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Karnataka Paediatric Journal

Original Article

Is continue positive airway pressure causing neonatal gastric perforation?

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Received: 15 March 2023
Accepted: 16 July 2023
EPub Ahead of Print: 11 August 2023
Published: 25 September 2023

DOI
10.25259/KPJ_11_2023

Quick Response Code:

ABSTRACT

Objectives: Neonatal gastric perforation (NGP) is a rare surgical emergency that causes significant morbidity and mortality and costs thousands of health dollars. We aim to assess risk factors, outcomes, and preventive measures for NGP.

Material and Methods: We retrospectively reviewed clinical notes, charts and operative findings for all NGPs from 2000 to 2022 in the Neonatal Intensive Care Unit. The demography, gestational age at birth, age of perforation, potential risk factors, intraoperative findings, incision site and outcome were analysed. Study ethically approved.

Results: A total of 8 NGPs were sampled. The gestational age ranged from 24–35 (mean of 28.4) weeks. The birth weight was 700–3030 g (1402 g). Seven had respiratory distress and received respiratory support. Six were on continuous positive airway pressure (CPAP), and one was intubated. One baby was on room air and had a <1 cm perforation in the posterior gastric wall by nasogastric tube (NGT). The intubated baby had perforation due to necrotising enterocolitis (NEC) involving the posterior gastric wall (size – 1.5 cm). The remaining six babies had CPAP-related NGP (Estimated $P < 0.05$) found at the greater curvature (Size >2 cm). Six had left upper quadrant surgical incisions, and two had right-sided incisions requiring an extension. The NGP mortality rate is 1 out of 8 (12.5%).

Conclusion: CPAP is the leading cause of NGP in low body weight and premature babies. NGT and NEC also cause perforation. Clinical assessment is key to appropriate surgical incisions and minimize the mortality rate.

Keywords: Neonatal, Continue positive airway pressure, Gastric perforation, Surgical emergency

INTRODUCTION

Neonatal gastric perforation (NGP) is a rare but serious condition that can be difficult for clinicians to manage in neonates. In 1825, Siebold published the first description of neonatal gastrointestinal perforation.[1] A study reported the first successful surgical repair in 1951.[2] In 1943, it was described in first instance of gastric perforation in a newborn accompanied by a congenital lack of muscle inside the accompanying gastric tissue.[3] According to statistics, NGP accounts for 7% of all gastrointestinal perforations in newborns and the frequency is 1:5000 live births. The rate of NGP is steadily rising, possibly as a result of the rising number of premature and very low birth weight newborns.[4] In contrast, the mortality rate associated with NGP has decreased by a factor of roughly tenfold perhaps as a result of the quality of newborn intensive care improving NGP remains a very uncommon condition despite its rise in prevalence, with mostly case reports or reports of brief series. As a result, there are still questions about a number of elements of NGP, including its cause and the most effective course of action. Nonetheless, research continued to

dominate on this rare phenomenon in the second half of the 20th-century case reports and series continued to predominate, with substantial discussion of the aetiologies in the newborn population.[5] Understanding risk factors and prognostic markers for clinical outcomes related to surgical repair of infant gastric perforations has been the focus of more recent research. Given the rarity of this disease, it is debatable and unclear what proportion of these characteristics is important. The purpose of this study is to evaluate the occurrences and associated factors with NGP and define prognostic factors.

MATERIAL AND METHODS

This study was a retrospective analytical study in the Neonatal Intensive Care Unit, Waikato Hospital New Zealand from 2000 to 2022. This study aims to assess the particular aspects of NGP including sociodemographic factors, details of causative factors, and find the clinical outcomes of NGP's intervention. The data extraction form was used to collect the demography, gestational age at birth, age of perforation, potential risk factors, intraoperative findings, incision site, and outcome which were analysed. To achieve the study objectives initially, the descriptive analysis was carried out using the statistical software Statistical Package for the Social Sciences (version 26) to know the characteristics and distribution of variables and identifies the relationship between two variables. This descriptive analysis was conducted through two steps including univariate and bivariate analysis. The Chi-squared test was used to check the relationship between two categorical variables as this study dataset comprises more than 50 observations, where 5% is used as the significance level.

RESULTS

A total of 8 NGPs were sampled. The gestational age ranged from 24–35 (mean of 28.4) weeks [Figure 1]. The birth weight was 700–3030 g (1402 g). Seven had respiratory distress and received respiratory support. Among the total, six were on continuous positive airway pressure (CPAP) with mask ventilation since their birth due to respiratory distress. While the remaining two babies, one was intubated and one was on room air. The CPAP pressure was at 6 cm H_2O since their birth except one had initially 6 cm H_2O then increased to 8 cm H_2O. The baby was on room air and had a <1 cm perforation in the posterior gastric wall by nasogastric tube (NGT) while the intubated baby had perforation due to necrotising enterocolitis (NEC) involving the posterior gastric wall (size - 1.5 cm) while remaining six babies had CPAP-related NGP (Estimated $P < 0.05$) found at the greater curvature (Size >2 cm). Six had left upper quadrant surgical incisions, and two had right-sided incisions requiring an extension [Figure 2]. The NGP mortality rate is 1 out of 8 (12.5%).

