

**Early Peritoneal Drainage Alone Vs. Laparotomy in Neonatal Necrotizing Enterocolitis Management: A Comparative Analysis****L Dasaradha Rao<sup>1</sup>, Sravanthi Vutukuru<sup>2</sup>, Sasidhar Thorlikonda<sup>3</sup>, Tarun Chowdary Mulpuri<sup>4</sup>, Rohit Sajja<sup>5</sup>**<sup>1</sup>Associate Professor of Pediatric Surgery, Siddhartha Medical College, Vijayawada, Andhra Pradesh<sup>2</sup>Assistant Professor of Pediatric Surgery, Siddhartha Medical College, Vijayawada, Andhra Pradesh<sup>3</sup>Assistant Professor of Pediatric Surgery, Siddhartha Medical College, Vijayawada, Andhra Pradesh<sup>4</sup>Senior Resident, Department of Paediatric Surgery, Siddhartha Medical College, Vijayawada<sup>5</sup>Assistant Professor of Pediatric Surgery, Siddhartha Medical College, Vijayawada, Andhra Pradesh

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Conflict of interest: Nil

**Abstract:****Aim:** Management of neonatal perforated necrotizing enterocolitis in a high-volume center.**Methods:** Retrospective analysis of all newborns managed with NEC between 2019-23. 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 data was analyzed.**Results:** Total 78 neonates were treated with perforated NEC. Out of which 42 were male, 36 were females. 20 were treated alone with primary peritoneal drain alone, 58 underwent salvage laparotomy after peritoneal drain. Group -1 (primary peritoneal drain alone) 30 patients – Air + serous fluid, Group 2 (salvage laparotomy followed by primary peritoneal drain), 12 air+ serous fluid, 27 bilious aspirates, and 19 feculent. Group -1 (12/20) survived group 2 (33/58) survived.**Conclusion:** Early peritoneal drainage helps in stabilization of neonates with perforated NEC, in neonates with air and serous fluid alone most of time peritoneal drain alone is enough. Laparotomy is required only in cases no improvement and with bilious and feculent aspirates. Early and aggressive intervention and timely management have better chance of survival.**Keywords:** NEC, Necrotising Enterocolitis, Surgical Emergency Neonatal, Preterm.

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**Introduction**

Necrotising enterocolitis (NEC) is the dominating surgical emergency in preterm neonates. More than 90% of neonates developing NEC are born preterm, and the risk is inversely related to gestational age and birth weight [1]. NEC affects 5%–7% of preterm neonates and 10%–15% of preterm neonates with a birth weight of <1500 g [1].

The disease is characterised by inflammation of the bowel which may progress to bowel necrosis, bowel perforation, peritonitis, sepsis, multisystem organ failure and death.

Initial treatment of NEC is supportive with bowel rest, gastric decompression, broad-spectrum antibiotics, fluid resuscitation and parenteral nutrition [1].

However, around 50% of all neonates with NEC will need emergency surgery due to intestinal perforation or deteriorating clinical or biochemical status. Mortality rates after surgically treated NEC vary between 20% and 67% [2].

Santulli in 1975 first hypothesized that the development of NEC had three essential components: injury to intestinal mucosa, presence of bacteria, and availability of metabolic substrate [3].

The tissue of the intestinal wall in patients with necrotizing enterocolitis shows inflammation and bacterial invasion. As the disease progresses, tissue shows ischemia, followed by necrosis, and ultimately perforation, which may be either micro perforation or a frank perforation [4].

**Pathogenesis:** GI tract is characterized by an immaturity of cellular and humoral immunity, increased permeability reduced gastric acid secretion, reduced concentration of proteolytic enzymes, incomplete innervation and decreased motility and immaturity of the intestinal epithelium and microvilli barrier function. Compromise of the intestinal epithelial barrier appears to be the first event leading to activation of the inflammatory cascade.

Full term neonates who develop NEC usually have other associated factors that predispose them to disease such as sepsis, low APGAR scores, prolonged rupture of membranes, exchange transfusions, neural tube defects and congenital heart disease. 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.

**Materials and Methods**

This is retrospective study of neonates admitted and treated for perforated NEC between 2019 to 2023.

