

Surgical Excision of Postintubation Granuloma Under Jet Ventilation

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Following the use of an endotracheal or tracheostomy tube, circumferential lesions, stenosis, or granulomatous lesions at the cuff level or tip of the tube may be observed on the tracheal wall. This injury mainly occurs due to excessive pressure of the cuff on the tracheal wall and may be prevented by a high-volume, low-pressure cuff and a carefully monitored tracheostomy tube. Although there is an overall improvement in the design of high-volume cuffs, hyperinflation of these cuffs may still contribute to tracheal injuries. If the size of the granuloma is limited, the lesion is treated by excision (microlaryngeal surgery) under general anaesthesia. Using jet ventilation during the operation minimizes the trauma caused by intubation and reduces the risk of oedema and the risk of barotrauma, as it provides ventilation over a possible stenosis. In addition to providing better visualization of the surgical field and superior surgeon comfort, jet ventilation also increases the success of the operation. In this case report, we aimed to present a successful anaesthesia technique performed by jet ventilation in a patient with a postintubation granuloma, which was excised by microlaryngeal surgery without the need for reintubation.

Key Words: Intubation, granuloma, jet ventilation, anaesthesia

Introduction

In general, laryngeal granulomas are benign lesions located in the 1/3 posterior aspect of the vocal cords and may either be unilateral or bilateral. They are typically associated with three etiological factors including endotracheal intubation, improper use of voice, and gastroesophageal reflux. It is known that endotracheal intubation may cause significant laryngeal and tracheal injury and laryngeal granuloma is one of the late complications related to this injury. Laryngeal granuloma may be encountered even in the event of intubations lasted shorter than 24 hours. Pressure necrosis, which results from traumatic effect in the arytenoid cartilage due to high positive pressure caused by intubation tube cuff, and characteristic features of female larynx are the predisposing factors (1, 2). Symptoms appear in the form of hoarseness (88%), sore throat (35%), dyspnoea (18%), and neck swelling and the treatment is excision of granuloma by microlaryngeal surgery under general anaesthesia (3, 4).

While ventilation is provided during microlaryngeal surgery, small-diameter endotracheal tubes are preferred to visualize surgical area as clearly as possible. Nevertheless, it is sometimes observed that even the tubes in that diameter hinder the view and make the surgery difficult. Moreover, in certain cases, laryngotracheal stenosis may be at such a level that could make endotracheal intubation impossible. In this case, jet ventilation option through a thin cannula should be considered. Jet ventilation was first used in 1967 by Saunders during routine bronchoscopy and then, as of 1980, supraglottic, infraglottic, and transtracheal options have been developed to be used in microlaryngeal surgery. Today, jet ventilation is being used in trachea and larynx surgeries, bronchoscopy, pneumonectomy, and broncho-pleural fistulae (5).

In the present case report, a microlaryngeal surgery performed by jet ventilation was reported in a patient, who was admitted to Ear, Nose and Throat Clinic with hoarseness and dyspnoea and in whom endotracheal granuloma due to endotracheal intubation during a previous appendectomy was detected.

Case Presentation

A 30-year-old female patient was admitted to the Ear, Nose and Throat Clinic with cough, shortness of breath, and hoarseness lasting for 4 months. Her personal history revealed appendectomy a year ago. Evaluation of the patient's records showed

that the surgery had lasted for 105 minutes, intubation had been performed by an endotracheal tube No. 7.5, and intubation and anaesthesia had been completed without any complication.

Bronchoscopy demonstrated bilateral granulomatous configuration in the vocal cords that caused narrowing in the posterior 1/3 of the lumen and was considered as post-intubation granuloma (Figure 1). After obtaining consent of the patient, microlaryngeal surgery was planned under general anaesthesia. The patient underwent standard monitoring and fluid replacement was initiated through an intravenous line. Anaesthesia induction of the patient, of whom the body weight was 67 kg, was performed using 30 µg remifentanyl and 200 mg propofol; 14 mg mivacurium was administered to facilitate laryngoscopy and intubation. Jet ventilation catheter of 40 cm in length (Acutronic Medical Systems AG, Hirzel, Switzerland) was inserted under the guidance of a laryngoscope and the catheter was fixed in the way to be located below the glottis. Jet ventilation settings were as follows: a driving pressure (DP) of 1.3 bar, an inspiration time of 55%, an FiO_2 level of 0.8, and a frequency of 130 min^{-1} .

