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Role of percutane peritoneal drainage in management of neonatal pneumoperitoneum: is surgery always necessary?

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ABSTRACT

Aims: The standard procedure in the management of neonatal pneumoperitoneum (NP) cases is laparotomy. However, in some of the cases in which surgery is not a viable option, percutaneous peritoneal drainage (PD) can be performed in order to stabilize the patient prior laparotomy. This study reviews the role of PD in NP patients using previous studies in the literature.

Methods: 26 neonates diagnosed with NP in Van Yüzüncü Yıl Faculty of Medicine, Van Training and Research Hospital neonatal ICU from April 2015 to January 2018 were retrospectively reviewed. In terms of surgical assessment, patients were divided into 2 groups according to their birth weight. Group A consisted of neonates with birth weight above 1000 grams whereas Group B consisted of neonates with birth weight above 1000 grams whereas Group B consisted of neonates with a birth weight of 1000 grams or below. Demographic values, diagnosis, and treatment methods were put on record in patient files.

Results: 10 cases (7 male – 3 female) in Group A had a mean body weight of 1850 (Range: 1070 – 3400 gr) grams. In this patient group, NP developed as a result of pneumothorax, necrotizing enterocolitis (NEC) and spontaneous intestinal perforation (SIP). 3 (30%) of the patients who were treated with classical approaches were lost during the treatment period. Group B consisted of 16 (9 male – 7 female) patients with a mean body weight of 780 (Range 470 – 950) grams. In this case group, NP developed as a result of NEC. PD was performed prior to conventional treatment procedures and 5 (31%) of the patients were lost during the treatment period.

Conclusion: Group B had similar mortality rates with Group A. result explains to us that PD is a viable option in stabilizing the patient prior to laparotomy as a starting procedure, especially in neonates below 1000 grams and deemed as surgically unstable.

Keywords: Neonatal pneumoperitoneum, peritoneal drainage, newborn, necrotizing enterocolitis

INTRODUCTION

Trapped air collected below the diaphragm in upright-position X-rays indicate pneumoperitoneum.[1] Regardless of the reason, neonatal pneumoperitoneum (NP) leads to abdominal distension, nutritional intolerance, respiratory distress, shock and eventually death. Etiology is hard to discern using clinical assessment and radiological studies. NP is usually related to intestinal perforation but is rarely caused without and it does not always indicate surgical intervention.[2] Neonatal intestinal perforation can develop secondary to necrotizing enterocolitis (NEC), spontaneous intestinal perforation (SIP), meconium-related ileus, gastric perforation and atresia. Bowel resection with or without ostomy (BR/O), patch drainage and wait (PD&W), peritoneal drainage (PD) insertion and combined methods can all be used for treatment. Choosing a surgical technique for each patient is a challenge due to high rates of surgical morbidity and mortality in those cases.

In this study, we would like to review the approach to neonatal pneumoperitoneum and role of peritoneal drainage in the context of the literature.

METHODS

26 neonates diagnosed with NP in Van Yüzüncü Yıl Faculty of Medicine, Van Training and Research Hospital neonatal ICU from April 2015 to January 2018 were retrospectively reviewed. The study was carried out with the permission of Ethical Committe of Faculty of Van Yüzüncü Yıl (Date:04.01.2018, Decision No: 2018101). All procedures were carried out in accordance with the ethical rules and

the principles of the Declaration of Helsinki. Patients' body weight, sex, diagnosis, gestational age and treatment choices were all put on record. Cases were divided into two groups according to their birth weight. Patients with birth weight above 1000 grams were included in group A whereas patients with birth weight equal or below 1000 grams were put into group B.

BRO routinely performed in NEC, SIP and other intestinal perforations. BRO includes opening of ostomy with healthy bowel tissue after resection of necrotizing segments. We used BRO approach in the all cases above 1000 grams and under 1000 grams after performing of PD. The PD & W method was preferred especially in cases where BRO could develop short bowel syndrome. In this method, all perforation areas were sutured without taking into account the necrosis areas and left to heal spontaneously with peritoneal drains. PD technique includes the insertion of pen rose drain to peritoneal cavity from right lower quadrant of abdomen under local anesthesia for removing of the air and infected peritoneal content from abdomen. PD was used in patients who are accepted unstable for surgery under 1000 grams.

