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ORIGINAL ARTICLE

Comparing Postoperative Sore Throat (POST) Following Intubation using Macintosh Laryngoscope Versus C-MAC® Video Laryngoscope

KHOO BH[1], YEOH CN[2], LEE CY[2], NADIA MN[2], RAHA AR[2]

[1]Department of Anaesthesiology and Intensive Care Unit, Hospital Sibu, Sarawak, Malaysia
[2]Department of Anaesthesiology and Intensive Care, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia

ABSTRAK

Kesakitan kerongkong selepas pembedahan (POST) adalah komplikasi yang sering berlaku dengan kadar insidens sebanyak 30-90% sekiranya intubasi dilakukan menggunakan laringoskopi konvensional (Macintosh). Walaupun kesakitan kerongkong biasanya akan pulih sendiri dan tidak mendatangkan keburukan jangka panjang, ia boleh menimbulkan perasaan ketidakpuasan dan ketidakselesaan kepada pesakit selepas pembedahan. Objektif kajian ini adalah untuk membandingkan kadar insidens POST selepas intubasi menggunakan laringoskopi Macintosh berbanding dengan laringoskopi video C-MAC® pada selang waktu tertentu selepas pembiusan. Kajian prospektif kawalan secara rawak ini terdiri daripada 128 orang pesakit bertaraf "American Society of Anesthesiologists" (ASA) I dan II yang telah mendapat pembiusan penuh dan menjalani pembedahan elektif di Pusat Perubatan Universiti Kebangsaan Malaysia. Semua pesakit dalam kajian mempunyai struktur pernafasan yang normal dan dibahagikan secara rawak kepada Kumpulan 1 yang menggunakan laringoskopi Macintosh dan Kumpulan 2 yang menggunakan laringoskopi video C-MAC® untuk prosedur intubasi. Pesakit dipantau mengikut gejala sakit kerongkong, serak suara, sukar menelan dan batuk pada tempoh pemulihan, 6 jam, 12 jam dan 24 jam selepas intubasi. Tahap keparahan gejala POST ditentukan dengan menggunakan skala penilaian numerikal (NRS). Kajian menunjukkan kadar insidens POST adalah lebih tinggi untuk kumpulan yang menggunakan laringoskopi Macintosh (61.9%) berbanding dengan kumpulan yang menggunakan laringoskopi video C-MAC® (47.9%) walaupun perbezaan statistik tidak signifikan (p=0.107). Skala kesakitan median

Address for correspondence and reprint requests: Yeoh Chih Nie. Department of Anaesthesiology and Intensive Care, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latiff, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia. Tel: +603-9145 5555 Email: yeoh@ukm.edu.my

yang digunakan untuk menilai tahap gejala POST adalah rendah untuk kedua-dua kumpulan dan tiada perbezaan bererti. Insidens untuk gejala serak suara, sukar menelan dan batuk untuk kedua-dua kumpulan selepas pembedahan juga tiada perbezaan yang signifikan. Kesimpulannya, kadar insidens POST selepas intubasi menggunakan laringoskopi video C-MAC® adalah setanding dengan laringoskopi konvensional Macintosh. Kajian ini mendapati gejala POST selepas intubasi bagi kedua-dua kumpulan adalah rendah.

