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To evaluate the role of nasogastric tube as a guide to facilitate nasotracheal intubation.

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Abstract

Nasotracheal intubation is an established airway management technique in various intra-oral and oropharyngeal surgical procedures. Nasal trauma is chief complication associated with it. In order to overcome nasal trauma we conducted a randomized controlled study over 60 adult patients undergoing elective surgery under general anaesthesia using nasogastric tube as a pathfinder to facilitate the passage of nasal endotracheal tube till it reaches oropharynx (Group I) compared with the conventional technique (Group II) i.e blind insertion of nasotracheal tube into nasal cavity. We concluded that in group I 86.7% patients had easy insertion of nasotracheal tube compared to 43.3% in group II ($p < 0.001$). Nasogastric tube decreases incidence of nasal trauma ($p < 0.001$), increased passage of nasotracheal tube via lower nasal pathway ($p < 0.001$) as well as decreased number of attempts for nasotracheal intubation ($p = 0.018$).

Keywords: Epistaxis, Nasotracheal Intubation, Nasogastric Tube

Introduction

Nasotracheal intubation is an age old effective and safe established airway management technique involving insertion of endotracheal tube through the nose into the trachea. It is useful for intraoral or oropharyngeal procedures, complex orofaciomaxillary and microlaryngeal surgeries, etc. Patients with obstructive sleep apnoea and cervical spine instability are other indications.[1]

However, it is also associated with complications like epistaxis, turbinate avulsion, bacteremia, retropharyngeal mucosa dissection, injury to polyp and injury to adenoids. Among these epistaxis due to nasal trauma is most common.[2]

There are two main anatomical pathways in the nostril through which the endotracheal tube may pass. The lower pathway lies along the floor of nose underneath the inferior turbinate. The upper pathway lies above the inferior turbinate just below the middle turbinate. The nasotracheal tube may take any of the above two pathways. The lower pathway is considered to be the safer route for nasotracheal intubation, as it is located away from the cribriform plate and middle turbinate which is a very fragile, porous and vascular structure.[2, 3]

Common anatomical variations like concha bullosa, septal deviations, spur, nasal polyps can cause unilateral obstructions and thereby affect intubation. Deviated nasal septum also changes the airflow dynamics. These variations must be diagnosed during pre-anaesthetic evaluation to prevent complications. [2]

There are many studies regarding aiding of nasotracheal intubation i.e. helping the nasal tube to be placed into the trachea, but we understand that the major resistance felt in the path, as well as maximum nasal trauma occurs until the nasal tube crosses the posterior nares to reach the oropharynx. Therefore the focus of this study was to safely guide the nasotracheal tube to reach the oropharynx and then further into the trachea.

Here, we reinforce that fiber optic guided intubation is the gold standard for safe nasotracheal intubation. However, it is an expensive and time consuming procedure, which is generally not available in emergency setups of our country.

A nasogastric tube, an easily available tool in the operation theatres, has been seen to pass through posterior nares with minimal trauma to the nasal passage probably due to its soft consistency, flexibility and an atraumatic rounded tip. Being thin, it is likely to pass along the floor of the nose i.e. lower pathway following path of least resistance. It can also be pulled back anytime with ease owing to its long length. [3, 7]

Therefore, we decided to plan a study using nasogastric tube as a path finder to facilitate the passage of the nasal endotracheal tube till it reaches the oropharynx, during nasotracheal intubation.

Material and Methods

After approval from the institutional ethics committee, this prospective randomized controlled study was conducted on 60 adult patients (age 18 to 60 yrs.) of either sex, belonging to American Society of Anesthesiologists (ASA) physical status I and II, undergoing elective surgeries planned to be done under general anaesthesia. Patients with history of hypertension, recurrent epistaxis, abnormal coagulation status, basilar skull fracture, predicted difficult airway, severe mid-facial trauma and oropharyngeal or nasal growth were not included in this study.

Preparation of patient

The patients were assessed a day prior to surgery. Detailed clinical history was taken and general physical examination was carried out. All the routine investigations were checked. Detailed nasal examination was done. Findings of nasal patency test and anterior rhinoscopy were noted. Patients were explained about the procedure and VAS (0-10) in detail. Consent for participation in the study was taken from the patients. Patients were kept fasting for six hours prior to surgery. Nasal preparation was done with xylometazoline nasal drops a day prior to surgery as well as early morning before surgery.

