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COMPARATIVE STUDY OF HAEMODYNAMIC CHANGES DURING INTUBATION WITH BONFILS RETRO MOLAR ENDOSCOPIC INTUBATION DEVICE AS OPPOSED TO CONVENTIONAL INTUBATION WITH A LARYNGOSCOPE.

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ABSTRACT Bonfils retro molar intubating endoscope helps in intubating the patient with difficult airway. Conventional laryngoscopy and intubation causes a haemodynamic stress response which can be detrimental to some patients. This study was done to compare the haemodynamic changes between Bonfils intubating endoscope and conventional laryngoscope for intubation in difficult airway. Eligible patients were randomized into two groups of 50 each. One group was intubated using Bonfils intubating endoscope and other was intubated using conventional laryngoscope. Heart rate, Systolic and Diastolic blood pressure were recorded prior to induction and at 1, 3 and 5 minutes after induction using non-invasive means. The values recorded in the Bonfils group were slightly more than those recorded in the laryngoscope group but the difference was statistically insignificant (p>0.05). Authors concluded that the stress response caused by Bonfils intubating endoscope is similar to that caused by intubation with conventional laryngoscope in difficult airway situations.

KEYWORDS : Difficult Airway, Bonfils Retro Molar Intubating Endoscope, Haemodynamic Stress response.

INTRODUCTION:

Endotracheal intubation is an essential technique in modern anaesthesiology. Conventional laryngoscopy using a Macintosh blade usually provides satisfactory visualisation of the glottis in majority of the patients. But difficult airway remains a challenge for anaesthesiologists and the incidence of difficult intubation can be as high as 13%.[1] One device which helps in such situations is BONFILS retro molar intubation endoscope (Figure 1). It is a rigid fibre optic scope with an angled end meant for orotracheal intubation. Its other advantages are that it is cheaper and portable. Being rigid it does not get damaged easily and can be helpful, especially for use in remote areas.

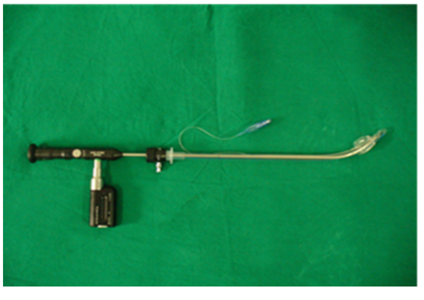

Figure 1. Bonfils loaded with Endotracheal tube

Conventional laryngoscopy as we know causes a stress response due to mechanical stimulation and subsequent catecholamine release which manifests in the form of increased blood pressure, heart rate, myocardial contractility and at times result in arrhythmias.[2] This stress response in patients of systemic diseases like hypertension, coronary artery disease, raised intra cranial pressure, etc. may be life threatening.[3] Otherwise healthy individuals who suffer polytrauma deplete their catecholamine reserves and in such patients also, this stress response may be detrimental. The stress response can be reduced by various means like topical anaesthesia, deepening the plane of anaesthesia, beta blockers, opioids, vasodilators, etc. [4,5] However in patients with haemodynamic instability it might not be possible to use any other agent or technique other than topical anaesthesia of airway. Bonfils retro molar intubating endoscope may help in reducing this stress response while trying to intubate the patients with difficult airway especially in patients of polytrauma with injuries of the face and cervical spine. This may be due to the reduced mechanical stimulation of the airway.

In this study, half of the patients with difficult airway were intubated using conventional laryngoscope and the other half intubated using BONFILS intubating endoscope. Haemodynamic changes caused in both the groups were recorded with an aim to find that whether BONFILS intubating endoscope caused less haemodynamic changes vis-à-vis conventional laryngoscopy in difficult airway situation.

MATERIALS & METHODS:

After obtaining permission from the hospital ethics committee, a prospective study was conducted with 100 patients with difficult airway who were randomly allocated into two groups. Patients with airway in Mallampati Class III and IV were considered to be with difficult airway. Inclusion criterions were patients in American Society of Anaesthesiologist Class I and II with age between 18 and 60 years without any systemic disease. Exclusion criterion were extremes of age, patients with systemic diseases like Hypertension, Diabetes, Coronary Artery Disease, patients for intracranial surgery, patients on any drugs which could alter the haemodynamic response, mouth opening < 3 cm, history of reactive airway disease and morbid obesity.

