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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF AIRTRAQ OPTICAL LARYNGOSCOPE AND HUGE MED VIDEO LARYNGOSCOPE FOR LARYNGEAL VISUALISATION AND ENDOTRACHEAL INTUBATION IN ADULTS WITH ANTICIPATED DIFFICULT INTUBATION

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Abstract

Background and Aims: Complications arising from difficult or failed tracheal intubation still remains a leading cause of anaesthetic morbidity and mortality.This has lead to development of multiple novel laryngoscopes. This study was designed to compare performance of Airtraq optical laryngoscope with Huge Med Video laryngoscope for laryngeal visualisation and endotracheal intubation.

Material and Methods: In this prospective randomized clinical study, seventy ASA grade I and II patients aged 18-60 years of either gender scheduled for elective surgery under general anesthesia were randomly assigned into two groups:Group A and group B in which laryngoscopy and tracheal intubation was performed using Airtraq optical laryngoscope(group A) and HugeMed video laryngoscope(group B) respectively. The time taken and number of attempts for endotracheal intubation along with Cormack Lehane(CL) grading were recorded. Heart rate and blood pressure(SBP, DBP, MAP) were recorded at predefined time intervals.

Result: Mean intubation time was 15.3±11.791sec in group A compared to 34.1011±17.471sec in group B.Majority of patients in both groups were intubated in first attempt (97.1% and 94.3% in group A and group B respectively). Patients in both groups remained haemodynamically stable in the post intubation period. On comparing the ease of intubation, majority of patients in group A and group B had CL grade I, very few patients in group A [6(17.1%)] and in group B [2(5.7%)] had CL grade II.

Conclusion: Both Airtraq and Hug Med video laryngoscopes are effective devices for laryngoscopy and endotracheal intubation with high success rate of intubation although time needed for tracheal intubation is shorter with Airtraq optical laryngoscope.

Introduction:-

For an anaesthesiologist difficult airway, either anticipated or unanticipated, holds a great deal of concern. Complications arising from difficult or failed tracheal intubation still remains a leading cause of anaesthetic morbidity and mortality.[1] This lead to development of multiple novel laryngoscopes, all of which aims to reduce the difficulty of laryngeal visualization, specially in difficult airway situation.[2]

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Video laryngoscopes allow the larynx to be viewed indirectly. The shifting of 'Point of view' from the anaesthesiologist's eye to the laryngoscope blade allows blade designs to be used with video laryngoscopes which would not work well for direct laryngoscope.As no direct line of sight between the practitioner's eye and the larynx has to be achieved, these devices have a role in situations where conventional laryngoscopy is difficult, particularly when the larynx is located anteriorly and thus can avoid complications associated with multiple attempts of laryngoscopy, delay in endotracheal intubation and lack of oxygenation.

Video laryngoscopes are either channeled or unchanneled. In channeled video laryngoscope, a channel for the endotracheal tube is integrated into the blade of video laryngoscope. Once an adequate view of the laryngeal inlet is obtained and the scope positioned correctly, advancing the endotracheal tube within the channel will inevitably direct the tube between the vocal cords without need for additional navigation of the tube e.g. Airtraq.[3,4] In unchanneled video laryngoscope, the endotracheal tube has to be loaded onto a stylet, then navigated into the field of view of the video laryngoscope and finally advanced into the laryngeal inlet e.g. Huge Med, C-Mac, Glidoscope.

In this study, we compared channeled Airtraq video laryngoscope with unchanneled Huge Med Video laryngoscope regarding time taken and number of attempts of intubation, effect on hemodynamic variables and adverse effects if any.

Subjects and Methods:-

After approval of institutional ethical committee [RNT/STAT./IEC/2018/416 dated 18/07/2018] and registration in Clinical Trial Registry of India [CTRI/2019/03/017997], the present study was conducted in a tertiary care centre during a period of one and a half years (July 2018 to Dec 2019).

In this prospective, randomized clinical study, seventy ASA physical status I & II patients of both sex, aged 18-60 years scheduled for elective general surgery and ENT surgery under general endotracheal anesthesia (GETA) were enrolled. All the patients were subjected to a detailed preanesthetic evaluation to rule out any anatomical or systemic disorders and assessment of airway [i.e. abnormal dentition (loose teeth, missing teeth, bucked teeth, edentulous), mouth opening, modified mallampatti class, range of neck movements, any head and neck pathology] was performed for all patients. Routine and relevant special investigations were carried out accordingly during the evaluation.

