

Perforated Necrotizing Enterocolitis: What Is The Rational Approach? Peritoneal Drainage or Laparotomy?

Dr.Sunil Kumar Reddy. C¹, *Dr. Dasaradharao.L²

¹Associate Professor, Department of Pediatric Surgery, Andhra Medical College, Visakhapatnam, AndhraPradesh, India

²Assistant Professor, Department of Pediatric Surgery, Andhra Medical College, Visakhapatnam, AndhraPradesh, India

*Corresponding author: Dr..Dasaradharao.L

Abstract: **Aim:** Necrotizing Enterocolitis (NEC) is one of the most common life threatening gastrointestinal emergency in the neonatal period. This study is aimed to identify the subset of neonates with perforated NEC (Bell's Stage IIIb) who will benefit from peritoneal drainage alone and who will require salvage laparotomy and the role of sepsis in the outcome. **Materials and Methods:** This is retrospective study of neonates admitted and treated for perforated NEC between June 2013 to December 2016 (3½yrs). The records were reviewed and data pertaining to gestational age, sex, weight, severity of sepsis, nature of discharge from peritoneal drain, treatment offered and survival were recorded and the data was analyzed. **Results:** Total of 68 neonates were treated for perforated NEC. 52 were males and 16 were females. Of the 68 neonates, 25 neonates were treated with primary peritoneal drainage (PPD) alone (Group-I) and 43 neonates underwent salvage laparotomy after PPD (Group-II). Of the 25 pts in group I the peritoneal drain fluid was air ± serous fluid in 16 and bilious ± feculent in 9 and of the 43pts in group II, air ± serous fluid was the peritoneal drain fluid in 9 and bilious ± feculent in 34. In group I early sepsis was present in 15pts and severe sepsis in 10pts while in group II early sepsis was present in 32pts and severe sepsis in 11pts. 19/25 pts (76%) with air ± serous fluid on peritoneal drainage survived, whereas 15/43 pts (34.9%) with bilious ± feculent discharge survived. 33/47 pts with early sepsis survived while none of the neonates with severe sepsis survived. **Conclusion:** Primary peritoneal drainage (PPD) is an useful first step in assessment and stabilisation of neonates with perforated NEC. In neonates with air ± serous fluid on peritoneal drainage, PPD alone may be successful but with bilious ± feculent discharge on peritoneal drainage, salvage laparotomy is required. Neonates presenting with early sepsis have better chance of survival.

Keywords: NEC, Perforation, Peritoneal drainage

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I. Introduction

Necrotizing Enterocolitis (NEC), known as "DISEASE OF PARADOXES" is a common life threatening emergency in neonates. Incidence is on the rise due to more number of premature infants surviving due to advances in neonatal care. Traditionally, in cases of perforated NEC (Bell's Stage IIIb) exploratory laparotomy and various surgical procedures were done^{1,2}. Ein etal³ in 1977 described the use of peritoneal drainage in cases of perforated NEC as a temporizing procedure in neonates who were very ill, septic and too unstable for laparotomy and he found that 3 of the 5 neonates survived with peritoneal drain alone. Since then primary peritoneal drainage (PPD) has been used as treatment for perforated NEC and several reports were published that PPD alone may serve as definitive therapy in neonates with perforated NEC^{4,5,6,7}.

The choice of treatment (PPD or Laparotomy) varies widely between institutions. Majority of the neonates treated with PPD were more premature, had low weight and more co-morbid factors than their counterparts treated with laparotomy. Due to this apparent bias in treatment selection it has not been possible to entirely identify which procedure is better for which patient^{5,8}. Neonates who were treated by PPD were subjected to salvage laparotomy if there was evidence of clinical deterioration^{4,6,9}. It is very difficult to identify which neonate is improving or deteriorating based on clinical and laboratory investigations. This led to delay in doing laparotomy early in neonates who needed it, thus resulting in failure of salvage laparotomy⁹.

In this study we tried to identify the subset of neonates who will benefit from PPD alone and the subset of neonates who need salvage laparotomy based on the nature of discharge from peritoneal drain. We also tried to assess the role of sepsis at presentation in the outcome/survival of neonates treated with either PPD alone or PPD with salvage laparotomy

II. Materials and Methods

This is retrospective study of neonates admitted and treated for perforated NEC between June 2013 to December 2016 (3½yrs). The records of neonates with clinical and radiological proof of NEC with perforation (free intraperitoneal air on radiograph) were reviewed. The data pertaining to gestational age, sex, weight, severity of sepsis, nature of discharge from peritoneal drain, treatment offered and survival were recorded and analyzed. All neonates with perforated NEC treated with PPD on admission and the neonates who underwent subsequent salvage laparotomy after initial PPD were included in the study. The neonates with perforated NEC who underwent laparotomy directly without PPD were excluded from the study. For peritoneal drain, a corrugated rubber drain was inserted in the right flank under local anesthesia under aseptic precautions.

