

Original Article

Complicated Necrotizing Enterocolitis: A Retrospective Study

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ABSTRACT

Objective: To study the surgical outcome of patients with complicated necrotizing enterocolitis (NEC).

Design: A retrospective clinical study

Setting: Ibn Sina Hospital, Kuwait

Materials: Fifty babies who had definite or advanced NEC (Bell's stage-II or Bell's stage-III) were included in this retrospective study. These babies were subjected to some surgical intervention during the course of the disease. Forty patients had thrombocytopenia during the acute attack of the disease. All the 8 patients who died had platelet counts less than $100 \times 10^9 / L$.

Intervention: Surgical intervention was done in all 50 patients. Three of them previously managed by only medical management during an acute attack of NEC needed surgery for bowel strictures. Out of 47 patients, percutaneous peritoneal drain insertion (PD) was done in

eleven cases while twenty had PD followed by laparotomy. Primary laparotomy without prior PD was done in sixteen cases. Isolated small bowel was involved in 50% of cases while only large bowel was diseased in eleven (22%) of cases. The rest (28%) had both large and small bowel involvement.

Results: There was maximum mortality (five) in these fourteen patients with both small and large bowel involvement. Forty-two of all surgically managed patients survived and are still alive.

Conclusion: NEC remains the disease of premature and low birth weight infants. Thrombocytopenia and pan intestinal involvement is associated with poor outcome. PD insertion is useful but it may be associated with strictures.

KEYWORDS: bowel strictures, necrotizing enterocolitis, peritoneal drain, surgical intervention

INTRODUCTION

Necrotizing Enterocolitis (NEC) is one of the commonest surgical emergencies with a mortality rate exceeding that of any other gastrointestinal condition requiring surgery in neonates^[1]. Improved surgical outcome of NEC over the past two decades could be because of earlier diagnosis, more effective medical treatment, advances in critical care and selective prompt surgical treatment^[2,3,4]. However, overall mortality rates remain high^[2,3] but more accurate knowledge of clinical picture, risk factors, diagnostic modalities and treatment options may contribute to reversal of this trend. We studied various clinical, surgical and microbiological factors and attempted to correlate them with outcome of the disease. A retrospective analysis of patients with complicated NEC with Bell's stage II and stage III (Bell's Classification)^[5] was performed in a tertiary care centre for pediatric surgery in Kuwait.

SUBJECTS AND METHODS

We reviewed the medical records of all infants with NEC treated at Ibn Sina Hospital, Kuwait from June 2000 till June 2004. Bell's classification was used to stage the disease. Stage I patients were those suspected to have the disease because of perinatal stress or systemic manifestations (hyper or hypothermia, lethargy, apnea or bradycardia) or gastrointestinal manifestations (poor feeding, high nasogastric aspirates, abdominal distention or positive stool occult blood) or abdominal radiograph showing distention with mild ileus. Stage II patients had definite disease when in addition to features mentioned in earlier stage there was persistent occult or gross gastrointestinal bleeding or marked abdominal distention. Abdominal radiograph of these patients showed marked distention of abdomen or ileus or bowel wall edema or ascites or fixed intestinal loops or pneumatosis intestinalis or presence of portal vein

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Table 1: Types of CHD in 15 patients with NEC

CHD* Description	Number of Patients	Died
Isolated Patent Foramen Ovale	4	0
Patent Ductus Arteriosus	6	1
ASD/VSD	2	0
AV Canal	1	1
Pulmonary Atresia	1	1
Tetralogy of Fallot	1	0

*CHD: congenital heart disease

gas. In Stage III patients, the disease was advanced where in addition to features mentioned in previous stages, there was rapid deterioration of vital signs with septic shock or marked gastrointestinal hemorrhage. Pneumoperitoneum was seen in abdominal radiographs of patients with advanced disease. Patients with mild or suspected NEC (Bell's stage I) and those managed with only medical treatment were excluded from this study. The remaining 50 patients with complicated NEC that was definite (Bell's stage II) or advanced (Bell's stage III) disease who needed some surgical intervention along with medical treatment were further studied and analyzed.

