A had to undergo a greater number of ET tube manipulation compared to the group B. This difference was found to be statistically significant ($p = 0.027$). The study also concluded that the required number of attempts in which the group A required greater number of attempts compared to the group B. This was also found to be statistically significant ($p = 0.031$).

**Conclusion**: The study concluded that the simple tests can be performed to identify a more patent nostril for the passage of nasotracheal tube. It also identifies the abnormalities of

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nasal passage such as bony spur, turbinate hypertrophy, enlarged adenoids and septal deviation hence reduces the chances of epistaxis. Thereby reduces tube manipulation required and number of attempts significantly.

**Introduction**

In 1774, Alexander Monroe, professor of anatomy at Edinburgh, described his method of inserting a tube, through the larynx in order to ventilate the lungs, with bellows. The technique of naso-tracheal (NTI) intubation, was first developed by Sir Ivan W. Magill, during the first world war (1924- 1918), who was an anesthetist in the faciomaxillary unit at Sidcup, U.K. Since then, the technique of intubation has been erratic, with long periods of stagnation being occasionally broken by improvements. The potential for providing a safe and certain airway with complete protection, against soiling of trachea- bronchial passage makes intubation, a truly valuable technique. The standard oral route for tracheal intubation can be unsuitable for some maxillofacial surgeries. In the 1980's, nasotracheal intubation was the recommended method for polytrauma patients, as it provides good access to the facial skeleton.

Occlusion frequently needed for the adjustment and fixation of maxillary fracture and advancement. NTI is one of the most common methods for established airway management in patients undergoing surgeries, especially in the maxillofacial field.[2] Nasotracheal intubation (NTI) is one of the commonest methods used to induce anesthesia for surgeries of the head and neck region. NTI involves the tracheal tube to pass through nose hence allowing better isolation and good surgical access for intraoral procedures. The knowledge of NTI empowers the surgeon to become a part of the team involved in managing anesthetic complications involving the NTI.[3] NTI has historically been performed by inserting the endotracheal tube (ETT) blindly through the nostril and then guiding the tip through the vocal cords using direct laryngoscopy with or without the assistance of Magill forceps However, nasotracheal intubation is a blind procedure that may lead to complications such as epistaxis, avulsion of the middle and inferior turbinate, and tearing of the nasal septum.[1]

Retropharyngeal perforation (RPP) has been reported and carries the attendant risks of infection and abscess formation. Surgical as well as antibiotic therapy may be necessary for adequate management Septal deviations may be found in >50% of patients but are often asymptomatic.[5] Such structural anomalies may hinder the passage of the tube through the nasal cavity, requiring the intubation to be re-attempted on the other nostril and makes the procedure lengthy and traumatic, although the epistaxis can be easily controlled but in rare cases can be severe and can make. Hence, predicting and selecting the nostril that would be easier for nasotracheal intubation and less associated with complications, such as epistaxis, would be conducive to a safer airway management. Furthermore, in some cases, a particular nostril must be selected due to the location of the lesion in surgery; thus, it would be beneficial for the patient if the risks and incidences of complications associated with the selection of nostril were examined.[2]

**Material and methods**

**SOURCE OF DATA:**

A total of 50 patients, getting operated in the Department of Oral and Maxillofacial

Surgery under GA were included in this study. 25 patients were placed into the GROUP

A - blinding, and 25 in the GROUP B – non blinding. Both nostrils were assessed

preoperatively and intra op assessment by anesthesiologist using various tests for various

parameters and all recorded in two score sheets respectively.

**INCLUSION CRITERIA**

- Patient willing to participate in the study.
- Healthy individuals in the age group of 18 to 60 years.
- Patient indicated for surgery under general anaesthesia.

**EXCLUSION CRITERIA**

- Patients with systemic disorders.

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 Patients with severe space infections spreading to para pharyngeal spaces.

 Pregnant and lactating women

 History of present nasal trauma and maxillary fractures

 Underlying bleeding or clotting disorders.

**SEQUENCE OF PATIENT CARE:**

On reporting to our unit, case history was taken & systematic examination of the patients was done depending on their chief complaints. The necessary radiographic investigations were carried out.

**STUDY DESIGN:**

50 patients undergoing maxillofacial surgical procedure under general anesthesia in which naso-endotracheal intubation was required were included in this study. a proper case history with questionnaire and pre operative evaluation and scoring was done. All the patients' medical history were documented. Patients were then evaluated on the basis of predetermined inclusion and exclusion criteria.

