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The Use of McGrath® MAC Video Laryngoscope in Difficult Airway

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Authors' contributions

This work was carried out in collaboration between both authors. Author AYHT conceptualized the idea and edited the manuscript, while author RVA did the literature search and wrote the first draft of the manuscript. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Rigid indirect video laryngoscopes were designed to aid glottis visualisation in difficult airway. The McGrath® MAC video laryngoscope was designed similarly for routine use. The unique design of the blade makes it easy to use in patients with limited mouth opening and facilitates tracheal intubation without use of stylet. It is compact and easy to assemble with preparation time less than one minute making it a reasonable choice in cases of unanticipated difficult intubations. This case series demonstrates its successful use as a rescue device in patients with difficult intubation. One of the patient was intubated awake with the help of McGrath® MAC video laryngoscope thus making it an attractive alternate for fibre optic bronchoscopy assisted tracheal intubation.

Keywords: Video laryngoscope; McGrath® MAC; difficult intubation; awake intubation.

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1. INTRODUCTION

Rigid indirect laryngoscopes were designed to aid in the visualisation of the larynx in situation of a difficult airway. A video laryngoscope involves the electronic transmission of digital image from the video camera located at the tip of the device to the video screen where the image is displayed. The McGrath® MAC video laryngoscope was designed and marketed by Aircraft Medical Limited for routine use. We report three cases of successful tracheal intubation in situation of difficult airway with the McGrath® MAC video laryngoscope, including an awake intubation.

2. CASE 1

The patient was a 43 years old Chinese female with no significant past medical history. Her airway assessment revealed Malampatti class 2, thyromental distance of 4 cm with normal mouth opening and no limitation of neck movement. She was considered to be borderline obese with BMI of 30 kg/m^2. However difficult airway was encountered during two previous surgeries.

The first surgery was an emergency lower segment caesarean section and was planned to be done under general anaesthesia. Upon induction of anaesthesia, ventilation via face mask was easy but multiple attempts at laryngoscopy revealed grade 3 laryngeal view according to Cormack and Lehane classification [1] but tracheal intubation was unsuccessful. The attempts were performed with the aid of stylet, bougie and flexible tip direct laryngoscope. General anaesthesia was reversed and subarachnoid block was performed instead for the surgery when she was awake.

Similarly, six years later she was planned for laparoscopic adhesiolysis and cauterisation of endometriosis under general anaesthesia. In view of a known history of difficult airway, awake flexible fibre-optic bronchoscope assisted intubation was attempted. However, great difficulties were encountered due to a very anterior larynx and patient discomfort. She was only successfully intubated on the third attempt.

She was subsequently listed for elective laparoscopic total abdominal hysterectomy, bilateral salphingectomy and right oophrectomy to be performed under general anaesthesia. Based on the previous two airway findings, she was deemed to be a case of difficult airway again. The various options of airway intubation were discussed with the patient and decision was made to perform tracheal intubation under general anaesthesia since airway and ventilation can be maintained via facemask. Preparations were made for the flexible fibre optic bronchoscope and difficult airway equipments to be within immediate access. In the event of the need for an emergency surgical airway, the otorhinolaryngologist was also informed to be present in the operating room complex. She was induced with 130 mg of intravenous propofol, muscle paralysis was achieved with 30 mg of intravenous atracurium after easy mask ventilation was ascertained. She was maintained on 100% oxygen and 5% desflurane. Direct laryngoscopy was performed with the McGrath® MAC video laryngoscope which showed a grade 3 laryngeal view according to the Cormack and Lehane classification. The laryngeal inlet was visualised on the video screen with partial obscuration of the anterior extremity. Tracheal intubation was performed successfully on the first attempt using a size 7.5 endotracheal tube with a stylet *in situ*.

3. CASE 2

The second patient was a 52 years old Chinese female with no significant past medical history. She was scheduled for laparoscopic bilateral salpingo oopherectomy and adhesiolysis under general anaesthesia. Airway assessment revealed Mallampatti Class 2, thyromental distance of 4.0 cm, limited mouth opening of 3 cm and full range of neck movement. Difficult airway was anticipated and equipments for difficult airway were within immediate access.

