The Internet Journal of Anesthesiology
Volume 27 Number 2

Blood Pressure And Heart Rate Responses To Insertion Of The Laryngeal Mask Airway Or Tracheal Intubation

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Citation

O Ajuzieogu., A Amucheazi., H Ezike. *Blood Pressure And Heart Rate Responses To Insertion Of The Laryngeal Mask Airway Or Tracheal Intubation*. The Internet Journal of Anesthesiology. 2009 Volume 27 Number 2.

Abstract

The choice of securing the airway during general anaesthesia often lies between endotracheal intubation and insertion of the laryngeal mask airway. It has been hypothesized that both are associated with some degree of pressor response which may be dangerous in some group of patient. In this prospective, randomized, and controlled trial, we compared the blood pressure and heart rate changes after insertion of the laryngeal mask airway (LMA), and endotracheal intubation (ET). Seventy-five patients scheduled for routine surgery were randomly allocated to one of two groups and were ventilated either through an ET, or a LMA. The data collected was subjected to analysis using SPSS 17 and showed that insertion of the ET was associated with a more significant increase in arterial pressure. We conclude that in patients in whom the increased stress response to insertion of a ET may represent a health hazard the LMA should be used where possible.

INTRODUCTION

In 1983, Archie I. J. Brain developed the laryngeal mask airway (LMA), which provides a useful alternative for airway management during spontaneous or controlled ventilation[1]. Since then it has been put to use in patients with different physiologic make-up. Studies abound in literature on the haemodynamic responses to LMA insertion when compared to the ET intubation.[2,3,4]. In this study, we investigate the haemodynamic changes, if any, amongst patients undergoing anaesthesia in the University of Nigeria Teaching Hospital in South East Nigeria.

METHODS

The study was approved by our institutional ethics committee, and patients provided written, informed consent before inclusion. The inclusion criteria were age 20–65 yr, ASA physical status I–II, elective surgical procedures (duration 1–2 h) and Mallampatti 1 and II airway. Patients who had a history of difficult endotracheal intubation, respiratory, cardiac or esophageal disease, age less than 18, and a history of gastro-esophageal reflux were excluded from the study. We randomly allocated the patients to one of two groups: ET group and LMA group. The study spanned a period of 3 months and a total of seventy-five patients were involved. They were randomly assigned to anesthetists experienced in handling both devices. Anaesthesia was induced with fentanyl 3 µg/kg and propofol 2–3 mg/kg IV until loss of eyelash reflex was noted. Pancuronium 0.1 mg/kg was administered to facilitate intubation. Intubation/ insertion was attempted 5 minutes after injection of pancuronium. Duration of intubation/ insertion was defined as the time from the start of intubation/ insertion until inflation of the cuffs. Difficulty of intubation was graded I–IV according to the criteria of Cormack and Lehane (6). Intubation of the trachea was attempted with endotracheal tubes, size 7.0/7.5 for women and 8.0/8.5 for men. Women were ventilated via a LMA size 3, men via a LMA size 4. The LMA was inserted blindly according the recommended instructions (7) and inflated accordingly. Insertion conditions of the LMA were graded according to ease of insertion: excellent (no resistance to insertion), good (slight resistance to insertion), poor (moderate resistance to insertion), or impossible. Anaesthesia was maintained with a 50- to 100-mg/kg/min propofol infusion, and supplements of fentanyl 1-2µg/kg. Blood pressure and heart rate variations were monitored non-invasively via omicron blood pressure monitor/DASH 2000.Systolic arterial pressure (SAP), diastolic arterial pressure (DAP), and heart rate (HR) were recorded immediately before and 1, 2, 3, 5, 7, 10, and 15 min after intubation/airway insertion; and immediately before and 1, 3, and 5 min after extubation/airway removal. SpO_2, end-tidal CO_2 were monitored.