Kata kunci: faringitis, intubasi, laringoskopi, serak suara

ABSTRACT

Postoperative sore throat (POST) is a common complication with incidence of 30-90% when intubation was done using conventional Macintosh laryngoscope. Although POST is usually self-limiting and with no long-term morbidity, it can lead to patient's discomfort and dissatisfaction in the postoperative period. The objective of this study was to compare the incidence of POST following intubation using Macintosh laryngoscope and C-MAC® videolaryngoscope (VL) at various time intervals post anaesthesia. This prospective randomised controlled study comprised of 128 patients with American Society of Anesthesiologists (ASA) I and II status who underwent elective surgery under general anaesthesia in Universiti Kebangsaan Malaysia Medical Centre. All recruited patients have normal airway and divided randomly into Group 1 and Group 2 that used Macintosh laryngoscope and C-MAC® VL during intubation, respectively. Patients were evaluated for sore throat, hoarseness of voice, dysphagia and coughing at recovery, 6 hours, 12 hours and 24 hours after intubation. Severity of POST was assessed using numerical rating scale (NRS). Incidence of POST was found to be higher in the Macintosh laryngoscope group (61.9%) compared to C-MAC® VL group (47.9%) although the difference was not statistically significant (p=0.107). Median pain score was used to assess the severity of POST, showing low and comparable in both groups at all time intervals. There were also no significant differences seen in hoarseness of voice, coughing and dysphagia for both groups during postoperation. Incidence of POST following intubation using C-MAC® VL and conventional Macintosh laryngoscope were comparable. This study revealed that severity of POST was generally low in both groups.

Keywords: hoarseness, intubation, laryngoscope, pharyngitis

INTRODUCTION

Securing the airway by means of endotracheal intubation is a routine procedure in general anaesthesia. Following intubation, postoperative sore throat (POST) is a common complication with reported incidence

of 30-90% (McHardy & Chung 1999; Geng et al. 2015; Lee et al. 2017). Although POST is usually self-limiting and with no long-term morbidity, it can lead to patient's discomfort and dissatisfaction in the early postoperative period.

The cause of POST is multifactorial and various ways were suggested to reduce it. In a systemic review by El-Boghdadly et al. (2016), some potential risk reduction interventions for POST were suggested such as smaller endotracheal tube (ETT), limiting cuff pressure, intravenous, topical or inhaled steroids, topical non-steroidal anti-inflammatory drugs (NSAIDs), liquorice, magnesium and ketamine gargle. Videolaryngoscopy (VL) was suggested as well but the studies focuses on Glidescope® and AirWay Scope® (Najafi et al. 2014; Nakanishi et al. 2016).

Direct laryngoscopy (DL) remains the gold standard technique for intubation. It requires alignment of the oral-pharyngeal-laryngeal axes for optimal glottic visualisation. In doing so, it may require lifting forces of 12-42 N to expose the glottis (Nakanishi et al. 2016). In a simulator study where intubation attempts were carried out by novice physicians, it found that the maximum force applied on the tongue was higher by using DL than VL (Nakanishi et al. 2016). Another study on actual patients also showed that the peak lifting force on the base of the tongue during laryngoscopy was lesser with the application of Glidescope® VL than the Macintosh DL (Russell et al. 2012).

It is surprising that reduction in the incidence of POST has not been consistently shown in intubation using VL in comparison to DL. After all, VL confers direct view of airway anatomical structures during intubation. In a Cochrane systemic review, Lewis et al. (2017) found that there was no statistically significant difference in the incidence of sore throat in post anaesthesia care unit and 24 hours postoperation. Many of these studies used Glidescope® for intubation rather than C-MAC® (Karl Storz) which is the VL most commonly used in our institution.

This study was carried out to investigate the effects of standard C-MAC® VL in reducing the incidence of POST at various time intervals post anaesthesia and the associated features of POST such as cough, hoarseness of voice and dysphagia.

MATERIALS AND METHODS

This prospective single-blind randomised controlled study had obtained approval from the Research Committee of Department of Anaesthesiology & Intensive Care, Universiti Kebangsaan Malaysia Medical Centre (UKMMC) and the Medical Research & Ethics Committee, UKMMC (FF-2018-054). Written informed consent was obtained from all patients who were scheduled for elective surgery under general anaesthesia with endotracheal intubation in UKMMC from June 2018 till March 2019.