The patient was induced with 150 mg of intravenous propofol and 75 mcg of fentanyl. Upon demonstration of easy mask ventilation, 30 mg of intravenous atracurium was administered. After three minutes of mask ventilation with 100% oxygen and 1.5% Sevoflurane, direct laryngoscopy was performed with size 3 Macintosh blade laryngoscope and revealed grade 4 laryngeal view according to the Cormack and Lehane classification. Flexible tip direct laryngoscope with a size 3 blade was used on the second attempt which did not improve the laryngeal view significantly. Tracheal intubation was attempted with a bougie resulting in oesophageal intubation. Patient was mask ventilated in between the intubation attempts to maintain oxygen saturation at 100%. The McGrath® MAC video laryngoscope with size 3

blade was used on the third attempt. The larynx was visualised on the video screen showing only the posterior extremity and successful tracheal intubation was finally achieved with the aid of a bougie.

4. CASE 3

The third patient was an 83 years old Chinese female with known medical history of ischemic heart disease, sick sinus syndrome on permanent pace maker, poorly controlled diabetes mellitus and nasopharyngeal carcinoma treated with radiotherapy but complicated with osteonecrosis of paranasal sinuses. She presented with one day history of worsening stridor necessitating tracheal intubation at the emergency department. Her airway assessment showed Malampatti class 4, thyromental distance of 5 cm, limited mouth opening of 3 cm and limited neck extension. In view of her medical history and anticipation of difficult airway, decision was made for awake flexible fibre optic bronchoscopy assisted intubation in the operating room to secure the airway. The otorhinolaryngologist was also on site in event of the need for emergency surgical airway.

Airway anaesthesia was achieved with 4 ml of nebulised 1% lignocaine and topical sprays of 10% lignocaine to the oropharynx and nasopharynx. Bronchoscopy was first attempted by a skilled anaesthesiologist with at least ten years of experience through the nose but was unable to obtain a clear passage due to extensive post-radiation scarring. Subsequent attempts were performed through the mouth but were unsuccessful due to patient discomfort, copious amount of secretions, mucosal oedema and faulty instrument with suboptimal optics. Subsequently, McGrath® MAC video laryngoscope with size 3 blade was used and showed only the posterior extremity of the larynx on the video screen. Topical 2% lignocaine spray was applied to the larynx before a bougie was used to assist in the successful tracheal intubation of a size 7.5 endotracheal tube.

5. DISCUSSION

Airway management has always been a challenge even to the experienced anaesthesia care provider. Due to the nature of time sensitivity and unpredictability, failures of timely airway management were often met with devastating consequences. Based on the closed claims project, difficult intubation is responsible for 6.4% of total claims and 57% of the brain damage or death [2].

Difficult airway in terms of difficult laryngoscopy or difficult intubation became more unpredictable in locations outside the operating theatre, from the emergency department to the general patient wards [3]. The incidence of difficult tracheal intubation in general surgery population ranges from 1.5% to 8% [4] but it increases in patient with cervical spine (20%) or laryngeal pathology (30%) [5]. The success of intubation depends upon number of factors which includes but not limited to patient, environment, person intubating, medications and device used.

Video laryngoscope is a rigid indirect optical device that electronically transmits digital images from the video camera at the tip of the device to be projected on to a video screen. It provides a good view of the larynx when conventional laryngoscopy fails and is being increasingly used for difficult intubations [6,7].

The early video laryngoscope blades were designed based on the anatomy of the tongue and the oropharynx. It was recommended to use stylet with endotracheal tube so as to conform an acute angle that is similar to the video laryngoscope blade [7].

The McGrath® MAC video laryngoscope was a modification of initial McGrath® scope, both of which had been useful in difficult intubations [7,8]. The components of the McGrath® MAC video laryngoscope include a proprietary battery pack, a 2.5 inch liquid crystal display (LCD) video screen, a complementary metal-oxide semiconductor (CMOS) video camera, light-emitting diode (LED) light source and a disposable blade made of optical polymer fixed on to a reinforced internal alloy chassis with a curvature similar to a conventional Macintosh blade.

