Case Report

Percutaneous transtracheal jet ventilation as a guide to tracheal intubation in severe upper airway obstruction from supraglottic oedema

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We report two cases of severe upper airway obstruction caused by supraglottic oedema secondary to adult epiglottitis and Ludwig’s angina. In the former case, attempts to intubate with a direct laryngoscope failed but were successful once percutaneous transtracheal jet ventilation (PTJV) had been instituted. In the case with Ludwig’s angina, PTJV was employed as a pre-emptive measure and the subsequent tracheal intubation with a direct laryngoscope was performed with unexpected ease. In both cases recognition of the glottic aperture was made feasible with PTJV by virtue of the fact that the high intra-tracheal pressure from PTJV appeared to lift up and open the glottis. The escape of gas under high pressure caused the oedematous edges of the glottis to flutter, which facilitated the identification of the glottic aperture. We believe that the PTJV should be considered in the emergency management of severe upper airway obstruction when this involves supraglottic oedema.

Br J Anaesth 2005; 94: 683–6

Keywords: airway, obstruction; complications, glottic flutter; complications, intubation, difficult, guided; complications, Ludwig’s angina; epiglottitis, infection; ventilation, transtracheal, jet

Accepted for publication: January 4, 2005

Maintenance of a clear and secure airway is fundamental to every general anaesthetic technique. Unfortunately reports of airway catastrophies leading to mortality still appear in the literature.1–3 The introduction of percutaneous transtracheal jet ventilation (PTJV) has made a significant contribution in maintaining oxygenation and ventilation in patients with a difficult airway.4 We describe two cases of severe upper airway obstruction where direct laryngoscopic tracheal intubation was performed with ease by using PTJV.

Case 1

A male bus driver of 54 yr of age, weight 73 kg, height 1.7 m, was apparently well when he returned home from work but felt a slight sore throat on retiring to bed. He woke up during the early hours complaining of a severe sore throat, coughing, vomiting, choking, and fever. His condition deteriorated and approximately 10 h later he was brought to the accident and emergency (A&E) department. On arrival he had stridor, was dyspnoeic, confused, restless, and was unable to phonate appropriately. His past medical history included irritable bowel syndrome and peptic ulcer disease and he was allergic to penicillin. He smoked 30 cigarettes a day. He had a ventiliatory frequency of 28 b.p.m., pulse 129 beats min⁻¹, arterial pressure 162/88 mm Hg, temperature 38°C, and SpO₂ 98% on breathing oxygen via a variable performance mask. Approximately 20 min after arrival and whilst being assessed by the clinical staff, he had a grand mal fit and was given an i.v. injection of diazepam 10 mg. He became semiconscious and developed a compromised airway. At this stage, the on-call anaesthetist was asked to attend. The Glasgow Coma Score was 6 (out of 15) and his airway appeared to be partly obstructed, but with some difficulty it was feasible to perform facemask ventilation. Although spontaneous breathing was present it was judged to be inadequate. The results of arterial blood gas analysis were as follows: pH 6.84, PaO₂, 42.5 kPa, PaCO₂, 15.2 kPa, SaO₂, 100%, HCO₃⁻, 19 mmol litre⁻¹, BE, −21 mmol litre⁻¹. After administration of propofol 75 mg and succinylcholine 100 mg, tracheal intubation was attempted by a staff grade anaesthetist and subsequently by two consultant anaesthetists but failed. The glottic area was very oedematous and it was not possible to identify the anatomy of the glottic area, which was obstructed by a large mass thought to be arising from the epiglottis. A cannula #
(VBM Jet Ventilation CatheterTM, 14 gauge) cricothyroidotomy was performed and it was connected via Manujet III (VBM)TM to a wall outlet that delivers oxygen at 4 bar (58 psi). A driving pressure of 3 bar (44 psi) was selected and, after confirming that the cannula was intra-tracheal by aspirating air, PTJV was commenced. The escape of gas via the oral cavity was confirmed and a direct laryngoscopy was attempted again. A 8.0-mm cuffed oral tracheal tube was passed using a tracheal tube introducer with ease by the consultant anaesthetist who had previously failed to intubate the patient. The intubation was found to be feasible because the glottic area appeared to be lifted up and opened, and the escape of gas under high pressure caused the edges of the glottic aperture to flutter.

A CT scan of the head, a lumbar puncture, and microbiological analysis of the cerebrospinal fluid were normal. His white blood cell count (WCC) was 25.1 \times 10^9 litre^{-1} with a neutrophil count of 22.2 \times 10^9 litre^{-1}. A diagnosis of adult epiglottitis was made on the basis of history, presentation, appearance at nasendoscopy, and biopsy results. The nasendoscopy showed oedematous epiglottis with several areas of leukoplakia. The biopsy specimen taken from the left-sided superior edge of the epiglottis showed extensive ulceration and necrosis with associated acute inflammation in the sub-epithelial stroma. No malignancy was seen. The patient was treated with aciclovir, ceftriaxone, clindamycin, and metronidazole. The sputum sample failed to grow any organism. Extubation was carried out on the seventh day in the operating theatre following a check nasendoscopy. Having made a good recovery he was discharged home 13 days after admission to the hospital. He did not require a tracheostomy.

