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Neonatal esophageal perforation: nonoperative management

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ABSTRACT

Background: Esophageal perforation is a rare complication of enteric instrumentation in neonates. Enteric tube placement in micro-preemies poses a particular hazard to the narrow lumen and thin wall of the developing esophagus. The complication may be difficult to recognize or misdiagnosed as esophageal atresia, and is associated with considerable mortality. Historically, management of this life-threatening iatrogenic disease was operative, but trends have shifted toward nonoperative treatment. Here, we review neonatal esophageal perforation at our own institution for management techniques, risk factors, and outcomes.

Materials and methods: Seven neonatal patients with esophageal perforation were identified and charts reviewed for demographics, comorbidities, etiology of perforation, diagnostic modalities, management decisions, complications, and outcomes.

Results: Mean gestational age was 27.2 ± 4.0 wk, and weight at diagnosis was 892 ± 674 g. All seven patients had esophageal perforation resulting from endotracheal or enterogastric intubation and were managed nonoperatively. Treatment included removal of the offending tube, *nil per os*, and antibiotics. Five patients required additional interventions: four tube thoracostomies for pneumothoraces and one peritoneal drain for pneumoperitoneum. Three patients died because of sequelae of prematurity (intraventricular hemorrhage, necrotizing enterocolitis, and sepsis). One patient was diagnosed as having esophageal atresia; esophagoscopy before surgical repair established the correct diagnosis.

Conclusions: Neonates, particularly those under 1500 g, are at substantial risk for iatrogenic esophageal perforation during enterogastric intubation. Nonoperative management may be a safe initial strategy in the neonatal setting, but more aggressive interventions may ultimately be required. Despite recent improvement in early recognition of this injury, misdiagnosis still occurs.

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1. Introduction

Esophageal perforation is a rare complication of enteric instrumentation in children, most commonly after endoscopy for stricture dilation or foreign body extraction [1,2]. Although the first report of neonatal esophageal perforation by James Fryfogle in 1952 was spontaneous in origin, an increasing body of literature suggests that iatrogenic causes are far more common [3,4]. In preterm and low birth weight infants, endotracheal intubation and enteric tube placement for suction or feeding pose a particular hazard to the developing esophagus. Moreover, esophageal perforation resulting from enterogastric tube insertion in neonates can be difficult to recognize because many of these babies are premature and frequently intubated. The injury may also produce a specific diagnostic dilemma because presenting symptoms and radiographic findings may not be readily distinguishable from those of esophageal atresia [5,6].

Historically, neonatal esophageal perforation was treated similarly to adults, often involving operative drainage, repair, and/or diversion. Successful reports of nonoperative treatment over the last several decades have prompted a shift in current management away from a surgical approach as the initial treatment strategy [2,4,5,7]. Nonoperative management uses a neonate's intrinsic propensity for wound healing such as parenteral nutrition, *nil per os* (NPO) status, intravenous antibiotics, and drainage procedures when indicated [8]. Although the mortality rate in neonates with esophageal perforation remains high at 21%–30%, most deaths are attributed to comorbidities common to this high-risk group, such as congenital cardiac diseases, intraventricular hemorrhage, necrotizing enterocolitis, and sepsis [5,9–11].

In the present study, we briefly review the literature and examine cases of neonatal esophageal perforation at our institution to evaluate risk factors, management techniques, and outcomes.

2. Materials and methods

After approval was obtained from our institutional review board, our clinical database was queried for the International Classification of Diseases, Ninth Revision code for esophageal perforation from January 2000–December 2012. To select for a neonatal population, patients older than 1 mo at the time of diagnosis were excluded from further review. The charts of the remaining patients were reviewed for the following information: age and sex, demographics, comorbidities, etiology of perforation, diagnostic modalities, management decisions, complications, and outcomes.

3. Results

Seventeen children were initially identified with a diagnosis of esophageal perforation. Ten patients were excluded because they were older than 1 mo. The age range of excluded patients was 10 mo–17 y.

Seven infants were identified who met inclusion criteria for further chart review, consisting of four males and three females (Table 1). All patients were preterm with an average gestational age of 27.2 ± 4.0 wk. Five of the seven weighed <750 g, and only one was over 1200 g. The diagnosis of esophageal perforation was made within the first week of life in five patients with an average age and weight at diagnosis of 4.4 ± 4.2 d and 892 ± 674 g, respectively. From 2000–2012 at our institution, there were 14,171 total neonatal intensive care unit admissions, 461 of whom weighed <750 g. Our observed incidence of esophageal perforation was therefore 0.05% of all neonatal intensive care unit (NICU) admissions and 1.08% of infants born weighing <750 g.

The etiology of perforation was iatrogenic in all patients. One patient sustained an esophageal injury during repeated endotracheal intubation attempts at birth; the remaining six esophageal perforations resulted from attempted enterogastric tube placement. Plain chest x-ray was the initial diagnostic modality used in all but one patient. Two patients had water soluble contrast studies to confirm the suspected diagnosis: one as the initial diagnostic modality and the other to confirm clinical suspicions despite inconclusive plain film findings. One patient had the diagnosis confirmed by esophagoscopy, as detailed in the following. Three patients had conclusive diagnoses identified on plain film and did not require further studies. Water soluble contrast studies were used to document healing in two patients before initiating feeds. Contrast studies were not performed in two patients before initiating oral feeds: in one for unknown reasons, and in the other, enteral nutrition was contraindicated for nearly 2 mo due to concurrent necrotizing enterocolitis.

One patient was initially diagnosed with esophageal atresia at an outside hospital after repeated unsuccessful attempts to pass an orogastric tube (Fig. 1A). On transfer to our institution, blood-tinged aspirate from this patient's Replogle tube (Covidien, Mansfield, MA) was noted, raising clinical suspicion for esophageal perforation. Before planned repair of the presumed atresia, esophagoscopy in the operating room demonstrated a hypopharyngeal perforation and no esophageal atresia (Fig. 1B).

The offending tube was removed in the six patients in whom the perforation was caused by enterogastric tubes. In three of these patients, enterogastric tubes were replaced under fluoroscopic guidance 10.0 ± 3.6 d after diagnosis. Broad-spectrum antibiotics were initiated in all patients, for an average treatment course of 10.4 ± 0.9 d in those infants who survived to completion of treatment. No patients received acid suppressive agents.

Esophageal perforation was identified as either thoracic or cervical based on imaging. Of the four infants with a thoracic esophageal perforation, two had submucosal injuries with tracts paralleling the esophageal column and two had free perforation into the pleural space. Two patients had a cervical esophageal perforation. As previously noted, the infant misdiagnosed with esophageal atresia demonstrated a hypopharyngeal injury on endoscopy.

All patients were treated without primary thoracic surgery. Four infants developed pneumothoraces requiring tube thoracostomy for drainage. One patient developed a large