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ORIGINAL ARTICLE

HAEMODYNAMIC CHANGES DURING NASOTRACHEAL INTUBATION: A COMPARISION BETWEEN DIRECT LARYNGOSCOPIC AND FIBREOPTIC TECHNIQUE

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ABSTRACT: Nasotracheal intubation is a skill greatly appreciated by anaesthetists and surgeons in head and neck specialities. The introduction of fibreoptic intubation has revolutionized the anaesthetic management of difficult airway and its increasing use in clinical anaesthesia has drawn attention to the circulatory responses during fibreoptic intubation. The aim of this study was to compare changes in Heart rate, Systolic and Diastolic blood pressures, SpO_2 and $EtCO_2$ levels, associated complications and time required to achieve successful nasotracheal intubation with fibreoptic and laryngoscopic technique. 100 patients of ASA grade I & II between 18-50 yrs of age undergoing elective surgeries requiring nasotracheal intubation were allocated into two groups. Group I was intubated in the conventional manner using a Macintosh laryngoscope and Group II was intubated using a fibreoptic bronchoscope. Vital parameters like heart rate, blood pressure (Systolic and diastolic), ECG, oxygen saturation, $EtCO_2$ and N_2O/Isoflurane% with O_2 were continuously monitored and recorded preoperatively, immediately after induction, at intubation and every 1min for further 5 min. Intubation time was also recorded. Incidence of epistaxis and post- operative sore throat were noted. Nasotracheal intubation was accompanied by significant increases in blood pressure and heart rate compared to post induction values in both groups but there was no significant difference between the two groups. SpO_2 and $EtCO_2$ were maintained within normal range during both of intubation procedures, although the time required for intubation was longer in fibreoptic bronchoscope group. There was no significant difference in the incidence of epistaxis between the two groups. It was concluded that stress response to fibreoptic nasotracheal intubation in similar to nasotracheal intubation facilitated by Macintosh laryngoscope.

KEYWORDS: Nasotracheal intubation, Fibreoptic bronchoscope, Conventional laryngoscope.

INTRODUCTION: Nasotracheal intubation is a skill greatly appreciated by anaesthesiologists and surgeons in head and neck specialities. Dental damage being one of the commonest negligence claims against anaesthesiologists, nasotracheal intubation can protect teeth. Nasotracheal placement eliminates biting on the tube during recovery, and the tube can be withdrawn partially and used as a nasopharyngeal airway. This does not usually leads to nasal bleeds as the presence of the tube temponades potential bleeding points in the nose.

The cardiovascular response to laryngoscopy and tracheal intubation has been extensively studied during the past three decades. Stimulation of the upper respiratory tract during tracheal intubation while a patient is under general anaesthesia activates the sympathoadrenal system, perhaps involving baroreceptor system provoked by airway nociceptive stimulus and in some cases results in hypertension, tachycardia, and an increase in intracranial pressure.

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The extent of stress reaction is affected by many factors: the technique of laryngoscopy and intubation, and the use of various airway instruments, like flexible fibreoptic bronchoscope and the laryngeal mask airway. Premedication and induction drugs may attenuate the circulatory response and different pharmacologic combinations were tested for this purpose.

Introduction of fibreoptic assisted tracheal intubation into anesthetic practice by Murphy in 1967 and Taylor and Towey in 1972 has revolutionized the anaesthetic management of difficult airway. The era of fibreoptic laryngoscopy has changed difficult intubation techniques and blind nasal intubation is becoming a rare event, and a technique of the past. Fibreoptic intubation is a skill that anaesthesiologist needs to be master.

The increasing use of fibreoptic bronchoscopy in clinical anaesthesia has drawn attention to the circulatory responses during fibreoptic intubation.