A pilot study in our institution had shown that the mean time of intubation was 14.21±2.8 seconds with Airtraq optical laryngoscope compared to 17±4.3 seconds for HugeMed videolaryngoscope.For study to have a power of 80% with α error of 0.05, 27 patients were required in each group. To compensate for dropouts, we decided to include 35 patients in each group. A "p value" of <0.05 was considered statistically significant.

Inclusion Criteria:1) Age between 18-60 years of either sex. 2) Patient recognized as anticipated difficult intubation [evaluated by mouth opening (≤2.5cm) and Mallampatti class (III and IV)] during pre anesthetic evaluation.

Patient with uncontrolled hypertension, cardiac disease, renal or hepatic impairment, BMI > 30 kg/m^2 and pregnant women were excluded from the study.

After obtaining written informed consent from all patients, they were randomly assigned to one of the two groups using computer generated tables of random numbers in opaque sealed envelopes as depicted in consort diagram (Fig.1). In Group A (Airtraq Optical laryngoscope group), laryngoscopy and tracheal intubation were performed using Airtraq laryngoscope no. 3 & 4 (Manufacturer Prodol Meditec Limited, China). In Group B (HugeMed video laryngoscope group), laryngoscopy and tracheal intubations were performed using Huge Med video laryngoscope (Manufacturer Shenzhen HugeMed Medical Technical Development Co., LTD) with number 3 or 4 blades.

All patients enrolled in the study were kept fasted overnight before surgery. Tab Alprazolam 0.25 mg, tab Ranitidine 150 mg were administered to every patient night before surgery. In the morning of day of surgery, chlorhexidine mouth wash was done and then 2 hours before the surgery, capsule omeprazole 20 mg was given with sips of water.

When patients arrived to operation room standard monitoring (pulse oximeter , noninvasive blood pressure , and electrocardiogram) was applied and patient´s baseline vitals: heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and peripheral oxygen saturation (SpO_2) were noted.

A peripheral intravenous line with 18G cannula was secured, infusion of Ringer lactate was started at rate of 8 ml/min. Patients were premedicated with injection glycopyrrolate(0.005 mg/kg), ondansetron(0.1 mg/kg), midazolam(0.05 mg/kg), and inj Fentanyl(2 mcg/kg) intravenously. Patients were pre-oxygenated for 3 minutes with 100% oxygen and induction was done with inj Thiopentone (5-6 mg/kg), inj Succinylcholine (1.5 mg/kg), and tracheal intubation was done by using either Airtraq optical laryngoscope or HugeMed video laryngoscope as per the group allocation by an anaesthesiologist having experience of atleast 1 year in use of these devices.

The time taken for endotracheal intubation (from insertion of laryngoscope blade upto inflation of cuff of ET tube), number of attempts of intubation and the Cormack Lehane grading were noted. The tube was then fixed and connected to breathing circuit for ventilation.

For maintainance of anaesthesia, 66% nitrous oxide with 33% oxygen, isoflurane 0.6-1.0% and vecuronium bromide 0.08 mg/kg as loading dose followed by intermittent doses 0.015 mg/kg) were used. Heart rate and blood pressure (SBP, DBP, MAP) were monitored continuously and were recorded at predefined time intervals after intubation at 1, 3, 5, 7, 10 min and at end of surgery. After 10 minutes of intubation surgery was allowed to start, so that surgical stimulus did not interfere with hemodynamic parameters.

Statistical Analysis:
Statistical analysis was performed using MS Excel Software (Microsoft Excel, Redmond, Washington:2003) with SPSS version 20. The continuous data was analyzed by independent T test and Chi-square test was used for categorical data. Differences were considered significant at $p<0.05$.

The primary objective studied was to compare the time taken for endotracheal intubation between the two groups. Secondary objectives of the study were to compare the number of attempts required for endotracheal intubation, Cormack and Lehane grading of glottis view, the impact on haemodynamic variables and to compare the incidence of adverse events (if any) between both groups.

Results:-

Both the Airtraq optical laryngoscope and HugeMed video laryngoscope groups were comparable with respect to distribution of patients according to age (p=0.2206), weight (p=0.3800) and gender (p=0.607)[Table 1]. Both the groups were also similar when factors predicting difficult laryngoscopy and intubation such as presence of loose teeth (p=0.221), number of missing teeth (p=0.638), presence of artificial teeth (p=0.398), presence of bucked tooth (p=0.357), mouth opening (p=0.726) and Mallampatti grading of patients (p=0.31) were compared in the study population [Table 2 and 3].

