Airway Management of a Neck-Burned Child with Mc-Grath Series 5 Videolaryngoscope and Gum Elastic Bougie

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Abstract: *Background:* Anesthetic management of a neck-burned child presents many problems but especially airway difficulties are characteristic. In addition to differences between pediatric and adult airway, concomitant challenges of postburn sternomental contractures may lead to the catastrophic outcomes. Videolaryngoscope is an alternative intubation device which improves laryngeal view and does not require a direct glottic view. Gum elastic bougie is also a well-known and valuable aid for management of difficult intubation.

Case Report: We presented a successful airway management of a 10 year old boy underwent post-burn contracture releasing surgery for his neck and left upper extremity with Mc-Grath Series 5 videolaryngoscope and gum elastic bougie. The patient had limitation in neck mobility because of severe burn contracture (patient's neck was contracted in the flexed position, his chin and lower lip was restrained down to the anterior trunk) with lack of any respiratory disorder. After preoxygenation we administered anaesthesia induction. Mask ventilation was failed because of excessive gas leak. So we inserted laringeal mask airway without significant desaturation. After providing adequate ventilation we administered muscle relaxant. After two unsuccessful attempts we performed intubation with Mc-Grath Series 5 videolaryngoscope and gum elastic bougie. We confirmed correct tube placement via capnograph.

Conclusion: Concurent use of Mc-Grath Series 5 videolaryngoscope and gum elastic bougie in management of pediatric difficult airway is suitable as an alternative technique.

Keyword: Pediatric airway management, Mc-Grath Series 5 Videolaryngoscope, gum elastic bougie, post-burn neck contracture.

1. INTRODUCTION

Anesthetic management of a neck-burned child presents many problems but especially airway difficulties are characteristic. In addition to differences of pediatric airway(relatively larger tongue, shorter jaw, narrower cricoid cartilage, longer palate and epiglottis, increased risk of laryngospasm, etc.) concomitant challenges of postburn sternomental contractures (such as flexion contracture, restricted mouth-opening, subglottic stenosis, tracheomalacia, obstructive sleep-apnea, etc.) may lead to the catastrophic outcomes related to the failure of intubation and mask ventilation [1].

Videolaryngoscope (VL) is an alternative intubation device which improves laryngeal view and does not require a direct glottic view. However improved laryngeal view does not always mean an easy intubation. VL is considered more effective with concurrent use of gum elastic bougie (GEB) [2, 3].

In this case we presented a successful airway management of a child who had neck-burn with a Mc-Grath Series 5VL and a GEB.

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2. CASE REPORT

A 10 year-old ASA II Syrian war victim boy with 24kg body weight underwent post-burn contracture releasing surgery for his neck and left upper extremity.

On preoperative examination, the patient had limitation in neck mobility because of severe burn contracture (Figure **1, 2**) but his larynx and trachea were not affected by burn with lack of any respiratory disorder. We predicted a grade III or IV Cormack Lehane (CL) view using classical Macintosh blade because within the Class III Modified Onah Classification, patient's neck was contracted in the flexed position, his chin and lower lip was restrained down to the anterior trunk [4, 5].

After preoxygenation via 100% oxygen for three minutes of tidal volume breathing we administered 1mg midazolam, 25mcgr fentanyl, 20mg lidocaine and 100mg propofol as anaesthesia induction. It was not possible to provide adequate ventilation because of excessive gas leak between the face and seal of the mask. So we inserted easily size 2.5 classical laringeal mask airway (LMA), lubricated with lubricating jelly and inflated to minimal occlusive volume without significant desaturation. After providing adequate ventilation and maintenance of anesthesia via 2.5% sevoflurane we

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Figure 1: Right aspect of the patient.

Figure 2: Left aspect of the patient.

administered 20mg rocuronium for muscle relaxation. We obtained grade 4CL view with classical Macintosh blade. Considering the limitation in extension of the neck and to reduce the number of attempts we performed laringoscopy with McGrath Series 5VL (Aircraft Medical, Edinburgh, UK) and grade 2 CL view was obtained. An unsuccessful attempt was done with a 5 number endotracheal tube (ETT) (malleable stylet inserted and curved as the curve of the VL blade) because it was stuck on the blade of VL.

After this we ventilated the patient via LMA again, then a 10Fr x 70cm coude tip GEB(SunMed Medical, Largo FL, USA) was advanced into the trachea with VL and we railroaded the 5 number ETT through the GEB. We confirmed correct tube placement via capnograph.

After the maintanance of anaesthesia without complication and the patient regained his airway reflexes the ETT was successfully removed. After fully recover of the patient, he had nothing to complain about his throat. Postoperative courses were uncomplicated, too.

3. DISCUSSION

In an anticipated difficult airway preparation of the theatre is essential. As a precaution for failed airway we prepared GEB, VL, different number airways, face masks, LMAs, ETTs. Surgical team was also ready for urgent tracheostomy and in case of difficult intubation we planned intubation after surgical scar release as an alternative. We decided that it was not appropriate choice for this patient because CL view of laryngoscopy and anatomically borderline state with respect to other cases [6, 7].

Although most children have an easily managed, normal airway [8, 9] they have also higher oxygen demand and risk of hypoxemia. In addition challenges of postburn sternomental contractures such as flexion contracture, restricted mouth opening, subglottic stenosis, tracheomalacia, obstructive sleep apnea, etc. may lead to the catastrophic outcomes related to the failure of intubation and mask ventilation. In a study by Jeong *et al*, the incidence of CL grade III and IV view was 39.4% in adults who has postburn sternomental contracture and there were significiant correlation between modified Onah Class 2b, 3 and the CL grade III and IV view [5].