Tracheal intubation which is accomplished with a fibreoptic bronchoscope is thought to attenuate the circulatory responses to intubation as stimulation of oropharyngeal structures may be avoided. However, previous studies have provided inconsistent findings. Smith J. E. et al. found a greater increase in heart rate and a smaller pressor response with fibreoptic than with laryngoscopic nasotracheal intubation. Conversely, Tsubaki S. J. et al. found that the fibreoptic nasotracheal intubation caused less severe circulatory and catecholamine responses than did laryngoscopic nasotracheal intubation. Staender S. et al. demonstrated similar blood pressure and heart rate changes. However, Latorre F. et al. showed that neither fibreoptic or laryngoscopic nasotracheal intubation provoked major haemodynamic or endocrine stress responses. These different results might be attributable to difference in study methods, sample size and techniques of anaesthesia and intubation.

This study was designed to investigate in a larger sample whether there is clinically relevant difference between the circulatory responses to fibreoptic and conventional nasotracheal intubations carried out by experienced anaesthesiologist.

AIMS AND OBJECTIVES: Aim of this study was to compare conventional nasotracheal and fibreoptic nasotracheal intubation in view of changes in Heart rate, Systolic blood pressure, Diastolic blood pressure, SpO_2 and $EtCO_2$ levels, associated complications and to compare the time required to achieve successful intubation with fibreoptic and conventional technique.

MATERIAL AND METHODS: After obtaining institutional ethical committee approval, and written informed consent hundred patients between 18-50 years of age of ASA grade I and II of either sex undergoing elective surgical procedures under general anaesthesia requiring nasotracheal intubation were included in this prospective study.

Patients with a history of full stomach, major illness like T.B., bronchial asthma, known hypertension, convulsions and major cardio-vascular and respiratory problems, Vital organ dysfunction, recently receiving medication known to affect blood pressure and heart rate, predicted difficult airway and patient with allergy to study medication were excluded from the study.

After a detailed history, general and systemic examination and necessary investigations patients were fasted overnight and were restricted to oral intake of clear fluids for 4-6 hr before surgery and all the patient were premedicated with Inj. Glycopyrolate 10μg/kg i.v just before induction and the patients nasal cavities were pre-treated with cotton swabs dipped in a 3.0 – 4.0 ml solution of 4% lignocaine and 0.6% ephedrine.

After 5 minutes of pre oxygenation all the patients were induced with Inj. Fentanyl 2μg/kg i.v., Inj. Vecuronium 0.1mg/kg i.v. and Inj. Thiopentone 5–7mg/kg i.v. The patients lungs were ventilated with oxygen 50%, nitrous oxide 50% and isoflurane 1% by facemask using a Bain system with an initial fresh gas flow rate of 90ml/kg minute until the neuromuscular block was complete (no visible response to train–of–four stimulation). Guedel oropharyngeal airway was used if it seemed necessary.

All the intubations were performed by one anaesthesiologist. Immediately before intubation, patients were randomly allocated to either Group I or II. A portex cuffed nasotracheal tube was used in the study. Nasotracheal tubes with an internal diameter of 7.5 mm and 7.0 mm were used for male and female patients, respectively. Before intubation, the nasotracheal tube was immersed in luke warm sterile water for a few minutes to make it softer and more pliable. Then the nasal tube was lubricated with 2% lignocaine gel and threaded over a fibreoptic bronchoscope with an outer diameter of 5.1 mm.

In Group I patients a nasotracheal tube was introduced in to the prepared nasal orifice and further advanced through the larynx into the trachea under vision in the conventional manner using a Macintosh laryngoscope. Intubation was completed, if necessary, with the help of Magill forcep and the nasotracheal tube was then connected to Bain system and correct positioning of the nasotracheal tube confirmed clinically by bilaterally equal air entry on auscultation.

While in Group II patients the assistant stood at the patient's left side to lift the jaw upwards and open the mouth; the operator stood at the patient's head, to insert the fibrescope from the prepared nostril into the oropharynx to look for the glottis. After visualising the glottis, the fibreoptic bronchoscope was passed between the vocal cords downward until the tip positioned above the carina. The tracheal tube gently 'rail roaded' into position with an anti-clockwise rotation through approximately 90° as the bevel negotiated the larynx in order to avoid impaction on the arytenoids or vocal cords and after confirmation of the tip of the tube to be approximately 2cm above the carina, the bronchoscope was removed and then the nasotracheal tube was then connected to Bain system and correct positioning of the nasotracheal tube confirmed clinically by bilaterally equal air entry on auscultation.