Maintenance of anaesthesia was performed by infusing propofol at a dose of 6-10 mg kg h^{-1} and remifentanyl at a dose of 0.05-0.25 µg kg minute^{-1} as total intravenous anaesthesia. In addition, the patient received 8 mg dexamethasone, 50 mg ranitidine and 10 mg metoclopramide. During the procedure that lasted for 25 minutes, adequate oxygenation was provided by jet ventilation without serious reduction in saturation. Based on the detection of 95% saturation on the 10th minute of the procedure, DP was increased to 1.5 bar. The procedure continued by maintaining the oxygen saturation between 97% and 98%. The granuloma was excised under precise surgical view provided by a thin catheter (Figure 2). No other complication was developed. Anaesthetic agents were discontinued at the end of procedure and jet catheter was removed. Respiration of the patient was supported via a mask and the patient started spontaneous breathing in 2-3 minutes. After providing adequate spontaneous breathing, the patient was transferred to the recovery room. Thus, the procedure was completed without intubation in any phase from induction to recovery.

Discussion

In addition to trauma in the posterior larynx caused by endotracheal tube, other factors (abnormal position of the patient's head, use of extremely large tube inappropriate for the patient's larynx, mislocation or overpressure of tube cuff, and extubation trauma) that enhance trauma contribute to the development of granuloma (6). This possible complication may be prevented by precise attention paid in airway manipulations.

Blanc and Tremblay (7) classified the endotracheal intubation-related complications in three groups as location of in-



Figure 1. Bronchoscopic image of postintubation granuloma



Figure 2. Bronchoscopic image of jet ventilation catheter

tubation tube, duration of intubation, and extubation. They determined the predisposing factors for the development of laryngeal granulomas as female gender, obesity, short neck, and hereditary airway anomalies. Female gender and short neck were among these risk factors in the present patient.

In a similar study, Barton et al. (8) determined that laryngeal granulomas, which they evaluated as due to traumatic intubation, are related to the trauma and ischemia in the tracheal wall due to high pressure caused by large-diameter tube or cuff. In the present case, the previous intubation period of the patient was limited to a 105-minute surgery period suggesting that the granulomatous configuration was related to the pressure caused by the cuff rather than duration. As a general rule, it is possible to lower the likelihood of complications such as intubation-related granuloma by using the possible smallest-diameter tube, paying attention to cuff pressure, avoiding extreme extension or flexion of the neck, and providing adequate muscle relaxation and anaesthesia depth. Monitoring the cuff pressure via a manometer is important, as the pressure is likely to increase within the process with the use of nitrous oxide even though the initial inflation is within the normal ranges (9).

The treatment of laryngeal granulomas is the excision via microlaryngeal surgery. While ventilation is enabled during microlaryngeal surgery, small-diameter endotracheal tubes are preferred to visualize the surgical area as clearly as possible. It is sometimes observed that even the tubes in that diameter make the surgical view difficult. In this case, jet ventilation option via a thin cannula may be considered. Manipulations become easier with this technique, which is performed by a thin catheter, as it allows precise visualization of anatomic configurations and completely exposes the surgical field for

the surgeon. Moreover, it is possible to lower the risk of oedema by eliminating intubation-related trauma via jet ventilation. Jet ventilation was primarily developed to be used during routine bronchoscopy. Thereafter, this technology has been adjusted to provide ventilation via one of the supraglottic, infraglottic, and transtracheal routes to be used in microlaryngeal surgery (10).

Studies have determined that infraglottic technique is more effective than supraglottic technique as it provides ventilation below the level of vocal cords and causes minimal movement in the cords (11). Blowing of blood and tissue particles to the upwards and outside with expiratory airflow appears to be another advantage of the technique (12). Khan et al. (13) successfully used the infraglottic ventilation in the treatment of laryngeal lesions and in taking biopsy from vocal cords and observed no related complications such as hypoxia, hypercapnia, or barotrauma. In the present case as well, infraglottic jet ventilation was performed and the granuloma was excised under precise surgical view by means of the thin catheter. Performing supraglottic technique as the other option was reported in a 50-case series that underwent microlaryngeal surgery for tracheal stenosis (14). In that series, successful airway management was provided and need for intubation due to hypoxia was reported in only one case.

Conclusion

In the present case report, which presented a patient who underwent surgical intervention for intubation-related granuloma, safe airway management and gas exchange were provided via infraglottic jet ventilation technique without need for re-intubation and the patient was transferred to the recovery room at the end of intervention after a successful recovery without need for re-intubation. Thus, the risks for intubation and possible granuloma development were eliminated in the patient, who previously developed granuloma despite very short intubation period. In conclusion, jet ventilation allows effective gas exchange without causing high airway pressure or hemodynamic problem. Moreover, jet ventilation provides precise surgical view and working conditions and makes it possible to eliminate the risk in patients at high-risk for intubation-related granuloma.

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