RESULTS

No significant differences were detected among the two groups with respect to age, weight, gender, total fentanyl dose, and Mallampati score (Table 1). Insertion time was significantly shorter in the LMA group (Table 1). No supplemental dose of fentanyl was administered during the intubation/insertion procedure until the end of the 15-min observation period. In the ET group, 25 patients were as classified grade I, 9 patients were grade II, and 1 patient was grade III according to the criteria of Cormack and Lehane (6). All patients were intubated without difficulty. The LMA was easily inserted without resistance in 33 patients (82.5%), with slight resistance in 6 patients (15%). One patient required two trials for insertion (2.5%). In the ET group (Figs. 1), significant increases in HR, SAP, and MAP were detected from 1 to 10 min compared with baseline values. After LMA insertion, the increase in HR SAP, DAP, and MAP was less.(Fig 2) The increases in HR, SAP, DAP and MAP were significantly greater in the ET group compared with the LMA group.(Fig 3) All two groups showed a significant increase in HR. SAP, DAP, and MAP at 1, 3, and 5 min after extubation/airway removal.(Fig 4 ,5)

Figure 1

Table 1. Demographic Data

	LMA group	ET group
Age (yrs)	40	35
Male/Female	20/25	15/15
Weight (kg)	80	70
Mallampati score	2	2
Duration of intubation/airway insertion (s)	15	25
Mean total fentanyl dose (mcg)	400	430

Figure 2

Table 2. Heart rate at specified time points

PRE INTUBATION/INSERTION VALUES						
GROUP	LMA			ET		
TIME(Min)	BP(mmHg)	MAP	HR	BP(mmHg)	MAP	HR
1	110/70	83	75	110/70	83	80
2	110/70	83	80	120/80	93	90
3	120/75	90	80	125/90	102	110
5	125/80	95	90	130/95	107	115
7	125/80	95	95	130/80	97	120
10	130/85	100	100	130/90	103	115
15	125/75	92	110	130/95	107	120
POST EXTUBATION VALUES						
GROUP	LMA			ET		
TIME(MIN)	BP(mmHg)	MAP	HR	BP(mmHg)	MAP	HR
1	120/70	87	110	130/85	100	115
3	110/70	83	105	130/80	97	110
5	105/70	82	80	120/70	87	100