Both the groups were comparable in respect of attempts of intubation. Majority of patients in both the groups (97.1% and 94.3% in group A and group B respectively) were intubated in first attempt only. When time taken for intubation was compared it was found that group A (Airtraq) had statistically significant lesser duration of intubation (15.30±11.79 sec) than group B (Huge Med video laryngoscope) (34.10±17.47 sec) [p=0.000]

On comparing the ease of intubation, majority of patients in group A and group B had Cormack Lehane (CL) grade I, very few patients in group A [6(17.1%)] and in group B [2(5.7%)] had CL grade II. None of the patients had CL grade 3 and 4 in our study (p>0.05). [Table 4]

Both the groups were comparable when haemodynamic parameters [SBP, DBP, MAP, HR and SpO_2] were measured at baseline, pre intubation, post intubation 1, 3, 5, 7, 10 minute and at end of surgery [Fig 2].

Proportions of complications occurring during intubation procedure were also comparable between both the groups. 4 patients in Airtraq group and 3 patients in Huge Med video laryngoscope group had soft tissue injuries.

Discussion:-

Due to absence of any single factor that reliably predicts the existence of difficult airway, many difficult intubations are not recognised until after induction of anaesthesia. The failure to successfully intubate the trachea and secure airway remains major cause of morbidity and mortality in anaesthetic and emergency settings.[3]

Macintosh laryngoscope remains the most popular device used to facilitate endotracheal intubation and constitute gold standard despite the recent developments in airway device technologies.[1]Video laryngoscopes are relatively recent entrants in the field of rigid laryngoscopes with benefit of better glottic view. Video laryngoscopes have rapidly gained in popularity as rescue or even primary devices for endotracheal intubation because they offer a better glottic visualization than direct laryngoscopy, the learning curve is fast, and minimal head and neck manipulation is needed.[5] Moreover, projecting what the operator sees on a screen also creates a new dynamic interaction during airway management. The entire anesthesia team can assess progress in real time, which enhances communication and cohesion of the group and improves coordination between the assistant(s) and the operator. [6]

There are two major factors responsible for determining the success and ease of endotracheal intubation: the adequacy of laryngeal view obtained and the ease of maneuvering ETT inside glottic opening. [7-12] Both the Huge Med and Airtraq videolaryngoscopes claim to have an advantage over conventional laryngoscope in cases of unanticipated difficult tracheal intubation. [13-15]

To avoid a situation where a poorly designed device leads to failed tracheal intubation causing harm to patient, there is a need to determine the clinical utility of these devices before their widespread acceptance into clinical practice. Till date, we have not been able to access any detailed randomized studies comparing the Huge Med and Airtraq video laryngoscopes. Therefore, we compared the performance of Huge Med and Airtraq video laryngoscopes in terms of intubation time, number of attempts, Cormack lehane grading, hemodynamic responses and incidence of tissue injury in routine anesthesia practice. [1]

The airway assessment done in the preoperative period plays a vital role in anticipating difficult airway during laryngoscopy and endo tracheal intubation. We evaluated the dentition anomalies, the mouth opening and the Mallampatti grading to assess the difficult airway. In our study we found that both the groups were comparable with respect to these parameters.

In the present study, the number of patients intubated in first attempt were 34 (97.1%) in group A (Airtraq), and 33 patients (94.3%) in group B (Huge Med videolaryngoscope). Remaining patients in both the groups were intubated in second attempt. Our results are similar to study conducted by Raza N et al [1] in which they were able to intubate 27 (93.1%) and 25 (89.2%) patients in first attempt in channeled Airtraq and unchanneled McGrath video laryngoscope group respectively. Remaining 2 and 3 patients respectively were intubated successfully in second attempt. The number of attempts at tracheal intubation was comparable with unchanneled C-Mac video laryngoscope and channeled Airtraq laryngoscope in a study done by Mc Elwain J et al[16] in which 30 (97%) patient and 28 (90%) patients respectively were intubated in first attempt. 1 and 2 patients were intubated in second attempt in C-Mac and Airtraq laryngoscope group respectively. Also 1 patient was intubated in third attempt in Airtraq group. These findings suggest that both channeled and unchannelled video laryngoscopes are effective tools for indirect laryngoscopy and endotracheal intubation.

In our study the mean intubation time was 15.303±11.791 seconds in Airtraq group which was statistically significantly less than 34.1011±17.471 seconds in Huge Med video laryngoscope group.