Figure 1: Showing the peritoneal drain in Right flank



Sepsis was classified as early and severe sepsis. Neonates were considered to have severe sepsis if on presentation they had any 2 of the following features: High grade fever(>102°F) with marked leucocytosis(>12,000/mm³), circulatory failure needing pressors, sclerema, positive blood cultures and significantly elevated CRP.

Nature of discharge from peritoneal drain was classified as a) Air ± Serous fluid b) Bilious ± Feculent. Survival was described as being alive at the time of discharge.

III. Results

A total of 68 patients(pts) with perforated NEC treated with PPD alone or PPD followed by salvage laparotomy were analyzed in this study. Males were 52 and females were 16 (M:F – 3.2:1). These 68 pts were categorized into two groups:

Group I: Patients treated with PPD alone (25pts)

Group II: Patients who underwent salvage laparotomy after PPD insertion (PPD + LAP) (43pts)

Group I: 25 neonates (19 preterm and 6 term). Mean gestational age was 31.5 weeks (28 – 39 weeks), mean weight was 1.74kgs (1.2 – 2.3 kgs), severe sepsis noted in 10pts, on peritoneal drainage the discharge was air ± serous fluid in 16pts and bilious ± feculent in 9pts. 12 of the 25pts survived (48%).

Table 1: Showing the survival in relation to nature of discharge from peritoneal drain and sepsis in GROUP I

Parameter	No of Pts	Survival	
		n	%
PERITONEAL DRAIN FLUID:			
a) Air ± Serous fluid	16	12	75
b) Bilious ± Feculent	09	00	00
SEPSIS:			
a) Early sepsis	15	12	80
b) Severe sepsis	10	00	00

12/16 pts (75%) who had air ± serous fluid discharge from drain site survived and none of the 9 pts with bilious ± feculent discharge survived. Of the 4/16 pts who died, 2pts had severe sepsis on presentation, 1 had associated cardiac anomaly and 1 child had sudden deterioration, the cause could not be ascertained. 9pts with bilious ± feculent discharge were very sick on admission, had severe sepsis, were too unstable for laparotomy and expired within 36hrs after admission.

Group II: 43 neonates (31 preterm and 12 term). Mean gestational age was 35 weeks (32 – 40 weeks), mean weight was 2.16kgs (1.4 – 2.6 kgs), severe sepsis noted in 11pts, on peritoneal drainage the discharge was air ± serous fluid in 9pts and bilious ± feculent in 34pts. All the 43 pts underwent salvage laparotomy.

Indications for laparotomy were as follows:

- a) Persistent bilious or feculent discharge from drain – 26pts
- b) Features of peritonitis and/or clinical deterioration – 8pts
- c) Features of intestinal obstruction (persistent significant gastric aspirate, abdominal distension and constipation) – 9pts

The mean duration from PPD to laparotomy was 3.5 days (2 - 9days)

The procedures performed in these 43pts were as follows:

- a) Enterostomy ± Resection – 17pts
- b) Resection ± EEA – 9pts
- c) Perforation closure – 5pts
- d) Peritoneal lavage – No perforation identified – 9pts

Extensive gangrene – 3pts

No obvious perforation or gangrene was found in all the 9 pts who had air ± serous fluid discharge from drain site. Of these 43 patients 22 patients survived (51.2%).

Table 2: Showing the survival in relation to nature of discharge from peritoneal drain and sepsis in GROUP II:

Parameter	No of Pts	Survival	
		n	%
PERITONEAL DRAIN FLUID:			
a) Air ± Serous fluid	09	07	78
b) Bilious ± Feculent	34	15	44
SEPSIS:			
a) Early sepsis	32	22	69
b) Severe sepsis	11	00	00

