APGHN
Archives of Pediatric Gastroenterology, Hepatology, and Nutrition

Original Article

Coagulation Parameters as a Prognostic Factor for Mortality in a Neonate with Duodenal Obstruction

Dito Desdwianto[1], Ariandi Setiawan[1], IGB Adria Hariastawa[1], Sarwendah Pratiwi Budiman[1]

[1]Pediatric Surgery Division, Departement of Surgery, Faculty of Medicine Universitas Airlangga – Dr. Soetomo General Hospital, Surabaya, Indonesia

e-ISSN: 2830-5442

Corresponding author:
Dito Desdwianto
ditodesdwianto@gmail.com

Published:
31st May 2024

DOI:
https://doi.org/10.58427/apghn.3.2.2024.1-7

Citation:
Desdwianto D, Setiawan A, Hariastawa A, Budiman SP, Coagulation parameters as a prognostic factor for mortality in a neonate with duodenal obstruction. *Arch Pediatr Gastr Hepatol Nutr.* 2024;3(2):1-7.

Abstract:

Background: Although the mortality cases of duodenal obstruction are only about 5%, this abnormality remains a burden in pediatric surgery. Several conditions can worsen a patient's outcome, and a proper understanding of the coagulation parameters is vital for a good result.

Methods: This is a descriptive-analytic study. Data on duodenal obstruction in neonate patients were taken from medical records from 2016 to 2020. The data were then processed using SPSS 26.0

Results: From 59 samples of neonates with duodenal obstruction, most of them were born full term 38 (64%), with 32 male patients and 27 female patients. The number of neonates who died based on complete obstruction were 12 (20.3%), and there was no significant difference between neonates who died with low birth weight and normal birth weight. The most commonly performed surgical procedure was the kimura procedure (43 patients), with a mortality rate of 14%. In the analysis of coagulation parameters including platelets, prothrombin time (PT), and activated partial thromboplastin time (APTT), only APTT demonstrated significant correlation with mortality with the p- value of 0.016, OR 3.98.

Conclusion: There was a significant correlation between activated partial thromboplastin time (APTT) and mortality, with abnormal APTT had 3.98 times higher risk of dying.

Keywords: duodenal obstruction, neonates, prognostic factor

Introduction

Duodenal obstruction is one of the most common congenital anomalies in neonates; the incidence occurs in 1 per 5.000 – 10.000 live births, affecting boys more commonly than girls.[1] Although the mortality cases of duodenal obstruction are only about 5%, this abnormality remains a burden in pediatric surgery.[2]

Duodenal obstruction is anatomically classified as complete and incomplete obstruction. An incomplete obstruction due to a fenestrated web or diaphragm is considered a stenosis. Complete obstruction includes atresia, which may be accompanied by an annular pancreas. Those two types of obstruction have different mortality rates.[3,4]

Other factors that are thought to influence mortality in cases of congenital duodenal obstruction are gestational age and birth weight.[5,6] In addition, various congenital disorders also often accompany congenital duodenal obstruction, such as congenital heart defects, Down syndrome, and other congenital intestinal anomalies.[7,8]

Perioperative coagulation management has a significant impact on the perioperative journey of patients.[9] Anaesthesia providers play a critical role in the surgical setting. Various tests are available to identify coagulation abnormalities in the perioperative period, such as platelets, APTT and PT. A proper understanding of the interpretation of the coagulation parameters is vital for a good outcome.[10,11]

This study aims to identify prognostic factors for mortality in a neonate with duodenal obstruction. The results of this study are expected to be used as a reference regarding the prognostic factors for mortality in patients with duodenal obstruction so that it can be used in clinical practice to reduce mortality in cases of congenital duodenal obstruction.

Methods

This study was a descriptive-analytic study with a retrospective cohort design to identify prognostic factors for mortality in a neonate with duodenal obstruction. The target population is all neonate patients with duodenal obstruction from 2016 - 2020. This study used secondary data by looking at medical records at Dr. Soetomo General Hospital Surabaya. The inclusion criteria were all cases of duodenal obstruction in neonates, which were proven through clinical examination and babygram imaging, and who underwent surgery at RSUD Dr. Soetomo Surabaya from 2016 to 2020, while the exclusion criteria in this study were incomplete medical record data and patients aged more than 28 days. Once the diagnosis is made, appropriate resuscitation with correction of fluid balance and electrolyte abnormalities is required in addition to

gastric decompression. At our institution, all neonates diagnosed with duodenal obstruction receive a complete metabolic profile, complete blood count, coagulation studies, and radiology plain photographs. Emergency surgery is only performed in cases where malrotation with concomitant volvulus cannot be excluded. Depending on the pathology, the operative techniques performed are duodenoduodenostomy, web excision duodenoplasty, or Ladd's procedure.

