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Comparative Study of Airway Management and Hemodynamic Response during Intubation with Two Different Video Laryngoscopes (Glidescope versus Intubating Laryngeal Mask Ctrach)

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Abstract

Poor laryngeal view may result in failed intubation and subsequent complications up to death. Rigid fiberoptic laryngoscopes including GlideScope (GS) and intubating laryngeal mask airway (ILMA) CTrach (CT) provide view of the airway and so facilitate process of intubation and reduce its complications. This study was designed to compare airway management and hemodynamic response with the use of GlideScope versus ILMA CTach during intubation.

Methods: 100 patients were included in this study of which 50 were randomly assigned to group I and the others to group II. A standard anesthesia and airway management protocol was used. Time to intubation (TTI) Successful intubation during first attempt, and within three attempts, and failure of intubation with the use of both test devices were recorded. Hemodynamic changes were measured.

Results: Overall time to intubation (TTI) was significantly longer with the use of intubating laryngeal mask airway (ILMA) CTrach (CT) 112 ± 20s in comparison to 55 ± 10s with the use of GlideScope GS ($p < 0.0001$).. Successful intubation during first attempt was significantly higher with the use of GS (P 0.0395). Initially with the use of GS quality of laryngeal view was good in 44 cases, in comparison to 22 cases with the use of CT ($p < 0.0001$). Laryngeal view was blurred in 18 cases, and poor in 10 cases with the use of CT initially in comparison to 4, and 2 cases respectively with the use of GS. Optimization maneuvers significantly improved the quality of laryngeal view in all study groups. As regard hemodynamic changes there were no significant differences between the two study groups. Systolic blood pressure, diastolic blood pressure, mean arterial blood pressure, and heart rate were significantly increased at 1, and 2 minutes after intubation in comparison to their levels before intubation inside each group ($p < 0.001$) there was no difficulty in ventilation with the use of CT. With the use of both study devices there was no desaturation during insertion, any severe soft tissue or dental trauma, and any aspiration or regurgitation.

Conclusion: In conclusion use of GS gave an advantage of faster intubation time which decrease the apneic period and reducing the risk of hypoxia during intubation. On the other hand the use of the CTrach gave the advantage of easy ventilation in between intubation attempts, or even securing the airway with the LMA in case of failure of intubation especially in cases of difficult intubation. The use of CTrach failed to get any advantage in attenuating the hemodynamic response during tracheal intubation in comparison to GS.

Keywords: *Intubation; Video laryngoscopes; GlideScope; LMA CTrach*

Introduction

In spite of careful airway assessment, direct laryngoscopy (DL) occasionally yields unexpectedly poor laryngeal views [1]. Such difficulties, even if ultimately successful, may result in multiple laryngoscopic attempts and may be associated with hypertension, oxygen desaturation, airway and dental injuries, intensive care admission, neurologic impairment, and up to death [2,3]. The search for alternatives to DL has result in numerous supraglottic devices for routine use and airway rescue [4]. Rigid fiberoptic laryngoscopes offer the advantage of providing a non-line-of-sight view of the airway and visual control of endotracheal tube (ETT) advancement [5]. The GlideScope (GS) Video Laryngoscope (Saturn Biomedical System Inc., Burnaby, British Columbia, Canada) is a relatively new intubating device. It is a laryngoscope with high resolution camera embedded within the blade with embedded antifogging mechanism, and a light source mounted beside the camera for illumination. The image is displayed on a small monitor [4,5]. The laryngoscope blade bends through 60° at the midline and is 18 mm wide. It was designed to give an improved view of the glottis, as it is able to look round the corners, and may be useful for all intubations [6]. LMA Ctrach (CT) is a modified version of intubating LMA (ILMA) that allows continuous video-endoscopic monitoring of the tracheal intubation procedure [7]. This system comprises of LMA with fibroptic channels and detachable LCD viewer. So, this system enables simultaneous viewing of larynx and process of ET intubation via LMA [8]. This study was designed to evaluate the differences between the GS, and the CT as regard the clinical efficacy in viewing laryngeal structures, overall time of intubation, successful intubation during first attempt, Successful intubation within the three attempts, and hemodynamic changes.