100 patients were randomized into conventional laryngoscopy group (Group-L, *n*=50) and the Bonfils group (Group-B, *n*=50) using computer generated random tables and concealment done using opaque sealed envelope. Written informed consent was taken from all the patients. Group L was intubated in the conventional manner and the hemodynamic changes in the form of Heart rate (HR), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were recorded before induction and subsequently at 1, 3 and 5 min after induction using non – invasive means. Group B was intubated using the Bonfils intubating endoscope and the haemodynamic changes were recorded as for Group L. The results were statistically analysed to compare both the groups.

Patients were taken into the Operation room and were administered Glycopyrrolate 0.2 mg, Midazolam 1mg and Fentanyl 2 µg/kg prior to induction after attaching the routine monitors. They were pre oxygenated with 100% oxygen for 5 min with a well-fitting face mask. Thiopentone was used for induction of anaesthesia with the dose titrated to the loss of eyelash reflex. Ventilation was confirmed prior to administration of muscle relaxant. Succinyl Choline 2 mg/kg was used for intubation. After confirmation of correct placement of the endotracheal tube and return of spontaneous respiratory efforts, patients were administered intravenous injection of vecuronium 0.1 mg/kg.

The first group (Group – L) was intubated after induction and adequate muscle relaxation by conventional laryngoscopy using Size 3 or 4 Macintosh blades. Stylet was used if required. Bonfils intubation endoscope was prepared prior to induction in patients in the Bonfils group (Group – B). The device was loaded with size 8.0 or 8.5 mm Internal diameter, cuffed, Poly Vinyl Chloride Endotracheal Tube (ETT) after spraying their inner lumen with a silicone spray. They were loaded such that the proximal end of the tube projected beyond the tip of the endoscope by at least 1 centimetre to prevent injury to trachea by the tip of the rigid endoscope (Figure 2)

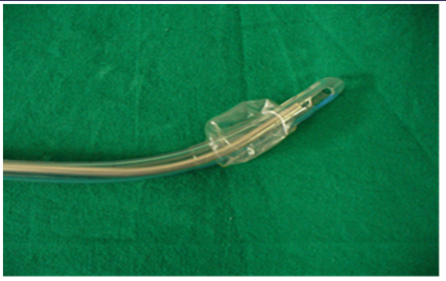

Fig. 3 ETT protruding beyond Bonfils tip

After induction and adequate muscle relaxation, Bonfils endoscope with the loaded ETT was introduced intra orally and advanced laterally past the tongue under vision. When the epiglottis came into view, the scope was guided below it or laterally to provide a clear view of the glottis. The endoscope was passed beyond the vocal cords, ETT slided into the trachea and the endoscope subsequently removed after placement of the ETT. Correct placement of the tube was confirmed by auscultation of lungs and capnometry.

Non Invasive Blood Pressure (NIBP) was set in auto mode with measurements at every minute. Subsequently the data was retrieved from the multipara monitor. The data used for study included SBP, DBP and HR recorded prior to induction (base line values) and after induction at 1, 3 and 5 minutes interval. If the attempts to intubate the patient by either means took more than 3 minutes, if the patient started desaturating or required administration of any drugs other than mentioned above during intubation, the study was abandoned for that patient.

Demographic and clinical data from the two groups were compared using the two tailed *t* test and chi-square test. The comparison of hemodynamic data between the two groups were made using the two-way repeated measure analysis of variance (MANOVA) and an unpaired *t* test. All quantitative data were expressed as mean±standard deviation (SD). A *P* value of less than 0.05 ($p<0.05$) was considered statistically significant.

RESULTS:

A total of 50 patients were included in each group. However only 40 patients could complete the study in Laryngoscope group (Group L) and 36 patients completed the study in Bonfils group (Group B). Rest of the patients could not be included in the study as there was deviation from the study protocol. The two groups were identical in terms of all the patient characteristics (Table 1).