Procedure

On the day of surgery, patients were taken in the operation theatre and standard monitors like ECG, non-invasive blood pressure (NIBP) and pulse oximeter attached.

Intravenous access was established and intravenous fluid started. Baseline vital data was noted. Patients were then randomized to either of two groups by drawing slips from an opaque sealed envelope.

Group I (n=30) - Nasogastric tube guided nasotracheal intubation

Group II (n=30) - Conventional nasotracheal intubation

Patients in both the groups were given general anaesthesia using standard protocol. Inj. glycopyrrolate 0.2mg and inj. fentanyl 2mcgkg^{-1} were given intravenously. Pre-oxygenation with 100% O_2 was started using Bain's circuit for three minutes. Induction of anaesthesia was done using inj. propofol 2mgkg^{-1}. After checking adequacy of mask ventilation inj. vecuronium bromide 0.08mgkg^{-1} intravenously was given. The more patent nostril was chosen. In Group I patients (i.e. in the nasogastric tube guided technique) with the head extended, a lubricated nasogastric tube (16Fr) was inserted into the tracheal tube (7.5 mm and 7.0 mm for male and female respectively) and positioned with its tip protruding about 20 cm from the distal end of the tracheal tube (Fig. 1). The nasogastric tube was lubricated with lignocaine jelly and inserted into the nasal cavity along the floor of the nose in an attempt to advance it along the lower pathway (Fig. 2). Direct laryngoscopy was done and after the nasogastric tube become visible in oral cavity the tracheal tube was advanced along the nasogastric tube till the oropharynx. The nasogastric tube was then retrieved from the nose (Fig. 3). For Group II patients (i.e. conventional nasotracheal intubation method), intubation was performed by advancing the nasotracheal tube along the nasal floor to the posterior nasopharyngeal wall.

To evaluate the role of nasogastric tube as a guide to facilitate nasotracheal intubation in patients following parameters were noted:

1. Ease of insertion
2. Number of attempts of both nasotracheal intubation and nasogastric tube insertion
3. Incidence of nasal trauma
4. Time taken for nasotracheal intubation
5. Post operative nasal pain
6. Complications, if any

Ease of insertion was noted as easy - if no resistance is felt during intubation, or difficult - if resistance was felt. In case resistance was felt the tube was manipulated, if still resistance persisted then other nostril was chosen for nasotracheal intubation. Number of attempts taken for nasogastric tube insertion and nasotracheal intubation were noted separately. More than 3 attempts were considered as failure and patient was excluded from the study. Nasal trauma was evaluated by direct laryngoscopy using a 4-point scale: no epistaxis; mild epistaxis (blood on the tracheal tube only); moderate epistaxis (blood pooling in the pharynx) or severe epistaxis (blood in the pharynx sufficient to impede intubation).

In both the groups, the nasotracheal tube was further advanced into the trachea (using Magill's forceps if required). Time taken for nasotracheal intubation was taken as time from start of nasogastric tube insertion to successful placement of nasotracheal tube for Group I patients and for nasotracheal tube insertion and its placement into trachea for Group II patients. After confirming the position of tube by capnography and auscultation, ventilation was resumed. The pathway taken by the tracheal tube was assessed using a fibreoptic endoscope alternately above and below the tracheal tube in the nostril.

Maintenance of anaesthesia was done using isoflurane (up to 1%) in O_2 and N_2O (33:67), inj. vecuronium bromide 0.02mgkg^{-1} and fentanyl 1mcgkg^{-1} intravenously as required. Rest of the procedure proceeded as routine. At the end of surgery all anaesthetic agents were stopped and neuromuscular blockade was reversed using inj.

glycopyrrolate 0.4 mg and inj. neostigmine 0.05mgkg^{-1} intravenously after spontaneous respiratory efforts were noted. Patients were extubated after arrival of all reflexes and adequate muscle power and shifted to recovery room followed by ward thereafter.

Nasal pain was assessed at 6 hours and 24 hours post operatively and noted as VAS. Visual analogue scale rating more than four was taken as significant and patients will be given inj. diclofenac 75mg i.m. for analgesia. Complications like persistent nasal bleed, nasal stuffiness, nausea, vomiting etc. were noted.