Our findings are similar to study by Raza N et al [1], in which the time for intubation was 13.5±4.3 seconds in Airtraq group compared with 17.8 seconds in McGrath videolaryngoscope group. Hazarika et al [17], also noted a significant increase in the intubation time in Coopdech video laryngoscope, group CL (26.85±7.5 sec) compared to Airtraq group, AL (21.7±5.8 sec.). However, McElwain J et al [16] noted in their study that the duration of 1st intubation attempt was 16±15 seconds in C-Mac video laryngoscope compared with 22±17 seconds in Airtraq group.

In the present study, the intubation was 18.8 seconds quicker using Airtraq laryngoscope than Huge Med video laryngoscope. This finding may be attributed to hand–eye coordination required for using optical or videolaryngoscopes.[9,10,12] The hand–eye coordination required with channeled Airtraq laryngoscope is probably less as compared to unchanelled Huge Med video laryngoscopes as the ETT gets the required curvature and becomes properly aligned with the visualizing lens of the device in former. Although Huge Med laryngoscope provided a good laryngeal view, maneuvering ETT into the trachea required more time.

In our study we had no cases of failed intubation as both the groups had only Cormack Lehane grade 1 and 2 patients which indicate easy airway. The patients in both groups remained haemodynamicaly stable in the post intubation period. This can be explained by the fact that both the video laryngoscope and Airtraq laryngoscope mitigate the need of aligning the laryngeal, pharyngeal and oral axis in one line, hence lesser force is needed for laryngoscopy. This helps in attenuating the haemodynamic response to laryngoscopy.

In the present study both the groups had similar incidence of soft tissue injury. Hazarika et al [17] noted no incidence of complications in both the groups in their study. Video laryngoscopes may improve safety by avoiding many unnecessary laryngoscopy and intubation attempts by improving Cormack and Lehane grading.

Our study has some limitations: First we assessed only number of attempts and time taken for endotracheal intubation. Assessing performance of indirect laryngoscopes also includes adequacy of vocal cord visualization, external manipulation or maneuvers needed, and position of head and neck (neutral/ sniffing). Secondly in our study, all the patients had either Cormack Lehane grade I or II. Further studies are needed to consider these factors and assess the efficacy of both Airtraq and HugeMed videolaryngoscopes in Cormack Lehane grade III and IV patients.

To conclude we can say that both Airtraq and Huge Med video laryngoscopes are effective devices for laryngeal visualization and endotracheal intubation with a high success rate of intubation although the time needed for tracheal intubation is shorter with the Airtraq video laryngoscope.

