A COMPARISON BETWEEN THE GLIDESCOPE AND THE MCCOY LARYNGOSCOPE IN MANIKIN MODEL WITH MANUAL IN-LINE STABILIZATION TECHNIQUE

By

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ABBREVIATIONS

ABC	Airway , Breathing And Circulation
ATLS	Advance Trauma Life Support
C/L	Cormack Lehane
C2-5	Cervical Segment 2 To 5
CLS	Modified Cormack-Lehane Score
CLS	Cormack Lehane Score
CSI	Cervical Spine Injury
ETT	Endotracheal Tube
GlideScope	GlideScope Video Laryngoscope®
Macintosh	Macintosh Laryngoscope
Manikin	Laerdal Manikin Airway
McCoy	McCoy Laryngoscope
MILS	Manual In Line Stabilization Technique
SPSS	Statistical Program Science Program
VAS	Visual Analogue Scale

ABSTRAK

Latarbelakang: Intubasi trakea dalam pesakit kecederaan servikal spinal adalah sesuatu yang mencabar. Kecederaan akut seperti ini memerlukan intubasi trakea laryngoskopi secara terus, dengan teknik standard iaitu "Manual in-line stabilization" (MILS). Malangnya teknik ini menyebabkan kesukaran laluan udara ("Difficult airway"). Secara idealnya intubasi perlu mudah, pantas dan pergerakan servikal spinal yang minimal dalam kecederaan kepala dan leher. Ada kemungkinan alat laryngoskopi bukan secara terus (indirect) seperti GlideScope boleh dijadikan laryngoskopi yang ideal.

Kaedah: Kami mengkaji perbandingan GlideScope dan McCoy laryngoskop dalam model manikin secara teknik MILS. Seramai 47 rakan anestetik terlibat di dalam kajian ini secara prospektif dan kohort. Setelah penerangan ringkas pengunaan GlideScope dan McCoy , setiap peserta melakukan laryngoskopi dan intubasi dengan setiap alatan secara bergilir. Mereka dinilai berkenaan kadar kejayaan intubasi, purata masa intubasi, pemulihan skor glottis dan pilihan laryngoskopi mereka.

Keputusan. Kami mendapati kadar kejayaan intubasi adalah 91.5% di kalangan McCoy laryngoskop dan 87.2% di kalangan GlideScope. Secara statistic ianya adalah tidak signifikan. (Nilai p <0.727). Intubasi menggunakan McCoy laryngoskop adalah lebih cepat dari Glidescope dengan purata masa intubasi masing-masing adalah 24.4 saat ± SD15.97 dan 35.3 saat ± SD 17.56. Nilai p <0.001 menunjukkan data ini adalah signifikan. "Modified Cormack Lehane Score" (CLS) untuk kelas I dan II adalah lebih banyak di kalangan pengguna GlideScope (72.3%) berbanding McCoy (46.8%). Manakala peratusan penambahbaikan CLS kelas IIIb ke IIIa adalah 60% dan kelas

IIIa ke II sebanyak 73%. Pilihan laryngoskop di kalangan peserta adalah McCoy sebanyak 53.2% berbanding GlideScope sebanyak 46.8%.

Kesimpulan: Dalam kajian manikin ini, purata masa intubasi lebih pantas secara signifikan di kalangan pengguna McCoy. Sementara itu pemulihan skor glottis dan komplikasi dental adalah signifikan di kalangan pengguna GlideScope. Tiada perubahan signifikan untuk kadar kejayaan dan kemudahan intubasi di antara dua laringoskop tersebut. Kedua-dua laringoskop menjadi pilihan yang hampir sama di kalangan pengguna kajian. Secara perbandingan prestasi GlideScope adalah setara dengan laringoskop McCoy di dalam kajian kesukaran laluan udara ini ("Difficult airway") ini, kecuali kebaikan pemulihan yang besar pada skor glottis. Walaubagaimanapun ini tidak menyebabkan intubasi lebih cepat dan mudah daripada McCoy. GlideScope mungkin alternatif yang sesuai dalam pengurusan kesukaran laluan udara ("Difficult airway management") walaubagaimanapun ujian klinikal perlu dilakukan ke atas pesakit.

