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Effect of Different Types of Intubation techniques on Blood Pressure and Heart Rate Responses: A Comparison of C-Mac Video Laryngoscope and Macintosh Laryngoscope in Cardiac Surgery Patients.

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Abstract

Background:
Hemodynamic response to intubation always remains a cause of concern for anesthesiologists particularly in patients undergoing cardiac surgeries where sympathetic stimulation could prove to be detrimental for patients. Keeping in view the advantage of Video laryngoscopy we compared C Mac video laryngoscope with Macintosh laryngoscope to evaluate the hemodynamic alteration and efficacy in patients posted for cardiac surgeries.

Methods:
Sixty adult patients posted for various cardiac surgeries were divided into two groups using computer-based randomization, and tracheal intubation was performed using either C Mac video laryngoscope or Macintosh laryngoscope. The primary outcome measures were hemodynamic response to intubation. Incidence of successful tracheal intubation in first attempt, duration of intubation and glottic view (percentage of glottis opening-POGO) and airway complications were also compared.

Results:
Haemodynamic response to intubation was significantly more in Macintosh group when compared to C-Mac group. Intubation time was significantly shorter with Macintosh laryngoscope (15.3 vs. 20.8 s; P < 0.001). Both groups were comparable in terms of incidence of successful tracheal intubation in first attempt and POGO scoring.

Conclusion:
Although statistically C-Mac Video Laryngoscope causes significantly lesser hemodynamic alteration as compared to Macintosh laryngoscope, the haemodynamic response was well within 20% of baseline values with both the devices.

Categories: Anesthesiology, Cardiac/Thoracic/Vascular Surgery, Cardiology
Keywords: airway intubation, airway access, anaesthesiology, cardiac anaesthesiology, cardiovascular physiology

Introduction

Intubation and laryngoscopy are procedures that are basic in maintaining the airway during surgical interventions but these practices cause hemodynamic responses which manifest as changes in blood pressure and heart rate. These physiological alterations can be particularly devastating for patients with pre- existing conditions such as hypertension, diabetes, autonomic neuropathy, coronary artery diseases and cardiomyopathy leading to more serious complications [1,2].

The impact of these hemodynamic responses is influenced by both the technique used and the expertise of the practitioner. The typical means through which a glottis may be indirectly viewed while employing video laryngoscopy like C-Mac can require less force when compared to the traditional Macintosh laryngoscopes thus; this lower power could help diminish stress responses and enhance patient stability [3, 4]. However, positioning of endotracheal tube along visual axis of camera requires very precise hand-eye coordination making intubation difficult despite clear visualization [5, 6].

The duration and force used during intubation are directly linked to hemodynamic responses. Longer intubation times and greater force can intensify sympathetic stimulation, causing notable increases in blood pressure and heart rate [7, 8]. The hypothesis is that the C-Mac video laryngoscope, with its ability to reduce the necessary force and shorten intubation time, might lessen these hemodynamic changes more effectively than the Macintosh laryngoscope [9, 10].

This study focuses on comparing the hemodynamic responses of patients undergoing cardiac surgery when intubated with either the C-Mac video laryngoscope or the Macintosh laryngoscope. By looking at variations in blood pressure and heart rate, the research aims to see if video laryngoscopy provides a more stable hemodynamic profile during intubation [11, 12]. It's essential to understand how different intubation techniques affect these physiological parameters, as these variations can have significant consequences for patient outcomes and perioperative management.

The expected results from this study should provide valuable insights into how to achieve better hemodynamic stability during intubation. By examining the causes of these hemodynamic changes and the role of the autonomic nervous system in controlling heart rate, the research aims to contribute to better patient care and outcomes in cardiac surgery. Additionally, the study will explore potential improvements in intubation technology and new methods that could enhance the safety and effectiveness of these procedures.

Comparison of C-Mac Video Laryngoscope and Macintosh Laryngoscope

The C-MAC video laryngoscope and the Macintosh laryngoscope have some key differences. The C-MAC video laryngoscope shows Class I Cormack and Lehane scores more often than the Macintosh laryngoscope [13]. The Macintosh laryngoscope creates a bigger cervical angle during intubation at the occiput-C1 segment. However, the angles at each segment before intubation don't show much difference between the two devices . The C-MAC video laryngoscope takes more time for endotracheal intubation than the Macintosh laryngoscope. But its Macintosh-shaped blade makes it easier to put into the mouth, which doctors like [15]. Also, the C-MAC video laryngoscope moves the upper cervical spine less during tracheal intubation. This makes C-MAC video laryngoscope better for patients with fake cervical immobilization compared to the Macintosh laryngoscope [16,14]. These differences show how the C-MAC video laryngoscope can help when tracheal intubation might be tough[13].