Figure 3

Figure 1: Haemodynamic changes in the ET group

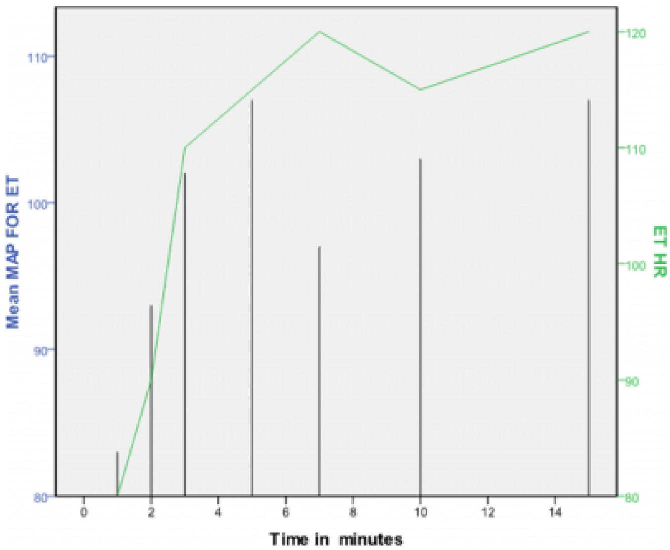


Figure 4

Figure 2: Haemodynamic changes in the LMA group

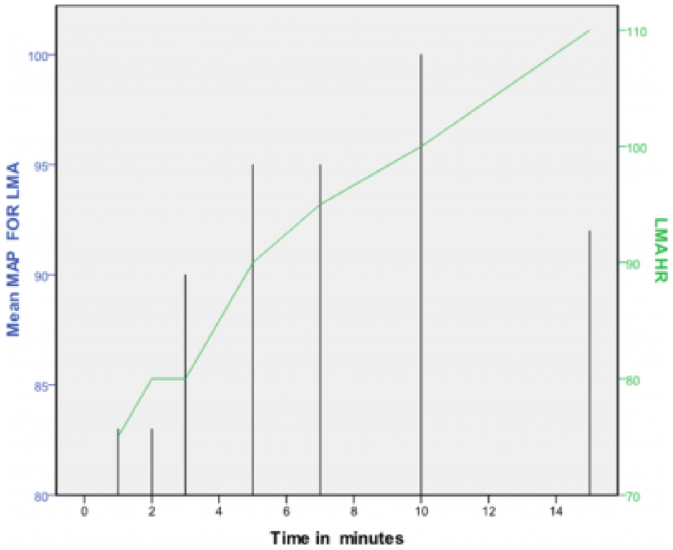


Figure 5

Figure 3: Comparison of haemodynamic changes in the ET/LMA groups

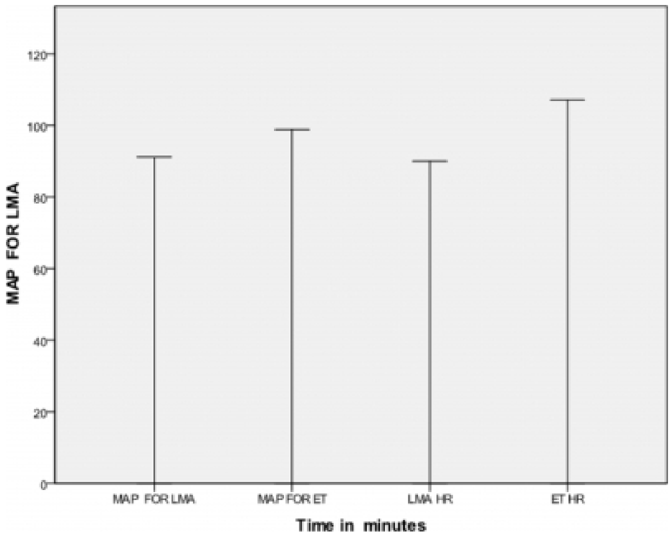


Figure 6

Figure 4: Post-extubation/removal haemodynamic changes in the ET/LMA groups with 95% confidence interval

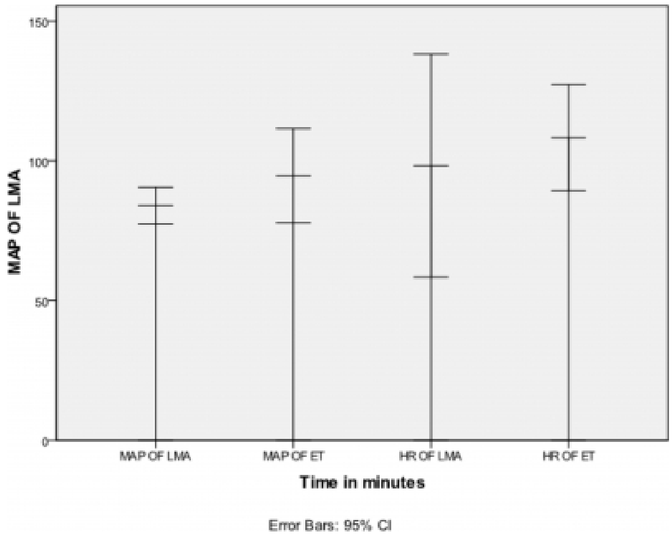
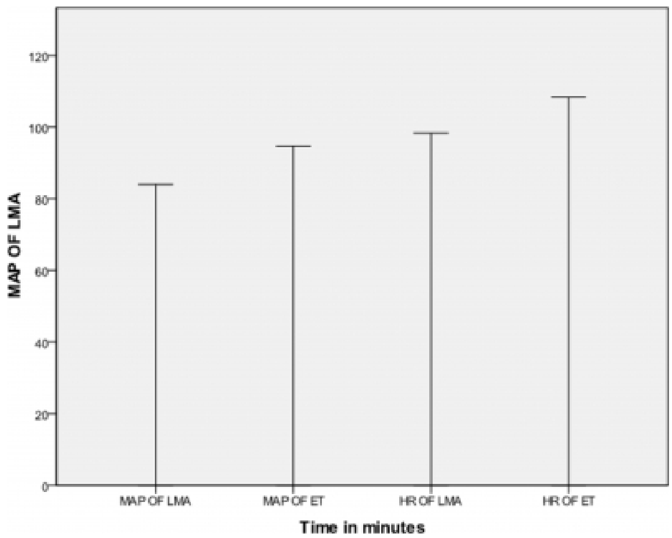