The intubation time, namely the period between introduction of the laryngoscope or fibreoptic bronchoscope until the endotracheal tube was in place and an end-tidal carbon dioxide ($EtCO_2$) waveform was seen on the monitor was recorded by an anaesthesiologist using a stop watch. Patients requiring more than 120sec to achieve successful nasotracheal intubation were excluded from the statistical analysis of data.

After successful intubation, anaesthesia in all the patients was maintained with Isoflurane 1% and 0% nitrous oxide in oxygen. During the observation period, a fresh gas flow of 90ml/kg/min was used and end-tidal carbon dioxide partial pressure was maintained at 35 – 40 mmHg. Inspired and end tidal concentrations of isoflurane, oxygen, nitrous oxide and carbondioxide were measured and displayed digitally with a multifunction monitor (RGM). Lactated Ringer's solution was infused at a constant rate of 15ml/kg/hr.

Vital parameters like heart rate, blood pressure (Systolic and Diastolic), ECG, oxygen saturation, EtCo2 and N_2O/Isoflurane% with O_2 at intervals were continuously monitored and recorded preoperatively, immediately after induction (Post induction values), at intubation, at every 1min for a further 5 min and intubation time was recorded.

Any ontoward incidence like bleeding while conventional or fibreoptic laryngoscopy, epistaxis and nasopharyngeal or oropharyngeal tissue trauma were observed, recorded and tabulated. All patients were questioned after surgery for sore- throat.

Epistaxis was defined as any blood seen trickling outside the nasal cavity during or just after intubation and extubation.

All the observations were recorded and tabulated and all the data were stored on disk and analysed with SPSS (Version 13.0, SPSS Inc., Chicago, IL) statistical software. The male/female distribution between the two groups was compared using Chi-square test. Demographic data, blood pressure and heart rate data were compared between the two groups using the two-way repeated measure analysis of variance and the two-tailed Student's test. The comparisons of blood pressure and heart rate data within groups were done using Friedman's repeated-measure analysis of variance. Where the calculated F-value exceeds the critical value for the 0.05 probability level, a Student-Newman-Keul's test was used to determine which differences were significant. The quantitative data were expressed as mean (Standard deviation). A p-value less than 0.05 was considered

On the basis of results obtained & statistical evaluation inference was drawn.

OBSERVATIONS AND RESULTS: There were 50patients in each group. The two groups were comparable with respect to age, gender and weight. (Table-1)

Parameters	Group I	Group II
No: of patients	50	50
Age Range (yrs)	18-50	18–50
Mean Age (yrs)	34.02±7.02	32.38±7.71
Sex distribution (M/F)	29/21	30/20
Mean Weight (kg)	55.68±5.33	57.26±6.36

TABLE 1

The mean length of time for successful nasotracheal intubation was shorter in direct laryngoscopy group compared with the fibreoptic group, 39.24±1.985 (range 36 to 42) versus 61.78±3.683 (range 62 to 68) , respectively ($p<0.05$) . Oxygen saturation was maintained above 95% and $EtCO_2$ was maintained at 35–40 mmHg
at all times in all patients.

Pre induction mean systolic and diastolic blood pressure and heart rate were similar in the two groups.

Changes in haemodynamic parameters: systolic, diastolic blood pressure and heart rate are listed in Table 2.

A significant reduction in SBP and DBP was evident after the induction of general anaesthesia in both groups ($p<0.05$). At intubation there was an increase in those parameters. Mean SBP and DBP remained significantly elevated as compared to post induction values for 3 minutes after intubation in both groups. A gradual decline was inspected between 2 and 5 minutes post intubation. (Graph 1 and 2).

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Slight increase in mean heart rates was noted in both groups after the induction of general anaesthesia was the rise was not significant as compared to the baseline values (p>0.05). Tracheal intubation caused further significant increase in mean heart rate in both groups compared with baseline and post induction values (p<0.05). The increase compared to baseline values was sustained for 2 minutes in fibreoptic group and for 1 minute in conventional laryngoscopy group. (Graph 3).

