



# Case Report of an Innovative Method of Repairing Proximal Perforations in Necrotizing Enterocolitis

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## Authors' contributions

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

## Article Information

### Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/86666>

**Received 24 February 2022**

**Accepted 03 May 2022**

**Published 05 May 2022**

**Case Report**

## ABSTRACT

Necrotizing enterocolitis (NEC) is one of the most common gastrointestinal disorders affecting preterm infants. Initially, NEC can be managed both medically and surgically, with surgical intervention becoming inevitable in the context of intestinal perforation. Surgical management of NEC depends on the severity and location of the perforation, with resection being the standard approach. Subsequently, a primary anastomosis or enterostomy can be performed depending on the clinical condition. This case reports addresses the innovative technique of utilizing a gastrostomy for proximal duodenal jejunal perforations and the advantages that come along with it.

**Keywords:** Necrotizing enterocolitis; neonates; intestinal perforation; gastrostomy.

## 1. INTRODUCTION

Necrotizing enterocolitis (NEC) is the most common neonatal surgical emergency. In NEC, the intestines become highly immunoreactive and initiate an extensive inflammatory reaction

that leads to necrosis of the intestine and ultimately perforation with subsequent widespread systemic disease [1]. NEC is associated with a significant mortality of 20-30%, which can go up to 50% in preterm infants that underwent surgical intervention [2].

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The most common presentation is that of a preterm infant with feeding intolerance, abdominal distension and bloody stools after the first week of life. Plain abdominal radiography remains the gold standard in diagnosing and evaluating the severity of NEC. An early and important sign of NEC is bowel dilatation, which can precede the clinical features, and is present in 90% of neonates with NEC. An ominous sign is the presence of free intraperitoneal gas which suggests bowel perforation, which is an absolute indication for surgical intervention [3].

Management of NEC is divided into medical and surgical intervention. The principles of medical management in NEC are supportive care, antibiotic therapy, and monitoring response to treatment [4]. Supportive care entails bowel rest with discontinuation of enteral feeds and initiation of total parenteral nutrition, fluid replacement, and gastric decompression with intermittent nasogastric suctioning. With regards to surgical intervention of NEC, variable techniques exist depending on the stability of the neonate and the extent of the disease (i.e. focal/multi-focal, pan-intestinal or total intestinal gangrene). This paper addresses the variable techniques utilized and discusses a case where a gastrostomy was created to repair a proximal jejunum perforation in NEC.

## **2. PRESENTATION OF CASE**

A one-month-old baby girl, born at 31 weeks, via a spontaneous vaginal delivery with a birth weight of 1700 grams, was born in good condition. The baby was transferred to the NICU, for prematurity, immediately after birth, and was started on total parenteral nutrition through a nasogastric tube from day 2 post-delivery. On week two of life, the baby developed feeding intolerance and a distended abdomen. On examination, the abdomen was distended and tense on palpation with a girth of 32cm and mild erythema around the umbilical cord. Bowel sounds were absent. Examination of the other systems was unremarkable.

A diagnosis of NEC was made with the abdominal x-ray confirming pneumoperitoneum necessitating the need for surgical intervention. Findings at laparotomy revealed a perforated terminal ileum, cecum, and ascending colon leading to fecal peritonitis. A total of 8 cm of bowel was resected and the ileum was brought as a stoma and the transverse colon as a mucus fistula, with the creation of the bridge. Six days

later, the patient suffered from two more perforations the first being 1 cm below the duodenal jejunal junction affecting around 30% of the bowel circumference and the second being 35cm away from the proximal stoma. The short bowel was edematous but not ischemic. Thus, the two perforated sites were repaired and the previous stoma was fixed to the fascia as was the mucus fistula. Two days later, a third perforation occurred this time 3mm proximal to the duodenal jejunal junction. The incision site was revisited and the ileostomy opening was released revealing feces and turbid free fluid. To aid in the repair of the perforation, a gastrostomy was created with an intact Penrose drain. The previous stoma and mucus fistula were fixed. Post-operatively, the infant was admitted into the NICU for post-operative care. The tip of the gastrostomy was in the body of the stomach, and the gastrostomy was kept open for free drainage of gastric secretions for a period of one week. The output was bilious in nature. Subsequently, and relying on clinical judgment, it was used to administer enteral feeds, without a dye study being done, which avoided prolong use of the central line to administer total parenteral nutrition. Four weeks from the post-operative date, the infant was discharged home with no complications encountered.