25 patients were randomly placed into the group A and rest 25 in the group B. In the blinded group the pre operative evaluation score sheet was not given to the anesthesiologist, rest 25 non blinding group the sheet was discussed and evaluated with the anesthesiologist and all scores given and collected. Those who successfully met and agreed to the study criteria and who signed the informed consent for the surgical procedure were enrolled in the study. Preoperative PNS was taken. The area of interest was scored and intraoperative findings noted and studied.

GROUP –A. blinding In this group 25 patient wereevaluated preoperatively. This was not disclosed with the anesthetist. The intubation is done according to the intraoperative findings as per the anesthesiologistevaluation. Nasal septal deviation, epistaxis, adenoid enlargement and turbinate hypertrophy is evaluated if any. Within the nasal passage of NT tube, the difficulty of intubation is assessed. Important aspect of this procedure is the evaluation of the nasal passage and findings and putting them to the test with reviewing the results from intraoperative findings. This recognizes any nasal obstruction and helps us determine the resultant hindrance if any in the nasal passage and the additional time taken to complete the procedure.

GROUP- B. non blinding The 25 patients' evaluation done preoperatively are reported to the anesthesiologist and the intubation is done accordingly in the chosen nostril, intraoperative findings are discussed with the anesthesiologist and a proper evaluation is done. Nasal septal deviation, epistaxis, adenoid enlargement and turbinate hypertrophy is evaluated preoperatively and intraoperatively. The sequence is recorded along with the time that is taken, bleeding noted and manipulation required for same. The importance of this step is the evaluation of the ease or difficulty of intubation with the chosen evaluated nostril and the easy passage of nasal tube with least manipulation and reduced time spent for the anesthesiologist.

**Armamentarium**: In general, the armamentarium employed for carrying out the intubation procedure was as follows

- Nasotracheal tube
- Local anesthesia jelly lidocaine
- 5cc syringe
- Macintosh laryngoscope
- Preoperatively Oxymetazoline nasal drops
- Nasal speculum
- Nose questionnaire Posterior rhinoscopy mirror/ St. Clair Thompson mirror
- Bright light source
- Vernier caliper digital

Standard traditional nasotracheal intubation was performed on each patient with oxymetazoline drops placed in both nostrils and local anesthesia lidocaine jelly was used to prepare the nostrils which helps in passage of the tube.

**SAMPLE SIZE ESTIMATION**: n= z2 pq/e2= (1.96) (0.99)(0.01)/(0.1)2=3.84=~4 Value of z statistic – 45% confidence limit--z Prevalence of maxillofacial surgical patients = 1% --p Non prevalence = 1-0.01= .99 –q Instrumental error – 0.1-- e Since it's a population study, the variation cannot be accommodated in a smaller sample size of 4, so Sample size of 50 has been taken considering the incidence of the population going for surgery under general anaesthesia.

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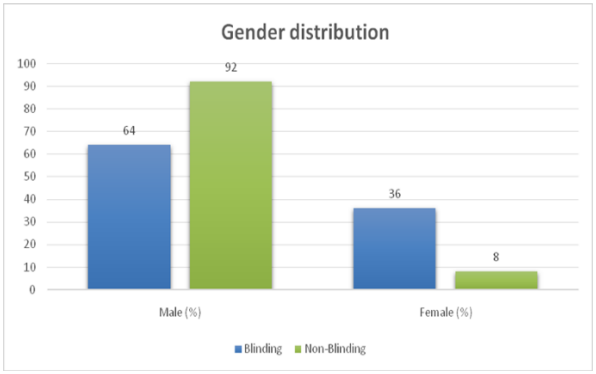
## Results

**Table 1- Gender Distribution**

| | Male (%) | Female (%) |
|---|---|---|
| Group A | 16 (64.0) | 9 (36.0) |
| Group B | 23 (92.0) | 2 (8.0) |
| Total | 39 (78.0) | 11 (22.0) |