The advantages of using the C-Mac Video Laryngoscope over the Macintosh Laryngoscope are numerous and significant, particularly in enhancing airway management procedures. One major benefit is the C-MAC's closed design with the original Macintosh steel blade shape, which eliminates gaps and edges that can harbour bacteria, thus promoting better hygiene in medical settings[16]. Its slimmer profile and slanted edges help prevent potential damage to the mouth and teeth during intubation, offering a notable improvement over the Macintosh laryngoscope [16]. The inclusion of a small digital camera and high-power LED in the C-MAC ensures clear visuals without image quality reduction or dependence on external light sources, thus enhancing visualization during procedures [16]. The C-MAC also provides both direct laryngoscopic and camera views on a portable, high-resolution monitor, offering superior visualization compared to the Macintosh laryngoscope, which aids in accurate guidance and improved success rates during intubation [16,17]. Its versatility as both a direct laryngoscope and a video laryngoscope, with the capability to switch between views based on the situation, enhances its flexibility and adaptability, making it a preferred choice for anesthesiologists and medical professionals[17,18].

However, the Macintosh Laryngoscope may still be preferred in certain scenarios. It is often chosen in both simple and complex airway situations for successful intubation due to its versatility [19] . Additionally, the Macintosh laryngoscope is favoured for visualizing the glottic opening, crucial for the accurate placement of the endotracheal tube [19]. It also allows for quicker intubation times, particularly in normal airway scenarios, compared to the C-MAC, highlighting its efficiency [15]. While the C-MAC's blade design closely resembles the standard Macintosh curve, allowing a more traditional approach akin to direct laryngoscopy, the hyper angulated curvature of the GlideScope video laryngoscope blade, which is sometimes necessary for enhanced glottic exposure in difficult airways, requires a specially designed curved rigid stylet for tube direction-a potential limitation compared to the Macintosh Laryngoscope [20] . Thus, the choice between the Macintosh and the C-MAC Video Laryngoscope depends on specific airway scenarios and intubation requirements, emphasizing the importance of considering individual patient needs and clinical circumstances.

Impact of Different Intubation Techniques on Blood Pressure

How does the intubation technique affect blood pressure responses in cardiac surgery patients?

In cardiac surgery patients, the physiological response to intubation techniques is a critical area of study, particularly concerning the impact on blood pressure and heart rate. Tracheal intubation under general anesthesia stimulates the upper respiratory tract, activating the sympathoadrenal system and resulting in hypertension and tachycardia [21] . This response can be particularly pronounced during the distinct phases of airway stimulation in orotracheal intubation, which involves both direct laryngoscopy and the subsequent advancement of the tracheal tube into the trachea [9].

There is considerable variability in the reported hypertensive effects of laryngoscopy alone compared to laryngoscopy followed by intubation [21]. This discrepancy highlights the complex interplay of factors such as the duration of laryngoscopy, patient age, medications used, and the depth of anesthesia. These factors all contribute to the cardiovascular responses observed during these procedures [22] .

To mitigate the cardiovascular responses associated with intubation, various strategies have been employed. For instance, the administration of medications like labetalol and esmolol, often in combination with opioids, has been explored as a means to reduce these hemodynamic changes and minimize cardiovascular complications [22]. Additionally, the choice of intubation technique itself can significantly influence blood pressure responses. Techniques such as lightwand-assisted intubation have been associated with fewer hemodynamic changes compared to the traditional laryngoscopic method, particularly in normotensive patients [23].

This research seeks to further elucidate the physiological mechanisms underlying these hemodynamic responses, providing insights that are particularly relevant to the field of cardiovascular physiology [24]. Understanding these mechanisms not only contributes to the optimization of anesthesia practices but also enhances patient safety and outcomes in cardiac surgery settings.

Materials And Methods

Study Design and Participants

This prospective, randomized, single-blinded study was conducted in a tertiary care hospital after obtaining approval from the Institutional Ethics Committee. A total of 60 patients were enrolled, and written informed consent was obtained from each participant. The inclusion criteria were patients of either sex, aged between 40 and 60 years, weighing between 35 and 70 kg, classified as ASA grade I & II, with a body mass index (BMI) ≤30, and a Mallampati Grade of 1 or 2. Patients were excluded if they had uncontrolled diabetes mellitus, uncontrolled hypertension, autonomic neuropathy, pregnancy, or known neurovascular disease.

