Original Article

Hemodynamic Responses to Endotracheal Intubation: A Comparison Between Bonfils Intubation Fiberscope and Direct Laryngoscopy

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Abstract

Background: Laryngoscopy and intubation are intensely stimulating procedures and can induce marked sympathetic responses. We hypothesized that by minimizing the oropharyngeal stimulus with Bonfils rigid fiberscope intubation, the hemodynamic responses to endotracheal intubation will be lesser. Therefore, we compared Bonfils intubation with conventional direct laryngoscopic intubation in adult patients with normal airway. **Materials and Methods:** Sixty adult patients of either sex, belonging to American Society of Anesthesiologists grade 1 or 2, were randomized into Bonfils group and laryngoscopy group, and studied over a 2-year period. Anesthet ic technique was standardized in both the groups. Hemodynamic variables were recorded at pre-induction, induction, post-induction at laryngoscopy and intubation, thereafter for every minute for 10 min, and half hourly till the end of surgery for both the groups. Intubation time, intubation attempts, and postoperative complications like hoarse voice and sore throat were compared between the two groups. **Results:** There was no statistically significant difference between the two groups with respect to systolic blood pressure, mean blood pressure, and heart rate changes throughout the study period. There was a statistically significant difference in the diastolic blood pressure (DBP) values between the groups ($P < 0.05$) for the first 10 min following intubation. The time required for intubation was significantly longer in the Bonfils group (36 ± 6 s) compared to the laryngoscopy group (28 ± 6 s) ($P = 0.000$). The incidence of postoperative sore throat ($P = 0.009$) and hoarseness of voice ($P = 0.045$) was significantly lesser in the Bonfils group compared to the laryngoscopy group. **Conclusion:** There was no clinically significant difference in the hemodynamic changes following intubation using either Bonfils fiberscope or conventional laryngoscope. Bonfils intubation required longer time, but was associated with lesser incidence of sore throat and hoarseness of voice when compared to laryngoscopic intubation.

Key words: Bonfils rigid fiberscope, hemodynamic changes, laryngoscopy, postoperative hoarseness and sore throat

Introduction

Laryngoscopy and intubation are intensely stimulating procedures and induce marked sympathetic response. Traction on the supraglottic region is one of the factors responsible for producing this response.[1] Although a transient hemodynamic change is of little consequence to healthy people, these may be detrimental to patients with cardiac and CNS co-morbidities. There are various maneuvers by which sympathetic response can be attenuated. The Bonfils retromolar[2] [Figure 1] fiberscope is a rigid fiberscope with an angled end, designed over 20 years ago by Pierre Bonfil for difficult intubations. It is known to cause less trauma to the airway,[3] allow faster intubation, and cause lesser hemodynamic changes than direct laryngoscopy. We hypothesized that by minimizing the oropharyngeal stimulus with Bonfils rigid fiberscope intubation, the hemodynamic responses to endotracheal intubation will be lesser when compared to conventional direct laryngoscopy technique in adult patients with normal airway.

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Materials and Methods

Sixty patients of either sex, belonging to American Society of Anesthesiologists grade 1 or 2, aged 18–60 years, and presenting for elective surgeries under general anesthesia were recruited for a single-center, open-label, prospective randomized study. Written informed consent was taken from the patients. Data were collected for a 2-year period (July 2009–June 2010) at Manipal Hospital (a corporate tertiary care center with postgraduate training program), Bangalore,

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Karnataka, India. The study was approved by the institutional review board (Hospital Ethics Committee for Human Research, Manipal Hospital), which supervised the data collection and safety issues.

Patients with Mallampati[4] grade 1 or 2 were included in the study. Exclusion criteria were patients with cardiorespiratory abnormalities (New York Heart Association heart failure grades 3 and 4, bronchial asthma, chronic obstructive pulmonary disease, and restrictive lung disease), patients who have had previous history of difficult intubation, and those who had cervical spine lesion or instability and severe obesity (body mass index greater than 35).