Methods

After approval of our human ethical committee and informed written consent 100 patients were included in this study. Inclusion criteria were; ASA I-II patients, age 20-60 years old, and elective non cardiac surgery requiring general anesthesia with endotracheal intubation. Exclusion criteria were gastroesophageal reflux disease, body mass index, previous neck surgery, known airway pathology or cervical spine injury and those who required rapid sequence intubation, or difficult airway.

Patients' characteristics and airway measurements were recorded preoperatively. Mallampatti class (MP) as modified by Samsoon and Young was detected with the patients' sitting with enough mouth opening and tongue protruded. Thyromental distance (TMD) was measured as the distance between the anterior chin and the thyroid notch with the head in full extension. For endotracheal intubation patients were randomly allocated to group I with the use of GS (50 patients), and group II with the use of CT (50 patients). Patients were unaware of their group allocation. Randomization was concealed via sealed opaque envelopes.

Two senior anesthesia consultants with more than 20 years of experience were participated in this study. Both consultants had similar educational training for use of the CT and GS on mannequin, and more than 30 successful intubations with both study devices before the study.

A standard anesthesia protocol was followed. Glycopyrolate 3 μg/kg was given to all patients 10-15 minutes before anesthesia. After connection to standard monitoring devices all patients in the 2 study groups were preoxygenated for three minutes. Anesthesia was induced with intravenous injection of midazolam 0.05 mg/ kg, fentanyl 1 μg/kg, propofol 1-2 mg/kg, and rocuroniun 0.6 mg/kg. Anesthesia was maintained with sevoflurane 2% in oxygen during the study period. The patients were placed in the sniffing position with their head on a pillow. Approximately 90 seconds after administration of rocuronium all patients of the two study groups underwent endotracheal intubation with the use of one of the two study airway devices.

In patients of group I GS was used for endotracheal intubation. For insertion of the GS the camera portion was applied along the middle of the tongue and the tip was positioned in the vallecula, the epiglottis was elevated by lifting the blade into the vallecula. A view of the epiglottis and glottis was available on the monitor as soon as the camera section of the GS entered the mouth. The tube stylet was curved to follow the 60° angulation of the GS blade .The following maneuvers was applied to optimize the laryngeal view if it was unsatisfactory initially: suction, adjustment of light, external laryngeal pressure, withdrawal of the blade, and increased lifting force. In some cases, slight rotation of the endotracheal tube (ETT) was required after removing the stylet to facilitate tube passage into the trachea. The GS was withdrawn after visual confirmation of tracheal placement. Auscultation and capnography were performed as additional tests for appropriate tube placement.

In patients of group II CT size 3 was used for patients 30-50 kg, size 4 was used for patients 50-70 kg, and size 5 > 70 kg. Prior to insertion of the CT the cuff was deflated, anti-fogging solution was applied to the fibroptic lens, the viewer was connected, and focus was adjusted by using pre-focus card. The CT was inserted by using the one handed rotation technique. The cuff was inflated with air to achieve just airtight seal (maximum air volume: size 3 = 20 ml, size 4 = 30 ml, size 5 = 40 ml). Breathing system was connected to CT and then ventilation was checked. If necessary the CT was manipulated to obtain the least resistance to ventilation and minimal leak. Ventilation via the CT was maintained through this time. If the larynx could not be viewed CT was subsequently manipulated by the following predetermined maneuvers to optimize the laryngeal view: suction, adjustment of light, adjustment of focus, Chandy maneuver (rotation of the device in the sagittal plane using the handle to lift the cuff slightly away from the posterior pharyngeal wall), up-down maneuver, left-right maneuver or jaw thrust. Aim was to see the vocal cords and the laryngeal inlet in the center of the viewer. After obtaining the best possible view, a lubricated size 7 an armoured endotracheal tube (Portex Ltd, Hythe, Kent, and U.K.) was introduced in the trachea through the CT under vision and the viewer was then detached. CT cuff was deflated, and then the CT was removed over the ETT with the aid of a stabilizer rod. Correct intubation was confirmed by chest auscultation and capnography.

