

Compare the Outcomes of Laparotomy Versus Laparostomy Tube in Neonates Presented with Pneumoperitoneum

GAURI SHANKAR PANDIT¹, RANJANA KUMARI PANDIT², FAISAL MAHMOOD³, NAHIDA BURKI⁴, RIJA NAWAZ ABBASSI⁵, FATIMA AL ZAHRA⁶, ASAD IQBAL⁷, NADEEM AKHTAR⁸

¹Post Graduate Resident Children Hospital, Pakistan Institute of Medical Sciences PIMS Islamabad

²Medical Officer, Care Plus Hospital, G8 Markaz Islamabad

^{3,4,5}Post Graduate Resident Children Hospital, Pakistan Institute of Medical Sciences PIMS Islamabad

⁶Medical Officer, Children Hospital PIMS

⁷Post Graduate Resident Children Hospital, Pakistan Institute of Medical Sciences PIMS Islamabad

⁸Professor Pediatric Surgery, Children Hospital PIMS

Corresponding author: Gauri Shankar, Email: gspandit9@gmail.com

ABSTRACT

Objective: The purpose of this study is to compare the outcomes of laparotomy versus laparostomy tube in neonates presented with pneumoperitoneum.

Study Design: Retrospective study

Place and Duration: Children Hospital, Pakistan Institute of Medical Sciences PIMS Islamabad. Jan 2021-Dec 2021

Methods: There were 130 neonates of both genders were presented in this study. All the included neonates had pneumoperitoneum and admitted for surgery of abdomen. Detailed demographics of enrolled cases were recorded after taking informed written consent. Patients were equally divided in two groups. Group A received laparotomy among 65 patients and group B received laparostomy tube (conservative management) among 65 patients. Outcomes among both groups were assessed and compared in terms of efficacy, hospital stay, complications and pain score by visual analog score.

Results: Majority of the neonates were males 78 (60%) and 52 (40%) neonates were females. Most common symptom was abdominal and scrotal distension, followed by vomiting, cyanosis, respiratory distress and tachypnea. Efficacy of group B was found among 55 (84.6%) cases, 6 cases required laparotomy and 4 patients were died because of sepsis. Hospital stay was lower in group B 3.9±10.74 days as compared to group A 6.2±11.41 days. Post-operative lower pain score was observed in group B 0.9±1.66 as compared to group A 4.2±2.53. Complications were also higher in group A found in 10 (15.4%) cases as compared to group B in 4 (6.2%) cases.

Conclusion: We concluded in this study that use of laparostomy tube among neonates with pneumoperitoneum was equally affective and useful in terms of success rate while hospital stay, and complications were lower as compared to laparotomy group.

Keywords: Pneumoperitoneum, Hospital stay, Laparotomy, Laparostomy tube, Complications, Pain Score

INTRODUCTION

There is a surgical emergency if there is gas in the peritoneal, often known as pneumoperitoneum. Pneumoperitoneum is caused by a ruptured or punctured intra-abdominal viscus in the vast majority of cases (>90%) [1]. Pneumoperitoneum has been described as a benign, spontaneous, non-surgical, asymptomatic, or idiopathic condition that, if diagnosed, can be treated with solely conservative methods.

After evaluating the available literature, we identified numerous reports supporting cautious waiting for this entity [1-4], with positive results including shorter hospital stays and fewer laparotomies, each of which carries its own set of risks for complications and death. For premature infants with low or extremely low birth weights who cannot withstand the rigors of surgery, the placement of an intra abdominal drain has been proposed as a temporary measure to improve the newborn's health and stability [5]. When the diagnosis is NEC, studies have shown that there is no substantial difference in death among infants managed with laparoscopy or peritoneal drain installation. A single abdominocentesis is another method reported in the literature for treating spontaneous pneumoperitoneum by inserting 12 size nelton drain in the right iliac fossa and aspirating abdominal gas, after which the neonate is monitored until the pneumoperitoneum resolves on its own.[6]