We recruited 128 patients aged between 18-65 years old with American Society of Anesthesiology

(ASA) I and II status, who had undergone surgery in less than four hours with patient's head in supine and neutral position. Patients with potential difficult airway, planned surgery on the neck, oral cavity, pharynx or larynx, surgery requiring insertion of throat pack or nasogastric tube, pregnant patients, patients with pre-existing sore throat, and morbidly obese patients of body mass index (BMI) >35kg/m^2 were excluded in this study.

Patients were divided randomly by computer-generated random table into Group 1 or Group 2 where endotracheal intubation was done using Macintosh laryngoscope and C-MAC® video laryngoscope, respectively.

In the theatre, patients were placed supine and in the optimal intubating position. Standard monitoring consisting of electrocardiography, non-invasive blood pressure monitor, pulse oximetry and capnography. An appropriate sized ETT was selected based on the patient's gender and body size – ETT size 7.0-7.5 mm for females and ETT size 7.5-8.0 mm for males. The ETT cuff was tested for leaks and lubricated with KY jelly® prior to use. A lubricated ETT stylet was inserted to facilitate intubation.

All patients were preoxygenated for three minutes and given general anaesthesia using intravenous (IV) fentanyl 2 mcg/kg, IV propofol 2 mg/kg followed by IV rocuronium 0.6 mg/kg to facilitate endotracheal intubation. Mask ventilation was carried out for 3 minutes with sevoflurane in 100% oxygen to achieve minimal alveolar concentration (MAC) of 1.0-1.2. Endotracheal intubation was done using either Macintosh laryngoscope (Group 1) or C-MAC® video laryngoscope (Group 2). Intubation characteristics, namely application of external laryngeal pressure to aid glottis visualisation using the backward upward right pressure (BURP) manoeuvre, use of airway adjuncts such as gum elastic bougie, number of intubation attempts and Cormack & Lehane score were recorded. Successful intubation was confirmed by capnography and auscultation. The ETT cuff was inflated to achieve a cuff pressure of 25 mmHg, using the VBM® pressure manometer. The cuff pressure was monitored hourly and maintained less than 25 mmHg throughout surgery. Patients who required more than two intubation attempts were dropped out from the study.

Intravenous morphine 0.1 mg/kg was administered for intraoperative analgesia. Patients with surgery exceeding four hours were also dropped out from the study. At the end of surgery, neuromuscular blockade was reversed with neostigmine 0.05 mg/kg and atropine 0.02 mg/kg. Aggressive suction during extubation using Yaunkeur suction device was avoided. Extubation was carried out once patient was conscious, able to obey command and had adequate return of muscle power. Duration of anaesthesia was defined as the time interval between starting of anaesthesia induction until extubation and it was recorded.

Postoperatively patients were transferred to the recovery bay for observation. Assessment for POST was

carried out at recovery, 6, 12 and 24 hours post intubation. The severity of POST was graded using Numerical Rating Scale (NRS), in which 0 indicated no pain and 10 indicated worse pain. Presence of other complaints such as cough, hoarseness of voice and dysphagia were also assessed by direct questioning.

Sample size was calculated using PS Software version 3.0 based on Fleiss et al. (1980) formula. We calculated our sample size using incidences of POST from previous study (Aqil et al. 2017) between Glidescope® and Macintosh group (31.4% versus 58.6%). With power of study at 80%, alpha value of 0.05 and 10 % dropout, our estimated sample size was 128 patients.

All data analysis was performed using SPSS for Windows version 23.0 (IBM Corp, Armonk, NY, USA). Results were presented as mean ± standard deviation, median (interquartile range) or frequency (percentages) where appropriate. For between-group analysis, independent t-test or Mann-Whitney U test were used for normally distributed continuous data and not normally distributed data, respectively. The qualitative data analysis was done using Chi-square or Fisher exact test if insufficient numbers were present. A *p* value less than 0.05 was considered as statistically significant.