Patient characteristics including (gender, weight, age, and ASA class), and preoperative airway assessment were recorded. Overall time to intubation (TTI) was measured from the time the airway device entered the patient's mouth until end-tidal carbon dioxide was first detected for confirmation after ETT was inserted. Quality of laryngeal view was graded as good (laryngeal structures clearly visible), blurred (laryngeal structures recognizable but not sharp), or poor (laryngeal structures not recognized). Intubation was only attempted if view was good, or at least blurred. Modified Cormack-Lehane grade of laryngeal view was recorded initially and after getting the best laryngeal view in both study groups. Each patient was given a maximum of three attempts for intubation with maximum three minutes for each. After any failed attempt patient was given mask ventilation before the next trial. After failure of three attempts, or if the best quality of laryngeal view remained poor, one trial of blind intubation was allowed for patients in group II, and if failed intubation by direct laryngoscopy was done, and patient was excluded from the analysis for TTI, and hemodynamic parameters. Blind intubation was not allowed for patients in group I. TTI, Successful intubation during first attempt, second attempt, within three attempts, and failure of intubation with the use of both test devices were recorded. Hemodynamic changes including systolic blood pressure, diastolic blood pressure, mean arterial blood pressure, and heart rate were measured immediately before intubation, and every minute for the next 5 minutes after intubation. Complications including bleeding, lacerations, soft tissue or dental trauma, Difficulty in ventilation, desideration, esophageal intubation, aspiration, and regurgitation were recorded.

Sample size was determined as 50 in each group allowing an alpha-error of 0.05 and beta-error of 0.2 (power 80 %) to detect difference of 50 seconds for the intubation time between the two study devices. SPSS software version 17.0 (SPSS Inc., Chicago, IL, USA.) was used to perform all statistical analysis. For statistical analysis Fisher's exact test was used for comparison of gender, Mallampatti, and ASA class, successful rate of intubation, quality and grade of laryngeal view. Student's t-test was used for comparison of hemodynamic data and over all time of intubation between the two study groups. Data expressed as mean ± standard deviation, or number and percentage of patients. P value of < 0.05 was considered significant.

Results

One-hundred patients were included in the study of which 50 patients were randomized to (group I), and the other 50 were randomized to (group II). CT was inserted successfully with adequate ventilation during first attempt in all patients of group II. CT size 3 was used in 12 cases, size 4 in 28 cases, and size 5 in 6 cases respectively. Adult sized GS blade was used in 35 cases and pediatric size was used in 15 cases.

As regard patient's demographic data, preoperative airway assessment characteristics, and ASA class there were no significant differences between the two study groups (table I).

	Group I (GS) (N = 50)	Group II (CT) (N = 50)
Gender (M/F)	35/15	36/14
Weight (kg)	65 ± 12	67 ± 10
Age (yrs)	35 ± 9	36 ± 8
Mallampatti class: I	22 (44%)	21 (42%)
(number of patients): II	28 (56%)	29 (58%)
Thyromental distance (cm)	8.2 ± 1.1	8.4 ± 1.0
ASA PS: I	39 (78%)	37 (74%)
ASA PS: II	11 (22%)	13 (26%)

Table 1: *Patient details and preoperative airway assessment characteristics. GS (glideScope), CT (LMA CTrach). Data expressed as number of patients (N), percentage (%), or mean ± SD. P < 0.05 considered significant.*

Overall time to intubation (TTI) was significantly longer with the use of CT 112 ± 20s in comparison to 55 ± 10s with the use of GS ($P < 0.0001$) (table II).

Successful intubation during first attempt was significantly higher with the use of GS (p 0.0395). In group I 45 cases were intubated during first attempt, 5 cases during second attempt, and 50 cases within the three attempts in comparison to 36, 8, and 48 cases respectively in group II (table II).