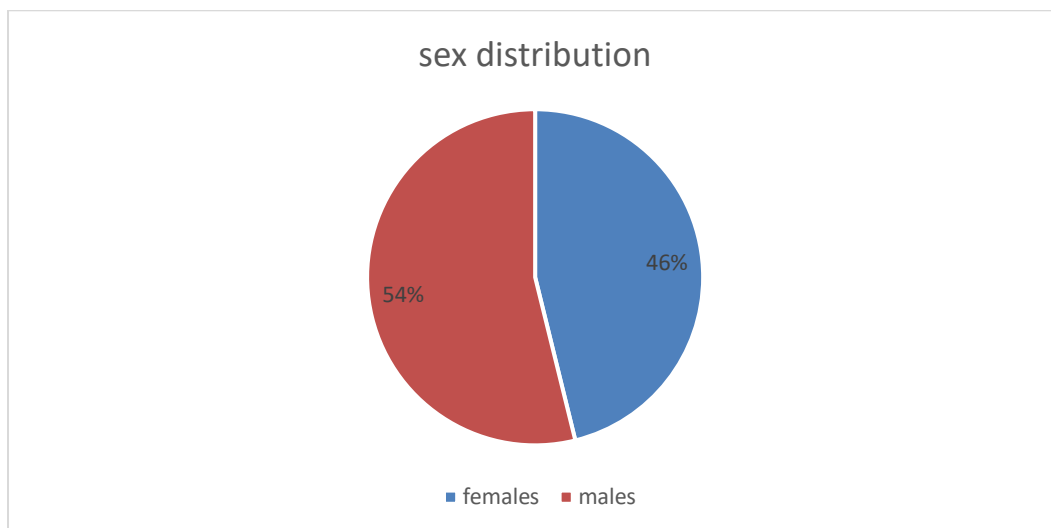
The records of neonates with clinical and radiological proof of NEC with perforation were reviewed. The data pertaining to gestational age, sex, weight,

severity of sepsis, nature of discharge from peritoneal drain, treatment offered and survival were recorded and analysed. 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 anaesthesia under aseptic precautions.

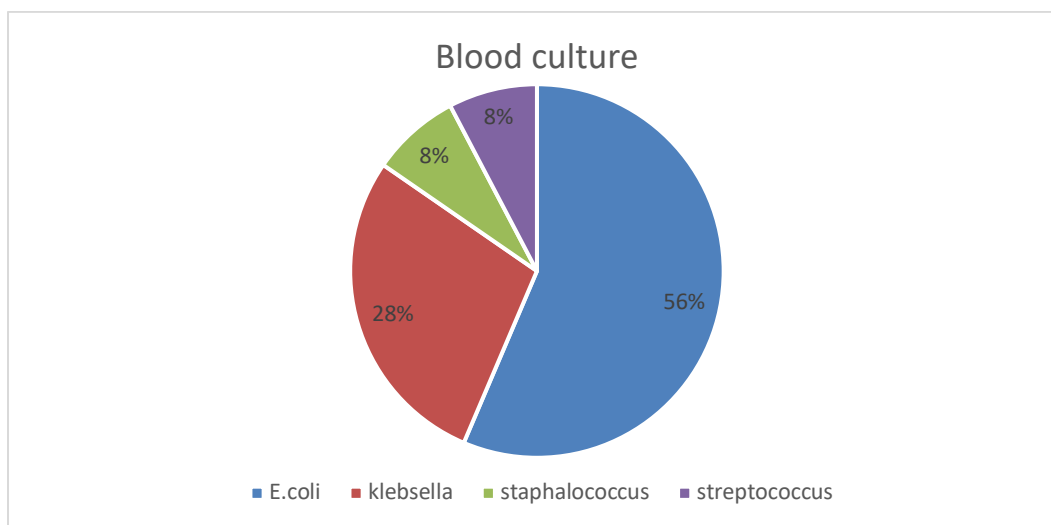
Nature of discharge from peritoneal drain was classified as a) Air ± Serous fluid b) Bilious ± Feculent. Survival was described as being alive at the time of discharge.

**Results**

A total of 78 patients (pts) with perforated NEC treated with PPD alone or PPD followed by salvage laparotomy were analysed in this study. Males were 42 and females were 36.