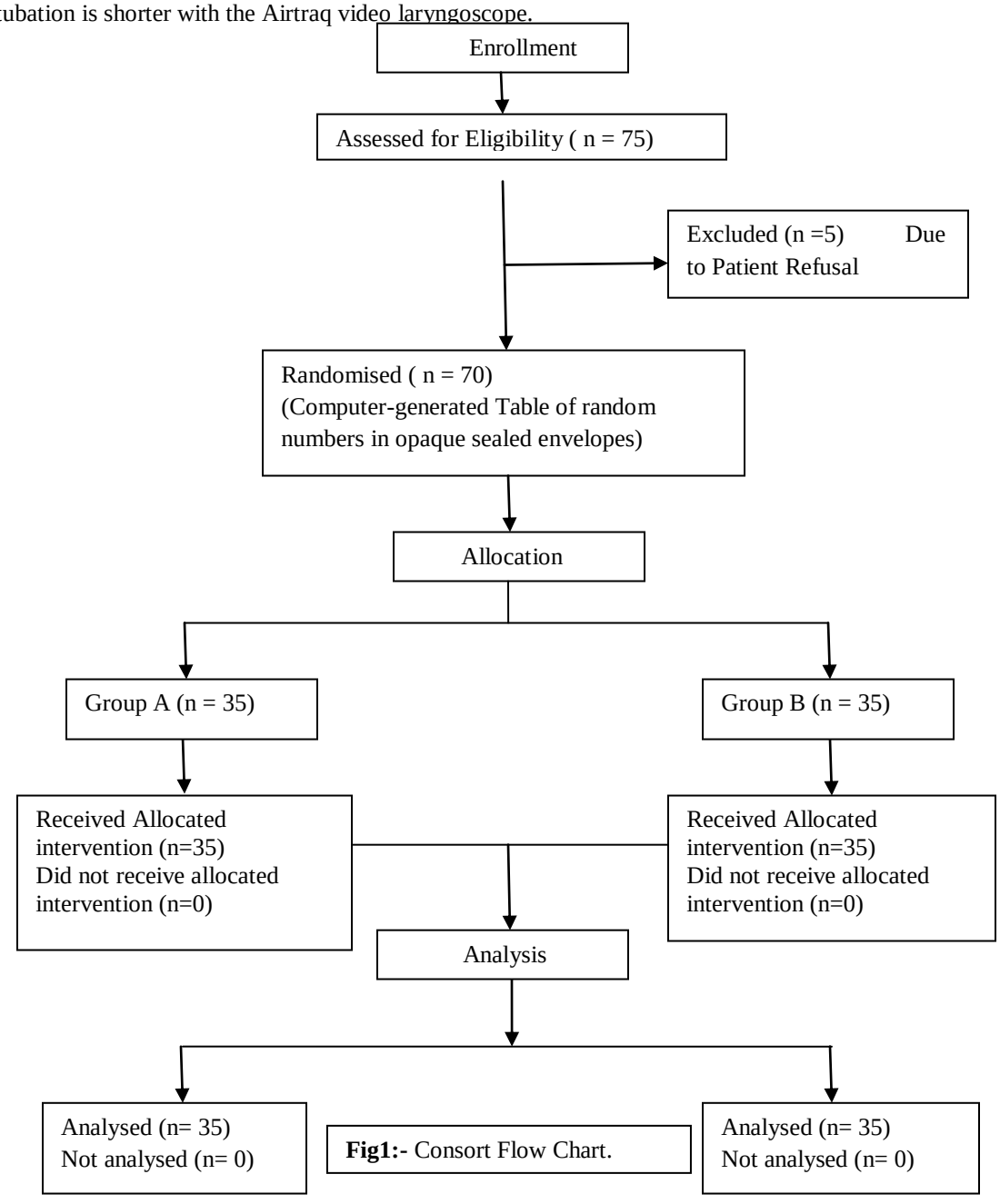

Fig1:- Consort Flow Chart.

