CASE REPORT

Endoscopic Intubation with Aid of Mechanical Ventilation via a Dedicated Nasopharyngeal Airway

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A young child with jaw-neck-sternum immobility suffering from acute upper airway obstruction was treated with nasotracheal intubation using flexible endoscope (FE). During this difficult intubation, an inserted trimming endotracheal tube acted as a nasopharyngeal airway and simultaneous supplement with mechanical ventilation through the tube successfully resuscitated and improved the patient's ventilation and oxygenation. This management can greatly facilitate visualization of the laryngeal apparatus and translaryngeal passage of the FE. This technique can be helpful in resuscitative ventilation and difficult intubation in a critical upper airway emergency. [*J Chin Med Assoc* 2007;70(9):400–402]

Key Words: dedicated airway, difficult tracheal intubation, mechanical ventilation, nasopharyngeal airway, neck immobility

Introduction

Urgent airway management is fundamental to intensive care practice, and tracheal intubation is frequently required to ensure adequate airway control in an emergency. In the presence of certain upper airway anatomic variants or pathology, visualization of the glottis by traditional direct laryngoscopy can be difficult. Here, we report a successful flexible endoscope (FE)-aided nasotracheal intubation in an emergent upper airway-compromised child with jaw-neck-sternum immobility using a nasopharyngeal tube (NPT) as a dedicated airway with mechanical ventilation (MV) support.

Case Report

A 3-year-old boy, weighing 12 kg, was admitted to the pediatric intensive care unit after surgical repair (resection of 1.5 cm trachea and end-to-end anastomosis) of an acquired tracheal stenosis due to a previous tracheostomy. To prevent tracheal wound disruption, the jaw was firmly stitched onto the upper sternum skin to prevent the head from turning. He was nasotracheally intubated with an inner diameter 4.5-mm endotracheal tube (ET) and received MV.

Unfortunately, 2 days later, the ET was pulled out accidentally. Immediately, the child showed marked respiratory distress and required urgent re-intubation. Traditional translaryngeal intubation by direct laryngoscopy was impossible because of the fixed posture over the jaw, neck and sternum. Initially, the blind method of nasotracheal intubation was tried but failed after several attempts, and resulted in bloody trauma. The child became worse, with marked sternum retractions and cyanosis. Auscultation revealed no breathing sounds through both lung fields. Pulse oximetry and cardiac monitor revealed rapid deterioration of SaO_2 to less than 50% and bradycardia to less than 40 beats/min. Emergency resuscitative ventilation was started.

First, Ambu-bag mask ventilation with pure oxygen was performed for 2 minutes but without clinical improvement. Breathing effort absence and cardiac beat slowdown toward stopping were noted. Arterial blood gases at this time showed pH 6.93, PCO_2 98 mmHg, and PO_2 22 mmHg, which indicated a severe airway obstruction. Therefore, NPT was tried to attain urgent upper airway access. A trimming conventional cuffed ET, inner diameter 4.5 mm, was selected as the NPT. It was lubricated and inserted via the patient's left nostril and advanced 11 cm (measured from the nostril to the lobule of the left ear) into the

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hypopharynx. The NPT was firmly secured and the cuff was inflated. Suctioning and pure oxygen Ambu-bag mask ventilation via the NPT was performed. Gradually, within 1 minute, the patient's heart rate increased to over 80 beats/min and SaO_2 rose to 95%. Rechecked arterial blood gases revealed pH 7.24, PCO_2 65 mmHg and PO_2 135 mmHg. For further stabilization of the patient, the NPT was connected to MV with settings of 50% oxygen, flow rate of 20 L/min, peak inspiratory pressure of 25 cmH_2O, positive end-expiratory pressure of 5 cmH_2O, and ventilation rate of 25/min.

In a stable patient condition, FE-aided nasal intubation was done. Two percent xylocaine was sprayed into the patient's right nostril and the NPT to achieve local anesthesia. A conventional 4.0-mm inner diameter non-cuffed ET was threaded over a 3.0-mm outer diameter FE (ENT-30PS; Machida, Japan) from the distal end and fixed to the control handle. Then, the FE tip was introduced into the right nostril, under FE visualization, and passed through the nasal tract. When the NPT came into view, a space separated by the NPT and bounded by soft palate, tongue base, and posterior pharyngeal wall was visualized. Further advancing the FE tip alongside the cuffed NPT and passing through the space brought the epiglottis and then the glottis into view. Traumatic swollen mucosa and bloody secretions pooling around the larynx were noted. To achieve a clear field and facilitate subsequent FE procedure, suction via and spraying 3% ephedrine into the NPT were done by an assistant.