**Figure 1: sex distribution**

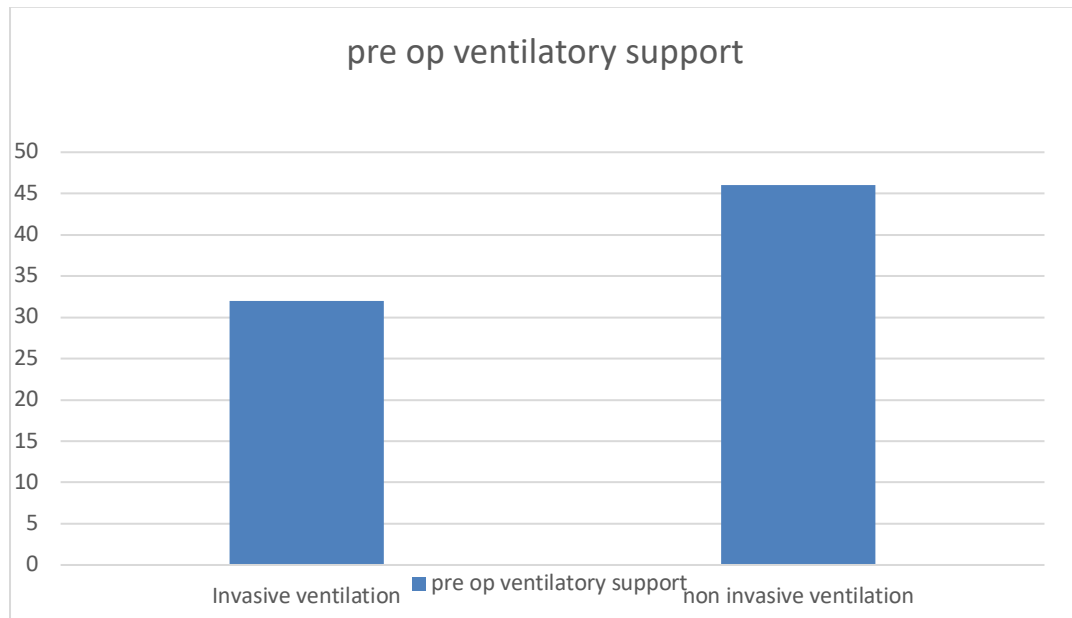


**Figure 2: Blood culture**

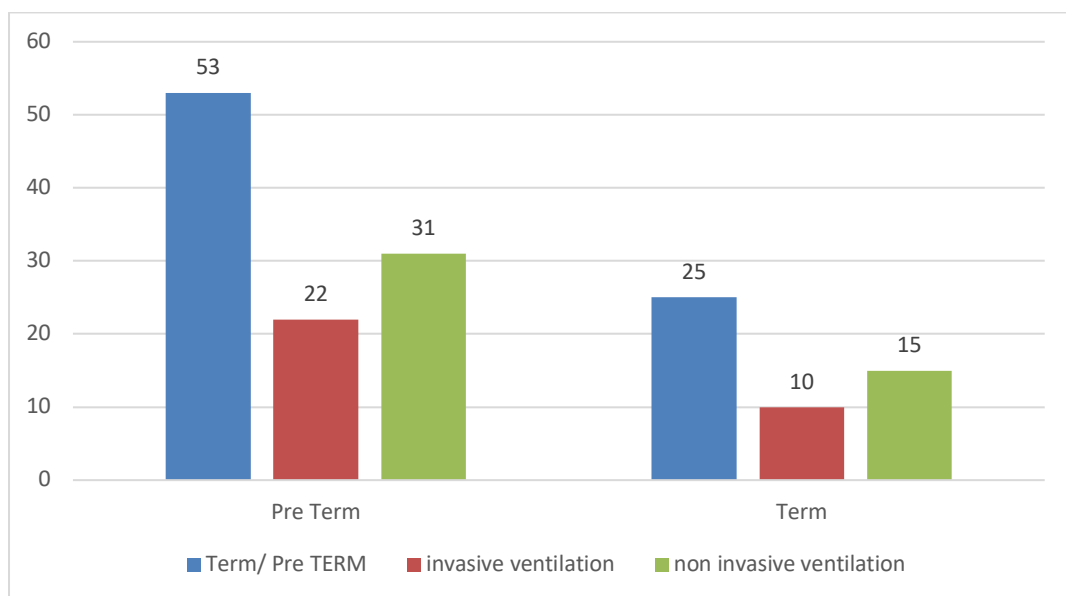
These 78 pts were categorized into two groups. Group I: Patients treated with PPD alone (20pts). Group II: Patients who underwent salvage laparotomy after PPD insertion (PPD + LAP) (58pts)

**Table 1: Comparison of group 1 and group 2**

Parameter	Group 1	Group 2
Total no of patients	20	58
Mean gestational age	32.5	35
Mean weight	1.5	1.8
Survival	60%	60.5%