Table 1.Patient Characteristics. Values are mean +/- SD and number

Patient Characteristic	Group L (n=40)	Group B (n=36)	P value
Weight (kgs)	67.9 +/- 11.5	65.2 +/- 8.0	0.24
Age (years)	35.7 +/- 10.5	37.3 +/-12.1	0.53
Sex (Male:Female)#	23:17	20:16	-

Before induction: The baseline readings of SBP, DBP and HR were recorded in both the groups prior to induction. The values for Group L were slightly less than that for Group B (Table 2). However the difference between the two groups was statistically insignificant for all the three sets of data. ($p>0.05$)

Table 2. Baseline values prior to induction. Values are mean +/- SD

Parameter	Group L (n=40)	Group B (n=36)	P value
SBP (mm Hg)	126.5 +/- 10.4	128.9 +/- 10.8	0.32
DBP (mm Hg)	81.3 +/- 7.6	84.0 +/- 7.9	0.13
HR (beats per minute)	79.5 +/- 9.7	82.8 +/- 9.7	0.14

One minute after induction: One minute after the induction a fall in SBP and DBP was recorded in both the groups due to the effect of inducing agents and also because by this time attempts to intubate the patients had not started. A corresponding rise in HR was also recorded (Table 3). The values recorded in the Group B are slightly more than that recorded in the Group L but the difference in values is statistically insignificant ($p>0.05$).

Table 3. Haemodynamic parameters 1 min after induction. Values are mean +/- SD

Parameter	Group L (n=40)	Group B (n=36)	P value
SBP (mm Hg)	113.0 ± 14.2	118.6 ± 14.2	0.09
DBP (mm Hg)	71.9 ± 10.9	76.3 ± 11.0	0.08
HR (beats per minute)	89.1 ± 10.0	90.8 ± 10.3	0.46

Three minutes after induction: At 3 min after induction SBP, DBP and HR showed higher values than those recorded before induction for both the groups (Table 4). This rise is attributed to the stress response which had taken place while attempts were being made to intubate the patient. SBP, DBP and HR are more in the Bonfils group than those in the laryngoscopy group but this difference is not statistically significant ($p>0.05$)

Table 4. Haemodynamic parameters 3 min after induction. Values are mean +/- SD

Parameter	Group L (n=40)	Group B (n=36)	P value
SBP (mm Hg)	148.3 +/- 17.4	149.8 +/- 17.0	0.70
DBP (mm Hg)	98.9 +/- 6.7	99.4 +/- 6.5	0.74
HR (beats per minute)	97.0 +/- 8.6	98.0 +/- 7.9	0.60

Five minutes after induction: At 5 min after induction the values for SBP, DBP and HR in both the groups is less than that at 3 min and is seen approaching the pre-induction values. However they stay slightly higher than the pre-induction values in both the groups (Table 5). When compared with Group L all the 3 values are more in Group B but this difference is statistically insignificant ($p>0.05$).

Table 5. Haemodynamic parameters 5 min after induction. Values are mean +/- SD

Parameter	Group L (n=40)	Group B (n=36)	P value
SBP (mm Hg)	132.3 +/- 12.0	135.3 +/- 11.8	0.27
DBP (mm Hg)	84.5 +/- 8.8	86.6 +/- 9.2	0.31
HR (beats per minute)	86.6 +/- 9.0	88.5 +/- 8.2	0.34

DISCUSSION: A major consideration with conventional laryngoscopy and intubation is the haemodynamic stress response. The magnitude of response is highly dependent on the severity, intensity and duration of stimulus. The local response to laryngoscopy and endotracheal intubation are known to cause increase in arterial blood pressure, heart rate and may be associated with various dysrhythmias. [2] In patients with depleted catecholamine reserves and in small children it may cause brady dysrythmias and cardiac arrest. Obtunding this reflex response during laryngoscopy and intubation remains a major concern for the anaesthesiologists especially in patients with systemic disease and haemodynamic instability.

Various authors have compared the haemodynamic response to tracheal intubation elicited by direct laryngoscopy with fibre optic intubation which is considered the gold standard for intubation in difficult airways and have found out that the use of either direct laryngoscopy or fibre optic bronchoscopy produces a comparable stress response to tracheal intubation. [6,7]

Bonfils intubating endoscope has been compared with various devices in management of difficult airway. Bonfils intubation fibre scope and the Macintosh laryngoscope have been compared in relation to the movement of upper cervical spine during laryngoscopy and the authors concluded that significantly less movement of the upper cervical spine occurred during laryngoscopy with the Bonfils fibre scope compared with the Macintosh laryngoscope.[8] Bonfils intubating endoscope was compared with flexible bronchoscope in intubation of patients with unanticipated difficult airway, the incidence of which varies from 1.5%-8.5% [9]. It was found that the median time of preparation & intubation with rigid endoscope was much faster than flexible endoscope (160 sec Vs. 229 sec). There was no significant difference with respect to endoscopic visibility or quality of intubation manoeuvre [10].