Randomization and Grouping

Participants were randomly assigned to two groups of 30 each: Group C-MAC and Group Macintosh. Randomization was achieved using a computer-generated schedule.

Anesthesia Protocol

All patients were anesthetized using a standardized anesthetic technique. Preoxygenation was followed by premedication with injection midazolam (0.3 mg/kg) and injection fentanyl (2 mcg/kg). Anesthesia induction was performed using injection etomidate (0.3 mg/kg), and muscle relaxation was achieved with vecuronium bromide (0.1 mg/kg). Complete relaxation was confirmed using a peripheral nerve stimulator monitoring the train-of-four response. Intubation was initially attempted in the neutral position and, if necessary, adjusted to the sniffing position. External maneuvers such as chin lift and jaw thrust were permitted and recorded.

Injection lignocaine was administered 90 seconds prior to laryngoscopy in both groups.

Outcomes and Measurements

The primary outcome was the comparison of hemodynamic responses to laryngoscopy and intubation between the two groups. Secondary outcomes included the incidence of successful intubation on the first attempt, time taken for intubation, and POGO scoring. Hemodynamic parameters-pulse rate, systolic, diastolic, and mean arterial blood pressure-were recorded at baseline, immediately after intubation, and three minutes post-intubation. Surgery commenced only after the final hemodynamic data were collected.

Training and Equipment Use

To minimize the learning curve associated with the equipment, each device was used for tracheal intubation 20 times on a manikin in separate sessions, followed by ten tracheal intubations in patients in the operating theatre before the study began. All intubations were performed by a single researcher to eliminate observer bias. Failure of intubation was defined as an attempt where the trachea was not intubated after three attempts or if intubation took longer than 60 seconds. All intubations were conducted using a 7.5 mm internal diameter endotracheal tube.

The time taken for intubation was measured from the introduction of the device between the incisors until the endotracheal tube passed through the vocal cords, confirmed visually by the attending anesthetist. The time from device introduction until the best glottic view was achieved was recorded separately from the intubation time. The POGO score (percentage of glottic opening) was assessed and recorded on a scale of 1 to 4: Score 1 (75-100%), Score 2 (50-75%), Score 3 (25-50%), and Score 4 (0-25%). The success rate of intubation on the first attempt was noted for each laryngoscope used. Immediate postoperative complications, including blood on the laryngoscope, dental injury, and airway trauma, were also documented.

Statistical Analysis

Patient Characteristics

The demographic data and patient characteristics were comparable between the two groups (Table 1). Both Group C-MAC and Group Macintosh had similar distributions in terms of age, weight, ASA grade, BMI, and Mallampati classification, ensuring that the groups were equivalent at baseline.

Hemodynamic Responses

The hemodynamic responses to intubation were analyzed and compared between and within the groups (Table 2 & Table 3). There was a significant increase in heart rate and mean arterial blood pressure immediately following tracheal intubation in both groups. However, intergroup comparison revealed that the hemodynamic response in the C-MAC group was significantly less pronounced compared to the Macintosh group.

Intubation Outcomes

Table 3 summarizes the incidence of successful intubation, the number of attempts required, time taken for intubation, POGO scores, and the incidence of injuries. The results showed that while most outcomes were comparable between the two groups, there was a notable difference in the time taken for intubation.

Specifically, the time required for intubation was significantly shorter in the Macintosh group (20.8 seconds) compared to the C-MAC group (15.3 seconds), with a p-value of 0.001.

Success Rate and POGO Scores

The success rate for intubation on the first attempt was 100% in the C-MAC group, whereas three patients in the Macintosh group required a second attempt. POGO scores were consistently 1 (indicating 75-100% glottic opening) for all patients in the C-MAC group. In contrast, a POGO score of 2 (indicating 50-75% glottic opening) was observed in four patients from the Macintosh group. Despite these differences, the variations in POGO scores and the incidence of injuries between the two groups were not statistically significant.

In summary, while both groups demonstrated effective intubation with comparable outcomes, the C-MAC group exhibited a less pronounced hemodynamic response and a higher success rate on the first attempt, albeit with a longer intubation time.