**Figure 1- Gender Distribution**

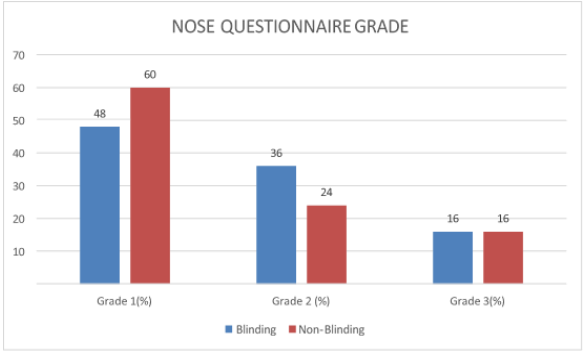



The percentage of males were more in the group B (92.0%) compared to the group A (64.0%).The mean age of the study population was 35.68 ± 12.94 years in the group B and 33.88 ± 13.37 years in case of group A

**Table 2- Nose Questionnaire Grading**

| Nose Questionnaire Grade | Group A | Group B |
|---|---|---|
| Grade 1 | 12 (48.0) | 15 (60.0) |
| Grade 2 | 9 (36.0) | 6 (24.0) |
| Grade 3 | 4 (16.0) | 4 (16.0) |

**Figure 2- Nose Questionnaire Grading**

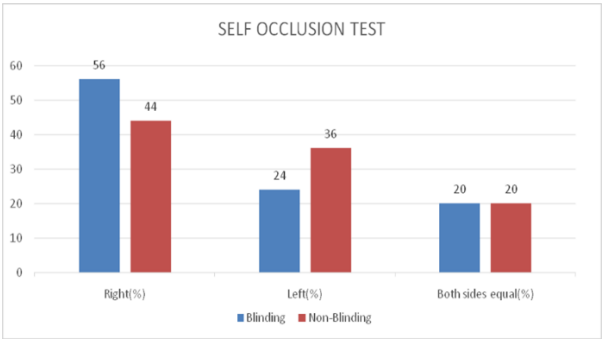



Nose questionnaire grade, showed grade 1 in 48.0% of the group A and 60.0% in group B. Grade 2 was seen in 36.0% of the group A and 24.0% of the group B and grade 3 was seen among 16.0% in both the groups.

**Table 3- Self Occlusion Test**

| Self-occlusion test | Group A | Group B |
|---|---|---|
| Right | 14 (56.0) | 11 (44.0) |
| Left | 6 (24.0) | 9 (36.0) |
| Both sides equal | 5 (20.0) | 5 (20.0) |

**Figure 3- Self Occlusion TEST**

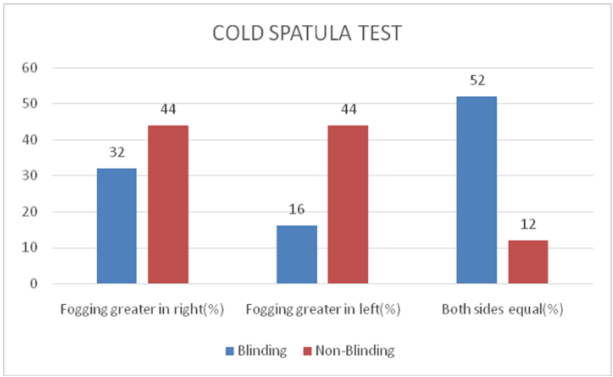



Self-occlusion test showed right side prominence in both the groups with 56.0% and 44.0% respectively. Left side prominence was seen among 24.0% of the group Aand 36.0% of the group B.

**Table 4- Cold Spatula Test**

| Cold spatula test | Group A | Group B |
|---|---|---|
| Fogging greater in right | 8 (32.0) | 11 (44.0) |
| Fogging greater in left | 4 (16.0 | 11 (44.0) |
| Both sides equal | 13 (52.0) | 3 (12.0) |

**Figure 4- Cold Spatula Test**



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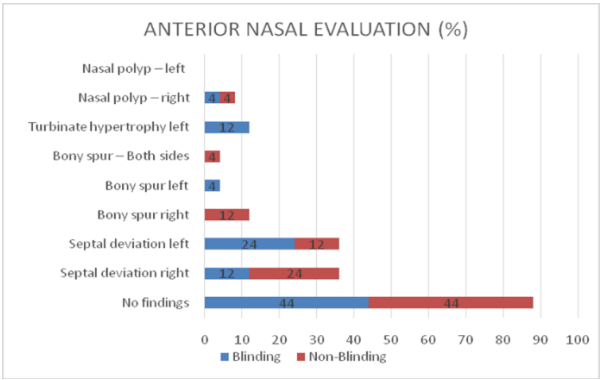
Cold spatula test found that the fogging was greater on right side in 32.0% and 44.0% in group A and group B respectively. Fogging was greater on left side only in 16.0% and 44.0% of the same groups respectively and was equal on both sides in 52.0% and 12.0% in group A and group B respectively.