Aim

Our primary aim in this study was to compare ease of insertion, number of attempts of both nasotracheal intubation and nasogastric tube insertion, incidence of nasal trauma and time taken for nasotracheal intubation. Secondary outcomes included post-operative nasal pain and complications, if any.

Sample size

According to previous study the incidence of proper placement of tracheal tube in conventional technique was 26.7% (8 out of 30) and in nasogastric tube guided technique was 66.7% (20 out of 30). [7] Considering that a clinically significant increase in proper tracheal tube placement was 40% in absolute terms, 30 patients were required for each group with an alpha error of 5% to achieve a significance level of 95% and power of 80%.

Statistical Analysis

The entire data was analyzed using statistical package for social science system version SPSS 18.0. For continuous variables, unpaired Student t-test was done while for categorical data, Chi-square test or Fisher exact test (whichever applicable) was done. For all statistical tests, a “p” value less than 0.05 was considered as significant.

Results

All the data collected was compiled and subjected to relevant statistical tests, following observations and results were obtained:

Demographic profile and Baseline Vital Parameters: Both groups were comparable in terms of age, sex, ASA status and baseline vital parameters like temperature, pulse, NIBP and respiratory rate.

Ease of Insertion of Nasotracheal Tube: We found that in Group I 86.7% patients had easy insertion of nasotracheal tube as compared to 43.3% in Group II. In Group I 13.3% patients had difficult insertion of nasotracheal tube as compared to 56.7% in Group II (Fig. 4). Statistical analysis using Pearson chi-square test for comparing ease of insertion of nasotracheal tube in both groups showed that in Group I there is ***statistically significant easy intubation*** in comparison to Group II ($p < 0.001$).

Number of Attempts For Nasotracheal Intubation: In Group I 73.3% patients had successful nasotracheal intubation in first attempt and 26.7% required second attempt for nasotracheal intubation whereas in Group II 43.3% patients had successful nasotracheal intubation in first attempt and 56.7% required second attempt for nasotracheal intubation (Fig. 5). Statistical analysis using Pearson chi-square test showed ***statistically significant decrease*** in number of attempts required for successful placement of nasotracheal tube in Group I ($p = 0.018$).

Nasal Trauma: In Group I 50% patients had no nasal trauma, 36.7% had mild nasal trauma, 13.3% had moderate nasal trauma and none had severe trauma. In Group II 33.3% patients had mild nasal trauma, 46.7% had moderate nasal trauma and 20% patients had severe nasal trauma (Fig. 6). Statistical Analysis showed that there was ***significant reduction in nasal trauma*** in Group I i.e. nasogastric tube guided technique as compared to Group

II i.e. nasotracheal intubation using conventional technique (p < 0.001).

Nasal Pathway: The pathway taken by tracheal tube was assessed using fiber optic endoscope in both the groups. For Group I in 90% patients the nasotracheal tube passed through lower pathway and in 10% patients it passed through upper pathway. For Group II in 26.7% patients the nasotracheal tube passed through lower pathway and in 73.3% it passed through upper pathway (Fig. 7). In Group I there is ***statistically significant increase in chances of passing of nasotracheal tube via lower pathway*** as compared to Group II (p < 0.001).

Time Taken for Intubation: Average time required for nasal intubation in Group I was 72.87 sec whereas in Group II it was 74.2 sec (Fig. 8). There was ***no statistically significant difference*** in time required for nasal intubation in both groups (p = 0.855).

Nasal Pain: The severity of patient's nasal pain was assessed by Visual Analogue Scale and recorded after completion of surgery at 6 and 24 hours. The overall combined ***VAS score of both the groups decreased with time*** (p = 0.01) but when VAS in individual groups were compared for 6 hours versus 24 hours the ***decrease was not statistically significant in Group I*** (p = 0.11) (Fig. 9). However, in ***Group 2*** there was ***significant decrease*** in VAS at 24 hours as compared to VAS at 6 hours (p = 0.048).

Complications: In our study none of the patient in either group developed any complication like persistent nasal bleed, nasal stuffiness, vomiting or any other nasal morbidity.

Discussion

Nasotracheal intubation is required in surgical procedures involving the oral cavity, head and neck region for better surgical access. Patients tolerate these nasotracheal intubations better and there are lesser chances of displacement of tube as compared to orotracheal intubation. Thus, it is of advantage to both surgeons as well as anaesthesiologists.