Under stable patient condition, when the FE tip was located at the oropharynx, we performed 3 sequential tests under the scope vision to evaluate the NPT pneumatic effect around the larynx. First, we disconnected the MV from the NPT. This caused the collapse of the peripharyngeal space and the laryngeal inlet. The surrounding soft tissue blocked, and even wedged into, the end and side holes of the NPT, especially during the patient's inspiration. Second, a continuous positive airway pressure (CPAP) of 5 cmH_2O was administered via the NPT. This brought an apparent dilation of the hypopharyngeal space and the laryngeal inlet. Third, we changed the CPAP to the MV mode, with the same settings as before. The intermittent peak inspiratory pressure ventilation produced further pulsatile dilation of the whole perilaryngeal lumen, including the hypopharynx, the laryngeal inlet, and the glottis.

With the aid of ventilation via the NPT, the FE tip was smoothly introduced into the trachea. The ET was gently slipped down and positioned at 3 cm above the carina. After verifying the proper position of the ET tip with the FE, the ET was tightly secured over the nare. The MV circuit was shifted from the NPT to the ET, and the NPT removed. Throughout the whole course of FE intubation, the patient's heartbeat was always kept above 90 beats/min and SaO_2 above 95%. No complications were attributed to this management.

Discussion

Swift establishment of a secure airway for ventilation and oxygenation is life-saving in many acute upper airway emergencies where severe respiratory compromise could rapidly progress to cardiac arrest, especially in critical ICU patients. In this child, the potential risk of tracheal wound disruption could have occurred if the head-neck posture was not managed optimally. This child represented a unique condition for emergency and difficult intubation because of his limiting neck extension, mouth opening, severely compromised pharynx, the unfeasibility of using head tilt-chin lift and jaw thrust maneuvers, and the inability to visualize the larynx by conventional laryngoscope.

A temporary and appropriate NPT placement provides a reliable route through which suction, topical medications (vasoconstrictors or anesthetics), oxygen flow and assistant ventilation can be administered. The way that the NPT sits longitudinally helps anterior separation of the soft palate and keeps the tongue away from the posterior pharyngeal wall. The inflated cuff also assists in situating the tube tip in a central position so that the end and side holes do not impinge on the surrounding soft tissue. Compared to the blind approach of FE in a closed hypopharyngeal space, the NPT used in this method can serve as a guide allowing for easier approach of the FE to the glottis, therefore preventing inadvertent trauma to the surrounding tissue. In addition, the administration of positive pressure oxygen ventilation alternating with suction via the NPT to the hypopharyngeal region can disperse local blood and secretions as well as splint and dilate the pharyngolaryngeal airway,[1,2] thereby improving visualization of the larynx[3] and the patient's ventilation and oxygenation.[4] In large children where a big NPT is used, FE and MV may be carried out simultaneously with a special adapter via the same NPT. After the FE is placed in the deep trachea, this NPT can be directly advanced into the trachea and serve as an ET.[5] In fact, in small children, this technique may be preferable with regard to safety and ease of use when compared to the laryngeal mask or ventilating bronchoscope. With the size 1 laryngeal mask airway, it is not possible to simultaneously ventilate and endoscope the patient.

This technique provides a secure method of maintaining airway and ventilation in upper airway-compromised patients, and is also a means of easily locating the glottis during FE. Insertion of an NPT can relieve the airway obstruction at the hypopharyngeal level and spare the critically ill child an unnecessary and potentially hazardous surgical intervention (either tracheostomy or percutaneous transtracheal ventilation). If a patient's respiratory distress is not relieved after an appropriate NPT placement, attention should be given to other possible causes. MV with high concentration of oxygen supplementation via this NPT can further stabilize the patient, allowing enough time for the commencement of subsequent examination and management in a more controlled environment.

In conclusion, our experience with this child demonstrates that the temporary insertion of an ET acting as a NPT, supplementing with MV or CPAP prior to and during FE intubation, can be a useful adjunct to the emergency management of the difficult airway in certain selected cases. The consistent pneumatic splinting action created by the technique facilitates visualization and opening of the glottis, FE instrumentation, and ventilation. The lack of significant complications and the ready accessibility of needed equipment suggest that it may deserve more widespread usage, particularly in patients who possess a compromised upper airway.

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