ABSTRACT

Background: Intubation of the trachea in patients with cervical spine injury is a challenging situation. Such acute trauma that requires direct laryngoscopy is accomplished with a standard manoeuvre of manual in-line stabilization technique. Unfortunately this technique creates unnecessary cause of difficult airway. Ideally intubation should be easy, fast and cause minimal cervical spine movement in cases of head and neck injury. There is a hope of indirect laryngoscopy with the GlideScope to achieve these goals.

Methods: We did a study comparing the GlideScope with the McCoy laryngoscopes in manual in line stabilization (MILS) technique in manikins. This prospective and cross over study involved a total number of 47 participants who were anaesthetic resident. Following a brief didactic instruction on the GlideScope and the McCoy each participant took turn performing laryngoscopy and intubation with each device. They were evaluated for each device on their success rate of intubation, mean intubation time, glottic score improvement and their preferences of laryngoscopy.

Result: We found that the success rate of intubation was 91.5% among the McCoy laryngoscope and 87.2% among the GlideScope users. Statistically these figures were not significant with p value of 0.727. The McCoy laryngoscope intubations were faster than the GlideScope. The mean times of intubation were 24.4 second ±SD 15.97 and 35.3 second ±SD 17.56, respectively. The p value was significant (p value <0.001). The modified Cormack Lehane Score (CLS) in class I and II were greater with the

GlideScope (72.3%) than the McCoy (46.8%). The CLS at moderate class of glottis IIIb to IIIa was improved for 60% and class IIIa to II for 73%. Among the participants, their preference of laryngoscope was almost the same where 53.2% had chosen the McCoy while another 46.8 % of them favoured the GlideScope.

Conclusion: In this study using manikins, mean intubation time was significantly faster in the McCoy group. On the other hand, the glottic score and dental trauma complications were found to be improved significantly in the GlideScope users. There was no significant difference in the success rate and easiness of intubation. Both laryngoscopes were being equally preferred among the participants. Overall, the GlideScope performance has comparable efficacy with the McCoy in this difficult airway, except it conferred greater improvement in the glottis score view. Unfortunately this did not facilitate intubation faster and easier than the McCoy. The GlideScope may be a good alternative for managing the difficult airway but clinical trials evaluating its use on patients with an actual difficult airway are needed.

CHAPTER ONE

1.0 INTRODUCTION

Managing the difficult airway is a major challenge for anaesthetic personnel. Adequate exposure and experience in this field will ensure airway crisis can be handled in a professional, safe and successful manner. In an emergency situation, process of securing the airway may be end up with failed ventilation which would increase in mortality and morbidity (Peterson *et al*, 2005).

The gold standard in securing the airway according to difficult airway algorithm guideline is to use the fibreoptic with the endotracheal tube for airway intubation (Robert A. Caplan, 2003). However this fibreoptic requires adequate training, experiences and it is fully operator dependent. It also require a well conducive setting such as the operation theatre and may not suitable during an acute airway crisis (Stroumpoulis *et al*, 2009a).

Another alternative in difficult airway management is the McCoy laryngoscope. The McCoy levering laryngoscope is a modified Macintosh laryngoscope, which has a hinged tip controlled by a lever on the handle. This additional feature will be useful to elevate the pharynx structures that obstruct the view of glottis in situation of restricted neck movement and obese patient. This device was found to be a preferred choice than the conventional Macintosh laryngoscope because of the above reason. (Uchida *et al*, 1997)

In relation to this, varieties of airways adjunct have been marketed for difficult airway management. All this tools aim to facilitate the ventilation and intubation by varies of ways such as improved easiness of airways insertion to ensure successful placement of the devices. Even with the popular supraglottic devices such as Laryngeal Mask and

Proseal, the standard endotracheal tube is still the preferred choice. This device does not protect the lung from aspiration making them unsuitable for patient at risk for this complication (Langeron *et al*, 2009).