	Group I (GS) (N = 50)	Group II (CT) (N = 50)
Successful intubation during first attempt (n).	45 (90%)*	36 (72%) P 0.0395
Successful intubation during second attempt (n).	5 (10%)	8 (16%)
Successful intubation within the three attempts (n).	50 (100%)	48 (96%)
Failure of intubation with the use of the test device (n).	0	0
Overall time to intubation (s).	55 ± 10*	112 ± 20 p < 0.0001

Table 2: *Comparison of the two study groups as regard, successful intubation of the larynx during first and second attempts, Successful intubation of the larynx within the three attempts, failure of intubation with the use of the test device, and overall time to intubation. *(Significant difference in group I in comparison to group II), P < 0.05 considered significant. Data expressed as number of patients (N), percentage (%), or (mean ± SD).*

Initially with the use of GS quality of laryngeal view was good in 44 cases, in comparison to 22 cases with the use of CT ($p < 0.0001$) (table III). Laryngeal view was blurred in 18 cases, and poor in 10 cases with the use of CT initially in comparison to 4, and 2 cases respectively with the use of GS (table III). Optimization maneuvers significantly improved the quality of laryngeal view in all study groups to be 50 cases good in group I in comparison to 42 in group II. Cases with blurred view in group I decreased to 0 and in group II decreased to 4 (table III). After optimization maneuvers quality of laryngeal view remained poor in 4 cases in group II. Blind intubation was tried as per the study protocol and succeeded for those cases.

With the use of modified Cormack-Lehane grade of laryngeal view it was I in 40 cases, II in 8 cases, and III in 2 cases in group I in comparison to 27, 20, and 3 cases in group II respectively (table III). Optimization maneuvers improved the grade of laryngeal view in both study groups (table III).

		Initial		Best	
		GS (N = 50)	CT (N = 50)	GS (N = 50)	CT (N = 50)
Quality	Good	44 (88%)* P < 0.0001	22 (44%)	50 (100%)*+ P 0.0267 P < 0.0058	42 (84%) + P < 0.0001
	Blurred	4 (8%)* P 0.0013	18 (36%)	0	4 (8%) + P 0.0013
	Poor	2 (4%)* P 0.027	10 (20%)	0	4 (8%)
Grade	I	40 (80%)* P 0.0102	27 (54%)	48 (96%) + P 0.027	44 (88%) + P 0.003
	II	8 (16%)* P 0.0135	20 (40%)	6 (12%)	6 (12%) + P 0.0026
	III	2 (4%)	3 (6%)	0	0
	VI	0	0	0	0

Table 3: *Comparison of the two study groups as regard Quality and modified Cormack-Lehane grade of laryngeal view. Data expressed as number of patients (N), percentage (%). Quality of laryngeal view was expressed as good, blurred, or poor. * significant for comparison of data between the two study groups (P < 0.05 considered significant). + significant for comparison of data between the initial and best quality, and grade of laryngeal view inside each group) (P < 0.05 considered significant).*

Hemodynamic values were recorded in table IV. Heart rate, Systolic, diastolic, and mean arterial blood pressure were significantly increased at 1, and 2 minutes after intubation in comparison to their levels before intubation inside each group (p < 0.001) with no significant difference between the two study groups (P > 0.05) (table IV), (table V).

		GS (N = 50)	CT (N = 50)
Heart Rate (beats/min)	Before intubation (base line)	66 ± 15	68 ± 14
	1 min after intubation	82 ± 12* P < 0.001	83 ± 10* P < 0.001
	2 min after intubation	80 ± 14* P < 0.001	82 ± 13* P < 0.001
	3 min after intubation	68 ± 13	69 ± 11
	4 min after intubation	73 ± 16	74 ± 18
	5 min after intubation	68 ± 12	67 ± 13
Mean arterial pressure (mm Hg)	Before intubation (base line)	71 ± 12	72 ± 13
	1 min after intubation	83 ± 15* P < 0.001	85 ± 13* P < 0.001
	2 min after intubation	91 ± 12* P < 0.001	90 ± 13* P < 0.001