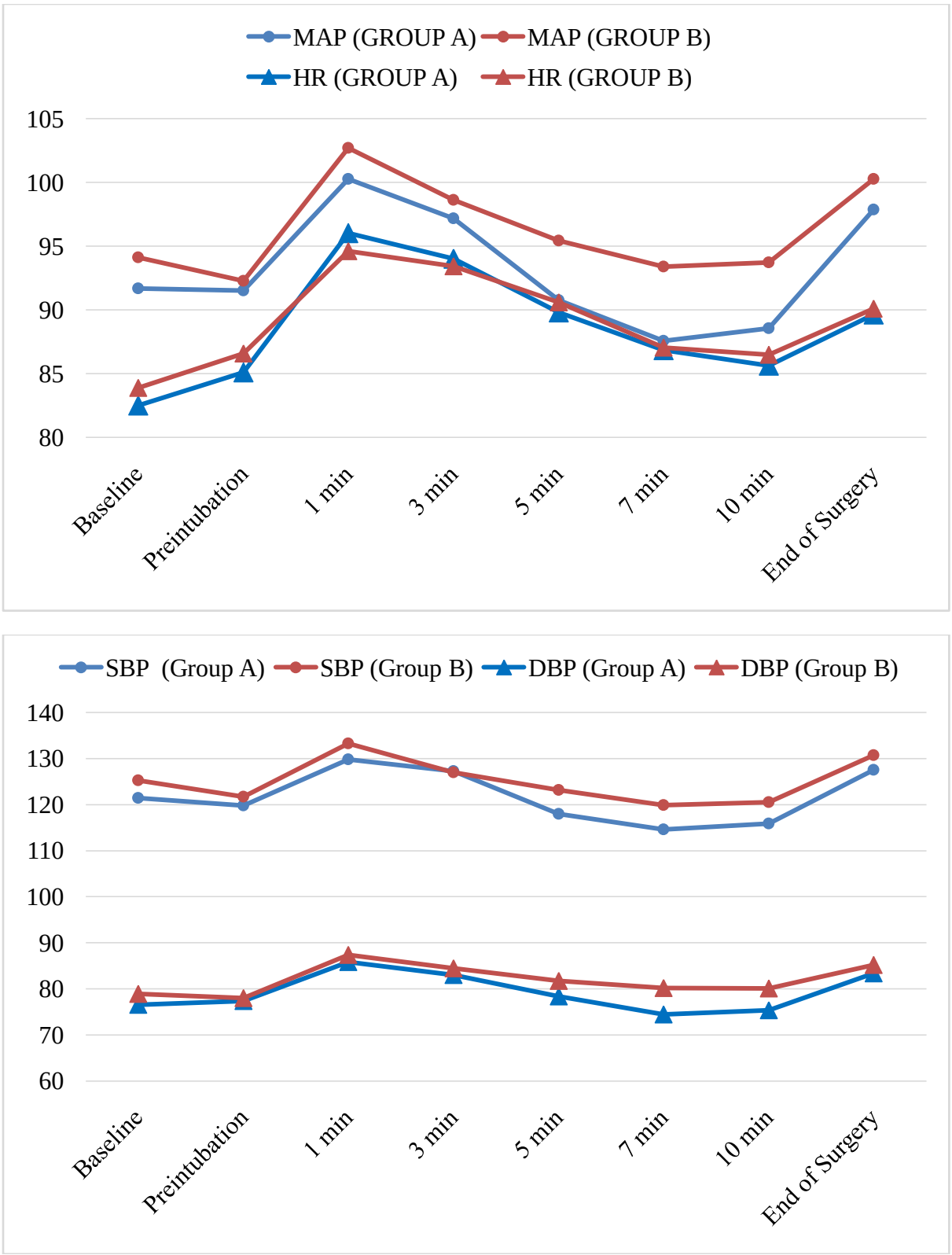

Fig II:- Comparison of haemodynamic parameters.

	Group A (n=35)	Group B (n=35)	p value
Age (years) Mean ±SD	36.23±9.84	38.40±13.20	0.2206
Weight (kg) Mean ±SD	58.29±11.00	61.00 ±14.71	0.3800
Male n (%)	12(34.3%)	10(28.6%)	0.607
Female n (%)	23 (65.7%)	25(71.4%)	

Table I:- Demographic profile of study population.

	Group A n (%)	**Group B** n (%)	**Total** n (%)	**p Value**
Loose Tooth				
0	34(97.1%)	33(94.3%)	67(95.7%)	p= 0.221
≥ 1	1(2.9%)	0(0.0%)	1(1.4%)	
Edentulous	0(0.0%)	2(5.7%)	2(2.9%)	
Missing Teeth				
Nil	29(82.9%)	27(77.1%)	56(80.0%)	p=0.638
1	1(2.9%)	0(0.0%)	1(1.4%)	
2	2(5.7%)	1(2.9%)	3(4.3%)	
4	2(5.7%)	4(11.4%)	6(8.6%)	
Multiple	1(2.9%)	2(5.7%)	3(4.3%)	
Edentulous	0(0.0%)	1(2.9%)	1(1.4%)	
Artificial teeth				
Nil	34(97.1%)	32(91.4%)	66(94.3%)	p= 0.398
1	1(2.9%)	0(0.0%)	1(1.4%)	
2	0(0.0%)	1(2.9%)	1(1.4%)	
Edentulous	0(0.0%)	1(2.9%)	1(1.4%)	
Complete Fixed Denture	0(0.0%)	1(2.9%)	1(1.4%)	
Bucked teeth				
0	35(100.0%)	33(94.3%)	68(97.1%)	p=0.357
1	0(0.0%)	1(2.9%)	1(1.4%)	
Edentulous	0(0.0%)	1(2.9%)	1(1.4%)	

Table II:- Assessment of Dentition.

		Group A (n=35)	Group B (n=35)	p value
Mouth Opening (cm) Mean±SD		2.93±0.18	2.94±0.16	p=0.726
Mallampatti Grading*	**3** n (%)	35(100.0%)	34(97.1%)	p = 0.31
	4 n (%)	0(0.0%)	1(2.9%)	

*Only Mallampatti grading 3 and 4 patients were enrolled in the study.

Table III:- Distribution of patients according to Mouth Opening and Mallampatti scoring.

		Group A n (%)	Group B n (%)	Total	p Value
Number of Attempts	1	34(97.1%)	33(94.3%)	67(95.7%)	p=0.55
	2	1(2.9%)	2(5.7%)	3(4.3%)	
Duration of Intubation (seconds)Mean±SD		15.30±11.79	34.10±17.47		p=0.000
Cormack Lehane Grade	1	29(82.9%)	33(94.3%)	62(88.6%)	p = 0.13
	2	6(17.1%)	2(5.7%)	8(11.4%)	

Table IV:- Parameters of Intubation procedure.

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