The practice of laparotomy on children and newborns is continually evolving and improving. There has not been a comprehensive study of its effects on regional and brain oxygenation[7], and the precise effects of surgical manoeuvres combined with standard anesthesiological methods in hemodynamic control are still up for discussion. The pneumoperitoneum (PP) created during abdominal laparoscopy is the primary source of the hemodynamic changes that occur throughout the procedure. Without changes in heart rate (HR), the major adaptive responses appear to be a decrease in venous return due to inferior vena cava constriction and a rise in central

vein pressure and arterial pressure. [8] Most studies have also found a 10% to 30% reduction in cardiac output with substantial pathophysiological alterations, highlighting the importance of having specialized anesthesiological assistance in paediatric laparoscopy, especially in babies. There has not been exhaustive research on the pathophysiological alterations to hemodynamics that occur during laparoscopic surgeries in children. [9,10] Therefore, standardizing minor invasive intraoperative evaluation in pediatric patients and throughout extended surgical operations need constant anesthesiological monitoring to avoid Unfavourable hemodynamic outcomes. [11,12]

Most cases of acute pancreatitis, helicobacter pylori perforation, intestinal blockage, colorectal rupture, and severe gastrointestinal bleeding need emergency gastrointestinal surgery. These diseases have similar clinical manifestations, including as sudden onset, extreme stomach pain, and the presence of diarrhoea, nausea, and vomiting. Failure to promptly administer appropriate therapy, which often requires conventional laparotomy, might have fatal consequences. However, there are considerable drawbacks to such therapy, such as a huge incision and a lengthy post-operative recovery period. Recent advances in laparoscopy have demonstrated great promise in enhancing the efficiency and clinical results of emergency surgical interventions. These benefits include a reduced size of the incision, a quicker healing period, higher levels of safety, and pinpoint precision during surgery. Given these benefits, laparoscopic surgery may replace open surgery as the preferred option for urgent gastrointestinal procedures. [13]

Outcomes in patients, such as post - operative pain, duration of stay, and time to recover, may be influenced by the chemical, mechanical, and biological characteristics of pneumoperitoneum, as has been proven in previous articles.[14,15]

In newborns presenting with pneumoperitoneum, this research aims to evaluate the efficacy of laparotomy vs laparostomy tube.

MATERIAL AND METHODS

This retrospective study was conducted at Children Hospital, Pakistan Institute of Medical Sciences PIMS Islamabad and comprised of 130 neonates. After obtaining informed written consent from the parents of neonates detailed demographics included age, sex and weight were recorded. Infants that have intestinal malrotation in addition to other treatable abnormalities were excluded from the study.

Participants in Group A were treated with a conventional laparotomy and sent to the operating room under general anaesthesia. Individuals in Group B had a laparostomy tube inserted while they were sedated and under local anaesthesia. Depending on the patient's health, a drainage tube may have been inserted. All surgical operations, from incision placement to avoiding intestinal adhesions, were performed in accordance with clinical recommendations deemed most effective for treating the patient's condition. This study evaluated and contrasted a number of factors connected with surgical procedures, including postoperative pain score, hospital stay length, and complication rates. Twenty-four hours following surgery, patients were asked to rate their discomfort on a 10-point visual analogue scale, with 0 indicating no pain, 3 indicating mild pain, 6 indicating moderate pain, and 7 indicating severe pain. Within the first three months after surgery, complications were documented. The data were displayed as a mean SD. The Student t-test was performed to evaluate the differences between the groups. Numbers from a census were put through the 2 test. Significant results were reported at the P 0.05 level. All of the data was analyzed with SPSS 22.0.

RESULTS

Majority of the neonates were males 78 (60%) and 52 (40%) neonates were females. Mean age of the neonates was 16.9±13.52 days and mean weight was 4.1±3.25 kg. (table 1)

Table-1: Demographics of the included neonates

Variables	Frequency	Percentage
Mean age (days)	16.9±13.52	
Mean weight (kg)	4.1±3.25	
Gender		
Male	78	60
Female	52	40

Most common symptom was abdominal and scrotal distension, followed by vomiting, cyanosis, respiratory distress and tachypnea. (figure 1)