	3 min after intubation	72 ± 14	70 ± 10
	4 min after intubation	73 ± 15	73 ± 14
	5 min after intubation	72 ± 12	71 ± 13

Table 4: *Comparison of heart rate, and mean arterial blood pressure inside and between the two study groups. Data were expressed as mean ± SD. *significant for comparison of data inside each group with the base line {before intubation}) (P < 0.05 considered significant*

		GS (N = 50)	CT (N = 50)
Systolic blood pressure (mm Hg)	Before intubation	108 ± 15	110 ± 14
	1 min after intubation	132 ± 12* P < 0.001	135 ± 10* P < 0.001
	2 min after intubation	128 ± 14* P < 0.001	131 ± 13* P < 0.001
	3 min after intubation	110 ± 13	108 ± 11
	4 min after intubation	105 ± 16	104 ± 18
	5 min after intubation	103 ± 12	105 ± 13
Diastolic blood pressure (mm Hg)	Before intubation	61 ± 12	62 ± 13
	1 min after intubation	83 ± 15* P < 0.001	85 ± 13* P < 0.001
	2 min after intubation	80 ± 12* P < 0.001	82 ± 13* P < 0.001
	3 min after intubation	68 ± 14	70 ± 10
	4 min after intubation	65 ± 15	68 ± 14
	5 min after intubation	64 ± 12	69 ± 13

Table 5: *Comparison of systolic and, diastolic arterial blood pressure inside and between the two study groups. Data were expressed as mean ± SD. *significant for comparison of data inside each group with the base line {before intubation}) (P < 0.05 considered significant).*

Rate of complications was low. We noticed some blood stained secretions in 3 cases after the use of CT suggesting trauma to the airway during intubation but none with GS. There was no difficulty in ventilation with the use of CT. With the use of both study devices there was no desaturation during insertion, no sever soft tissue or dental trauma, and no aspiration or regurgitation.

Discussion

There were many previous studies comparing the use of CT, or GS with conventional or other intubation techniques [9-12]. Few studies compared CT, with GS [13,14]. But to our knowledge this is the first study that evaluated, and compared the hemodynamic response to insertion of CT, and GS. Our study showed that the use of GS for intubation gave some advantages over the CT. Over all time to intubation (TTI) was significantly higher with the use of the CT in comparison to the GS, which is similar to results of previous works [13,14]. In work of NG., et al. [13] it was 73 ± 63s in comparison to 112 ± 20s in our study. This was due to the difference in the design of the two studies as NG et al study allowed intubation without confirmation of adequate ventilation but depending only on satisfactory laryngeal view. Also in work of NG., *et al*. [13] 180 s limit was applied for intubation to prevent desaturation in GS group. We applied 240s limit for intubation based on results of previous works used GS for intubation in normal airway that detected TTI to be less than

100s [9,13]. May be different protocol could be applied if study was designed for cases of difficult intubation as regard safe limit of intubation to insure no desaturation.

The longer TTI with the use of CT was needed to optimize the laryngeal view after attaching the viewer and confirmation of ventilation which was adjusted faster with the use of GS with simple maneuvers and intubation following immediately. The shorter the intubation time with the use of GS the lower the risk of hypoxia which give advantage for GS use for suspected cases of difficult intubation. GS is already an established device for difficult airway, and the time to intubation is significantly shorter with its use compared to direct laryngoscopy [9]. For cases with ankylosing spondylitis the modified Cormack-Lehane laryngeal grade is improved [12]. Although CT may have advantage over the GS for cases of suspected difficult intubation as patients can be ventilated in between intubation attempts even the option of securing the airway with the CT without tube is available [14]. Also CT may have a role in difficult intubation as its design would not be affected by anatomical factors causing difficult laryngoscopy [14].