Standard intraoperative monitoring included electrocardiography, capnography, noninvasive blood pressure, pulse oximetry, and nasopharyngeal temperature. Anesthesia was induced with fentanyl 2 μg/kg, thiopental 5 mg/kg, and xylocard 1.5 mg/kg. Muscle relaxation was achieved with rocuronium 0.6 mg/kg body weight administered intravenously. After 3 min of ventilation, patients were intubated with a standard laryngoscope with Macintosh blade in direct laryngoscopy (DL) group and with Bonfils fiberscope in Bonfils (BF) group as described by Bonfil.[2] Anesthesia was maintained with isoflurane 0.6% and nitrous oxide (67%) in oxygen (33%), fentanyl 1 mcg/kg/h and rocuronium 0.15 mg/kg top-ups. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP), and heart rate (HR) were recorded before induction, 1 min after induction, at preintubation (baseline), and thereafter every minute for 10 min, and at 30 min after intubation for all patients. "Intubation time," defined as the time interval from the time of insertion of laryngoscope/Bonfils to the time of removal of laryngoscope or Bonfils, was noted. The number of attempts taken to intubate was also recorded. An increase of 30% in SBP and HR from baseline values or SBP > 160 mmHg or HR > 120/min for two consecutive recordings was treated with esmolol 30 mg bolus administered intravenously. All patients were evaluated for the presence of postoperative hoarseness of voice and sore throat.

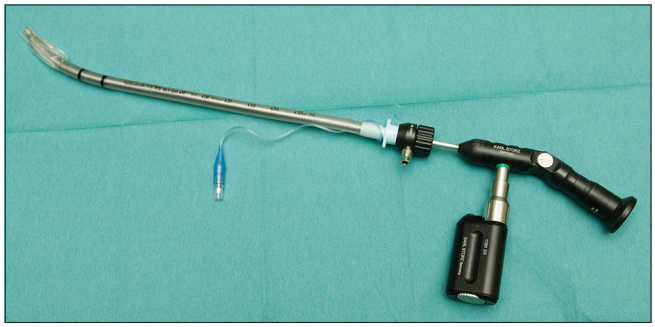

Figure 1: Bonfils optical stylet: A non-malleable fiberoptic rod with distal bend angle of 40° with endotracheal tube mounted just overlying (~1 cm) the distal tip of the optical stylet

Sample size calculation and randomization

Sample size was calculated on the basis of a previous study.[5] Group size was determined by using the sample size estimation "for two group mean method" (mean 1 ± SD 1 = 75 ± 12, mean 2 ± SD 2 = 81 ± 10, common SD = 11) with 80% power and 5% significance. With these assumptions, we were required to study 26 patients in each group. To compensate for loss to follow-up, we studied 30 patients in each group. A computer-generated simple 1:1 randomization table (created using Microsoft Excel 2003 software, Redmond, WA, USA) was used to allocate the patients to DL and BF groups.

Statistical analysis

Continuous variables were analyzed and compared using analysis of variance (ANOVA) and Student's *t*-test. Changes in the hemodynamic variables within each group were analyzed with multiple paired *t*-tests and *P* value of < 0.004 was considered as significant after applying Bonferroni's correction. Values were represented as mean ± standard deviation. Categorical data were analyzed using Chi-square test and *P* value < 0.05 was considered statistically significant. Statistical software used was SPSS-7.5, 1996 (SPSS Inc., Chicago, IL, USA).

Results

The two groups were demographically well matched [Table 1].

The preinduction and preintubation hemodynamic values were similar in both groups. There was no statistically significant difference between the two groups with respect to SBP, MBP, and HR changes throughout the study period [Figure 2]. But there was a statistically significant difference in DBP between the groups ($P < 0.05$) for the first 10 min, with a maximum DBP value of 73 ± 13 mmHg in the DL group as compared to 80 ± 12 mmHg in the BF group. In the DL group SBP, MAP, and HR remained below baseline values for 4–10 min, and in the BF group, the values remained below baseline for about 30 min. But the DBP was below baseline values for 30 min in the DL group as compared to 10 min in the BF group. Time

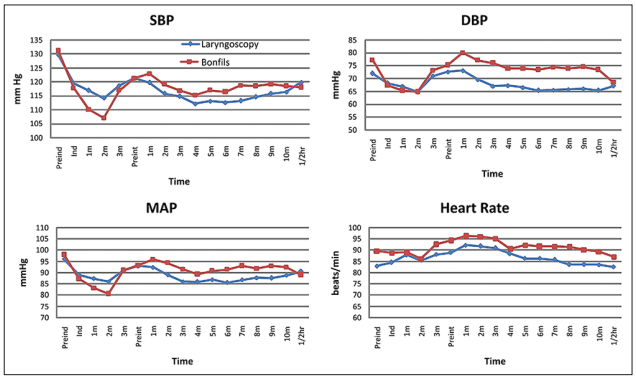

Figure 2: Hemodynamic variations during the study period. SBP = Systolic blood pressure, DBP = Diastolic blood pressure, MBP = Mean blood pressure, HR = Heart rate

at which the maximum increase in hemodynamic values occurred was 1 min after intubation in both the groups. None of the study patients required rescue medication for treatment of hemodynamic response following intubation.