It was expected that Bonfils intubating endoscope will produce less haemodynamic changes as the stress of laryngoscopy is omitted and at the same time mechanical stimulation of the oropharyngeal structures is also less but our study revealed that the haemodynamic changes caused by intubation using Bonfils intubating endoscope were comparable to that caused by the conventional laryngoscope. At all times i.e. at 1 min, 3 min and 5 min after induction the values of SBP, DBP and HR recorded in the Bonfils group were higher than those recorded in the laryngoscope group. However, the difference in both the groups is statistically insignificant. The findings of our study are different from another one comparing Bonfils intubating endoscope with conventional laryngoscope where authors found that the SBP, DBP, mean arterial pressure and HR values in the direct laryngoscopy group were significantly higher in the 5 successive minutes after intubation in comparison with the Bonfils retro molar group. [11] However there is a major difference in between the study population in both the studies. In our study all the patients had Mallampati class III/IV airway whereas in other study all the patients were either Mallampati class I or II airway and hence would have been subjected to less mechanical stimulation by Bonfils intubating endoscope.

Bonfils intubating endoscope is yet another device which is available to an anaesthesiologist for managing difficult airway situations. The equipment is sturdy, easy to carry and transport which makes it desirable for prehospital and peripheral settings, provides good optical quality, relatively resistant to wear and tear and does not require a high level of technical assistance. Compared to a flexible bronchoscope the learning curve is also shorter and the time required for intubation with Bonfils endoscope is less than that with a flexible bronchoscope [10]. However it does have its own set of disadvantages. Being rigid it provides less scope for manoeuvrability and has its own learning curve. The field of vision appears smaller and more distant as compared to the flexible fibre scope. Fogging of the lens sometimes poses a lot of difficulty in visualising the structures. It cannot be used where the mouth opening is severely restricted and for paediatric patients as the smallest endotracheal tube which can be inserted using it is 6.5 mm ID. It cannot be used for nasal intubations also which may be required for facial traumas and surgeries involving the oral cavity.

Our study had a few limitations. First of all the definition of difficult airway in our study is Mallampati Class III and IV. Mallampati classification takes into consideration only the effect of a disproportionately large tongue base on exposure of larynx. However various prospective analysis have revealed only moderate sensitivity and specificity with Mallampati test for predicting difficult airway [12]. Other predictors of difficult airway were not taken into consideration. So it is possible that our study may not apply to cases which have other predictors of difficult airway. We did not evaluate the efficacy of airway blocks and topicalization in reducing the stress response caused either by laryngoscope or Bonfils as in a haemodynamically unstable patient this may be the only possible way of reducing the stress response where other modalities like beta blockers and nitro glycerine cannot be used. We did not measure the blood pressure using invasive means by cannulating any of the arteries. Measurement of blood pressure by non invasive means has got a time lag before the values are displayed whereas invasive monitoring displays values in real time. Bonfils intubation endoscope is recommended for use in difficult airway situations. Such patients are most likely to be intubated awake whereas in our study we induced the patient prior to intubation. We also could not finish the study in the desired no. of subjects in both the groups as we had to deviate from the protocol due to various reasons.

Difficult airway is always a challenge and sometimes a nightmare for an anaesthesiologist. Compounded with haemodynamic instability the problem becomes even more difficult. From our study in which we compared the haemodynamic stress response during intubation with conventional laryngoscopy and Bonfils intubating endoscope in difficult airway situations, we conclude that the stress response caused by Bonfils intubating endoscope during intubation is similar to that caused by intubation with conventional laryngoscopy. However, the overall position of Bonfils intubation endoscope still remains open to question as it has still not been subjected to any comparative large scale study with reference to difficult intubation and hence requires comprehensive evaluation. Till then it should not be used as a core skill but as another alternative aid to intubation in difficult airway situations.

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