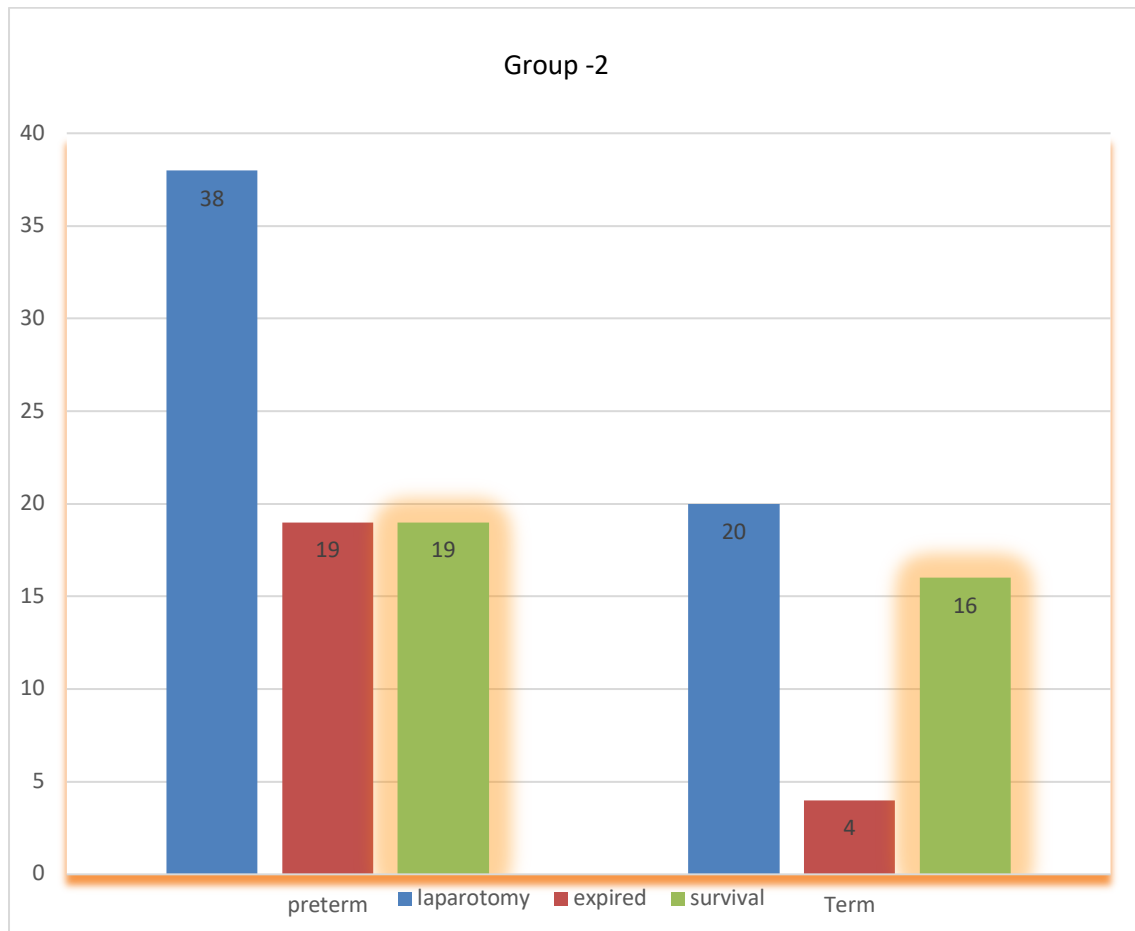
**Figure 3: pre op ventilatory support**



**Figure 4:**

Group 1:- 20 neonates (15 Preterm and 5 term). Mean gestational age was 32.5 weeks (30– 39 weeks), mean weight was 1.74kgs (1.2 – 2.3 kgs), severe sepsis noted in 8pts, on peritoneal drainage the discharge was air + serous fluid in 20 patients, 12/20 patients survived 60%.

Group 2: 58 neonates (38 preterm and 20 term) Mean gestational age was 35 weeks (32 – 40 weeks), mean weight was 2kg (1.4 – 2.6 kgs), severe sepsis noted in 11pts, on peritoneal drainage the discharge was serous fluid in 9pts and bilious ± feculent in 34pts.