RESULT

Out of 128 patients, only two patients dropped out due to prolonged surgery (more than four hours). The demographic and intubation data were shown in Table 1. Both groups were comparable in terms of gender,

Table 1: Demographic and intubation data. Values are expressed in number (percentages) or mean ± sd where appropriate

	Group 1 (n=63)	Group 2 (n=63)	p value
Age (years)	44.9 ± 13.2	45.1 ± 13.0	0.914
Body Mass Index (kg/m^2)	26.6 ± 4.2	25.3 ± 4.1	0.087
Gender			
Male	13 (20.6)	15 (23.8)	0.668
Female	50 (79.4)	48 (76.2)	
ASA			
I	25 (39.7)	22 (34.9)	0.581
II	38 (60.3)	41 (65.1)	
External Laryngeal Pressure			
Yes	29 (46.0)	25 (39.1)	0.471
No	34 (54.0)	38 (60.3)	
Use of airway adjuncts			
Yes	6 (9.5)	5 (7.9)	0.752
No	57 (90.5)	58 (92.1)	
Number of intubation attempts			
1	56 (88.9)	57 (90.5)	0.770
2	7 (11.1)	6 (9.5)	
Duration of intubation (min)	142.0 ± 51.0	130.0 ± 480	0.209

age, ASA status, BMI, application of external laryngeal pressure, number of attempts and Cormack & Lehane score. We noted there was bucking on ETT during extubation in both groups, with incidence of 25.4% in the Macintosh group, and 22.2% in the C-MAC® group. During extubation, we also found that 4.6% of the patients had blood-stained ETT. Both adverse events were not statistically significant (p= 0.543 for bucking on ETT and p=0.403 for blood stained ETT).

Incidence of POST namely hoarseness of voice, coughing and dysphagia was shown in Table 2 and were compared at different time intervals. Overall incidence of POST in our study was 54.0%. Incidence of POST was lower in the C-MAC® group than Macintosh group but statistically insignificant. Incidence of hoarseness of voice, postoperative coughing and dysphagia between two groups were comparable at all time intervals. Severity of POST through assessment of NRS was shown in Table 3. Median pain scores were low in both groups at all time intervals and were not statistically significant.

DISCUSSION

Up to date, there was no paper

Table 2: Comparison of postoperative sore throat, hoarseness of voice, coughing and dysphagia at different time intervals and their respective overall incidences. Values are expressed in number (percentage).

Time	Group		p value
	Macintosh (n=63)	C-MAC (n=63)	
Postoperative Sore Throat			
Recovery	23 (36.5)	15 (23.8)	0.120
6 hours	29 (46.0)	25 (39.7)	0.471
12 hours	24 (38.1)	16 (25.4)	0.126
24 hours	15 (23.8)	11 (17.5)	0.379
*Overall incidence of postoperative sore throa*t	39 (61.9)	30 (47.9)	0.107
Hoarseness of voice			
Recovery	28 (44.4)	24 (38.1)	0.469
6 hours	39 (61.9)	39 (61.9)	1.000
12 hours	21 (33.3)	27 (42.9)	0.271
24 hours	8 (12.7)	16 (25.3)	0.070
Overall incidence of hoarseness of voice	42 (66.7)	43 (68.3)	0.849
Postoperative coughing			
Recovery	7 (11.1)	5 (7.9)	0.544
6 hours	6 (9.5)	13 (20.6)	0.081
12 hours	11 (17.5)	14 (22.2)	0.503
24 hours	17 (27.0)	13 (20.6)	0.403
Overall incidence of postoperative coughing	19 (30.1)	18 (28.6)	0.845
Dysphagia			
Recovery	2 (3.2)	1 (1.6)	0.559
6 hours	1 (1.6)	1 (1.6)	1.000
12 hours	1 (1.6)	1 (1.6)	1.000
24 hours	0 (0.0)	0 (0.0)	-
Overall incidence of dysphagia	2 (3.2)	1 (1.6)	0.559

Table 3: Severity of POST using numerical rating scale (NRS) presented as median (25th-75th percentile)