Advancement of nasotracheal tube can traumatize nasal passage as a large tube is passed through the narrow nasal passage. Various studies have been done to overcome epistaxis due to nasotracheal intubation. Use of xylometazoline nasal drops, thermosoftening along with lubrication of tracheal tube, choosing the more patent nostril, progressive dilation with nasopharyngeal airways and use of smaller tracheal tube resulted in smooth passage of tracheal tube via the nostril.[4,5] Techniques to blunt the sharp edge of distal aspect of nasotracheal tube like using nasogastric tube, Wendl tube, red rubber catheter, suction catheter, oesophageal stethoscope, urethral catheter and glove finger also have been suggested.[6-13] After reviewing many techniques suggested in literature to minimize nasal trauma, we decided to use nasogastric tube as a pathfinder for nasotracheal intubation because it appealed to us as a simple, atraumatic technique, readily available and an economic option. We therefore, conducted a prospective randomized study in our institute to evaluate the role of nasogastric tube to facilitate nasotracheal intubation.

Demographic Profile and Baseline Vital Parameters: The demographic data including age, sex and ASA status as well as baseline haemodynamic parameters were **comparable in both the groups** as in the studies of Lim et al, Seo et al, Morimoto et al and Elwood et al.[7,9,10,11]

Ease of Insertion: Group I had 86.7% patients with easy insertion of nasotracheal tube as compared to 43.3% in Group II. In Group I 13.3% patients had difficult insertion of nasotracheal tube as compared to 56.7% in Group II. **In Group I there was statistically significant easy intubation** in comparison to Group II (p<0.001). Easy insertion of nasotracheal tube in technique using nasogastric tube could be very well explained as insertion of nasogastric tube in nasal cavity dilated the path and resulted in smooth transit of nasotracheal tube which is in concordance with the studies of Sugiura et al and Lim et al who also used nasogastric tube as a guide. Morimoto et al and Seo et al also found similar results using curve-tipped suction catheter and oesophageal stethoscope respectively. [6,7,10,11]

Number of attempts for Nasotracheal Intubation: In Group I 73.3% patients had successful nasotracheal intubation in first attempt and 26.7% required second attempt for nasotracheal intubation whereas in Group II 43.3% patients had successful nasotracheal intubation in first attempt and 56.7% required second attempt for nasotracheal intubation. There was **statistically significant decrease in number of attempts required for successful placement of nasotracheal tube in Group I** (p = 0.018). Decreased resistance in nasal cavity due to use of nasogastric tube probably resulted in a decrease in the number of attempts required to insert nasotracheal tube in Group I. Our results are thus consistent with those of Sugiura et al, Lim et al who also used nasogastric tube and Elwood et al who used red rubber catheter as a guide. [6,7,9]

Nasal Trauma: Group I had 50% patients with no nasal trauma, 36.7% had mild nasal trauma, 13.3% had moderate nasal trauma and none had severe trauma. In Group II 33.3% patients had mild nasal trauma, 46.7% had moderate nasal trauma and 20% patients had severe nasal trauma. There was **significant reduction in nasal trauma in Group I** as compared to Group II (p < 0.001). Reduced incidence of epistaxis may be attributed to the fact that less number of attempts for intubation were required in nasogastric tube guided nasotracheal intubation. Moreover, nasotracheal tube passed through lower pathway which resulted in less trauma in Group I. Trauma could occur to nasal cavity as a result of sharp and rigid edges of distal aspect of nasotracheal tube. Small rounded tip of nasogastric tube blunted the sharp distal end of nasotracheal tube as well as it reduced the contamination of the tube. Use of nasogastric tube thus helped to prevent nasal trauma after nasotracheal intubation. These observations were similar to those of Sugiura et al and Lim et al who used nasogastric tube, Enk et al who used Wendl tube, Elwood et al who used red rubber catheter, Morimoto et al who used curved tipped suction catheter and Seo et al who used oesophageal stethoscope as a guide to facilitate nasotracheal intubation. [6,7,8,9,10,11]