Figure 7

Figure 5: Post-extubation/removal haemodynamic changes in the ET/LMA groups



DISCUSSION

After induction of general anaesthesia, the anaesthetist becomes guardian of the patient's airway because protective reflexes have been obtunded. The tracheal tube and laryngeal mask airway are two devices that can be used. Placement of the tracheal tube requires the use of a laryngoscope. Tracheal intubation provides excellent protection of the airway from aspiration, allows positive pressure ventilation and is versatile in different kinds of surgery and positions. In the study all the patients were intubated without difficulty. Laryngoscopy(without intubation) and intubation violate the patient's protective airway reflexes, stimulate the pharyngeal tissues and lead to a hypertensive 'pressor' response [1,2] . This manoeuvre gives rise to a marked increase in arterial pressure and heart rate which be harmful to certain patients. Although these alterations are short lived, they may be undesirable in patients with pre-existing myocardial or cerebral insufficiency.[3,4] Shribman concluded that 'stimulation of the supraglottic region by tissue tension' is the major cause of the sympathoadrenal response and that placing a tube in the trachea adds little further stimulation.[5]

The laryngeal mask airway (LMA) was first described by Brain in 1983 and has been found to be relatively atraumatic to the pharynx and larynx during insertion.[6] The insertion technique is easily learnt, is less invasive, requires less anaesthetic and does protect the airway from secretions and blood though to a lesser degree than the tracheal tube. Other advantages include, excellent airway patency that can be obtained, which would not deteriorate during the course of the anaesthetic. Muscle relaxation is not required for its insertion or neck mobility. There is less effect on intraocular pressure, laryngeal and tooth trauma, laryngospasm and less risk of oesophageal and endobronchial intubation. The LMA has a role to play in patient safety during cases of difficult intubation and avoids the need for laryngoscopy[7] . Various workers have reported successful LMA placement on first attempt that varies between 67%-92%.[8] LMAwas placed successfully during the first attempt in 94% cases, while 4% required second attempt before successful placement and 2% required third attempt.[8] In a study by Jamil SN et al in children none of the cases LMA insertion failed, while it was reported successful in 92.6% of cases in previous studies [8,9,10]. In our study, the LMA was easily inserted without resistance in 33 patients (82.5%), with slight resistance in 6 patients (15%).

Several investigators have commented on minimal haemodynamic response to the insertion of laryngeal mask airway.[11,12] Studies that have been done comparing the haemodynamic and endocrine stress responses of endotracheal intubation via an ILM versus direct laryngoscopy have showed conflicting reports.[13,14]

Braude et a[12]compared the haemodynamic response of insertion of the LMA with tracheal intubation in patients and showed a significant increase in systolic pressure, one minute after the insertion of the LMA. This increase in arterial pressure was a similar, but attenuated, response to that after tracheal intubation. They also report a significant increase in heart rate immediately after LMA insertion. Knight el al[15] measured the haemodynamic response to tracheal intubation using a lighted stylet, and thereby avoided laryngoscopy, and found no difference compared to the response after laryngoscopy plus intubation. They suggest that stimulation of the glottis and pharynx is therefore nonspecific. Our study shows that significant increases in heart rate, systolic and diastolic pressure were observed in patients who were intubated whereas after LMA insertion, no significant increase in HR occurred, whereas SAP, and DAP slightly increased at 1 min . The reason might be that there is more mechanical pressure applied on the entire pharyngeal structures during laryngoscopy and intubation. Wilson et al [16] conducted a study in 40 healthy patients and compared the cardiovascular responses induced by the insertion of laryngeal mask airway with laryngoscopic tracheal intubation. The mean maximum increase in systolic blood pressure after laryngoscopy and tracheal intubation was 51.3% compared with 22.9% for the LMA insertion ($p<0.01$). Increase in maximum heart rate was similar, although heart rate remained elevated for longer period after tracheal intubation.

CONCLUSION

The haemodyn amic response to LMA insertion is less and is short lived than that observed during laryngoscopy and intubation. The LMA will be desirable in conditions where a pressor response will be deleterious

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