NRS	Macintosh	C-MAC	p value
At recovery bay	0 (0-2)	0 (0-2)	0.104
6 hours post intubation	0 (0-2)	0 (0-2)	0.204
12 hours post intubation	0 (0-2)	0 (0-1)	0.053
24 hours post intubation	0 (0-2)	0 (0-1)	0.170

Numerical rating scale (NRS) is a verbal rating pain scale from 0 to 10. Zero indicates no pain and 10 indicates worst pain ever experienced

comparing C-MAC® VL conventional blade with Macintosh laryngoscope in normal airway patient. Aziz et al. (2012) compared C-MAC® and Macintosh laryngoscope in the setting of predicted difficult airway. They found that the incidence of dental trauma, sore throat, sore throat severity and oxygen desaturation were not significantly different.

Najafi et al. (2014) and Aqil et al. (2017) studied POST after intubation with Macintosh laryngoscope versus Glidescope® and both studies found reduced incidence and severity of POST in Glidescope® group. Similar comparison by Cirilla et al. (2015), showing no difference in POST with sample size of 151 patients. In the present study, we found no significant difference between C-MAC® VL and Macintosh laryngoscope in terms of POST. This was similar with the findings in a Cochrane systemic review by Lewis et al. (2017). However, majority of the papers compared other videolaryngoscopes (VL) such as Glidescope®, AirWay Scope® with Macintosh laryngoscope (Lewis et al. 2017).

POST is a complication after tracheal intubation. It is usually self-limiting and resolve within 24 hours. Incidence of POST in the present study was consistent with reported incidence, up to 62% following general anaesthesia (Lee et al. 2017).

From the literature review, C-MAC® VL required lower force at the tongue base in comparison to Macintosh laryngoscope (Nakanishi et al. 2016). It was mentioned that lower force can reduce hemodynamic changes but amount of force that can cause tissue damage was not studied. Besides, intubation time for C-MAC® VL was longer than Macintosh laryngoscope (Aziz et al. 2012; Hodgetts et al. 2011). Although laryngoscopy view was better in C-MAC® VL, it did not promise shorter tracheal intubation because it needed additional time to adjust coordination through the screen. The longer the tissue contacts, the more the tissue injury and inflammation.

Tosh et al. (2018) compared C-MAC® VL D blade and Macintosh laryngoscope and found lower incidence and severity of POST by using C-MAC® D blade. They concluded that C-MAC® D blade had a better visualisation during laryngoscopy. This is probably contributed by its blade tip is more angulated. Our study used C-MAC® conventional blade. It has similar curvature and design as per

Macintosh laryngoscope. Thus, both C-MAC® and Macintosh laryngoscope should provide similar view which may explain the lack of difference seen in our study.

Hoarseness of voice is usually self-limiting (Yamanaka et al. 2009). From the literature, it was associated with prolonged ventilation, size of endotracheal tube used and high cuff pressure. In the present study, intubations were performed by trainees with experience more than three years and all intubations were Cormack-Lehane 1 and 2 which were easy and straightforward. As the vocal cords were easily viewed, there is less need for airway manipulation with the laryngoscopes or endotracheal tube. Hence there is less tissue injury and sore throat. This probably accounts for the lack of significance in hoarseness of voice between the groups.

Intubation can also cause dysphagia. Incidence of dysphagia in our study was low and resolved within 24 hours. This was probably because pain was tolerable and did not affect swallowing.

There are a few limitations in this study. Firstly, blinding among operators regarding type of device used was not possible. This may lead to a bias where greater confidence and care when performing intubation using C-MAC® VL. We also did not account for the the variability in intubation techniques, and familiarity of operators during intubation.

CONCLUSION

In summary, we found no difference in the incidence of POST which included sore throat, cough, hoarseness of voice or dysphagia following intubation using C-MAC® VL or conventional Macintosh laryngoscope.

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