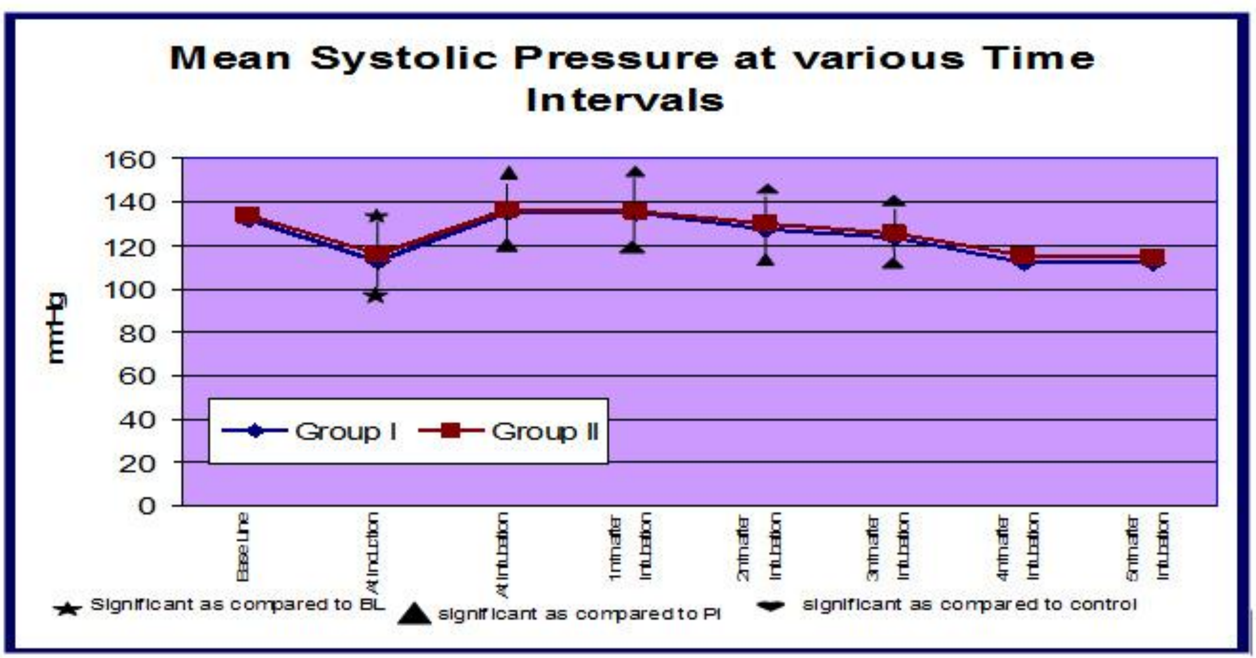
At no time during the study period was there a significant difference between the patients intubated with the Macintosh laryngoscope and those intubated with the fibreoptic bronchoscope with respect to mean systolic or diastolic blood pressure or heart rate.

	Groups	Baseline	Post induction	At intubation	After Intubation; min				
					1	2	3	4	5
SBP mmHg	I	131.96 (15.75)	112.56 (10.23)	135.26 (10.99)	135.10 (10.83)	127.52 (8.20)	123.34 (10.73)	112.22 (8.33)	112.12 (8.89)
	II	133.74 (12.88)	115.66 (11.46)	136.20 (11.89)	135.68 (11.70)	129.76 (10.26)	125.40 (10.12)	115.44 (9.47)	114.66 (9.91)
DBP mmHg	I	8.20 (10.68)	67.38 (10.74)	83.52 (11.96)	82.84 (11.67)	80.48 (10.32)	76.52 (9.78)	71.12 (8.81)	67.22 (10.61)
	II	81.16 (10.63)	70.20 (11.10)	82.96 (9.70)	82.30 (10.39)	81.34 (10.81)	77.14 (10.94)	73.00 (11.14)	70.06 (11.50)
HR beats/min	I	82.46 (11.48)	83.08 (11.15)	89.76 (11.26)	86.16 (11.10)	84.72 (10.48)	83.78 (10.59)	83.62 (10.54)	82.68 (10.91)
	II	84.22 (11.73)	85.72 (11.56)	93.76 (10.24)	90.14 (11.45)	89.98 (11.24)	87.86 (11.25)	87.20 (11.31)	84.70 (11.18)

Table 2: Blood pressure and heart rate changes associated with the nasotracheal intubation in the two groups

Values are mean (SD).