The surgical intervention was in the form of percutaneous insertion of peritoneal drain to stabilize the critically ill patients. Peritoneal drain was followed by laparotomy after stabilization of general condition. Patients with poor risk factors like extreme prematurity or very low birth weight and associated congenital anomalies were only managed by drain if there was remarkable improvement after drain insertion. Primary laparotomy without prior drain was done in good risk patients with stable general condition. During laparotomy, the surgical procedure was chosen according to intraoperative findings and clinical condition. Resection of necrotic bowel with end to end anastomosis was done whenever it was possible. Ileostomy or colostomy was performed when primary anastomosis was not feasible. Peritoneal cavity was thoroughly cleaned in all cases. Clinical details, laboratory results, bacteriological and fungal cultures, intraoperative findings and surgical procedures were recorded on a separate proforma for each patient. Clinical course of the disease was followed in the hospital and out-patient clinics.

RESULTS

The 50 patients entered into the study had an average gestational age of 30 weeks (range 24 to 40 weeks) and an average birth weight of 1.53 kg (range 0.490kg to 3.9kg). Thirty-three babies had respiratory distress at birth and 25 of these babies

Table 2: Platelet counts in 50 patients with complicated NEC

Platelet count x 10 ⁹ /l (range)	Number of patients	Died
> 150	10	0
100-150	31	0
< 100	9	8

needed ventilation after birth. Thirteen (24%) babies needed aminophylline for treatment of lung conditions. Congenital heart disease was seen in 15 (30%) cases (Table 1) and nine received indomethacin treatment. Umbilical vein catheter was put in five patients while they were in the neonatal medicine unit. History of maternal disease was obtained in 15 (30%) cases. Various maternal conditions were hepatitis (n = 1), diabetes (n = 3), eclampsia (n = 6), bronchial asthma (n = 1) and steroid treatment (n = 4).

Forty (80%) of these babies had low platelet count (platelet count less than 150 x 10⁹/l) during the course of their disease. Each one of the eight patients who died had platelets less than 100 x 10⁹/l (Table 2).

Positive bacterial blood culture could be obtained in 23 patients. Coagulase negative *Staphylococcus* was the most frequently grown organism (n = 11). Other isolates were *Staphylococcus aureus* (n = 5), *Klebsiella pneumoniae* (n = 5), *Enterobacter* (n = 3), *Pseudomonas aeruginosa* (n = 2), *Acinetobacter* (n = 2) and *Citrobacter* (n = 2). Fungemia was noticed in nine patients. The *Candida* species grown in blood were *albicans* (n = 3), *tropicalis* (n = 2), *glabrata* (n = 2) and *parapsilosis* (n = 2). Peritoneal fluid culture or wound swab culture had shown bacterial growth in 12 cases. *Klebsiella* species (n = 6), *Enterococcus fecalis* (n = 3), *E.coli* (n = 3), *Stenotrophomonas maltophilia* (n = 2) and *Citrobacter kuseri* (n = 1) were isolates from peritoneal fluid or wound swab cultures.

Surgical intervention was done in all these 50 patients. Three patients needed surgery for sequelae of the disease (bowel strictures). These three patients were treated earlier by medical management without any surgical intervention. The remaining 47 patients were treated by peritoneal drain (n = 11) or PD followed by laparotomy (n = 20) or primary laparotomy without prior drain (n = 16). Among the eight patients who died five were managed by initial peritoneal drain followed by surgery while two were treated by peritoneal drain only and one had primary laparotomy (Table 3).

Thirteen patients developed bowel strictures. Three of them were earlier managed conservatively and were operated for strictures. Eight patients treated by only PD developed strictures and another two patients who developed strictures

Table 3: Outcome of various surgical intervention methods

Treatment Method	Number of Patients	Died	Developed Stricture
Only Peritoneal drain	11	2	8
Peritoneal drain followed by laparotomy	20	5	2
Primary laparotomy	16	1	0

were treated by laparotomy after initial PD. None of the patients treated by primary surgery developed stricture. This entire group of 13 patients except one had colonic strictures. Left colon stricture was seen in 11 patients. One patient had right colonic stricture and in one of these patients with strictures, only small bowel was involved.