Difficult mask ventilation should also be kept in mind for these patients thereby rocuronium is the better choice as a relaxant because of its fast reversal by sugammadex [1].

In a such case the decision of the best and the safest technique is arguable. Different laryngoscope blades, awake intubation, flexible fiberoptic intubation (FFI), intubation through an intubating LMA, lightwand or providing surgical airway are considerable techniques in such a case.

Because the oxygen consumption of children is higher and time to desaturation after induction during the procedure is less than adults'; we must focus on the fastest technique too.

Awake intubation should be considered but it requires more experience and not appropriate for pediatric and anxious patient. Also inadvertent loss of the airway and complete airway obstruction during the attempted awake intubation was possible in a burned patient [10].

Although FFI is currently the gold standard for elective difficult airway management, this equipment can be unavailable in the most of the centre like our institution and it requires experienced anesthesiologist. In a manikin study Jepsen *et al*, showed that anesthesia residents performed endotracheal intubation(ETI) significantly faster with the McGrath Series 5VL comparing the FFI [11].

A recommendation of a particular device after induction of anesthesia in an anticipated difficult airway is impossible [9] so the point is experience of anesthesist. McGrath Series 5VL has been designed for ETI in patients over 15kg and the blade is adjustable to classical size 2-4 blade [12]. Although VLs have several advantages like better visualisation of the glottic entrance it does not mean a successful ETI. The time to successful intubation can get longer time comparing to conventional laryngoscope too [13].

Intubation via LMA is an alternative technique but without visualisation of the glottis it can be harmful to airway, the technique shows less successful rates and it is difficult to pass the ETT through the LMA [1].

Lightwand is not a suitable choice because scare lesion may obscure the light transillumination through the cricoid cartilage [1].

The advantages and disadvantages of currently commercially available VLs are summarized with paediatric sizes: GlideScope® (Verathon Medical Devices), DCI Video Intubation Systems (Karl-Storz Endoscope), TruView PCD (Truphatek), Airtraq (Prodol) and McGrath Series 5 (Aircraft Medical Ltd.) in Wallace and Engelhardt's review [14]. All devices has several advantages and disadvantages so that there is not suggestible VL for all clinical situations. Authors state that proficiency in one pediatric VL instead of several is essential and cost benefit. Although the length of blade is changeable McGrath Series 5VL's clinical application can be restricted within the older children due to the size and curved shape of blades [14, 15].

It seems to us VLs are going to be used more broadly in the future because of the advantages of their use in education of ETI. It's stated that the learning curve with McGrath is steep and short and the needed number of intubation attempts for providing competency with McGrath is three to four [7]. Another study stated learning intubation of infant younger than 2 years is provided between 10 and 20 attempts [16].

Mousa *et al*, compared C-MAC VL and classic Miller blade laryngoscope for teaching novice users neonatal endotracheal intubation. They found that the success rate was higher (75.2% vs 63.4%, P = 0.03), and time to successful intubation was longer, in VL group (57 vs 47 seconds, P = 0.008). Although time to successful intubation was longer in VL group. In both groups its longer than 30seconds suggested by neonatal resuscitation program and the difference might not be clinically relevant [17, 18].

Contradictory to these findings Sun *et al*, compared VL versus direct laryngoscope (DL) in children in their meta-analysis and found the time to intubation was longer with VLs in comparison to DLs as a preferred primary outcome. They found no significant difference between groups for success rate of the first attempt. Outcome of glottis visualization was heterogenous between studies. Incidance of complications was similar between groups in this meta-analysis. Author declared that further studies are needed to clarify the efficacy and safety of VLs in hands of nonexperts and in children with potential airway problems [13].

After all these debate it must be pointed out that a locally accepted alternative glottic visualisation device (e.g. optical stilette), endoscopic laryngoscope or VL should be available if conventional direct laryngoscopy fails (Plan A) [19].

GEB is a well-known and valuable aid and it can be advanced blindly beneath the epiglottis in patients with part of the glottis or only the glottis visible using conventional laryngoscopes. GEB is described as a key component of the "Plan A" of the guidelines and as

the most successful and effective device for management of the difficult airway [20]. Successful placement of the GEB into the trachea can be ascertained by the “clicks” of the bougie over the tracheal rings, the hold up of the bougie by a small bronchus or the rotation of the bougie as it enters a bronchus. Although there is a few reported complications and trauma of the airway by this technique [21] it is more rational using the GEB with VLs which obtain beter visualization of the glottic enterance. However there is still risk of injury like penetration of the palatal arc and other structures with concomitant use of GEB with VL when it is inserted blindly while looking at the screen of VL [22, 23].

Maassen *et al*, recommended avoiding stylet use because of it’s an important cause of VL assosiated complications [24].

It is more rational to consider reducing the complications rather than avoiding to use an instrument. Such complications can be reduced by a technique proposed by Holm-Knudsen. This technique consists of four steps; firstly looking in the mouth and inserting the VL, secondly looking at the screen and optimizing the position of the VL, thirdly looking in the mouth and placing the GEB or ETT as close as the tip of the laryngoscope and lastly introducing the GEB toward glottis while looking at the screen to minimize the injury risk [25].

CONCLUSION

Education and training of new technologies - techniques are essential precautions for airway management. Concurent use of Mc-Grath Series 5VL and GEB in management of pediatric difficult airway is suitable as an alternative technique.

CONFLICTS OF INTEREST

No conflicts of interest declared.

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