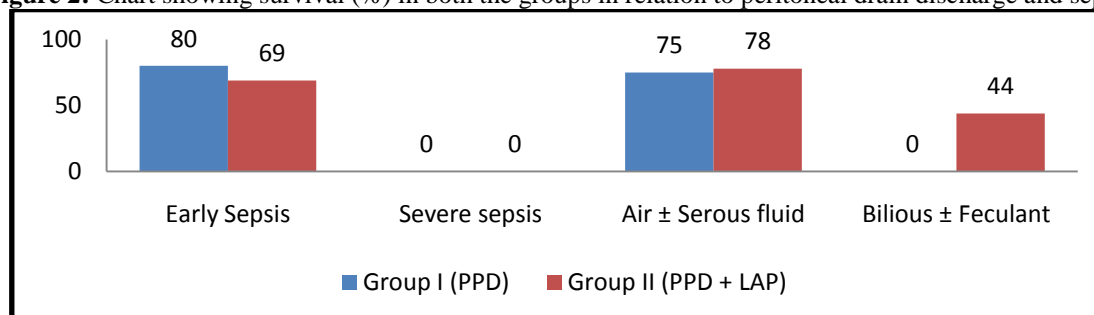
7/9 pts (78%) who had air ± serous fluid discharge from drain site survived. 2 patients succumbed to sepsis after the surgery. No obvious perforation or gangrene was found in any of these 9 pts and all 9 pts had features of early sepsis on presentation. 15/34 pts (44%) with bilious ± feculent discharge survived. Of the 34 pts 11 patients had severe sepsis on presentation and all of them expired. 15/23 pts (65.2%) who presented with features of early sepsis survived after the surgery.

Table 3: Comparison Of Group I and Group II:

PARAMETER	GROUP I (PPD)	GROUP II (PPD + LAP)
Total no of patients	25	43
Mean gestational age (weeks)	31.5	35
Mean weight (Kgs)	1.74	2.16
Severe sepsis	10 (40%)	11 (25%)
Survival	12 (48%)	22 (51.2%)

The above table shows that though neonates treated with PPD alone were more premature, had low weight and more % of pts with severe sepsis (40% vs 25%) as compared to their counterparts who underwent salvage laparotomy, the survival rates were almost similar (48% vs 51.2%) in both the groups and the difference is not statistically significant.

Figure 2: Chart showing survival (%) in both the groups in relation to peritoneal drain discharge and sepsis



In patients who had bilious or feculent discharge, the survival rates were 0% vs 44% for group I & group II respectively. The overall survival rates for patients presenting with early sepsis versus late sepsis is 72.3% vs 0%.

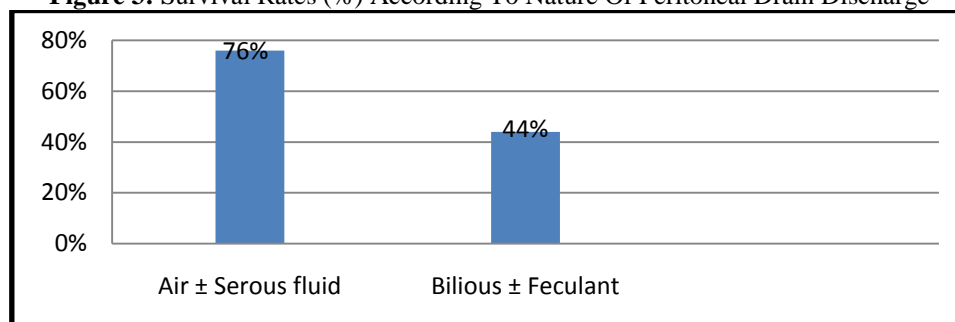
IV. Discussion

Perforated Necrotising enterocolitis is a common surgical emergency predominantly affecting premature and low birth weight neonates. These neonates are generally ill, sick and unstable to perform surgery. Peritoneal drainage was initially proposed as a measure to stabilize these neonates before laparotomy^{3,10}. The data regarding PPD has emerged in three phases

- a) Observational data comprised of anecdotal reports
- b) Retrospective studies comparing PPD with historical controls undergoing laparotomy
- c) Reports of PPD being used as a primary surgical procedure

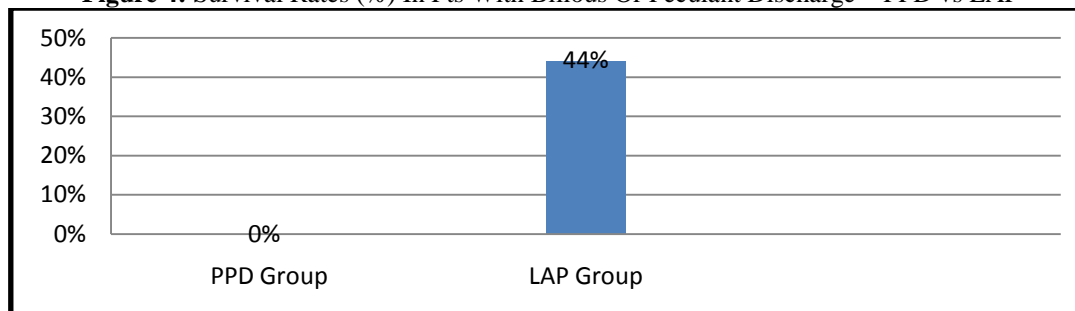
In several studies neonates treated with PPD had a younger gestational age, lower birth weight and were less stable as compared to their counterparts treated with traditional laparotomy. Despite this apparent bias in patient selection for the procedures (PPD or LAP), most studies including the present study found similar survival rates for both the procedures^{4,5,8,9,11,12}. Salvage laparotomy was done if clinical deterioration occurred after peritoneal drainage^{4,6,9}. This was not successful due to the delay in performing laparotomy after PPD. This delay was due to the difficulty in identifying the correct response (improvement or deterioration) of neonates treated with PPD⁹. PPD in all neonates with perforated NEC will help to stabilize the child^{3,10}. This procedure is easy to perform, can be done under local anesthesia and is a bed side procedure. Insertion of peritoneal drain will help relieve the distension, relieve diaphragmatic stenting in tense abdomens and drain the toxic intra-abdominal contents. PPD is an useful initial step in stabilization of all neonates with perforated NEC^{3,7,8,13,14}.