However there were a potential of new devices, such as indirect laryngoscope in managing difficult airway. The device is known as a GlideScope® video laryngoscope. This device is relatively new in our hospital practices and comparatively is simpler laryngoscope than fibre optic yet has more advantages than conventional laryngoscope. It is mobile, instant ready, easy and may not require much experience to be handled. It was developed by Canadian surgeon John Pacey, MD and became commercially available in late 2001 (Cooper, 2005).

In this study, we would like to determine the role of GlideScope in difficult airway scenario and comparing it with direct laryngoscope. We predicted that the GlideScope is superior then the conventional laryngoscope because it has quick time of intubation, higher success rate intubation, better glottis view and these will reduce potential of difficult airways situation. For the purpose of simulating difficult airway situation we chose manual in line stabilization (MILS) technique with cervical spine injury.

Failure to adequately immobilize the neck during tracheal intubation in patients with cervical spine injuries can result in devastating neurological outcomes (Hastings *et al*, 1993). Anatomic studies that mimic complete C4–5 ligamentous injury demonstrate that manual in line stabilization (MILS) reduces segmental angular rotation and distraction (Lennarson *et al*, 2001).

Consequently, when tracheal intubation was required in patients with potential cervical spine injuries, the rigid cervical collar is removed, and the cervical spine immobilized by means of MILS. However, a key concern is the fact that with cervical spine

immobilization, it is more difficult to visualize the larynx using conventional laryngoscopy (Nolan *et al*, 1993a). Failure to successfully intubate the trachea and secure the airway remains a leading cause of morbidity and mortality, in the operative and emergency settings (Mort, 2005). These issues have prompted, in part, the development of a number of alternatives to the Macintosh laryngoscope, including modifications of the Macintosh laryngoscope such as the McCoy laryngoscope as mentioned before.

It is a challenge to conduct this study as not many literatures could be found related to the device used with MILS in patient with cervical spine injury. However the efficacy of the GlideScope and the McCoy when use in manual in-line intubation is not known and could not been found in any literatures. Due to ethical reason the study has been conducted in the manikin model and the operators that performed an intubation were selected among the anaesthetist's colleagues. We also believe that the study is beneficial and may improve the airway management in cervical spine injury patient of our local setting

Until this moment, the GlideScope is not popular and not widely available in our general and district hospital. We are predicting that the GlideScope has a great advantage to those who are not trained enough in airway resuscitation. These include doctors in outpatient department, the paramedic or volunteers at the scenes of injury who are usually the front -liners. Their early interventions at the scene of event have a vast effect on the consequences of outcome once patient reached the casualty (Herff *et al*, 2009). Using this new device could increase successful intubation rate among them compared to the conventional laryngoscope. This was based from various studies that showed higher success rate among non airway personnel such as paramedic, nurses and medical student using the GlideScope. The success rate was high despite inexperience use with the new device.(Nasim *et al*, 2009, Savoldelli *et al*, 2009, You *et al*, 2009).

CHAPTER TWO

AIM AND OBJECTIVES

2.0 General objective

To compare between the McCoy laryngoscope and the GlideScope in manikin model with manual in-line stabilization technique among the airway provider.

2.1 Specific objective

2.1.1 To determine success rate of intubation with the McCoy laryngoscope and GlideScope in manikin model with manual in-line stabilization technique.

2.1.2 To determine mean time intubation with both the McCoy laryngoscope and GlideScope in manikin model with manual in-line stabilization technique.

