Postoperative Free Air is Not Always Normal - Necrotizing Enterocolitis Leading to Concurrent Colonic and Gastric Perforation

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We present a case of concurrent gastric and bowel perforation in a preterm neonate associated with necrotizing enterocolitis (NEC). Gastrointestinal perforation of any cause is a surgical emergency with high morbidity and mortality. The most common cause of perforation in neonates is NEC followed by spontaneous ileal perforation.

Early suspicion of gastric perforation in preterm neonates with abdominal distention, and aggressive management with early resuscitation, stabilization and surgical exploration is recommended for better outcome.

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Gastrointestinal perforation in neonates is a life-threatening surgical emergency. The most common cause of perforation is necrotizing enterocolitis (NEC). Intestinal perforation is significantly more common than gastric perforation which although possible, is rare1,2. Gastric perforation can be associated with prematurity, low birth-weight, neonatal intensive care unit (NICU) admission and NEC2.

The aim of this report is to present a case of concurrent gastric and bowel perforation in a preterm neonate with NEC.

THE CASE

A preterm male infant was delivered by category II emergency cesarean section at 34+6 weeks gestation weighing 2.730 kg. Pregnancy was complicated by preterm labor, premature rupture of membranes and a maternal history of previous myomectomy and several abortions. APGAR scores at birth ranged from 8 and 9 at 1 and 5 minutes, respectively. On day 3 of life, he was transferred from the postnatal ward to the NICU with abdominal distension, poor sucking and bilateral scrotal swelling. A scrotal ultrasound showed bilateral hydroceles with a right inguinal hernia and a suspected organized scrotal hematoma. He was started on empiric antibiotics (IV Ampicillin and Gentamycin) after blood culture was obtained. Abdominal X-ray revealed extensive pneumoperitoneum, football sign and lucency over the liver, see figure 1.

Emergency laparotomy with resection of the perforated transverse colonic segment and formation of colostomy with mucus fistula were performed. A Penrose drain was positioned in-situ in the right lower quadrant. He was on patient triggered ventilation (PTV) mode with Fraction of Inspired Oxygen (FiO2) 22% and kept on triple antibiotics (IV Ampicillin, Gentamycin and Metronidazole). He was stable postoperatively and extubated after 2 days. He was fed by total parenteral nutrition via a peripherally inserted central catheter (PICC).

On postoperative day 3, a routine abdominal X-ray showed a persistent pneumoperitoneum, see figure 2. A second laparotomy was performed and a new large gastric perforation at the greater curvature of the stomach was found. He was transferred to the NICU, intubated and ventilated on PTV mode and extubated after one day. Serial imaging showed no recurrence of perforation, but he was maintained for 15 days on antibiotics and 6 days of Fluconazole. A Gastrografin study performed one week after the second laparotomy showed no evidence of contrast leakage or obstruction.

Figure 1: Supine X-ray Showing Gross Pneumoperitoneum

Figure 2: Lateral Decubitus View on Day 3 Postoperative Showing Free Air

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Enteral feeding was started on day 15 of life (12 days after initial surgery and 9 days after gastrectomy) through a nasogastric tube (NGT) and slowly progressed to oral feeding, which was well tolerated with no additional complications, see figure 3. The histopathology results revealed that both the colonic and gastric perforation occurred as a result of necrotizing enterocolitis.

![Figure 3: Post-partial Gastrectomy Contrast Study (Gastrograffin)](image)

**DISCUSSION**

Gastrointestinal perforation is a surgical emergency. NEC, multiple perforations, prematurity, and delayed presentation are the mortality risk factors. Our patient had three risk factors, which together constituted a major threat to survival. The etiology may differ as it depends on the site of perforation, intestinal or gastric. Most perforations occur in the intestines, mainly due to NEC followed by spontaneous perforation.

Gastric perforation is a rare entity in neonates with a mortality rate of 45% to 58%. It is associated with prematurity, low-birth weight, neonatal intensive care unit (NICU) admission and NEC. It presents mainly during the first week of life with sudden abdominal distension. The exact etiology is unknown; it could be either iatrogenic (tube perforation, TEF fistula) spontaneous or secondary to NEC. Spontaneous perforation is rare (1:2900 live births). It could be associated with extreme resuscitation, use of nasal CPAP and perinatal stress, perinatal hypoxia-ischemia and distal obstruction. In addition, an ischemic perforation is described in the case of necrotizing enterocolitis.

NEC could be seen in the first 2 weeks of life, but it might be seen at 2 months of age in low birth-weight children. The incidence rate of NEC in the United States varies from <1 to 5 cases per 1,000 live births. The average annual incidence of NEC is 0.72 per 1,000 live births. NEC is either primary or secondary. Primary NEC is more commonly seen in the first week of life of preterm infants with no trigger. Secondary NEC occurs in preterm or term infants associated with perinatal asphyxia, polycythemia, respiratory distress and congenital anomalies, myelomeningocele and congenital heart disease.

Studies have found that preterm infants have immature intestinal motility and an undeveloped intestinal barrier with insufficient colonization by commensal flora compared to term infants. The main risk factors for NEC are prematurity, low birth weight and enteral feeds. Formula milk increases the risk of NEC and gastrointestinal perforation. NEC is 6 to 10 times more common in infants with exclusive formula feeding; it is 3 times more common in infants who are fed both formula and breast milk compared to infants on exclusively breast feeding. There is no association between gender and the rate of NEC. There is a high mortality and morbidity rate, and 20%-40% require surgical intervention.

Bell’s staging is used to classify neonates with NEC: stage 1 (suspected), stage 2 (definite) and stage 3 (advanced). Treatment options are divided into medical and surgical. Medical treatment is conservative by discontinuing oral feeds, insertion of a nasogastric tube. IV fluids/TPN with antibiotics and close monitoring of vital signs. Surgical options are either insertion of primary peritoneal drainage or laparotomy. Laparotomy may involve resection with primary anastomosis or resection with enterostomy and mucus fistula formation. If the remaining bowel is healthy, primary anastomosis is the procedure of choice. Pneumoperitoneum on simple radiography is a diagnostic sign of gastrointestinal perforation; therefore, it is a definite indication for surgery.

It is not unusual to find residual pneumoperitoneum after laparotomy. Persistent free air suggests an unrecognized perforation from the initial laparotomy, progression of the disease and further perforation or perforation from another site as in our case. Significant free air always indicates the need for further exploration because gastric perforation requires very aggressive treatment with wide resection/debridement and closure.

We have found no previous similar reports in the literature that describes a case of simultaneous gastrointestinal perforations in a neonate caused by NEC. We propose that the cause was a translocation of NEC due to the close proximity of the transverse colon with the gastric curvature. We would like to underline the importance of considering causes other than intestinal perforation in a neonate with or without NEC.

**CONCLUSION**

Gastrointestinal perforation in neonates is a life-threatening surgical emergency. The most common cause of perforation in neonates is necrotizing enterocolitis (NEC). Early suspicion of gastrointestinal perforation needs early resuscitation and intervention for a better outcome. Free air is always subnormal if it is still present three days post-laparotomy and should raise suspicion of another perforation.

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