**Table 5- Anterior Nasal Evaluation**

| Anterior Nasal Evaluation | Group A | Group B |
|---|---|---|
| No findings | 11 (44.0) | 11 (44.0) |
| Septal deviation right | 3 (12.0) | 6 (24.0) |
| Septal deviation left | 6 (24.0) | 3 (12.0) |
| Bony spur right | 0 (0.0) | 3 (12.0) |
| Bony spur left | 1 (4.0) | 0 (0.0) |
| Bony spur – Both sides | 0 (0.0) | 1 (4.0) |
| Turbinate hypertrophy left | 3 (12.0) | 0 (0.0) |
| Nasal polyp – right | 1 (4.0) | 1 (4.0) |
| Nasal polyp – left | 0 (0.0) | 0 (0.0) |

**Figure 5 - Anterior Nasal Evaluation**

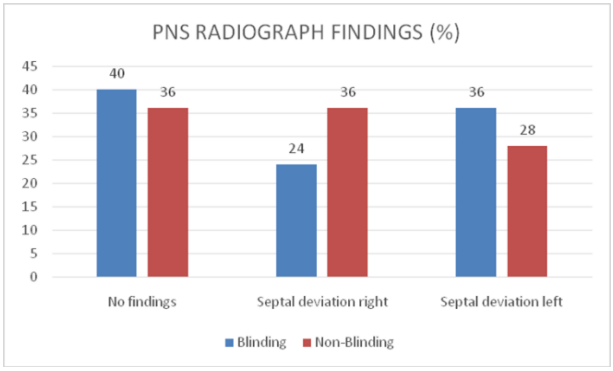



The most common finding in case of anterior nasal evaluation was septal deviation left in case of group A and septal deviation right in case of group B.

**Table 6- PNS Radiograph Findings – Septal Deviation**

| PNS radiograph findings | Group A | Group B |
|---|---|---|
| No findings | 10 (40.0) | 9 (36.0) |
| Septal deviation right | 6 (24.0) | 9 (36.0) |
| Septal deviation left | 9 (36.0) | 7 (28.0) |

**Figure 6- PNS Radiograph Findings – Septal Deviation**




Looking at PNS radiograph it was found that, most of the group ahad septal deviation to the right side (36.0%) while group B had septal deviation to left side (36.0%)

**Discussion**

Major maxillofacial surgical procedures are performed under general anesthesia, which calls for nasotracheal intubation. This needs unhindered passage of NT tube for safe and uncomplicated intubation. In most of the patient's anatomical variations like septal deviations, nasal bone fractures with fractured nasal septum, enlarged turbinates may make it difficult for the Nasotracheal tube to pass causing failure to intubate. And they may also cause associated complications like epistaxis, naso-endotracheal cuff tear and fractured turbinate bones.[2]

To avoid such complications pre-anesthetic evaluation can make the procedure much safer and reduce the chance of failures in intubation. Various evaluation methods range from simple tests, conventional PNS radiographs to use of Endoscopy, rhinoscopy and Rhinomanometry which are shown to be more precise and can be saved for situations where intubation is challenging. Drawbacks being that these are not readily available and add to the cost. Simple clinical evaluation methods are proven to be useful and reliable in assessment of nasal passage. The more cumbersome and expensive methods can be reserved for cases with difficult intubation.[6]

In our study Pre anesthetic evaluation methods involved self-occlusion test, cold spatula test, anterior nasal examination and posterior nasal examination. These tests were evaluated for the positive or negative predictability.

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Sensitivity and specificity for the findings and complications assessed. Conventional PNS radiographs were usedto identify septal deviations.

A self-assessment NOSE questionnaire grading used to rule out snoring or any other self- noticed findings.

Certain morphological variations in the nasal structure might make intubations challenging. In a study conducted by Lindsay P. Gray, MB[7] revealed the ethnic variations in septal deviation and nasal morphology found in different populations such as in Indians, septum deviated 38% and kinked 49% , Chinese deviated septum was 40% and kinked 45% ,European deviated septum was 34% and kinked 49%, African deviated septum was 30% and kinked 50% Australian deviated septum was 38 % and kinked 35%. Combination of all gives deviated septum 37% and kinked 42% in total.