## **3. DISCUSSION**

Creating a gastrostomy in the surgical management of NEC is not common practice and to the best of our knowledge there is no reports of it in literature.

Common surgical practices supported by literature are the following: laparotomy with enterostomy or primary anastomosis, proximal diverting jejunostomy, and the clip and drop technique.

Laparotomy with resection of the necrotic bowel is the standard approach to repair perforation. It can be preceded by peritoneal drainage in the neonatal intensive care unit to stabilize the neonate prior to surgical exploration. Depending on the focality and severity of the necrosis, primary anastomosis or enterostomy follows. Primary anastomosis is usually reserved for less severe and more stable infant, whereas enterostomy is preferred in more multifocal and severe NEC. Thus, because of the selection bias found when making the decision between the two methods, there is lack of solid data comparing the outcomes of each.

Another method that can be used when neither anastomosis or enterostomy are feasible options is the clip and drop technique which is usually performed in severe multi-focal NEC. In this approach gangrenous bowel is resected and questionable bowel is retained and re-examined in 24-48 hours to determine its viability, before proceeding to resection with anastomosis or enterostomy. Although this avoids short gut syndrome, the mortality associated with this technique is high. Lastly, when resection itself is not an option, due to the clinical instability of the infant or extent of the NEC a proximal diverting jejunostomy can be attempted as a stabilization procedure until more definite surgical approaches can be taken [5,6].

In our patient, the decision to create a gastrostomy was driven by the location of the perforation in the proximal jejunum and the severity of the NEC. The gastrostomy serves two functions. Firstly, it works as a protective stoma proximal to the perforation to facilitate healing of the perforation site and avoids creating a high output enterostomy that comes with its own set of complications such as fluid and electrolyte disturbances, retraction, prolapse, parastomal hernia, and skin excoriation [7].

Secondly, it can be used in early initiation of enteral feeding, avoiding the prolonged use of TPN and the complications secondary to it. Parenteral nutrition complications include parenteral nutrition associated liver disease (PNALD) and central line associated bloodstream infections (CLABSI) [8].

PNALD is a heterogenous liver injury that can include cholestasis, steatosis, fibrosis and cirrhosis with a high mortality rate that can result in end stage liver disease and the need for a combined small bowel and liver transplant [9]. CLABSI on the other hand, increases morbidity and mortality through late onset sepsis, extending hospital stay, and exposing the neonate to potent antimicrobial agents [10].

In comparison, initiating enteral feeds early, ideally with breastmilk, helps enhance the process of intestinal adaptation that occurs post intestinal resection to restore normal bowel functionality, while also providing the numerous benefits of breastmilk, such as improved growth and neurodevelopment and a decreased risk of late-onset sepsis [11,12]. Thirdly, due to the location of the gastrostomy, which makes it a low output stoma, future anastomosis can be performed more safely.

To further support the stated advantages of utilizing a gastrostomy in proximal perforations, the outcome of the patient was excellent with no major complication experienced intra-operatively or post-operatively. Our patient was discharged home four weeks following the surgery on full enteral feeds and in good condition.

#### **4. CONCLUSION**

Surgical resection of the necrotic bowel with the creation of a gastrostomy is a promising new technique for proximal bowel perforations in NEC. However, more studies are needed to evaluate the efficacy of gastrostomies in different NEC surgical presentations.

#### **CONSENT**

"All authors declare that 'Written informed consent was obtained from the patient and the parents for publication of this case report and that maximal patient anonymity was ensured and maintained during the writing of the case report."

#### **ETHICAL APPROVAL**

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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