Success rate of intubation after first attempt, and within three attempts was significantly higher with the use of GS in comparison to CT which runs with previous works [13,14]. With the use of GS the initial quality of laryngeal view was good in 90% of cases in comparison to 44% with the use of CT. This may be due to the design of the CT as the position of the lens, is very close to the laryngeal structures that makes image easily disrupted by secretions, moisture, or down folding of the epiglottis. For previous reasons the use of adjusting maneuvers was very helpful to improve the quality of view as the down folded epiglottis was repositioned. With the use of GS complete visualization of the posterior pharyngeal wall structures during advancement gave a guide for placement of the blade and easy capturing of good quality of laryngeal view. For those adjusting maneuvers were less important. Applying external laryngeal pressure as per routine direct laryngoscopy was useful to optimize anterior larynx, and obtain a good quality of laryngeal view. The use of the two study devices was associated with significant hemodynamic changes at 1, 2, and 3 min after intubation in comparison to the base line within each group with no significant differences between the two study groups. Several works compared the hemodynamic changes due to insertion of ILMA and classic laryngoscopy (CL). However there is controversy whether ILMA has advantages over CL as regard hemodynamic changes [17-20]. Some of previous studies get advantages with the use of ILMA over CL [17,18]. Others failed to get advantages with the use of ILMA, as regard hemodynamic changes [19,20]. On the other hand with the use of GS several previous works failed to detect advantages as regard hemodynamic changes in comparison with CL [21,22]. Enhancing of sympathetic activity that happens during elevation of the epiglottis and exposure of the glottis with the use of the GS, or CL may be the cause of hemodynamic changes during orotracheal intubation. Although these changes are transient but may lead to significant complications in hypertensive patients [15,16]. CT guided intubation has some advantages because this procedure does not distort the base of the tongue or directly stimulate the receptors of the larynx. For previous resone hemodynamic changes and stress response to insertion of CTrach theoretically may be less than that with GS or CL. With the use of CTrach hemodynamic changes may be associated with direct tracheal stimulation by tracheal tube rather than oropharyngeal stimulation and may be related to the longer duration of intubation which is associated with the three stage process of the CTrach placement, intubation and removal in comparison to that of the GS. Also repeated airway manipulation may have enhanced the hemodynamic response. When compared to GS ILMA guided tracheal intubation may impose a greater pressure on the oropharyngeal structures even exceeding the capillary perfusion pressure of the pharyngeal structures thus resulting in greater stimulation to the local structures [23]. A mechanical stimulation to the supralaryngeal area which is rich in nociceptive receptors can cause a strong hemodynamic response [24].

Conclusion

Use of GS gave an advantage of faster intubation time which decrease the apneic period and reducing the risk of hypoxia during intubation. On the other hand the use of the CT gave the advantage of easy ventilation in between intubation attempts, or even securing the airway with the ILMA in case of failure of intubation especially in cases of difficult intubation. The use of CT failed to get any advantage in attenuating the hemodynamic response during tracheal intubation in comparison to GS.

