

CASE REPORTS

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Gastric Rupture after Inadvertent Esophageal Intubation with a Jet Ventilation Catheter

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JET ventilation is a common method used during laryngeal or tracheobronchial surgery. Local tissue injury can result, however, from the high-pressure gas exiting the jet catheter, particularly if the tip of the catheter is misdirected from the laryngeal opening. Unfortunately, confirmation of proper catheter placement is somewhat inexact. This case report presents a complication of translaryngeal jet ventilation—acute gastric rupture—after inadvertent placement or migration of a metal tube catheter into the esophagus.

Case Report

A middle-aged woman complaining of chronic hoarseness presented for elective diagnostic laryngoscopy and vocal cord stripping. Her medical history was significant only for a right radical neck dissection for carcinoma of the tonsil, complimented with local cobalt radiation therapy, approximately 15 yr previously. Preoperative evaluation revealed an obvious deformity of the right neck with well-healed scarring. An airway evaluation found a reduced hyomental distance and limited visualization of the soft palate and pharyngeopalatine arches (consistent with Mallampati's class II); however, no limitation in neck extension or mouth opening was evident. The attending surgeon, who anticipated limited access to the vocal cords and expected the use of a laser during the procedure, requested translaryngeal jet ventilation.

After the placement of routine noninvasive monitors and several minutes of preoxygenation, general anesthesia was induced with thiopental and succinylcholine and maintained with midazolam and alfentanil. After establishing mask ventilation, direct laryngoscopy was attempted, but only a partial view of the arytenoid cartilages could be obtained. A malleable, ball-tipped copper tube catheter was

easily advanced into the larynx just anterior to the arytenoid cartilages. Jet ventilation was begun with intermittent bursts of 100% oxygen at approximately 25 pounds per square inch (psi). Auscultation of the chest noted bilateral, coarse breath sounds. Auscultation of the abdomen noted only "transmitted" airway sounds from the chest. The patient's head position was further manipulated during draping and subsequent placement of a suspension laryngoscope by the otolaryngologist. During the approximately 3 min after intubation, the SaO₂ decreased from a baseline of 98% to around 80%. Repeat laryngoscopy revealed displacement of the jet ventilation catheter into the esophagus. The catheter was immediately removed, replaced through the larynx, ventilation resumed, and auscultation reconfirmed bilateral breath sounds of similar quality to those appreciated after the initial intubation. No obvious gastric distention was noted at that time. After the oxygen saturation returned to baseline values, vocal cord stripping proceeded without incident. Before emergence, an orogastric tube was placed to remove any residual gastric air. On full awakening in the recovery room, the patient complained of severe epigastric pain. On examination, her abdomen was rigid and markedly distended, with guarding and rebound tenderness present. A semi-erect radiograph detected free air under both diaphragms. Emergent surgical exploration of the abdomen revealed a 7-cm tear in the middle of the lesser curvature of the stomach, without significant hemorrhage. After repair of the gastric perforation, the patient had an uneventful recovery.

Discussion

Jet ventilation techniques use small-bore catheters to introduce high-pressure gas either from above or below the vocal cords. The Venturi effect allows additional air to be entrained coincident with catheter pressurization and further augments inspiration. Although properly performed jet ventilation has been found safe in a variety of laryngeal, tracheal, and bronchial procedures,^{1,2} serious complications have been reported.³ Respiratory complications such as hypoventilation, pneumothorax, pneumomediastinum, or subcutaneous emphysema are reported with some frequency,^{2,4-6} but frank gastrointestinal injury appears rare.

The incidence of benign gastric distention (*i.e.*, requiring only gastric decompression) has been estimated at 0.32% in a large series of 942 patients.¹ Apparent displacement of a properly functioning jet catheter into

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CASE REPORTS

the esophagus resulted in severe abdominal distention, postoperative ventilation, and respiratory acidosis.⁷ Jet ventilation using a Carden's tube placed into the esophagus resulted in a gastroesophageal junction tear; whether the injury was caused by massive esophageal dilation or local trauma by the injected gas is not clear.⁶ Gastric rupture has been reported also with a Carden's tube attached to an automatic ventilator.⁸ In that case, a similar lesion (*i.e.*, a 7-cm tear along the lesser curvature of the stomach) was produced after multiple intubation attempts and a "few seconds" of esophageal ventilation at 1 bar (= 14 psi). It appears unnecessary to inject air only under high pressure into the esophagus to induce similar gastric injury. Resuscitative measures,⁹ nasal,¹⁰ and nasopharyngeal¹¹ (even inadvertent nasogastric¹²) oxygen administration appear ample to rupture the stomach, if a sufficient volume of gas is insufflated.

Paramount in preventing complications is proper confirmation of catheter placement before initiating jet ventilation. Short of directly visualizing the passage of the jet catheter across the vocal cords,⁶⁻⁷ the remaining corroborating signs of proper placement are non-specific. The presence of bilateral breath sounds and the absence of sounds in the epigastrium can be difficult to discern, given the propensity for broad "transmission" of sounds produced by turbulent gas insufflation. Distention of the stomach can cause an outward excursion mimicking appropriate diaphragmatic and chest movements.¹³ Conversely, the appearance of gastric distention by itself does not always indicate esophageal intubation.¹⁴ Other common methods, such as reservoir bag compliance, exhaled gas volume, tube condensation, and capnography, are generally reliable only when a cuffed endotracheal tube is inserted.¹⁵ A notable exception is the recent availability of a novel subglottic jet catheter (Hunsaker Mon-Jet Ventilation Tube #70-80100, Xomed Surgical Products, Jacksonville, FL) that incorporates a sampling port for capnographic confirmation.¹⁵ Even after proper initial placement and confirmation, the jet catheter can migrate into the esophagus, particularly if high injection pressures are used or if the catheter is inadequately affixed before positioning. Additional suggestions to reduce gastric injury or its sequelae include [1] using prophylactic gastric decompression,^{2,8} [2] initiating ventilation with a low injection pressure (*i.e.*, 15 psi) and short inspiratory and pro-

longed expiratory times,² [3] using the lowest pressure to provide adequate respiration,⁶ [4] maintaining adequate muscle relaxation,^{1,6} [5] avoiding nitrous oxide after jet ventilation,⁷ [6] obtaining surveillance radiographs postoperatively,⁸ and [7] consider avoiding this technique in patients with obesity,^{1,7} obstructive laryngeal lesions,¹⁻² poor lung/chest compliance,^{2,7} chronic obstructive pulmonary disease,⁷ or as noted herein, a difficult airway.

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