Figure 3: Survival Rates (%) According To Nature Of Peritoneal Drain Discharge



Our study was primarily done to identify the subset of neonates who will benefit from primary peritoneal drainage alone and those who need salvage laparotomy based on the nature of discharge from peritoneal drain. In our study of the 25 pts who had air ± serous fluid discharge from peritoneal drain, only 9pts (26%) required surgery. On laparotomy no obvious finding mandating surgery was identified. 2/9 pts died after laparotomy. We feel that laparotomy could have been avoided in these patients. Of the 16pts who did not need laparotomy, 12pts survived and 4 pts died(2 had severe sepsis, 1 had associated cardiac anomaly and in 1 the cause could not be ascertained). These findings suggest that those neonates who have only air ± serous fluid as discharge from peritoneal drain may benefit from PPD alone.

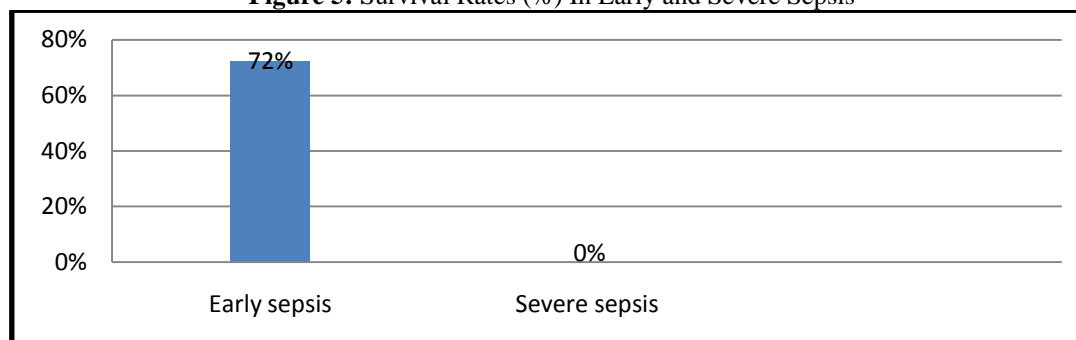
Figure 4: Survival Rates (%) In Pts With Bilious Or Feculent Discharge – PPD vs LAP



Of the 43pts who had bilious or feculent discharge from peritoneal drain, 9 were treated with PPD alone and none of them survived (all these pts succumbed within 36hrs after admission and were too unstable for laparotomy at any given time). Remaining 34pts underwent laparotomy and all these pts had either

perforation, gangrene or both. 15 of the 34pts survived (44%) after laparotomy. Presence of a definitive finding in these 34pts justifies the need for early surgery. This simple way of analyzing the nature of fluid from peritoneal drain will help in early identification of patients who need salvage laparotomy and insertion of peritoneal drain will help in the initial stabilisation of these patients.

Figure 5: Survival Rates (%) In Early and Severe Sepsis



In this study none of the neonates who presented with features of severe sepsis survived. Majority of these patients were symptomatic for >2days prior to admission. 72.3% (34/47) of the pts who presented with features of early sepsis survived. Early identification and prompt treatment in neonates with perforated NEC will increase their chance of survival.

V. Conclusion:

Primary peritoneal drainage is an useful first step in assessment and stabilization of all neonates with perforated Necrotizing Enterocolitis. Nature of discharge from peritoneal drain helps in early identification of neonates who need salvage laparotomy. Primary peritoneal drainage alone is successful in neonates with perforated NEC if the peritoneal drain discharge is air \pm serous fluid. Neonates who have bilious or feculent discharge from peritoneal drain need salvage laparotomy at the earliest after initial stabilisation and Neonates presenting with early sepsis have better chance of survival.

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