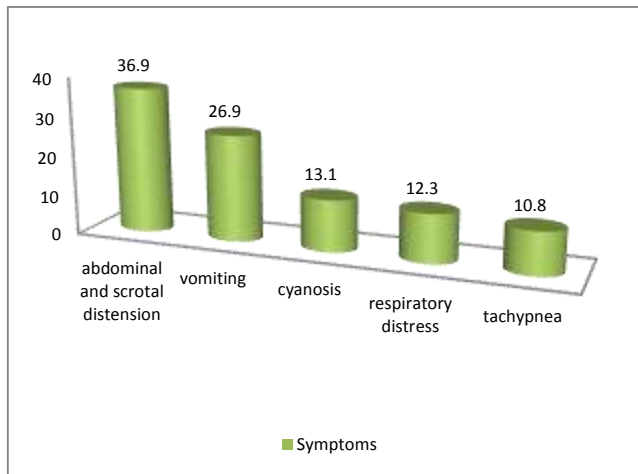


Figure-1: Symptoms among infants

Efficacy of group B was found among 55 (84.6%) cases, 6 cases required laparotomy and 4 patients were died because of

sepsis while in group A 53 (81.5%) cases were cured and 6 cases were died. (table 2)

Table 2: Outcomes among both groups

Variables	Group A	Group B
Efficacy		
Yes	55 (84.6%)	53 (81.5%)
No	10 (15.4%)	12 (18.5%)
Conversion to Laparotomy		
Yes	-	6 (9.2%)
No	-	59 (90.8%)
Mortality		
Yes	6 (9.2%)	4 (6.2%)
No	59 (90.8%)	61 (93.8%)

Hospital stay was lower in group B 3.9±10.74 days as compared to group A 6.2±11.41 days. Post-operative lower pain score was observed in group B 0.9±1.66 as compared to group A 4.2± 2.53 with p value <0.004. (table 3)

Table-3: Post-operative hospital stay and pain score among both groups

Variables	Group A	Group B	P Value
Mean Hospital Stay (days)	6.2±11.41	3.9±10.74	0.003
Mean pain score (VAS)	4.2± 2.53	0.9±1.66	0.001

Complications were also higher in group A found in 10 (15.4%) cases as compared to group B in 4 (6.2%) cases. (figure 2)

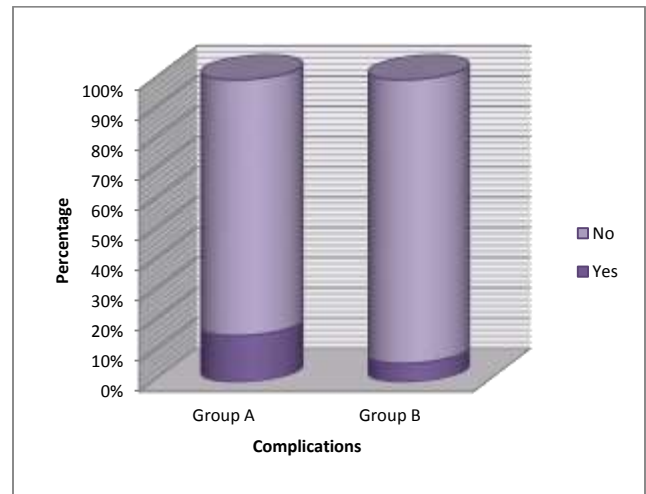


Figure-2: Frequency of complications among both groups

DISCUSSION

Once pneumoperitoneum is detected on abdominal imaging, it is immediately treated as a surgical emergency. When doctors are aware of the possibility of spontaneous pneumoperitoneum, they can take a less invasive approach, sparing the frail infants the stress of surgery and general anaesthesia.

Pneumoperitoneum that did not require surgery has been extensively studied in adults but has a far more scant data set for children. Before the discovery of necrotizing enterocolitis, it was thought that pneumoperitoneum in kids was always the result of a perforated viscus [6].