SBP – Systolic blood pressure; DBP – Diastolic blood pressure; HR – Heart rate.



Graph 1

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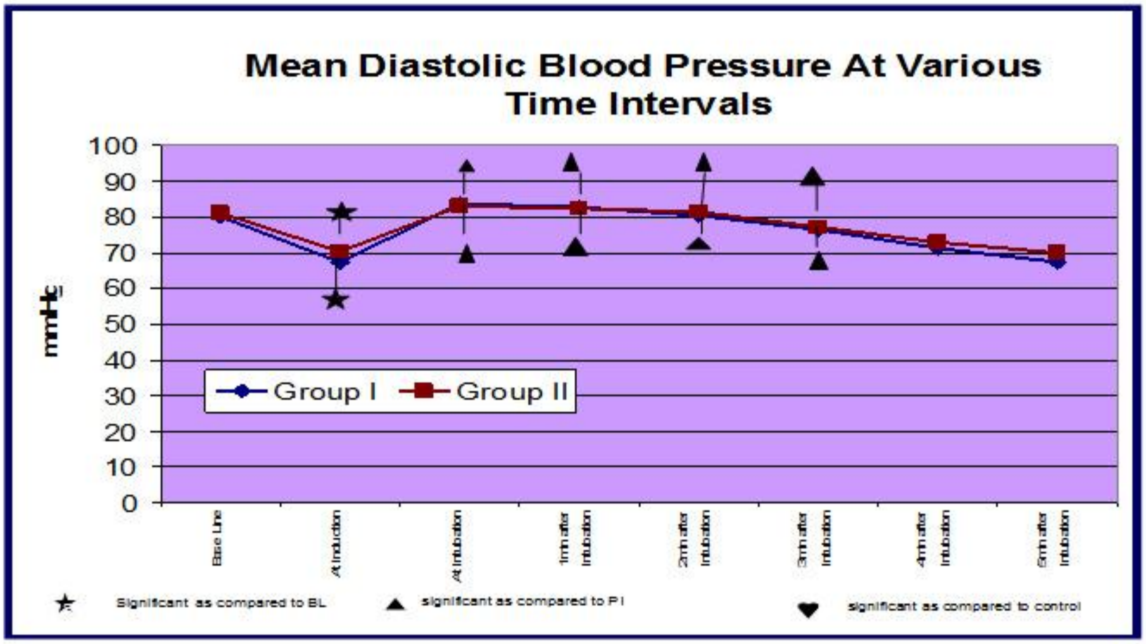
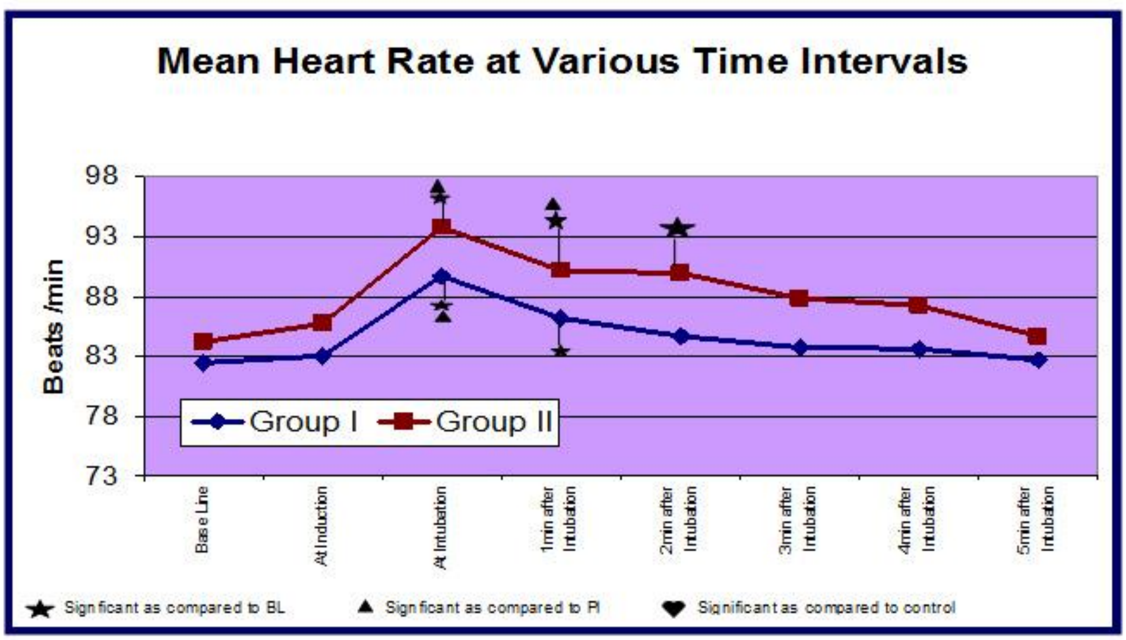
Systolic blood pressure (SBP) changes associated with nasotracheal intubations. Points represent mean ± SD.