The results were statistically assessed by using SPSS version 24. Normality controls were done using Shapiro-Wilk Test. Groups were compared in terms of mortality using independent sample t-test. Statistical significance level was set as $p<0.05$. Ethical acceptance was taken from the local ethic committee.

RESULTS

The study includes 26 (16 males–10 females) neonates with NP. Group A consisted of 10 patients with 7 males and 3 females. Their mean body weight was measured as 1850 (Range 1070 – 3400) grams. Group B had 16 patients with 9 males and 7 females. Mean body weight of this group was calculated as 780 (Range 470–950) grams. Different degrees of pneumoperitoneum Figure 1 were detected in all patients. 8 patients were operated for NEC Figure 2 and 1 patient was operated for SIP Figure 3.

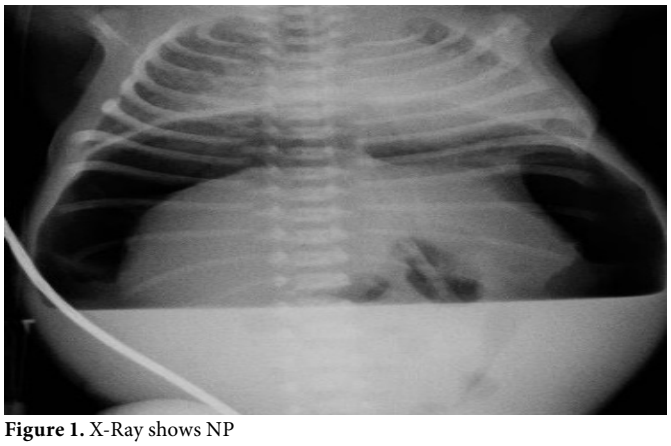


Figure 1. X-Ray shows NP

Intestinal resection – anastomosis was done in SIP case whereas BR/O was performed in NEC patients. 3 (30%) patients were lost due to NEC. Group B consisted completely of NEC cases. Due to high mortality risk associated with surgery, PD was performed in all patients as the initial treatment procedure Figure 4.