In addition to being a complication of CPR, mechanical breathing, gynecologic manipulations, dialysis, and intestinal endoscopic operations, non-surgical pneumoperitoneum has been linked to a wide variety of other conditions and medical interventions [16,17]. Pneumoperitoneum is also commonly caused by a history of abdominal surgery. However, postoperative free air usually clears up within 5 days in 97% of cases. [18]

In current study 130 neonates had pneumoperitoneum were presented. Mean age of the neonates was 16.9±13.52 days and mean weight was 4.1±3.25 kg. Majority of the neonates were males 78 (60%) and 52 (40%) neonates were females. Most common symptom was abdominal and scrotal distension, followed by vomiting, cyanosis, respiratory distress and tachypnea. These findings were comparable to the previous researches. [19,20] Idiopathic pneumoperitoneum may progress from subclinical perforations, but it is generally believed that these holes heal on their own. [21] Pneumoperitoneum can be diagnosed with a higher degree of accuracy with abdominal CT than with plain chest or abdomen radiography, which is the most commonly used imaging modalities for the detection of peritoneal clear air in the urgent context [22,23]

In current study hospital stay was lower in group B 3.9±10.74 days as compared to group A 6.2±11.41 days. Post-operative lower pain score was observed in group B 0.9±1.66 as compared to group A 4.2± 2.53 with p value <0.004. After 30 years of practice, the techniques and equipment used for minimally invasive laparoscopy have matured enough to provide a robust clinical process for urgent gastrointestinal surgery. [24,25] Laparoscopy is more popular because it results in smaller wounds, less pain, less time in surgery, less blood loss during surgery, a shorter stay in hospital, and fewer problems than traditional laparotomy. [26-30]

It is difficult to delay surgical exploration after the detection of pneumoperitoneum in patients exhibiting signs of illness and abdominal exam results indicating NEC, the most common cause of perforation, because it is vital to rule for visceral rupture. Pneumoperitoneum evaluation, on the other hand, follows a protocol developed by Karaman et al. [27,28] that includes a thorough history of cardiopulmonary resuscitation (CPR), intubation and breathing, a physical exam to search for macrocephalus, as well as a number of diagnostic methods.

CONCLUSION

We concluded in this study that use of laparostomy tube among neonates with pneumoperitoneum was equally affective and useful in terms of success rate while hospital stay, and complications were lower as compared to laparotomy group.

REFERENCES

- Estridge P, Akoh JA. Recurrent spontaneous pneumoperitoneum: a surgical dilemma. *Int J Surg Case Rep.* 2017;30:103–5
- Abdelmohsen SM, Osman MA. Idiopathic neonatal pneumoperitoneum, a case report. *Int J Surg Case Rep.* 2017;31:250–3.
- Čečka F, Sotona O, Šubrt Z. How to distinguish between surgical and non-surgical pneumoperitoneum? *Signa Vitae.* 2014;9(1):9–15.
- Gummalla P, Mundakel G, Agaronov M, Lee H. Pneumoperitoneum without intestinal perforation in a neonate: case report and literature review. *Case Rep Pediatr.* 2017;2017:1–5
- Broekaert I, Keller T, Schulten D, Hünseler C, Kribs A, Dübbers M. Peritoneal drainage in pneumoperitoneum in extremely low birth weight infants. *Eur J Pediatr.* 2018;177(6):853–8.
- Swanson JR. Surgical necrotizing enterocolitis defined. *J Perinatol.* 2014;34(10):731.
- de Waal EE, de Vries JW, Kruitwagen CL, et al. The effects of low-pressure carbon dioxide pneumoperitoneum on cerebral oxygenation and cerebral blood volume in children. *Anesth Analg* 2002;94:500–5.
- Gupta R, Singh S. Challenges in paediatric laparoscopic surgeries. *Indian J Anaesth* 2009;53:560–6
- Hodgson C, McClelland R, Newton J. Some effects of the peritoneal insufflation of carbon dioxide at laparoscopy. *Anaesthesia* 1970;25:382–90.