Nasal Pathway: The pathway taken by tracheal tube was assessed using fiber optic endoscope in both the groups. In our study, all the tracheal tubes were observed in one of the two pathways, consistent with previous studies. Nasogastric tube is likely to pass through lower pathway as it follows the path of least resistance (i.e. lower pathway, below the inferior turbinate). This was reestablished in our study where we found that for Group I in 90% patients the nasotracheal tube passed through lower pathway and in 10% patients it passed through upper pathway. For Group II in 26.7% patients the nasotracheal tube passed through lower pathway and in 73.3% it passed through upper pathway. **In Group I there was statistically significant increase in chances of passing of nasotracheal tube via lower pathway** as compared to Group II (p < 0.001). This was so because the nasogastric tube most likely passed through the lower pathway and nasotracheal tube followed the same path of nasogastric tube in guided fashion. Lim et al found that the incidence of passage via lower pathway was statistically more in nasogastric tube guided technique (p = 0.004) and our results are similar to those of Lim et al.[7]

Time Taken for Intubation: Average time taken for intubation was 72.8 seconds in Group I which is lesser time as compared to 74.2 seconds in Group II. However this **difference was not statistically significant** (p=0.85). Thus, we found that time required to intubate the patient was comparable in both the groups. Though it was expected that nasogastric tube guided technique might take longer time, as the withdrawal of the nasogastric tube was an additional step in its procedure, but it was found that there was no significant difference in time required to intubate the patient in both the groups. This can be attributed to the time required for nasotracheal tube to overcome the resistance in nasal cavity by the conventional technique. Our results are similar to Sugiura et al who compared blind intubation with or without nasogastric tube guidance as conventional blind technique required more attempts. However, our results are contrary to those of Lim et al, though the difference was not statistically significant. Studies of Elwood et al and Morimoto et al also showed longer time taken using red rubber catheter and curved tipped suction catheter respectively, due to the complexity of their technique which probably took longer time. [6,7,9,10]

Nasal Pain: The overall combined VAS score for pain after nasal intubation decreased with time (p = 0.01) indicating that the pain, if any, progressively decreased over 24 hours irrespective of the groups. When VAS in individual groups were compared for 6 hours with 24 hours the decrease was found to be statistically insignificant in Group I (p = 0.11) while it was significant in Group II (p = 0.048). This indicates that pain perceived by patients must have been less initially in Group I and hence the decline in VAS score was comparatively less with nasogastric tube guided technique. This is similar to Enk et al, Sadaqa et al but different from Lim et al who found no significant change in nasal pain.[7,8,13]

Complications: None of the patient in either group developed any complication like persistent nasal bleed, nasal stuffiness, vomiting or any other nasal morbidity. This finding is in contrast to Lim et al and Seo et al who found complications in both the groups though without any statistically significant difference. [7,11]

Therefore, in our study we found that, when compared with the conventional technique, nasotracheal intubation done using a nasogastric tube as a guide was easier, faster and required less attempts. As the endotracheal tube followed the nasogastric tube and passed through the lower pathway, this intubation was less traumatic both in terms of any bleeding as well as post-operative nasal pain without affecting the haemodynamics of the patient irrespective of their demographic profile.

Fiber-optic technique is an alternative option for nasotracheal intubation. It requires additional specialized equipment and also needs a higher level of training. Our study enforces that easy availability and short learning curve makes nasogastric tube guided technique, a feasible option for less traumatic nasotracheal intubation. Hence, it offers the anesthesia professionals additional option for patient care, especially in emergency setups.

However, our study was limited to the patients with normal nasal function who had no history of nasal trauma, epistaxis or coagulation disorder and an experienced anaesthesiologist performed all the intubations in paralyzed patients. Moreover the anaesthesiologist could not be blinded to the type of technique used for intubation. Hence, further studies where patients with comorbidities are included and anesthesiologist could be blinded to the type of technique used are recommended in future.

Conclusion

Nasogastric tube guided nasotracheal intubation technique improves ease of intubation, requires lesser attempts, ensures placement of nasotracheal tube in lower pathway resulting in reduced nasal trauma as well as nasal pain without affecting the haemodynamics of the patient irrespective of their demographic profile. It is thus recommended, as a good alternative method for nasotracheal intubation.