The data obtained were analysed using the SPSS version 23 application. Approval and informed consent for this study was granted by the Research Ethical Committee of Soetomo Hospital Surabaya under a Letter of Approval No. 1304/LOE/301.4.2/V/2023.

Results

From 59 samples of neonates with duodenal obstruction, most of them were born aterm pregnancy 38 (64%) patients, with 32 male patients and 27 female patients. In this study, the minimum operating age was 6 days and the maximum was 46 days with an average operating age of 18 days. Based on demographic data, we excluded data based on exclusion criteria and analysed variables based on outcomes. From Statistically for risk outcome, Birth weight had OR=2.23 for Low birth weight (LBW) with P value= 0.149, Gestation had OR=1.63 for Aterm with P value 0.404, Type of obstruction had OR 2.77 for complete with P value 0.709, and surgical procedure Kimura procedure had OR 1.4 with P value 0.493 (**Table 1**). Based on laboratory data statistically from ROC curve analysis, we got Hemoglobin with a cutoff point of 9.8 g/dL, white blood cells (WBC) 13.600 g/dL, Platelets 259.000, Protrombine time (PT) 12.2, and Activated partial thromboplastin time (APTT) 41. There was no significant correlation between blood count and mortality. Coagulation parameters platelets, PT, and APTT, only APTT there was a significant correlation with P- value (0.016), OR 3.98, 95% CI (1.294-12.294).

Discussion

Several modalities were studied to be used as predictors of outcome in infants with duodenal obstruction, including gestational age, low birth weight, surgical technique, type of obstruction, and blood coagulation function. Several other studies also assessed other variables, such as the presence or absence of coexisting congenital anomalies, age and weight at the time of surgery, and others.[12]

In this study, it was found that Low birth weight had a 2.3 times higher risk of dying than normal birth weight, but there was not a significant correlation between birth weight and outcome. In addition to being an adverse factor for duodenal obstruction,

Table 1. Data analysis on outcomes

Variable	Total (Outcome%)	OR	95% CI for OR	P
Birth weight				
LBW	13 (44.8%)	2.23	0.750-6.653	0.149
Normal	8 (26.7%)	1.00		
Gestation				
Preterm	6 (28.6%)	1.00		0.404
Aterm	15 (39.5%)	1.63	0.517-5.142	
Type obstruction				
Incomplete	6 (23.1%)	1.00		0.790
Complete	15 (45.5%)	2.77	0.888-8.694	
Surgical Procedure				
Kimura	18 (41.9%)	1.4	0.593-3.336	0.493
Duodenoplasty	2 (18.2%)	1.00		
Ladds	0 (0%)			
Others	1 (50%)			
Hb				
Anemia	2 (60%)	3.00	0.459-19.592	0.251
No	18 (33%)	1.00		
WBC				
No	13 (31.7%)	1.00		0.349
Leukocytosis	8 (44.4%)	1.72	0.552-5.382	
Thrombocyte				
Thrombocytopenia	12 (36.4%)	1.01	0.344-2.996	0.977
No	9 (36%)	1.00		
Electrolyte imbalance				
Yes	13 (39.4%)	2.76	0.493-0.4336	0.493
No	8 (30.8%)	1.00		
PPT				
Normal	3 (20%)	1.00	0.682-11.227	0.154
Abnormal	18 (40.9%)	2.76		
APTT				
Normal	8 (22.9%)	1.00		0.016
Abnormal	13 (54.2%)	3.98	1.294-12.294	

low birth weight is also at risk for other events that require surgery, such as necrotising enterocolitis, intestinal perforation, and meconium ileus. Of the 443 babies with very low birth weight studied by Okuyama, it was found that 150 babies (34%) needed surgery because they suffered from necrotising enterocolitis, intestinal perforation, and meconium ileus taken from 2003 – 2012. LBW male infants were more likely to have a more significant body weight than LBW female infants of the same gestational age. However, the morbidity and mortality rates for LBW boys are higher than for LBW girls. LBW male infants born at gestational age > 27 weeks are more at risk of experiencing respiratory disorders. Meanwhile, LBW male infants born at a gestational age between 23-25 weeks are more likely to experience gastrointestinal disturbances.[13]

Low birth weight has a negative impact on morbidity and mortality, including in patients with duodenal obstruction.

In congenital duodenal obstruction, several conditions can worsen the patient's prognosis, such as prematurity. Babies with a history of premature birth also experience more complex problems during treatment, especially postoperative care. Several studies have shown that prematurity (gestational age) has a poor prognostic value in patients with duodenal obstruction. This includes not only morbidity and mortality but also its management, both before surgery and after surgery.[14] In this study, it was found that full term babies had a 1.63 times higher risk of dying than preterm, but there was not a significant correlation between birth age and outcome.