2.1.3 To determine which laryngoscope will improve the glottis score with the use of the McCoy and GlideScope the in manikin model with manual in-line stabilization technique

2.1.4 To determine which laryngoscope is the preference among airway provider in situation of cervical spinal injury patient using visual analogue scale

CHAPTER THREE

3.0 LITERATURE REVIEW

3.1 Basic airway management in trauma

In major trauma condition, basic airway management is the first priority and the core skill that every emergency and critical care personnel must employed in order to resuscitate the victim. The trauma victim also may require shock management, control of haemorrhage and other treatment of life-threatening injuries including limbs injuries. However, this trauma victim not only required basic airway management for maintaining airway because this victim may present with various physical circumstances and condition. In this situation, for examples presence of shock, respiratory distress, a full stomach, maxillofacial trauma, cervical spine instability, head injury and cardiovascular combine to increase tracheal intubation difficulty in trauma patient (Smith *et al*, 2001a).

In these circumstances basic airway management algorithm may not be suffice. This difficult airway situation usually was best handled by the experience physician. This is because more attempt of securing the airway and intubation, the greater occurrence of hypoxemia, oesophageal intubation, gastric regurgitation and airway trauma (Domino *et al*, 1999).

3.2 Difficult airway

A difficult airway is defined as the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with laryngoscopy or tracheal intubation or both (Kovacs *et al*, 2007, Robert A. Caplan, 2003). It is also represent a complex interaction between patients factor, the clinical setting and the skills of the practitioner (Robert A. Caplan, 2003). The incidences of difficult airways were from 0.05-18% depending on the definition used and the study setting (Smith *et al.*, 2001a).

The difficult to mask and ventilate patient of the upper airway could be due to inadequate mask seal, excessive gas leak or excessive resistance to the ingress or egress of gas (Robert A. Caplan, 2003). For example having lack of teeth and disfiguring jaw may create ineffective seal with a face mask (Gupta *et al*, 2005). Various test done by the anaesthesiologist to recognised and predict this difficult to mask ventilate patient include Mallampati classification that correlates tongue size to pharyngeal size (Mallampati *et al*, 1985) , measurement of atlanto occipital joint extension and mandibular space assessment (Gupta et al., 2005). However, the use of simple anatomical descriptors or ranking and summating anatomical factors scores to create predictive scales of difficult intubation generally have low specificity especially used by infrequent operators during emergency situation (Crosby *et al*, 1998).

Difficult laryngoscopy occurs when it is not possible to visualise any portion of vocal cord. Difficult laryngoscopy is often defined with the respect to visible anatomic landmarks, often used Cormack-Lehane grading system (Cormack *et al*, 1984). It classified the relationship of glottis opening to it surrounding structure when laryngoscopy is performed. Cormack Lehane grade III and IV generally predict a difficult

laryngoscopy (Cormack *et al.*, 1984). However the grade of glottis viewed were influenced by the operator skill and may vary with different type of laryngoscope.

The reported incidence of difficult laryngoscopy between 2-8 percent in operating room (Crosby et al., 1998) and up to 14 percent in emergency trauma patients (Graham *et al*, 2004). The higher percentage was noted outside the operating room could be due to type of personnel and their level of training, the patient's condition and the use of drugs (Smith *et al*, 2001b).

Difficult intubation occurs when an experienced physician had more than two attempts of laryngoscopy used with the same blade, change in the laryngoscope blade or an adjunct to a direct laryngoscope (e.g. gum elastic bougie) or the use of an alternative device after failed intubation with direct laryngoscopy.

The overall incidence of difficult intubation was 5.8 % in general population (Shiga *et al*, 2005) and up to 17% in respiratory related injuries (Gupta et al., 2005). The factors that may contribute to difficult intubation include presence of poor flexion-extension mobility of the head on neck (Brechner, 1968), large tongue size (Samsoon *et al*, 1987) , a receding mandible and prominent teeth (Block *et al*, 1971).

In non emergency situation of difficult airway, the gold standard of airway tools is to use the fibreoptic intubation technique. An intubation over a flexible fibreoptic bronchoscope is often preferred as it minimise cervical-spine motion, required less mouth opening and higher chances of success (Sahin *et al*, 2004). Nevertheless it is not the perfect tools. It also spent some time to assemble due to separate bulky monitor and long pipe-like devices to be connected. Usually a trained paramedic will be assigned to prepare the device in order prior to its use.