- Tuna AT, Akkoyun I, Darcin S, et al. Effects of carbon dioxide insufflation on regional cerebral oxygenation during laparoscopic surgery in children: a prospective study. *Braz J Anesthesiol* 2016;66:249–53
- Tytgat SH, Stolwijk LJ, Keunen K, et al. Brain oxygenation during laparoscopic correction of hypertrophic pyloric stenosis. *J Laparoendosc Adv Surg Tech* 2015;A25:352–7
- Truchon R. Anaesthetic considerations for laparoscopic surgery in neonates and infants: a practical review. *Best Pract Res Clin Anaesthesiol* 2004;18:343–55.
- Peters MJ, Mukhtar A, Yunus RM, et al. Meta-analysis of randomized clinical trials comparing open and laparoscopic anti-reflux surgery. *Am J Gastroenterol* 2009; 104: 1548–1561
- A. D. Raval, S. Deshpande, M. Koufopoulou et al., "The impact of intra-abdominal pressure on perioperative outcomes in laparoscopic cholecystectomy: a systematic review and network meta-analysis of randomized controlled trials," *Surgical Endoscopy*, vol. 34, no. 7, pp. 2878–2890, 2020.
- K.-F. Hsu, C.-J. Chen, J.-C. Yu et al., "A novel strategy of laparoscopic insufflation rate improving shoulder pain: prospective randomized study," *Journal of Gastrointestinal Surgery*, vol. 23, no. 10, pp. 2049–2053, 2019.
- Mularski RA, Sippel JM, Osborne ML. Pneumoperitoneum: a review of nonsurgical causes. *Crit Care Med.* 2000;28(7):2638–44.
- Karaman A, Demirbilek S, Akin M, Gurunluoglu K, Irsi C. Does pneumoperitoneum always require laparotomy? Report of six cases and review of the literature. *Pediatr Surg Int.* 2005;21:819–24.
- Nielsen KT, Lund L, Larsen LP, Knudsen P. Duration of postoperative pneumoperitoneum. *Eur J Surg.* 1997;163(7):501–3.
- Al-Taher, R., Mansour, H., Al-Qaisi, M. et al. Spontaneous pneumoperitoneum in neonates: a case series. *Ann Pediatr Surg* 18, 33 (2022).
- Xie, W., Li, Z., Wang, Q. et al. Laparoscopic vs open Ladd's procedure for malrotation in neonates and infants: a propensity score matching analysis. *BMC Surg* 22, 25 (2022).
- Spinelli N, Nfonso V, Marcet J, Velanovich V, Frattini JC, Spinelli N, et al. Postoperative pneumoperitoneum after colorectal surgery: expectant vs surgical management. *World J Gastrointest Surg.* 2012;4(6):152–6.
- Chiu Y, Chen J, Tiu C, Chou Y. Reappraisal of radiographic signs of pneumoperitoneum at emergency department. *Am J Emerg Med.* 2009;27(3):320–7.
- Ng CS, Watson CJE, Palmer CR, See TC, Beharry NA, Housden BA, et al. Evaluation of early abdominal pelvic computed tomography in patients with acute abdominal pain of unknown cause: prospective randomised study. *BMJ.* 2002;325(7377):1387.
- Cui N, Liu J, Tan H. Comparison of laparoscopic surgery versus traditional laparotomy for the treatment of emergency patients. *J Int Med Res.* 2020 Mar;48(3):30060519889191.
- Zhou C, Wang W, Wang J, et al. An updated meta-analysis of laparoscopic versus open repair for perforated peptic ulcer. *Sci Rep* 2015; 5: 13976
- Ge B, Wu M, Chen Q, et al. A prospective randomized controlled trial of laparoscopic repair versus open repair for perforated peptic ulcers. *Surgery* 2016; 159 : 451–458
- Kong SH, Yang HK. Surgical treatment of gastric gastrointestinal stromal tumor analysis of 92 operated patients. *Digest Surg* 2008; 25: 208–212
- Karaman A, Demirbilek S, Akin M, Gurunluoglu K, Irsi C. Does pneumoperitoneum always require laparotomy? Report of six cases and review of the literature. *Pediatr Surg Int.* 2005;21:819–24.
- Agrawal V, Tiwari A, Acharya H, Mishra R, Sharma D. Laparoscopic "steering wheel" derotation technique for midgut volvulus in children with intestinal malrotation. *J Minim Access Surg.* 2019;15(3):219.
- Kozlov YA, Novozhilov VA, Rasputin AA, Us GP, Kuznetsova NN, Pakelchuk A. Endoscopic treatment of intestinal malrotation in newborns and infants. *Khirurgiya Zhurnalim NI Pirogova.* 2016;4:34.