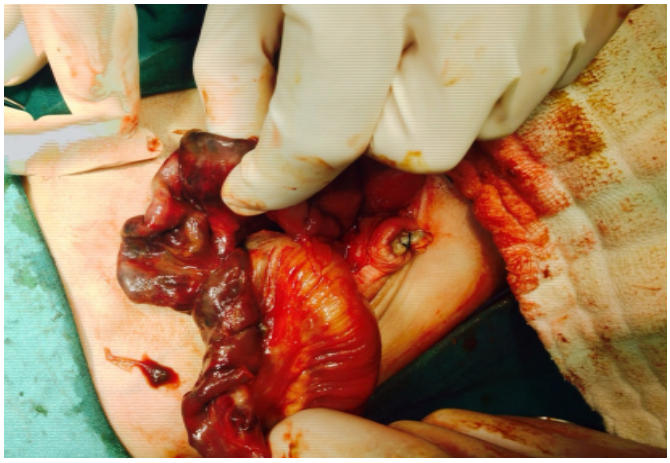


Figure 2. Intraoperative image of NEC

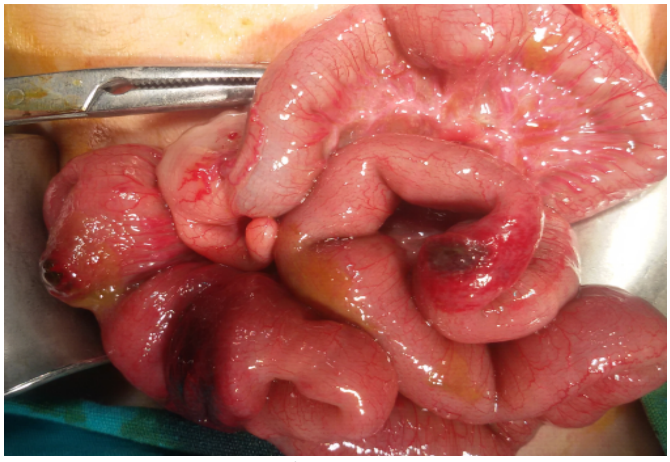


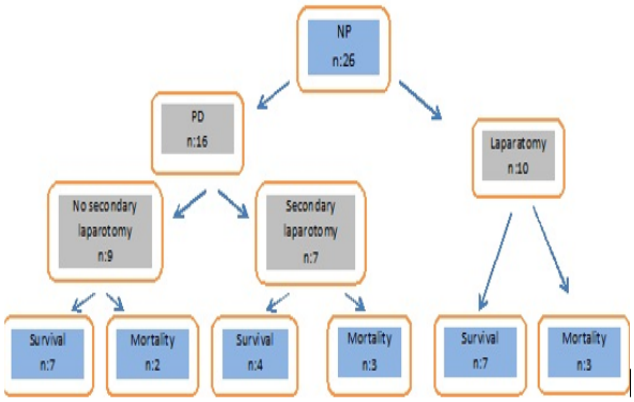
Figure 3. Intraoperative image of SIP

Figure 4. PD Inserted in right lower quadrant

In 7 patients with optimum hemodynamic conditions, 5 patients received BR/O surgery following a 12-hour observation period. 2 patients were operated using PD&W due to a risk of short intestine syndrome development. 2 out of 5 BR/O and 1 PD&W patient were lost due to long-term complications. 2 cases who received initial PD intervention were lost before secondary surgery due to instability. 7 patients showed a recession in pathology following PD so no additional surgical intervention was indicated. 5 (31.2%) patients in this group were lost. All finding data were outlined

on Table 1. In group B; patients with and without PD were compared for mortality. There was no significant statistical difference (p > 0,05). But patients who underwent PD had a higher risk of surgery than the other patients.

Table 1. Survival and mortality within 6 months after primaryintervention in infants



DISCUSSION

Pathology might not be clear in neonates operated for pneumoperitoneum. However, the most common reasons for pneumoperitoneum which does not require surgical intervention are mechanical ventilation and tension pneumothorax.[1] Gas transfer can happen between the chest and abdominal cavity due to periesophageal groove, congenital defects and pleuroperitoneal fistula.[1-3] Therefore, a conservative approach using chest tube is an effective solution in NP cases with pneumothorax without abdominal findings. Gastric perforation can rarely develop in the first week of life due to congenital or acquired reasons. Showing symptoms within the first week of life and absence of gastric air in upright x-rays might indicate gastric perforation. Emergency laparotomy in chosen patients or post-PD laparotomy in unstable premature newborns can be used for treatment. One of the most common reasons for pneumoperitoneum without perforation is pneumatosis cistoides intestinalis (PCI). PCI frequently accompanies NEC in preterm babies. It is often treated with conservative and medical methods.[1]