As a result the device may not be available in emergency situation. The device is sensitive and easily damage with it long pipeline lens. The manoeuvre demands an experiences and skills of the operator to handle it. In fact patient cooperation is a highly needed when intubation performed in an awake fibreoptic technique (Sidhu *et al*, 1993).

Numerous alternatives to direct laryngoscopy have been studied. Those include various blade design, laryngeal mask airways and indirect rigid fibre optic laryngoscope. However none of these methods combines with cervical-spine immobility are superior than fiberoptic bronchoscope (Sahin et al., 2004).

The effectiveness of GlideScope and conventional laryngoscope (Macintosh) has been studied in both real patient and manikin model. It has been shown that the GlideScope could offer an adjunct tool in difficult airway (Benjamin *et al*, 2006). The use of the GlideScope showed advantages than conventional laryngoscope when used by paramedic in normal and simulated difficult intubation scenario of manikin subject. It has been shown that it has a higher success rate and faster in time of intubation in experienced anaesthetists (Sajid Nasim, 2009).

3.3 Complications of difficult airway management

The complications of difficult airway may cause significant impact such as in the event of death or hypoxic brain damage. It also can be minor effect for example dental trauma (Smith *et al.*, 2001a). The reported complication in emergency intubation has shown that 3% death occurred within 30 minutes and 1% of pneumothorax (Schwartz *et al*, 1995). In the same study also noted that oesophageal intubation was noted to be 8 % whereas right main-stem bronchus intubation and rate of aspiration pneumonia of 4% respectively.

Drugs given during intubation procedure also may cause complication of the airway management. The risk of hypotension and cardiac arrest during emergency airway management is increased in patient who have high sympathetic tone and preload dependent cardiovascular systems for example in cardiac tamponade and severe hypovolemia (Schwab *et al*, 1998).

3.4 Cervical spine injury

There were 10% incidence of head and neck injuries co-exist with cervical spine injuries (CSI). CSI occurs in 2-5 % of blunt trauma patient were reported in United State according to US trauma centre between year of 1999 and 2001(Lowery *et al*, 2001). Out of these figure 7-14% were categorized as unstable segments (Ajani AE *et al*, 1998;). However in Malaysia, there were still lacked of published data to compare with other country.

In general, CSI occur most commonly between the ages of 15 and 45 years. There were 70% incidence occurs in men's than in women's (Lowery DW *et al*, 2001). The National Emergency X-Radiography Utilisation Study (NEXUS) has revealed that the C2 is the

most common cervical level fracture, accounting for 24%. The dislocation of the cervical spine occurred most common at the C5/6 and C6/7 level. Fracture of the vertebra body and the odontoid were likely to be associated with instability.

Missed CSI can have disastrous outcome if it is not detected early. The incidence of missed or delayed diagnosis were 1-5%, in which 30% of the patients developed secondary neurological damage (Davis JW *et al*, 1993). This happened when there were inadequate and incorrect interpretations of the cervical x-ray films.

The treatment of seriously injured patients requires rapid assessment of the injuries begin from the site of casualty. Apart from conventional of airway, breathing and circulation (ABC) the cervical spine injuries (CSI) must be presumed until it is excluded. There was consensus on how to recognize the cervical spine injury in patients who are alert but in unconscious victims the strategy are more controversial. (Pasquale M, 1998; Marion *et al*, 2000).

Before 1970s, the emergency care giver did not consistently immobilize the cervical spine. Previous researchers has found that three patients deteriorated while in the emergency rooms and seven others after the neck immobilization were not provided (Bohlman HH, 1979). This secondary injury, in another study was estimated ranging from 10-25% (Crosby, 1992). However, when the practice of cervical immobilisation become worldwide, more patients presented with intact neurological function (Crosby, 1992).

Current Advance Trauma Life Support (ATLS), has recommended a guidelines in managing patient with known and suspected of cervical spine injury (American College of Surgeons, 2004). The paramedic who first handled the patient should exclude the CSI. They should protect them with a cervical collar (Philadelphia) and hard board support