Also, it was found that 7% i.e 4 patients of bony spur was found on the left side in patients in study done by J. E. Smith and A. P. Reid[8], incidence in general population were found to be more inclined in the left side. Nasal polyps were found to be 2 % in the study. Lastly 3% inferior turbinate hypertrophy was noted in the study sample of 60 patients.

In our study it was found the deviation to be 62% had a nasal deviation with a very little predominance in the left side. Also, it was found that the incidence of bony spur was 18%, nasal polyps were found to be 16% and inferior turbinate hypertrophy was found to be 4%.

Cattleya Thongrong, PattramonThaisiam et al[1] in 2018 reassessed the patient's own opinion of nasal airflow method with OT and ST tests. Its sensitivity was 91.7%, specificity was 61.1%, positive predictive value was 75.9, and positive likelihoodratio was 2.36. For improved diagnostic value, the occlusion test was combined with the spatula test because it was a simple method with high sensitivity (95.8%)[1]

In our study Self-occlusion test (OT) showed right side prominence in both the groups with 56.0% and 44.0% respectively. Left side predominance was seen among 24.0% of the group a and 36.0% of the group B.

With the sensitivity of group Ain self occlusion being 88.46% and positive predictive value being 92.00% and for the group B sensitivity being 92.85% and positive predictive value also 92.85% and ST of both group A and group B having 94.73% and specificity of 93.33% with a positive predictive value of 94.73%. Showing the highly likeability of getting a positive result in test and our study results supports the Cattleya Thongrong, PattramonThaisiam et al[1] in 2018 study.

In a study by N Şengel, ME Toprak, NH Selmi1, MS Ataç[6] all test options were statistically compatible with nasal endoscopic examination results (OT + ST (P = 0.009),OT + radiologic assessments (P = 0.000), ST + radiological assessments (P = 0.000), OT + ST + radiological assessments (P = 0.000)).

But the mean percentages of compatibility suggest that the most successful indicator to identify the optimal nasal passage for nasotracheal intubation was provided by the joint result from the combined performance of all the three tests.

Our study observations were similar in sensitivity for the above series of tests and was found to be 100% in the recorded cases. Also, in the group B it was noted that the number of attempts required in the procedure was reduced and was found statistically significant (p = 0.031) proving that the simple radiological test combined with our evaluations were useful for choosing of the nostril.

Complications associated with intubation such as epistaxis, cuff tear of NT tube, turbinate perforation or turbinectomy are seen.

**Conclusion**

The simple tests such as self-occlusion test, cold spatula test , anterior nasal examination and posterior nasal examination along with the help of radiological examination such as PNS were found out to be very sensitive and specific for the identifying nasal passage abnormalities such as nasal septal deviation , bony spurs, turbinate hypertrophy , enlarged adenoids and these tests can be used to choose the correct nostril for the least complicated passage of the ET tube in nasal passage .

In our study, it was evident that the bleeding or epistaxis was found to be more amongst the subjects ingroup A compared to group B. This difference was found to be statistically significant (p = 0.031).

Also the group ahad to undergo a greater number of ET tube manipulation compared to the group B. This

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difference was found to be statistically significant (p = 0.027).

The study also concluded that the group A required a greater number of attempts compared to the group B. This was also found to be statistically significant (p = 0.031) Evaluation of the tests used in this study among the group B, it was found that, cold spatula test and the tests done in series had better sensitivity (true positive) (100.00%), while anterior and posterior nasal evaluation had lesser sensitivity (3125%). Better specificity (true negative) was seen with anterior and posterior evaluation and series test (100.00%), while least specificity was seen with cold spatula test (80.00%). Best positive predictive value (PPV) was seen with anterior and posterior evaluation and series test (100.00%), implying they both can positively predict the condition better compared to other tests, while least PPV was seen with cold spatula test (87.50%). Negative predictive value was more among cold spatula test and series test (100.00%) while less among anterior and posterior evaluation (45.00%) this compared to the group the best sensitivity was seen with cold spatula test (91.66%) and the least with anterior and posterior evaluation (30.00%). The specificity was more with cold spatula test, series test and parallel test (100.00%) and the least among anterior and posterior evaluation. PPV was also found to be high among these groups. Highest NPV was seen with cold spatula test (90.90%) and least with anterior and posterior evaluation (22.22%).

Observations from our study proved to be beneficial in choosing the best nostril for intubation by providing a safe and unhindered passage for nasotracheal intubation in head and neck surgeries.

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