Case 2

A housewife of 54 yr of age, weight 95 kg, height 1.5 m, was brought to the A&E department complaining of a swollen, painful throat and difficulty in breathing 2 days after extraction of two lower teeth by a dentist. There was no history of any other medical conditions. Pre-existing medications were zopiclone and amitriptyline taken for night sedation and there were no known allergies. She smoked 20 cigarettes a day. One day after dental treatment the patient began to experience an increasingly painful throat and dysphagia, and was unable to sleep lying flat as a result of increasing difficulty in breathing. The following day the symptoms progressed causing an increased amount of throat swelling and pain, marked shortness of breath, stridor, and fever. Her WCC was 24.0 \times 10^9 litre^{-1} with a neutrophil count of 21.4 \times 10^9 litre^{-1}. A diagnosis of Ludwig’s angina was made and the anaesthetists were asked to assess the airway. On examination the patient was found to be dyspnoeic, sitting upright on a trolley, able to phonate only in monosyllables, and unable to swallow although there was no drooling. The submandibular area was grossly swollen, indurated, and erythematous. The patient was alert with a ventilatory frequency of 24 b.p.m, heart rate 110 beats min^{-1}, and S_{O_2} 97% on 2 litres of oxygen via nasal cannula. There was trismus restricting the mouth opening to less than 1 cm. She was administered co-amoxiclav, metronidazole, nebulized epinephrine and salbutamol but these measures had no noticeable affect on the stridor or respiratory distress. Over the next 15 min the degree of airway obstruction increased markedly with decreased conscious level of the patient. The decision was made to take her to the operating theatre immediately with a view to securing the airway. As it was not possible to identify the cricothyroid membrane, a transtracheal cannula (VBM Jet Ventilation CatheterTM, 14 gauge) was inserted with difficulty between the second and third tracheal rings. Air could easily be aspirated and on connecting a capnograph monitor to the cannula to doubly ensure its intra-tracheal position, the P_{E CO_2} was in excess of 12 kPa. PTJV was commenced as described in the above case. In the presence of airway obstruction, which necessitated the need for PTJV, it was thought that an inhalation induction of anaesthesia was not appropriate. Therefore, a sleep dose of propofol 120 mg was given and a direct laryngoscopy was attempted. The glottic area appeared to be largely oedematous but recognition of the glottic area was found to be easy because it was lifted up, flapped open, and its edges fluttered. After administering suxamethonium 100 mg, an 8.0-mm cuffed oral tracheal tube was passed using a tracheal tube introducer uneventfully. The patient was transferred to the intensive care unit. On the third day post-presentation a submandibular abscess developed, which was incised and drained, and she was extubated on the fifth day. Microbiological investigation showed Candida albicans in tracheal aspirate and mouth swabs, but blood cultures were negative. She did not require a tracheostomy and was discharged home on the fourteenth day after initial presentation.

Discussion

In the case of adult epiglottitis two consultants and one staff grade anaesthetist failed to perform intubation using conventional measures such as the Macintosh laryngoscope and tracheal tube introducer, but intubation was feasible once PTJV had been instituted. In Case 2, PTJV was instituted initially and subsequent tracheal intubation was found to be unexpectedly easy. We believe that the intubation was facilitated by virtue of the high intra-tracheal pressure effect on the glottis. The high intra-tracheal pressure from the jet ventilation appeared to lift up and open the collapsed glottis. The high intra-tracheal pressure from the jet ventilation assisted intubation matches that of Patel.\(^5\) In his retrospective study over a period of 4 yr among patients who were admitted to the intensive care unit for ventilation for acute respiratory
failed. Movement of air bubbles with air flow to and from result of supraglottic oedema when facemask ventilation had airway with manual ventilation be considered in the emer-
ation. Other techniques that could be used to overcome kink-resistant cannulae. Although it is recommended to cannulae are easily kinked it is recommended to use airway of the lungs through the upper airway. As standard i.v. the upper airway as open as possible and to verify deflation particularly cautiously. During PTJV it is important to keep pass the cannula through the cricothyroid membrane, 5 1 bar) measured during PTJV through a 16-gauge needle, it was demonstrated that low frequency ventilatory rates, for example less than 30 b.p.m., produced peak airway pressures between 20 and 50 cm H2O. Expiration is passive secondary to PTJV in the management of the difficult airway. Based on our observations we believe that, in addition to its recognized efficacy in maintaining oxygenation and ventilation, the PTJV has an important role to play in assisting tracheal intubation in very difficult airway situations as a result of supraglottic oedema.

Acknowledgement

The authors would like to thank Miss A. Rachmanidou, Consultant Ear, Nose and Throat Surgeon, University Hospital Lewisham, London, UK, for allowing us to use the clinical data that became available while the patient in Case I was under her care.

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