**Figure 5: Group-2**

All the 43 pts underwent salvage laparotomy. Indications for laparotomy were as follows:

1. Persistent bilious or feculent discharge from drain – 26pts
2. Features of peritonitis and/or clinical deterioration – 8pts
3. Features of intestinal obstruction(persistent significant gastric aspirate, abdominal distension and constipation) – 9pts

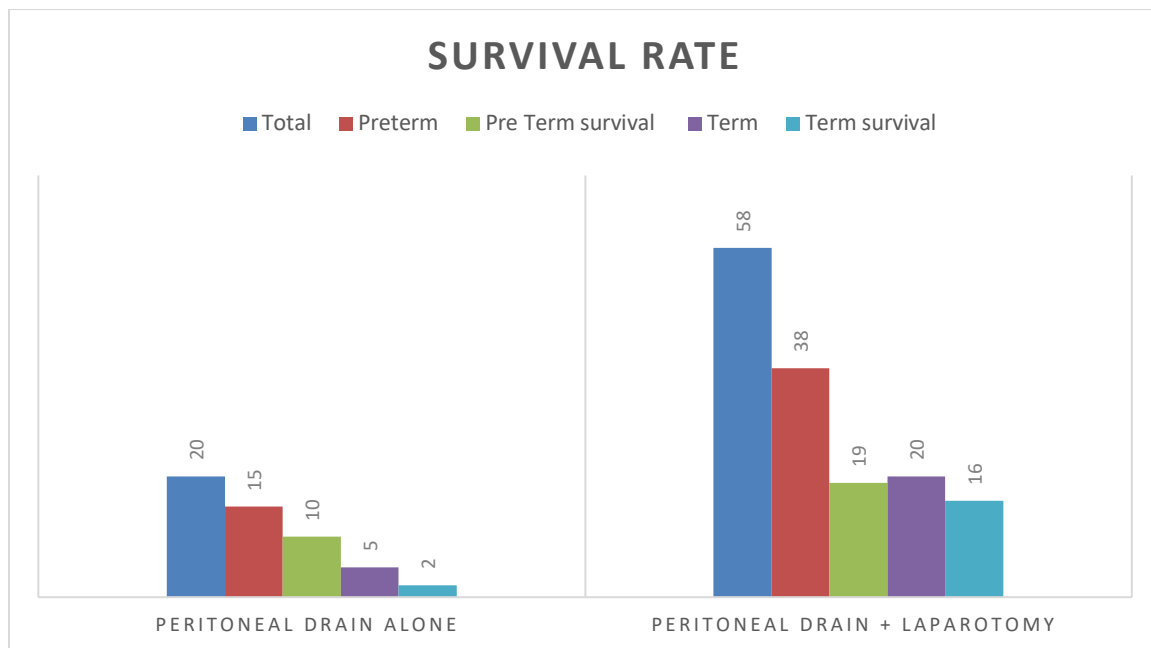
The mean duration from PPD to laparotomy was 2.5 days (2 - 7days) the procedures performed in these 58pts were as follows:

1. Enterostomy ± Resection – 30 pts
2. Resection ± EEA – 11pts
3. Perforation closure – 5pts

4. Peritoneal lavage – No perforation identified – 10pts
5. Extensive gangrene – 3pts

No obvious perforation or gangrene was found in all the 12 pts who had air ± serous fluid discharge from drain site. Of these 58 patients 35 patients survived (51.2%). 9/12 pts (75%) who had air / serous fluid discharge from drain site survived. 3 patients succumbed to sepsis after the surgery. No obvious perforation or gangrene was found in any of these 12 pts.

26/46 pts (56%) with bilious ± feculent discharge survived. Of the 46 pts 20 patients had severe sepsis on presentation and all of them expired. 20/26 pts (76%) who presented with features of early sepsis survived after the surgery.



**Figure 6: Survival Rate**

The given table shows that though neonates treated with PPD alone were more premature, the survival rates were almost similar (60% vs 60.3%) in both the groups and the difference is not statistically significant (Table 1). In patients who had bilious or feculent discharge. The overall survival rates for patients presenting with early sepsis versus late sepsis is 75% vs 0%.



**Figure 7:**

### 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

- Observational data comprised of anecdotal reports
- Retrospective studies comparing PPD with historical controls undergoing laparotomy
- 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 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 [4,5,8,9,10,11,12]. Salvage laparotomy was done if clinical deterioration occurred after peritoneal drainage [4,6,15]. Some were not successful due to the delay in performing laparotomy after PPD [7]. This delay was due to the difficulty in identifying the correct response (improvement or deterioration) of neonates treated with PPD. 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 anaesthesia 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 [7,8,13,14]. 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 20 pts who had air  $\pm$  serous fluid discharge from peritoneal drain. 12 pts survived and 8 pts died 6 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  $\pm$  serous fluid as discharge from peritoneal drain may benefit from PPD alone. Of the 58pts who had bilious or feculent discharge from peritoneal drain, definitive finding in 48pts justifies the need for early surgery after drain placement. This simple way of analysing 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. 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% 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.

### 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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