At laparotomy, bowel perforation was seen in 27 patients, isolated small bowel was involved in disease process in 25 (50%) patients while only large bowel was diseased in 11 (22%) cases. Fourteen (28%) patients had both small and large bowel involvement. Maximum (5) deaths were in patients with both small and large bowel involvement (Table 4).

Forty-two of these surgically managed patients are still alive and are on follow up in our outpatient clinics. Eight patients died due to severe NEC with septicemia.

DISCUSSION

Necrotizing enterocolitis is primarily a disease of prematurity. Only 10 to 15% of all cases of NEC are full-term infants^[6,7]. In our study only two (4%) were full-term babies with birth weight of 2.8 kg and 3.9 kg. The rest were premature with average gestational age of 30 weeks and average birth weight of 1.53 kg. Hence many (66%) of our patients had respiratory distress at birth because of hyaline membrane disease or lung disease of prematurity.

Congenital Heart Disease (CHD) has been associated with NEC but mere presence of CHD has not been associated with higher mortality^[8]. Like others we also observed that outcome of NEC patients with cardiac disease did not differ from those without cardiac diseases.

Thrombocytopenic patients with NEC have higher mortality^[9]. In our study highest mortality (88.8%) was noticed in patients with platelet counts less than $100 \times 10^9/l$.

Positive blood culture rate in the range of 20-35% has been reported in patients with NEC^[10]. 46% of our patients had positive blood culture. High positivity of blood culture in our study could be because of the fact that this is the study of only complicated NEC. Suspected or mild NEC (Bell's

Table 4: Pattern of bowel involvement and outcome

Involved Bowel	Number of Patients	Died (%)
Small intestine	25	1 (4)
Large intestine	11	2 (18.1)
Both small & large intestine	14	5 (35.7)

stage I) patients were excluded in our study. *Klebsiella* species, *Enterococcus fecalis*, *E.coli*, *Stenotrophomonas maltophilia* and *Citrobacter kuseri* were the isolates from peritoneal fluid in our patients. Similar organisms have been reported from peritoneal fluid in patients with NEC in literature^[11] except *Stenotrophomonas*, which was seen in two of our patients. Both these patients with *Stenotrophomonas* infection detected in wound swabs died.

Traditionally surgical treatment in form of laparotomy has been recommended for patients with NEC who do not respond to medical treatment. Since majority of these patients are critically ill, percutaneously placed PD became popular as the initial surgical intervention to stabilize patients before laparotomy. Role of PD has been extended even further in the last decade as this is now used as primary management^[12] or even as definitive management^[13] in patients with NEC. Survival after PD for perforated NEC reported in most series is about 60%. Overall, 77% of our patients with PD survived although 33 % of these developed bowel strictures. Stricture rate was highest (72%) in patients who were managed with PD as definitive procedure. Three of our patients had bowel strictures following medical management without any surgical intervention. The incidence of post-NEC stricture has been reported as 14 to 36%^[14,15]. Stricture rate is more after management with PD^[12]. However, many agree that more than 80% of patients show improvement after PD^[12,16].

Operative survival of NEC has improved over past two decades^[2,3]. We had only one death (6.5%) in patients who were managed by primary laparotomy. Better survival in these patients could be because of the fact that we chose relatively stable patients with better birth weight for primary laparotomy and preferred to put PD for patients who were critically ill.

Bowel involvement has been considered the most important factor influencing mortality rate in infants operated on for complicated NEC^[17,18]. Half (50%) of our patients had only small intestinal involvement while large bowel was involved in 22% cases. Involvement of both small and large bowel was seen in 14 (28%) patients and this group had maximum mortality (35.7%).

Overall survival in our patients was 84%. Improved survival in our study can be attributed to our flexible policy of management. We preferred to put PD for critically sick babies with complicated NEC and operated upon them after stabilization. Relatively stable patients were managed by primary laparotomy.

Necrotizing enterocolitis remains the disease of premature and low birth weight babies. Patients with congenital heart disease did not add to the mortality of the disease. Our data suggest that thrombocytopenia is a bad prognostic sign. Involvement of both small and large bowel is associated with poor outcome. PD insertion is linked with increased incidence of bowel strictures according to our study. However selective use of PD improves survival. Hence each case with complicated NEC should be managed on its own merit rather than following a fixed protocol.

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