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Figures

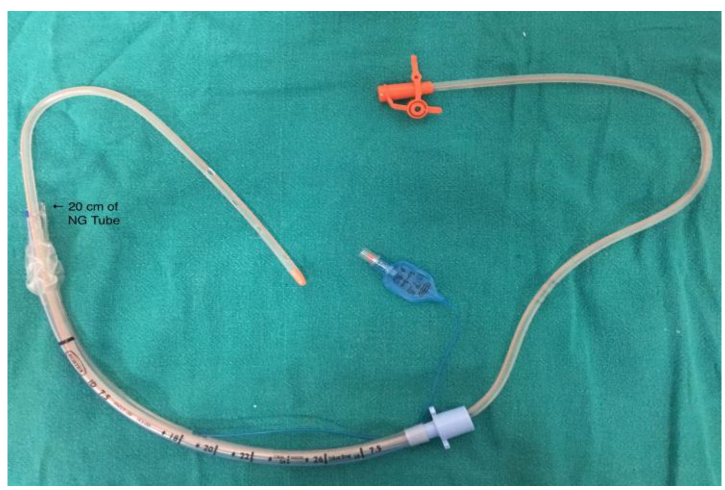
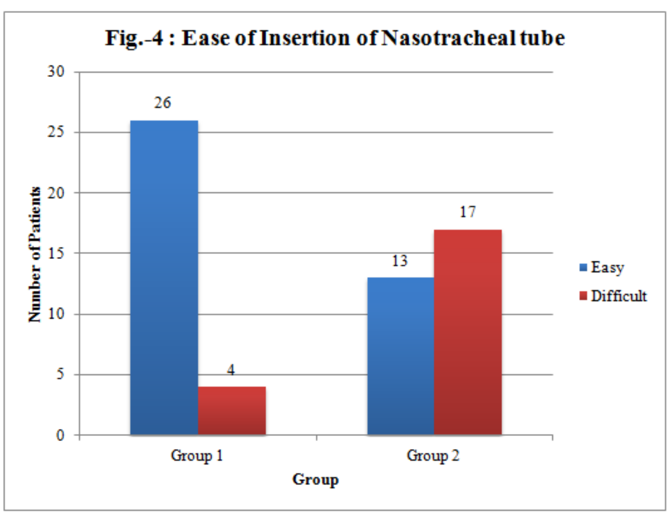
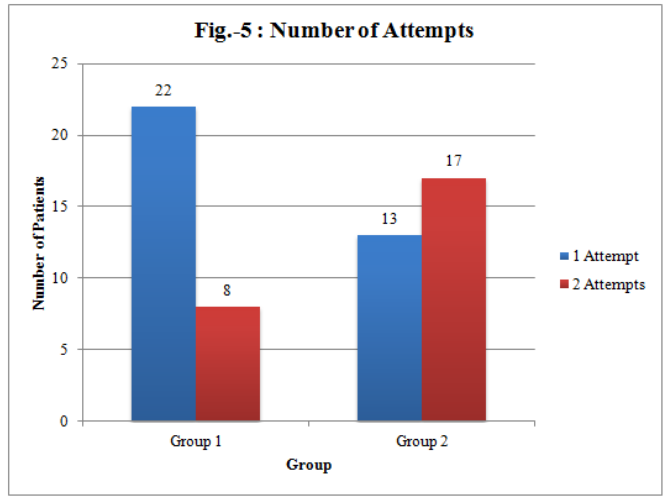


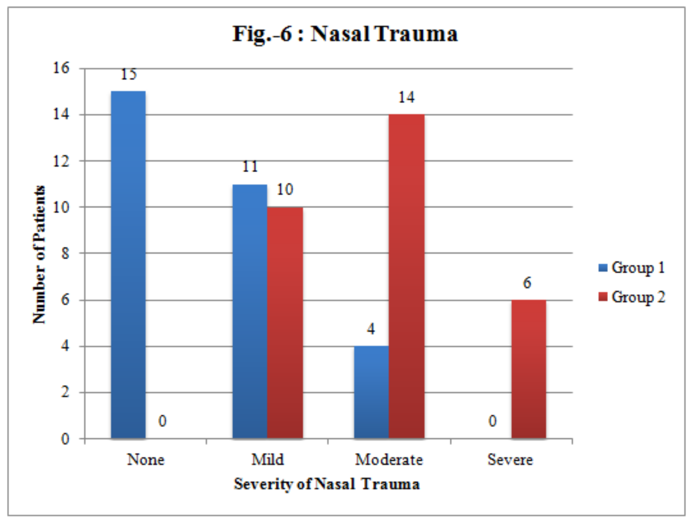
Fig.-1 : Endotracheal tube and nasogastric tube assembly showing 20 cm of nasogastric tube protruding from the distal end of endotracheal tube.