Graph 2

Diastolic blood pressure (DBP) changes associated with nasotracheal intubations. Points represent mean±SD.



Graph 3

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Heart rate (HR) changes associated with nasotracheal intubations. Points represent mean±SD.

There were 5 patients in group I and 4 patients of group II who had epistaxis and the difference was statistically insignificant.

12 patients in the laryngoscopic and 13 patients in the fibreoptic group admitted to sore throat on questioning after operaion.

DISCUSSION: During the induction of general anaesthesia, laryngoscopy and tracheal intubation are frequently performed. While securing the patient airway, haemodynamic changes may occur. The anaesthesiologist, trying to make the induction as smooth as possible, learned to appreciate the importance of that sequence of events. Some patients may experience substantial haemodynamic changes during the induction and intubation phase. Therefore, meticulous preparation before endotracheal intubation is warranted.

Our study demonstrated that nasotracheal intubation, facilitated by FOB, required more time, compared with direct laryngoscopy nasotracheal intubation. This was previously reported, both during the learning curve and also in experienced hands.[1,2] However, the increased duration of the fiberoptic procedure did not affect the hemodynamic response as compared with the direct laryngoscopy method. It brings us to the question, what is the most important factor that cause the stress response during intubation? Researchers have tried to separate the effect of laryngoscopy from that of tracheal intubation.

The effect of intubation alone was studied by Shribman et al.[3] who compared the cardiovascular response to direct laryngoscopy, with and without tracheal intubation. They found no difference between the two, and concluded that the laryngoscopy itself is the major contributor to the stress response. Adachi et al.[4] studied the cardiovascular response to a fiberoptic-guided intubation with television monitoring. They hypothesized that since that technique is minimally invasive; it causes a relatively low cardiovascular response. Their results failed to demonstrate the superiority of that method over classical laryngoscopy, and they concluded that endotracheal intubation itself is the major stimulus to cardiovascular response. In that study,[4] however, the FOB remained in the pharynx and did not cross the vocal cords. In addition, catecholamine levels were not measured. Our results show similar haemodynamic response to both intubation techniques. We therefore cannot conclude whether the airway instrumentation or nasotracheal intubation was the main cause for the hemodynamic changes.

The differences between our findings and those of Smith et al.[5] may be due to differences in anaesthetic technique. Smith et al. used vecuronium in the dose of 0.125 mg/kg. In our study, dose of vecuronium was 0.1 mg/kg and fentanyl 2 µg/kg was also administered. Fentanyl attenuates the circulatory responses to tracheal intubation,[6,7] and can suppress the circulatory responses to tracheal intubation more effectively than to laryngoscopy.[8]

In conclusion, we found that the stress response to fiberoptic orotracheal intubation is similar to nasotracheal intubation facilitated by the Macintosh laryngoscopy blade. No significant differences in hemodynamic parameters was found between the groups. Fiberoptic intubation is an important adjunct in airway management. Because it creates a similar stress response to regular laryngoscopy intubation, it should be safely applied whenever indicated.

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