The time required for intubation was significantly longer in the BF group (36 ± 6 s) compared to the DL group (28 ± 6 s) ($P = 0.000$). The incidence of postoperative sore throat was significantly lesser in the BF group compared to the DL group (2 and 10 patients, respectively) ($P = 0.009$). Postoperative hoarseness of voice was lesser in the BF group compared to the DL group (1 and 6 patients, respectively) ($P = 0.045$) [Figure 3].

Discussion

Pressor response during intubation results from stimulation by direct laryngoscopy as well as placement of the tracheal tube.[6] Maximum stimulus is generated by the stimulation of the epipharynx (i.e. vallecula) by routine laryngoscopy, followed by nose, nasopharynx, and tracheobronchial tree stimulation.[6] We hypothesized that BF group would cause less hemodynamic response to tracheal intubation due to reduced oropharyngeal stimulus. Previous studies have shown that the use of Bonfils fiberscope does not modify the hemodynamic response associated with endotracheal intubation, when compared to conventional laryngoscopy.[7,8] But another study by Najafi *et al*.[9] comparing intubating conditions and hemodynamic changes between Bonfils fiberscope and Macintosh laryngoscopy, without administering neuromuscular blocking drugs, found significant increase in HR and mean arterial blood pressure after intubation, only in the Macintosh group. Our study compared the hemodynamic changes between the two intubation techniques and found that there were no statistically significant changes in SBP, MAP, and HR. DBP changes, though statistically significant, were not of clinical relevance.

We found in our study that Bonfils intubation took a significantly longer time (36 ± 6 s) compared to direct laryngoscopy and intubation (28 ± 6 s) ($P = 0.000$). Najafi *et al*.[9] also found that intubation time was much longer in the Bonfils group (40 s) compared to the Macintosh group (11 s). Byhahn and coworkers[10] found that using a standard Macintosh laryngoscope blade significantly enhanced ease of insertion of Bonfils fiberscope and visualization of the glottic aperture, thereby decreasing the procedure time from 35–40 s to 20–25 s. They concluded that the learning curve with Bonfils is steep and 10 intubations supervised by an instructor usually prove effective for achieving sufficient skills to use the Bonfils on one's own and under less optimal conditions. Halligan[11] studied the learning curve of Bonfils on anesthesiologists and suggested that a performer becomes proficient only after 20–25 intubations.

We also found in our study that postoperative sore throat ($P \leq 0.009$) and hoarseness of voice ($P \leq 0.04$) was much lesser in the BF group compared to the DL group. Other studies have reported similar findings.[3]

Table 1: Demographic data

Variable	Direct laryngoscopy group	Bonfils group	*P*
Age (years)	33±10	35±10	0.56
Weight (kg)	64±11	65±12	0.89
Height (cm)	165±8	163±9	0.33
Sex (M:F)	16:13	13:17	0.45

Values expressed as mean±SD or numbers. M:F: Male:Female

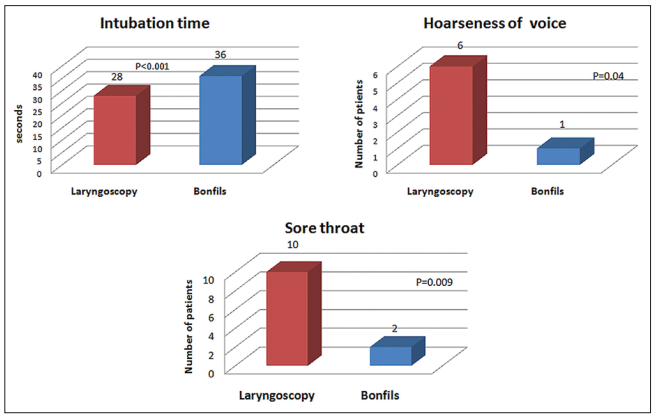

Figure 3: Comparison of intubation time, incidence of hoarseness and sore throat

Conclusion

There was no clinically significant difference in the hemodynamic changes following intubation using either Bonfils fiberscope or conventional laryngoscope. Time required for intubation was longer in the BF group compared to the DL group. Incidence of sore throat and hoarseness of voice was less when Bonfils fiberscope is used.

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