Discussion

The present study observed a significant increase in heart rate and mean arterial pressure (MAP) immediately after intubation in both groups. These increases were statistically significant but remained within 20% of baseline values for most patients. By three minutes post-intubation, these parameters had either returned to baseline or decreased further, except for MAP, which remained significantly elevated compared to baseline. This finding underscores the transient nature of the hemodynamic response to intubation, with MAP showing a prolonged elevation compared to heart rate.

An intergroup comparison revealed that the hemodynamic response was significantly greater in the Macintosh group compared to the C-MAC group. This result contrasts with some previous studies [26, 27], which did not find a significant difference between these devices. The discrepancy may be attributed to the reduced force required for laryngoscopy with the C-MAC video laryngoscope, as it does not require alignment of the three axes. However, other studies have not established a strong correlation between the force applied during laryngoscopy and the hemodynamic response [28].

Regarding intubation outcomes, the incidence of successful intubation on the first attempt was comparable between the two groups. However, a majority of patients in the Macintosh group required the sniffing position to achieve a proper glottic view and successful intubation, which aligns with findings from previous studies [26, 27].

The study also found that the time required for intubation was significantly longer with the C-MAC video laryngoscope compared to the Macintosh laryngoscope (20.8 vs. 15.3 seconds; p-value = 0.001). This delay may be attributed to the indirect nature of the C-MAC and the need to use a stylet for intubation. Although the C-MAC provides a better indirect view of the glottis, manipulating the endotracheal tube into the trachea requires skilled hand-eye coordination. In contrast, once the glottis is visible with the Macintosh laryngoscope, intubation is more straightforward. These observations are supported by previous research [27, 29].

POGO scores, which reflect the glottic view during laryngoscopy, were statistically similar between the two groups. This suggests that both the C-MAC and Macintosh laryngoscopes provide comparable visualization of the glottis.

Complications included two cases of blood staining on the device in the Macintosh group, likely due to mucosal injury, and one case of minor dental trauma [gum bleeding] in the C-MAC group. All complications were managed conservatively and did not result in severe adverse outcomes.

The study acknowledges several limitations. First, the anesthesiologist performing the laryngoscopy could not be blinded to the study groups, which may introduce bias. Second, the study only included patients with normal airways, whereas many cardiac patients have complex airway anatomy and may present with difficult airways in clinical practice.

Overall, while the study provides valuable insights into the comparative performance of the C-MAC and Macintosh laryngoscopes, further research is needed to address these limitations and validate the findings in a broader patient population.

Different types of intubations can elicit varying heart rate responses in cardiac surgery patients due to the distinct phases of airway stimulation involved. For instance, during orotracheal intubation, the increase in heart rate after laryngoscopy alone contrasts with the decrease observed after nasopharyngeal intubation and nasopharyngeal intubation combined with laryngoscopy [21]. Moreover, laryngoscopic stimulation of oro pharyngo laryngeal structures plays a crucial role in the hemodynamic stress response associated with tracheal intubation, particularly in hypertensive patients [30]. The sympathoadrenal response triggered by intubation can lead to a surge in plasma catecholamines, potentially precipitating myocardial ischemia due to poor cardiac reserve in these patients [31]. Studies have shown conflicting results regarding the hypertensive effect of laryngoscopy alone compared to laryngoscopy followed by intubation, emphasizing the importance of understanding the nuanced cardiovascular responses triggered by different phases of the intubation process [21]. Additionally, it has been found that the ILM and LW intubation devices cause less oropharyngeal and laryngeal stimulation compared to the LS, primarily detectable in hypertensive patients, which may influence the hemodynamic stress response in these individuals [30].

The autonomic nervous system plays a crucial role in regulating heart rate changes during intubation. Blood pressure and heart rate variability analysis serve as valuable tools to assess its impact on heart rate fluctuations. Research indicates that reductions in sympathetic nervous modulation to peripheral vasculature are more pronounced in the VIMA group compared to the TIVA group during intubation, highlighting the differential effects of various anesthetic techniques on autonomic function. While autonomic nervous modulation to the heart may not show significant differences between the VIMA and TIVA groups during intubation, the HF/LF ratio increases post-anesthesia induction and decreases post-insufflation, indicating dynamic autonomic responses to different stages of the procedure. Studies comparing heart rate changes during intubation in children and adults shed light on age-related differences in autonomic regulation. Assessment methods such as heart rate variability, blood pressure variability, and transfer function analysis have been instrumental in evaluating autonomic circulatory control and the effects of various anesthetic techniques on heart rate modulation during intubation. The choice of general anesthetic may not have a significant impact on cardiac autonomic responses following pneumoperitoneum induction for laparoscopic cholecystectomy, as changes in R-R interval variability and cardiac baroreflex indices were similar between VIMA and TIVA groups.