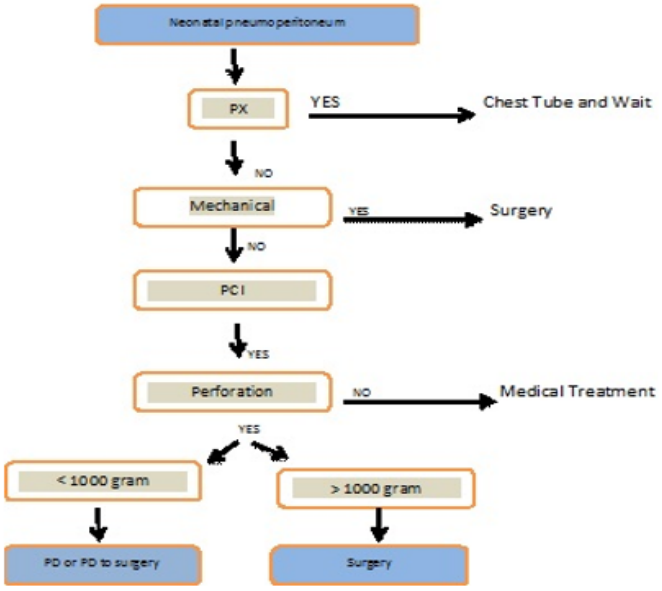
NEC is a quite severe inflammatory condition seen in premature babies with an incidence rate of 1-5% in neonatal ICUs. It is one of the leading mortality causes with 10-50%.[4,5] SIP is a rare condition which is seen in neonates with very low birth weight as intestinal perforations without necrotic changes. It is considered as a different clinical entity other than NEC.[6] It has a multifactorial etiology and can be related to congenital muscle anomalies, air embolism, indomethacin usage and high-dose steroid usage due to pulmonary dysplasia. SIP is frequent in premature babies and babies with low birth weight.[7] Although medical treatment is the most common management technique, about 30% of cases require bowel resection (with or without diverting enterectomy (BR/O)) and PD.[2-7]

BR/O has a complication rate around 68% which might manifest itself as local infection, sepsis, stricture, short bowel syndrome, incisional hernia, complications of long-term total parenteral nutrition, repeating surgeries and extended hospitalization periods.[4,8] Due to those complications, some of the authors suggest PD&W in those cases. This method is based on waiting for spontaneous healing with good angiogenesis.[8] Diesen reported a case that he treats an NEC with medical treatment, he saw old perforated bowel segment was spontaneously covered with momentum during another unrelated surgery.[9] Other than that, NP can develop in mechanical obstructions such as anal, intestinal and colonic atresia and Hirschsprung 's Disease as well.

Using PD in newborn NEC perforations was first suggested by Ein in 1977.[10] It was also reported that it can be used for resuscitation during a transition to laparotomy.[11] Some authors even argue that PD can be definitively used without laparotomy.[11,12] Moss's meta-analysis study which included 10 cases reported similar results with PD and laparotomy.[12] In our study, we also did not detect a significant difference in mortality rates when groups with and without PD were compared. However, it does show a positive effect on low birth-weight neonates (LBWN) survival rate. 43.7% of our LBWN cases did not require additional surgery. Birth weight is the most important independent factor in NEC-related PD.[4,12] PD prevents respiratory and circulatory complications caused by tension pneumoperitoneum[13] and makes time for the patient to obtain optimal vitals prior to appropriate surgical intervention.

Some authors reported that PD can be used in intestinal perforations seen in low birth-weight neonates as a primary intervention method and it shows about a 40% success rate in definitive treatment when used as the single metho.[13] Secondary surgery might be indicated in both NEC and SIP cases.[13] Although BR/O is the most commonly used technique for secondary surgery, PD can also be used to alleviate compression findings associated with the abdominal compartment. PD; thus making the demarcation line more prominent so that PD & W preference rates can be increased in selected cases with a risk of short bowel syndrome. All of our approaches were outlined on Table 2.

Table 2. Management of neonatal pneumoperitoneum



The limitations of our study, retrospective planning of the study, the low number of patients, and lack of a healthy

statistical analysis in terms of comparisons among patients under 1000 gram. In future trials, multi-centerial, prospective studies such as; only PD, only laparotomy and PD to laparotomy methods should be compared with each other in the cases of neonatal pneumoperitoneum with VLBW.

CONCLUSION

Pneumoperitoneum; despite the advances in surgical technique and neonatal intensive care, it has serious mortality rates. PD can be used as an initial procedure prior to laparotomy especially in surgically unstable neonates below 1000 gr. BR/O and PD&W are effective surgical procedures following hemodynamic stabilization.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Ethical Committe of Faculty of Van Yüzüncü Yıl (Date:04.01.2018, Decision No: 2018101).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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