Nasogastric Tube Placement and Esophageal Perforation in Extremely Low Birth Weight Infants

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Key Words
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Perforation of the esophagus associated with placement of nasogastric tubes is not uncommon in preterm infants. Herein we report three cases of iatrogenic esophageal perforation associated with nasogastric tube placement. With nonsurgical management of parenteral nutrition and broad-spectrum antimicrobial therapy, all three neonates survived without sequelae. Effective strategies to prevent such complications are discussed.

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1. Introduction

Nasogastric tube (NGT) placement is a common procedure in extremely low- birth-weight infants. The prevalence of misplaced NGTs in children is difficult to determine because of the differing definitions across studies; however, it has been reported to be as high as 21—43.5%. The complications of misplacement range from aspiration pneumonia...
and pneumothorax to perforation of the esophagus or the stomach. Iatrogenic esophageal injury in the neonates usually occurs at the pharyngoesophageal junction where the lumen is narrowed by the cricopharyngeus muscle. A recent report described five cases of esophageal perforation in premature infants over a 9-year period. In Taiwan, Soong et al also reported on three extremely premature infants with iatrogenic cervical esophageal perforation over a 2-year period in a tertiary care hospital. Ultrathin flexible endoscopy is also helpful to confirm the perforation site. Treatment varies with the location of the perforation and the time to recognition. Over the past decade, a shift from an aggressive early surgical intervention to judicious, nonsurgical management of esophageal perforation in selected adult patients has been observed. The most important prognostic factor is the time between the injury and the initiation of therapy. The experience in managing esophageal perforation in children, especially extremely low-birth-weight infants, is relatively lacking. We described three cases of probable esophageal perforation and all survived with nonsurgical treatment.

2. Case report

During a period of 6 months, three extremely low-birth-weight newborn infants experienced iatrogenic complications associated with NGT placement in a tertiary care hospital. The demographic data and their clinical presentation are summarized in Table 1. The indication for NGT insertion was enteral feeding, and tube replacement was routinely performed every 3–5 days. The placement of NGTs for these patients was performed by three different resident physicians. These 5-French feeding catheters are made of polyvinyl chloride by the same manufacturer (Symphon Chemical Corporation, Taipei, Taiwan). The process of replacement is smooth, and the auscultation method is used to verify the location of the newly placed NGTs. A sudden onset of oxygen desaturation and bradycardia were noted soon after feeding these infants through the newly placed NGTs. Two infants had right-side pneumothorax and underwent immediate chest tube placement. Air was drained from the thoracostomy tubes in these two infants. The third patient had pneumoperitoneum and did not receive laparotomy. These complications were detected by bedside radiographs (Figure 1). Taking the time sequence between NGT insertion and onset of clinical symptoms into account, esophageal perforation was considered to be the most probable cause of pneumothorax and pneumoperitoneum in these infants, although no contrast study or endoscopic examination was performed.

Leukocytosis or leukopenia in these cases may be associated with concomitant infections, such as bacteremia in

<table>
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<th>Table 1</th>
<th>The demographic data and clinical presentation of the three infants.</th>
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<td>Case</td>
<td>Age (day)</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
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<td>2</td>
<td>9</td>
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GA = gestational age; BBW = birth body weight; TPN = total parenteral nutrition; HFVS = high frequency ventilatory support; RDS = respiratory distress syndrome; ROP = retinopathy of prematurity.
these cases. With total parenteral nutrition supplement and broad-spectrum antimicrobial therapy (both antibiotic and antifungal agents), all three infants survived without significant sequelae ascribed to these iatrogenic complications. Enteral feeding through NGTs was restarted in these patients 8–10 days later and no complications were observed. Preventive strategies, including gentle manipulation, softening of NGTs, use of lubricants, verification prior to feeding, and prolonged intervals for replacement (interval for planned change of feeding catheters: from 3–5 days to 1 week), were initiated in this neonatal intensive care unit. These measures are considered effective because complications were not noted thereafter.

3. Discussion

Esophageal perforation is not uncommon in premature infants during NGT placement. We experienced three cases over a 6-month period and associated the high incidence with the recent change in texture of the NGTs, instituted by the manufacturer. The manufacturer’s suggestion for improving the texture of the NGTs was to soak the catheter in warm water for further softening, along with gentle manipulation, softening of NGTs, use of lubricants, verification prior to feeding, and prolonged intervals for tube replacement. As a result, no patient experienced esophageal perforation during NGT placement. Although costly, Silastic tubes reportedly prevent more episodes of esophageal perforation than polyvinyl tubes in very-low-birth-weight infants. Radiography remains the gold standard for determining feeding catheter location. The auscultatory method is less reliable in determining NGT location. The measurement of carbon dioxide level, the length of NGTs, aspirate pH level and appearance does not preclude the need for a radiograph. Radiography should be used to verify the location of a newly placed NGT prior to feeding or medication. However, this risk of radiation exposure is a greater concern in younger children than in adults, calling into question the routine use of radiographs for confirming tube location in this population. It is important for health care workers to select more reliable bedside tests in extremely low-birth-weight infants to avoid such complications occurring during NGT placement.

Esophageal perforation is a life-threatening complication of NGT placement if aspiration pneumonia or pneumothorax occurs. The reported mortality rate in adults is 10–25% when therapy is initiated within 24 hours of perforation, and it is 40–60% when therapy is delayed. Surgery is the mainstay of treatment, but recently there has been a trend toward more nonsurgical management. Early recognition and aggressive management are increasingly important. Treatment should be started as early as possible and includes intravenous fluid, cessation of feeding, broad-spectrum antibiotics, narcotic analgesics, total parenteral nutrition, and prompt decisions regarding surgical closure versus nonsurgical management. Gastric perforation is a rare but life-threatening complication of NGT placement. Gluer et al described two infants treated with laparoscopic repair who survived gastric perforation. However, Baum et al demonstrated the effectiveness of nonsurgical management in selected cases of esophageal perforation. In adults, patients with small, well-defined tears and minimal extraesophageal involvement are considered to be better managed by nonsurgical management. However, no relevant criteria can be applied in children with esophageal perforation. In this study, 2 weeks of broad-spectrum antimicrobial therapy seemed to be adequate for iatrogenic esophageal perforation in extremely low-birth-weight infants. This study further strengthens the observation that nonsurgical treatment is an effective treatment option for esophageal perforation associated with NGT placement in extremely low-birth-weight infants.

Conflicts of interest

All authors declare no conflicts of interest.

References