To mitigate heart rate fluctuations during intubation procedures with the C-MAC Video Laryngoscope versus the Macintosh Laryngoscope, it is crucial to consider the hemodynamic responses to the different devices.
Research indicates that the C-MAC video-laryngoscope extended the intubation time

significantly compared to other laryngoscopes, while also leading to a significant increase in mean arterial pressure values post- intubation at specific time intervals [32]. On the other hand, heart rate fluctuations were notably higher in the immediate minutes following intubation using the Macintosh laryngoscope in contrast to baseline values, highlighting potential physiological stress during the procedure [32]. While heart rate and optic nerve sheath diameter measurements did not show significant changes with the use of the C-MAC® video- laryngoscope, it is evident that both devices have their distinct impacts on hemodynamic responses during intubation procedures [32]. Despite the similarities observed in hemodynamic responses between the C-MAC Video Laryngoscope and other devices like the King Vision, specific strategies to counter heart rate fluctuations during intubation procedures using the C-MAC Video Laryngoscope versus the Macintosh Laryngoscope were not provided in the study, leaving room for further investigation and potential development of such strategies to optimize patient outcomes and procedural efficiency [33].

Variations in blood pressure and heart rate during intubation play a critical role in the management of cardiac surgery patients, particularly in those with pre-existing conditions. Research has shown that endotracheal intubation using different laryngoscopes can lead to significant changes in blood pressure and heart rate, with the Macintosh laryngoscope causing a more pronounced increase compared to the Airtraq group [34]. These hemodynamic alterations during intubation are crucial as they can impact the delicate balance between myocardial oxygen demand and supply, especially in patients with coronary artery disease [34]. Furthermore, cardiac patients, being more susceptible to hemodynamic instability during intubation, are at a higher risk of developing complications due to variations in blood pressure and heart rate, which may even precipitate myocardial ischemia [34]. The choice of laryngoscope, such as Airtraq®, has been shown to have clinical implications by maintaining a stable hemodynamic situation post-intubation in cardiac surgery patients, highlighting the importance of selecting the appropriate equipment for these procedures [34]. The monitoring of hemodynamic responses during intubation, particularly in hypertensive patients, is crucial as the stress response can lead to adverse cardiovascular events, emphasizing the need for meticulous attention to these variations in clinical settings [30].

To optimize hemodynamic stability during intubation procedures, employing the C-MAC Video Laryngoscope [VL] with the Macintosh blade can be a beneficial strategy, as it has been shown to result in minimal hemodynamic alterations during endotracheal intubation [25]. Additionally, utilizing the C-MAC VL may lead to fewer failed intubations compared to other video laryngoscopes like the McGrath, which can contribute to maintaining hemodynamic stability during procedures [36]. Anesthetists have rated the C-MAC VL as easier to use than the McGrath, potentially enhancing hemodynamic stability during intubation procedures [36]. Furthermore, the C-MAC VL has been found to have a lower incidence of minor oropharyngeal mucosal injuries compared to the McGrath, which may further aid in optimizing hemodynamic stability during intubation [36]. Overall, the C-MAC VL has been demonstrated to be superior in maintaining hemodynamic stability compared to the Macintosh Laryngoscope, making it a valuable tool in ensuring patient safety during intubation procedures [25].

Physiological responses play a crucial role in patient outcomes and perioperative management, particularly in cardiac surgery settings. Research has shown that interventions like music therapy can significantly reduce parameters such as pain and anxiety, potentially leading to improved patient outcomes and better perioperative management [35]. Despite this positive impact on anxiety and pain levels, studies have indicated that music intervention may not directly affect opioid consumption in the perioperative setting [35]. While no significant differences were observed in physiological parameters such as blood pressure and heart rate between groups receiving music intervention and the control group, the reduction in anxiety and pain levels remains a promising factor for enhancing patient outcomes and perioperative management [35]. The measurement of physiological responses like anxiety, pain, and opioid consumption before and after interventions provides valuable insights into their influence on patient outcomes and perioperative management, highlighting the importance of understanding these impacts for optimizing patient care in cardiac surgery settings [35].