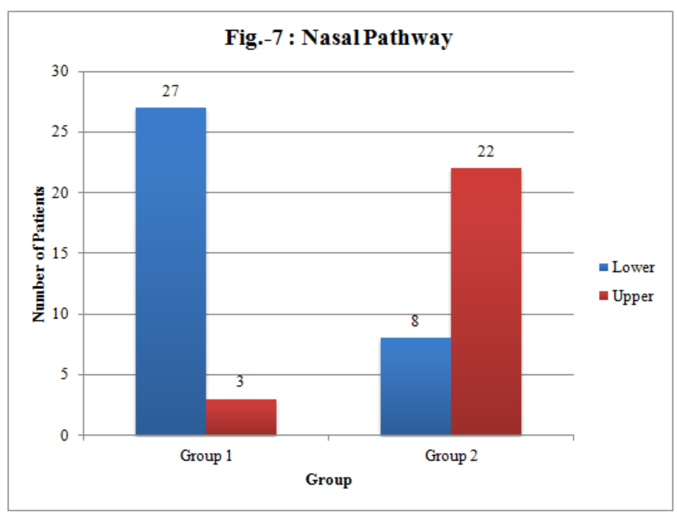
Fig.-2 : Introducing endotracheal tube and nasogastric tube assembly into patient's nostril.

Fig.-3 : Removal of nasogastric tube from endotracheal tube after lasyngoscopy









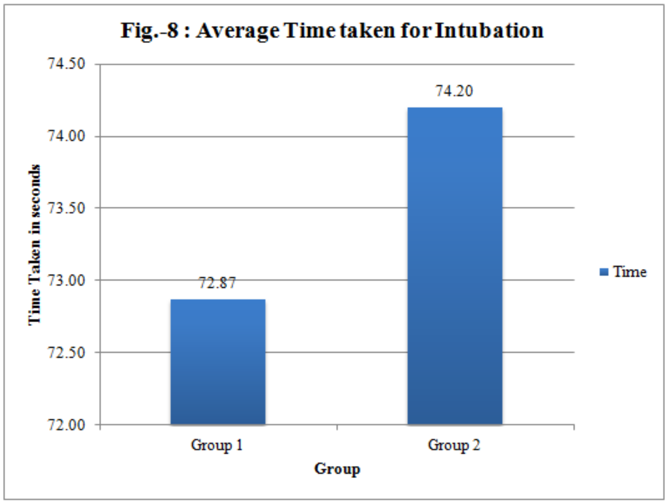


Fig.-8 : Average Time taken for Intubation
74.50
74.00
73.50
73.00
72.50
72.00
Time Taken in seconds
74.20
72.87
Time
Group 1
Group 2
Group

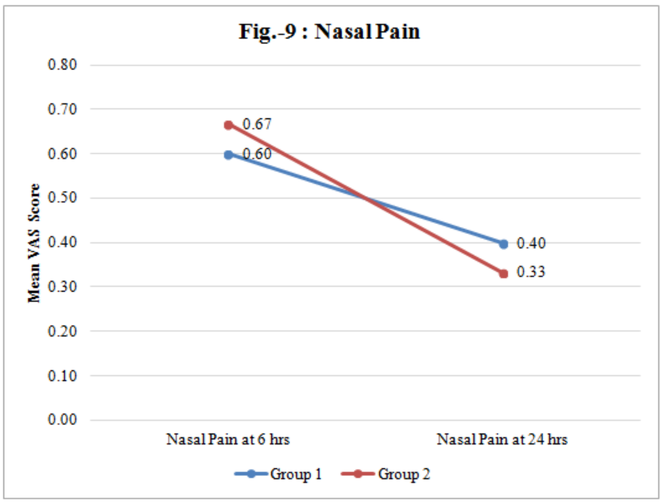


Fig.-9 : Nasal Pain
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Mean VAS Score
0.67
0.60
0.40
0.33
Nasal Pain at 6 hrs
Nasal Pain at 24 hrs
Group 1
Group 2