As illustrated in all 3 cases, the McGrath® MAC video laryngoscope was useful as an adjunct or even as a “rescue device” in situation of a difficult airway. The preparation time needed was less than a minute as it only involved loading the disposable blade on to the scope. The design of the blade allows the displacement of the tongue to the right. The laryngeal view may be further improved with forward and upward movement of the scope which is similar to the conventional direct laryngoscope with the Macintosh blade. This enables it to function both as an indirect laryngoscope as well as a direct laryngoscope. In

most cases, intubation can be achieved without the use of a stylet. Furthermore, being a "non-tracked" rigid indirect optical device, it has a slim design that allows it to be used in patients with relative small mouth opening. Due to its striking similarity with conventional Macintosh laryngoscope, it can be used for routine intubations, hence qualifying itself for routine use as well as for anticipated difficult airways.

The standard of care for an anticipated difficult airway had always been flexible fibre optic bronchoscope assisted intubation in a non-sedated subject [2]. However, there will be situations where such fibre optic equipments are not available or it may require a considerable amount of time to set up. When difficult airway is encountered in the emergency department, general ward, rural hospitals or any other remote locations, a video laryngoscope would be useful as a "rescue" intubating device. This is especially so when it is portable and cost significantly less than a flexible fibre optic bronchoscope. Awake fiberoptic bronchoscopic intubation performed by experienced users with appropriate sedation technique can still result in failure of tracheal intubation. The success rate for fiberoptic intubation ranges from 56% to 98.5% when performed by a skilled operator [9,10]. This may be due to excessive secretions, bleeding or patients who are unable to cooperate. One would need alternative airway techniques when this situation arise. A proper evaluation of the airway may not be feasible in an emergency situation [11], necessitating the need for a reliable, robust and portable intubating device. In a patient whose airway is well anesthetised, indirect laryngoscopy may be better tolerated in awake patient as compared to direct laryngoscopy because it exerts less pressure on the base of tongue [12], as illustrated by case 3. Video laryngoscope also allows suctioning to be done more efficiently with suction catheters that are of bigger gauge than the fiberoptic bronchoscope; video laryngoscope also have wider angle of view, hence likely to have an obstructed view of the larynx.

Numerous studies have reported that video laryngoscopy is easier to learn by both experienced and inexperienced users as compared to direct laryngoscope with Macintosh blade. This is also associated with higher first time success rate [12-15]. A study done on the C-Mac® video laryngoscope by Karl Storz Endoskope, which is also a video laryngoscope with a Macintosh blade, showed that it allows novice users to be trained in both direct and indirect laryngoscopy [12]. By having a continuous video feed of the laryngeal view, the trainer is able to guide the trainee doing the intubation in real time. The McGrath® MAC, being a very portable device measuring 180mm by 68 mm by 110 mm and weighing only 200g, makes a good intubating device for use by the airway code team since portability is of essence. As with any other videolaryngoscope the drawbacks of McGrath® MAC video laryngoscope can be learning cure, technical problem with instrument and cost. Poor visibility due to condensation or contamination by secretions and blood can be an issue. This may be overcome by applying anti-fog solution and suctioning of secretions and blood.

6. CONCLUSION

Based on our experience, the McGrath® MAC scope can be used routinely for intubation so as to overcome the learning curve. The unique design of the blade makes it easy to use in patients with limited mouth opening and facilitates tracheal intubation without use of stylet. It is compact and easy to assemble with preparation time less than one minute making it a reasonable choice in cases of unanticipated difficult intubations. Though desirable but gold standard randomised trials are usually not possible for evaluation of this scopes and we may have to rely on case control prospective studies as an evidence to support our more reliable, individually variable and very personal clinical skills.

CONSENT

All authors declare that informed consent was obtained from the patient (or other approved parties) for publication of this case report.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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