Future Directions for Research in Intubation Techniques

Future research on the effects of different intubation techniques on hemodynamic responses presents several important areas for exploration. A key area is understanding how advancing the endotracheal tube into the larynx and trachea affects hypertensive responses during intubation, as this phase is critical for patient management and requires further investigation [21]. Additionally, addressing the discrepancies in hypertensive responses to tracheal intubation observed in various studies could help clarify the variability in patient reactions and support more personalized approaches to care [9]. Research into the effects of nasopharyngeal intubation on intracranial pressure in patients with head injuries or intracranial pathology is also essential for optimizing management strategies and ensuring patient safety [21]. Furthermore, comparing cardiovascular responses induced by direct laryngoscopy versus intubation during tracheal intubation under general anesthesia could yield valuable insights into the physiological mechanisms involved and inform best practices [21].

Technological advancements are poised to enhance the safety and efficacy of intubation procedures, particularly in cardiac surgery. Innovations in intubation technology, such as improved video laryngoscopes, reduce the reliance on direct visualization and enhance patient safety and procedure effectiveness [37].

These advancements extend beyond the operating room to emergency departments and intensive care units, showcasing their versatility and impact on patient outcomes [37]. Efforts are underway to optimize the integration of new technologies, refine difficult airway prediction, and develop advanced airway management algorithms, aiming to further improve the safety and success rates of intubation [37].

Additionally, advancements like endoscopic cardiac positioners and stabilizers support better exposure and stabilization of target arteries during intubation [38]. Employing muscle-sparing techniques and non rib- spreading approaches in thoracic soft tissue openings also contributes to improved precision and safety in cardiac surgery [38]. Embracing these technological innovations is crucial for advancing surgical practices and patient care [38].

The search for novel approaches and devices in intubation continues, with ongoing research focusing on enhancing the safety and success rates of tracheal intubation in critically ill patients across various healthcare settings [39,40]. New devices, such as the laryngeal mask airway (LMA) and video laryngoscopes, have already made significant contributions by reducing airway incidents and complications [39]. Future research should prioritize exploring and developing innovative solutions that could transform intubation practices and improve patient outcomes in critical settings [40].

Conclusions

We conclude that though C-Mac video laryngoscope is statistically significantly better than Macintosh laryngoscope as far as attenuation to hemodynamic response to laryngoscopy and intubation is concerned in cardiac
patients; the haemodynamic response was well within clinically important range of 20% of baseline values with both the devices. The Macintosh laryngoscope has got advantage in terms of time required for successful intubation. However, to confirm these findings further larger clinical trials are required in patients with normal and difficult airways.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. Medical college institutional review board issued approval IRB- 2546/2023. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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Table 1. Patient Characteristics			
Characteristics	C-Mac Group (n=30)	Macintosh Group(n=30)	p Value
Sex n (male : female)	12:18	17:13	0.30
Age [Mean ± S D] (years)	46.4 ±12.6	44.6 ±13.9	0.56
Weight [Mean ± S D] (kgs)	56.3 ±14.6	53.7 ±16.7	0.52
Operations			
CABG	12(40%)	9(30%)	0.54
Valve Surgeries	16(53.33%)	20(66.67%)	
Others	2(6.67)	1(3.33%)	

Table 2. Distribution of heart rate and mean arterial blood pressure			
Heart Rate [Mean ± S D] (per minute)	C-Mac Group(n=30)	Macintosh Group(n=30)	p value
Preinduction	76.2 ± 14.3	81.7 ± 17.4	0.19
After intubation	83.8 ± 13.1	94.1 ± 18.6	0.016
After 3 mins of intubation	79.4 ± 10.3	84.3 ± 12.9	0.10
MAP (mmHg)			
Preinduction	103.2 ± 19.3	106.7 ± 20.2	0.49
After intubation	109.6 ± 12.7	120.3 ± 16.3	0.006
	105.9 ± 13.2	113.2 ± 14.1	0.042

Table 3 . Intubation Characteristics			
Parameters	C-Mac Group (n=30)	Macintosh Group (n=30)	p value
Incidence of successful intubation in 1st attempt	30 (100%)	27 (90%)	0.24
Time of intubation[Mean ± SD] (sec)	20.8 ± 4.6	15.3± 5.2	0.001
POGO Score			
1	30 (100%)	26(86.67%)	0.11
2	0	4(13.33%)	
3	0	0	
4	0	0	