DISCUSSION

NGP has three potential causes: Ischaemic, traumatic, and spontaneous. This may lead to foetal distress, shock, hypoxia, and ischaemic necrosis; subsequently, it is required postnatal intensive resuscitation.[6] In infants, dexamethasone and indomethacin can potentially lead to stomach perforation.[7] Furthermore, the hard NGT's mechanical damage could not be ruled out as the cause. In our situation, a combination of circumstances, including the patient's immaturity, positive pressure breathing, intravenous ibuprofen use, and perinatal distress, may have contributed to the patient's condition. According to reports, between the 2nd and 7th day of life is when stomach perforations are most common.[8] In our cases, age ranged from the 1st to the 18th day of life. Miller discovered that a newborn kid's gastric acidity peaked around 24 h of age, then declined over the course of the next 9 days, approaching the usual level for a child; thus, it is probable that elevated

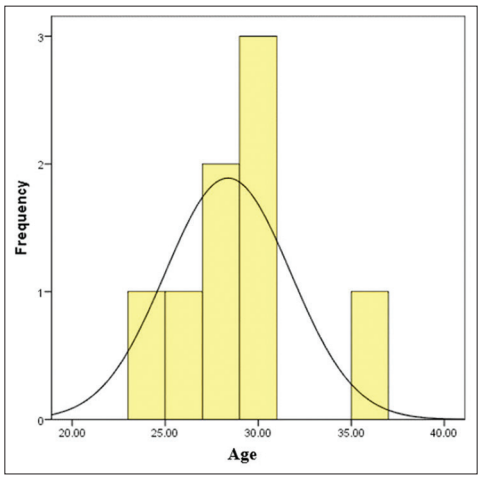

Figure 1: Histogram of the gestational age.

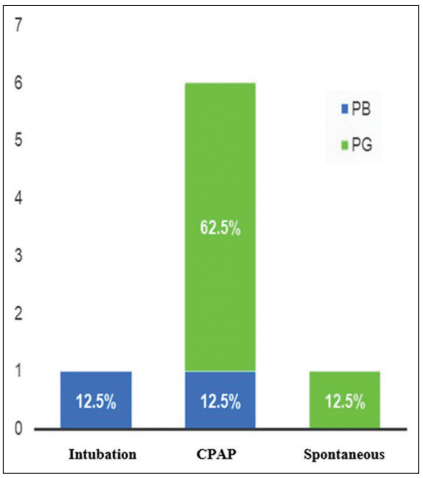

Figure 2: Comparison between the mode of ventilation and perforation site.

gastric acidity during the early infant period contributes to gastric perforation.[8] In a study, greater curvature NGP accounted for more than 50% of occurrences followed by lesser curvature and anterior.[9] This study reported that 75% of cases had perforation at the posterior gastric wall of greater curvature only two cases had a perforation at the posterior body of the stomach. Furthermore, compared to full-term babies, the death rate for infants with stomach perforations is greater in premature and low birth weight neonates.[10,11] This study recruited a total number of 8 NGPs and their gestational age ranged from 24 to 35 (mean of 28.4) weeks and their birth weight was 700–3030 g (1402 g). The majority (75%) had a positive prognosis while their duration of hospital stay varied from 5 to 112 days and only two cases ended up with death. The survival rate is impacted by the interval between diagnosis and surgery. There is a finite amount of time after the disease's first signs to complete a major procedure. Because stomach perforation spreads quickly, early diagnosis and treatment are crucial. The most critical course of action for stomach cancer is primary surgical repair.[12]

The most typical signs of gastric perforation are sudden abdominal distension and respiratory discomfort and also there are many other symptoms and indications, such as eating intolerance, acidosis, and shock. Seven had respiratory distress and received respiratory support.[13] Six were on CPAP, and one was intubated. One baby was on room air and had a <1 cm perforation in the posterior gastric wall by NGT.[14] The intubated baby had perforation due to NEC involving the posterior gastric wall (size - 1.5 cm). The remaining six babies had CPAP-related NGP (Estimated $P < 0.05$) found at the greater curvature (Size >2 cm). Six had left upper quadrant surgical incisions, and two had right-sided incisions requiring an extension. The NGP mortality rate is one out of eight (12.5%).[15]

CONCLUSION

NGP is caused by various risk factors although CPAP is the leading risk factor for NGP in low BW and premature babies despite the causes of NGT and NEC. The precise clinical assessment leads to reaching the appropriate surgical interventions for improving the positive prognosis and minimising the mortality rate is lower than literature.

Ethical approval

This study had Institutional Ethics Review Committee approval to conduct the study at Waikato Hospital New Zealand.

Acknowledgment

The authors wish to thank, S. Thiruvarangan, Research Assistant who assisted in this manuscript preparation and submission process at the final stage.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Balasubramaniam S, Samarakkody U, Jayaratnam S, Bailey-Wilde M. Is continue positive airway pressure causing neonatal gastric perforation? Karnataka Paediatr J 2023;38:81-3.