Bibliography

1. Caplan RA., *et al*. "Adverse respiratory events in anesthesia: a closed claims analysis". *Anesthesiology* 72.5 (1990): 828-833.
2. Gannon K. "Mortality associated with anesthesia. A case review study". *Anesthesia* 46.11 (1991): 962-966.
3. Mort TC. "Emergency tracheal intubation. Complications associated with repeated laryngoscopic attempts". *Anesthesia analgesia* 99.2 (2004): 607-613.
4. Peterson GN., *et al*. "Management of the difficult airway. A closed claims analysis". *Anesthesiology* 103.1 (2005): 33-39.
5. Warriner CB., *et al*. "The GlideScope (Video Laryngoscope): randomized clinical trial in 200 patients". *British Journal of Anesthesia* 94.3 (2005): 381-384.
6. Benjamin FJ., *et al*. "An evaluation of the GlideScope , a new video laryngoscope for difficult airways, a manikin study". *European Journal of Anesthesiology* 23.6 (2006): 517-521.
7. Dhonneur G., *et al*. "Tracheal intubation of morbidity obese patients: LMA CTrack versus direct laryngoscopy". *British Journal of Anesthesia* 97.5 (2006): 742-745.
8. Goldman AJ and Rosenblatt WH. "Use of the fibroptic intubating LMA CTrack in two patients with difficult airways". *Anaesthesia* 61.6 (2006): 601-603.
9. Lim Y and Yeo SW. "A comparison of the GlideScope with the Macintosh laryngoscope for tracheal intubation in persons with simulated difficult airway". *Anaesthesia and Intensive Care Journal* 33.2 (2005): 243-247.
10. Bilgin H and Bozkurt M. "Tracheal intubation using ILMA, C-Trach or McCoy laryngoscope in patients with simulated cervical spine injury". *Anesthesiology* 61.7 (2006): 685-691.
11. Xue FS., *et al*. "Comparison of hemodynamic response to orotracheal intubation with GlideScope video laryngoscope and fibroptic bronchoscope". *European Journal of Anaesthesiology* 23 (2006): 522-526.
12. Lai H., *et al*. "The use of GlideScope for tracheal intubation in patients with ankylosing spondylitis". *British Journal of Anaesthesia* 97.3 (2006): 419 – 422.
13. Ng S., *et al*. "Comparison of airway management during anesthesia using the laryngeal mask airway CTrack and GlideScope". *Anesthesia and Intensive Care* 35.5 (2007): 736-742.
14. Liu E and Goy R. "The LMA CTrach for unanticipated difficult intubation". *Anesthesia* 61.10 (2006): 1015.
15. Fuijii Y., *et al*. "Circulatory response to laryngeal mask airway insertion or tracheal intubation in normotensive and hypertensive patients". *Canadian Journal of Anesthesia* 42.1 (1995):32-36.
16. Sener E., *et al*. "Hemodynamic responses and upper airway morbidity following tracheal intubation in patients with hypertension : conventional laryngoscopy versus intubating laryngeal mask airway". *Clinics* 67.1 (2012): 49-54.
17. Das S., *et al*. "Comparative study of heart rate responses to laryngoscopic endotracheal intubation using intubating laryngeal mask airway under general anesthesia in patients with pure mitral stenosis for closed mitral commissurotomy". *Journal of Indian Medical Association* 111.4 (2013): 239 - 244.
18. Siddiqui NT and Khan F. "Hemodynamic response to tracheal intubation via intubating laryngeal mask airway versus direct laryngoscopic tracheal intubation". *The Journal of Pakisthan Medical Association* 57.1(2007): 11-14.
19. Akhlaqh S., *et al.* "Hemodynamic response to tracheal intubation via direct laryngoscopy and intubating laryngeal mask airway (ILMA) in patients under going coronary artery bypass grafting (CABG)". *Middle East Journal of Anesthesiology* 21.1 (2011): 99-103.
20. Chanq G., *et al.* "Comparative study of hemodynamic response to orotracheal intubation with intubating laryngeal mask airway". *Chinese Medical Journal* 119.11 (2006): 899-904.
21. Li X., *et al*. "Comparison of hemodynamic response to nasotracheal intubations with GlideScope video-laryngoscope, Macintosh direct laryngoscope, and fibroptic bronchoscope". *Zhonqquo Yi Xue Ke Xue Yuan Xue Bao* 29.1 (2007): 117-123.

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22. Xue F., *et al*. "Comparison of hemodynamic response to nasotracheal intubations with GlideScope videolaryngoscope, and the Macintosh direct laryngoscope". *Journal of Clinical Anesthesia* 19.4 (2007): 245-250.
23. Kihara S., *et al*. "Routine use of intubating laryngeal mask airway resulting in increased upper airway morbidity". *Canadian Journal of Anesthesia* 48.6 (2001): 604-608.
24. Hamaya Y and Dohi S. "Differences in cardiovascular response to airway stimulation at different sites and blockade of the responses by lidocaine". *Anesthesiology* 93.1 (2000): 95-103.

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