Difficult Airway for Patients Undergoing Spine Surgeries

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INTRODUCTION
The “cannot intubate, cannot ventilate” situation although rare is a nightmare for anesthesiologists. Difficult airway is defined as difficult facemask or supraglottic airway (SGA) ventilation, difficult SGA placement, laryngoscopy, tracheal intubation, or failed intubation. We presented three cases of difficult airway and their airway management.

CASE 1
A 30-year-old male patient presented with ankylosing spondylitis and kyphosis for posterior ostomy, correction, and internal fixation. Physical examination showed fixed extension deformity of the neck with no movement, restricted mouth opening with Mallampati Grade III. The patient could not lie flat and denied snoring at night. Difficult laryngoscopy was anticipated due to stiffness of cervical vertebra and lateral position. Difficult airway cart including flexible fiberoptic bronchoscopy, laryngeal mask airway of different sizes and types, thyrocricocentesis kit, and percutaneous transtracheal jet ventilation were available for back-up. The patient was monitored in the operative room with peripheral oxygen saturation, electrocardiogram, and noninvasive blood pressure. After preoxygenation with 100% oxygen using a mask, general anesthesia was induced with intravenous propofol, rocuronium, and fentanyl. Although the patient had easy facemask ventilation, we had difficulty in placing direct laryngoscopy into the mouth, and the patient was successfully intubated with fiberoptic bronchoscopy. There was no decrease of saturation or fluctuation of blood pressure during intubation. The operation lasted 4 h and the patient was successfully extubated postoperatively.

Case 2
A 9-year-old female patient was scheduled for posterior correction and internal fixation due to congenital arthrogryposis multiplex with scoliosis. She had a history of difficult intubation and the operation was canceled when she was scheduled for the same operation 3 months ago at a local hospital. Preoperative evaluation showed severe cervical–thoracic scoliosis, micrognathism, and short neck with limited extension [Figure 1a]. Her dentition was normal and mouth opening was limited with an interincisoral distance of about 2.5 cm. Mallampati Grade was II and her parents denied snoring at night. Our primary plan was to perform conventional intravenous induction since there was no difficult mask ventilation last time. Difficult airway cart was available for back-up. We also discussed the possibility of surgical airway with surgeons and parents. After preoxygenation, propofol and fentanyl were given intravenously. After confirming the success of bag ventilation, McGrath laryngoscopy revealed Cormack–Lehane Grade II view. The patient was paralyzed with rocuronium. Endotracheal tube was placed and the position was confirmed with capnography. The surgeon successfully did internal fixation from T10 to S1, and the patient was sent to Intensive Care Unit for further observation and extubated 2 h after the operation.
The anterior-posterior X-ray of the patient diagnosed as congenital arthrogryposis multiplex with scoliosis. (b) The anterior-posterior and lateral X-ray of the patient with Klippel–Feil syndrome.

**Figure 1:** 
(a) The anterior-posterior X-ray of the patient diagnosed as congenital arthrogryposis multiplex with scoliosis. (b) The anterior-posterior and lateral X-ray of the patient with Klippel–Feil syndrome.

**Case 3**

A 25-year-old female patient was scheduled for posterior internal fixation and correction due to Klippel–Feil syndrome with scoliosis. X-ray of the cervical spine revealed a fusion of C2-7 vertebrae and partial atlantoaxial fusion [Figure 1b]. The patient had a short webbed neck with limited neck extension and flexion (<20°), lower posterior hairline, and thoracic scoliosis. It looked like her head grew right out of her chest. Her mouth opening was normal and was assessed as Mallampati Grade II. Difficult airway was anticipated, glidescope video laryngoscopy (GVL) was selected as the first choice with fiberoptic bronchoscopy as plan B. Difficult airway cart was also available for back-up. After preoxygenation, the patient was induced with propofol, rocuronium, and fentanyl. The patient had difficult ventilation and GVL revealed Cormack–Lehane Grade IV view. The first two attempts of fiberoptic-guided tracheal intubation failed from oral route and we finally successfully intubated the patient from the nose. Her saturation dropped to the lowest level of 76%. She had an uneventful intraoperative period and extubated successfully after the operation.

**Discussion**

We presented three cases of anticipated difficult airway when tracheal intubation was required. Patients with congenital syndromes, which included Freeman–Sheldon syndrome, mucopolysaccharidoses, and Klippel–Feil syndrome, are at high risk of experiencing difficult airway due to craniofacial deformity. Patients with severe ankylosing spondylitis or cervical developmental abnormalities usually have problems of difficult airway because of limited mouth opening and cervical rigidity. All the three patients were successfully intubated and there was no airway complication or morbidity/mortality related to airway perioperatively. There was few data about the incidence of difficult airway in patients undergoing spine surgeries. The incidence of difficult laryngoscopy was between 4.9% and 13.0% in general adult surgical population[1-3] and 1.35% in pediatric patients.[4] The incidence of difficult mask ventilation was 8.9%.[5] At present, there is no single predictor of difficult intubation or mask ventilation, and Mallampati score is of limited value in predicting difficult airway. Even for senior anesthesiologists, prediction of difficult airway remains a challenge. Hence, preoperative evaluation is important and it is necessary to be prepared for unexpected airway management all the time.

Fiberoptic-guided intubation is the golden standard for elective management of difficult airways. Improvements in airway devices and simulated training of crisis management have provided anesthesiologists more options to handle anticipated or unanticipated difficult airway. SGA has been suggested as the ventilation equipment after unsuccessful initial intubation attempts and inadequate mask ventilation.[11] Moreover, video laryngoscopy can improve laryngoscopic view in patients with anticipated difficult airway.

Unlike other anesthetic techniques, the training of difficult airway management is limited. Although guideline is available, when it really happens, immediate judgment and management are important. Practical and nontechnical skills which include rapid response, correct decision, and teamwork are important for the success of handling this problem. Simulation education has been providing residents and attending opportunities to practice difficult airway algorithm, and it does improve their performance.

For an anticipated difficult airway, it is strongly recommended that the anesthesiologist should have a preplanned strategy depending on the condition of the patient, the skills and preferences of the anesthesiologist, and the equipment available. For unanticipated difficult airway, teamwork and intermittent simultaneous training are always necessary.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Heinrich S, Birkholz T, Iroushek A, Ackermann A, Schmidt J. Incidences and predictors of difficult laryngoscopy in adult patients undergoing general anesthesia: a single-center analysis of 102,305 cases. J Anesth 2013;27:815-21. doi: 10.1007/s00540-013-1650-4.
2. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: A prospective study. Can Anaesth Soc J 1985;32:429-34.
3. Arné J, Descoins P, Fusciardi J, Ingrand P, Ferrier B, Boudigues D, et al. Preoperative assessment for difficult intubation in general and ENT surgery: Predictive value of a clinical multivariate risk index. Br J Anaesth 1998;80:140-6.
4. Heinrich S, Birkholz T, Ihmsen H, Iroushek A, Ackermann A, Schmidt J. Incidence and predictors of difficult laryngoscopy in 11,219 pediatric anesthesia procedures. Paediatr Anaesth 2012;22:729-36. doi: 10.1111/j.1460-9592.2012.03813.x.
5. Cattano D, Killoran PV, Cai C, Katsiampoura AD, Corso RM, Hagberg CA. Difficult mask ventilation in general surgical population: Observation of risk factors and predictors. F1000 Res 2014;3:204. doi: 10.12688/f1000research.5131.1.