In this study, it was found that complete or total obstruction had a 2.77 times higher risk of dying than incomplete or partial obstruction. This was supported by previous research. Estiarla found that 60% of the samples were of the total obstruction type, and as many as 55% of patients with duodenal obstruction died.[15] Brantberg et al. conducted a study with 29 newborns with duodenal obstruction, in which 18 (62%) died (prenatal or postnatal) or had substantial developmental impairments. A total of 10 of the 21 children alive (48%) had substantial developmental disabilities. Of 11 newborns with total duodenal obstruction, five (45%) died or had substantially impaired neurological development.[16] The correlation between birth age and the type of obstruction to prognostic factors still needs to be studied more deeply. In its development, coagulation levels were not only used to determine coagulation status but were also used to predict the outcome of a disease. The use of Prothrombin time (PT) and Activated Partial Thromboplastin Time (APTT) as predictor variables, including duodenal obstruction, is still being developed. In this study, it was found that there was a significant correlation between Activated Partial Thromboplastin Time (APTT) and mortality with a P value of 0.016, and abnormal APTT had a 3.98 times higher risk of dying than normal APTT.

The weakness of this study is that it was conducted in one tertiary referral hospital, which may under-represent the population and the quality or standard of health services in Surabaya or Indonesia; another thing is that there is no additional information about the initial treatment in the previous hospital which causes bias in the results of laboratory tests. Secondly, some preoperative variables or risk factors were not included, such as congenital anomalies, as such data are not routinely recorded and/or examined.

Conclusion

The research results can be concluded as follows: there was a significant correlation between Activated Partial Thromboplastin Time (APTT) and mortality, with

abnormal APTT having a higher mortality rate than usual. Complete duodenal obstruction type had a higher mortality rate than incomplete duodenal obstruction type, and low birth weight had a higher mortality rate than normal birth weight. The correlation between the type of obstruction, birth weight and surgical procedure with mortality needs to be studied more deeply.

This data may not represent the wider population. Hence, a study with a larger number of samples is needed. Therefore, the research results can be more representative of the population.

Acknowledgements

The authors extend their sincere gratitude to the Faculty of Medicine, Universitas Airlangga, and Dr. Soetomo Regional Public Hospital for their invaluable support in conducting this research.

Funding

This research was a self-funded study.

Conflict of Interest

None declared.

References

1. Kimura K, Loening-Baucke V. Bilious vomiting in the newborn: rapid diagnosis of intestinal obstruction. Am Fam Physician. 2000;61(9):2791-8.
2. Chandrasekaran S, Asokaraju A. Clinical profile and predictors of outcome in congenital duodenal obstruction. Int Surg J. 2017;4(8):2605-611. https://doi.org/10.18203/2349-2902.isj20173396
3. Holcomb W. George, Murphy Patrick J. Aschcraft's pediatric surgery, 7th ed. New York: Saunders; 2020.
4. Puri P, Hollwarth M. Pediatric atlas surgery. Duodenal obstruction. New York: Springer, 2006.
5. Emmanuel A. A et.al. Pediatric Surgery. In: A Comprehensive Textbook for Africa. Second Ed. Switzerland. Springer. 2020.
6. Kim JY, You JY, Hae-Jin Chang K, et al. Association between prenatal sonographic findings of duodenal obstruction and adverse outcomes. J Ultrasound Med. 2016;35(9):1931-1938. https://doi.org/10.7863/ultra.15.090747.
7. Okuyama H, Ohfuji S, Hayakawa M, et al. Risk factors for surgical intestinal disorders in VLBW infants: Case-control study. Pediatr Int. 2016;58(1):34-9. https://doi.org/10.1111/ped.12815
8. Kilbride H, Castor C, Andrews W. Congenital duodenal obstruction: Timing of diagnosis during the newborn period.J Perinatol. 2010;30(3):197-200. https://doi.org/10.1038/jp.2009.143
9. Roshan TM, Stein N, Jiang XY. Comparison of clot-based and chromogenic assay for the determination of protein c activity. Blood Coagul Fibrinolysis. 2019;30(4):156-160. https://doi.org/10.1097/MBC.0000000000000806

10. Palta S, Saroa R, Palta A. Overview of the coagulation system. Indian J Anaesth. 2014;58(5):515-523. https://doi.org/10.4103/0019-5049.144643
11. Iqbal A, Greig M, Arshad MF, Julian TH, Ee Tan S, Elliott J. Higher admission activated partial thromboplastin time, neutrophil-lymphocyte ratio, serum sodium, and anticoagulant use predict in-hospital COVID-19 mortality in people with Diabetes: Findings from Two University Hospitals in the U.K. Diabetes Res Clin Pract. 2021;178. https://doi.org/10.1016/j.diabres.2021.108955
12. Kaempf JW, Gautham K. Do small baby units improve extremely premature infant outcomes? J Perinatol. 2022;42(2):281-285. https://doi.org/10.1038/s41372-021-01076-9
13. Ito M, Tamura M, Namba F. Role of sex in morbidity and mortality of very premature neonates. Pediatr Int. 2017;59(8):898-905. https://doi.org/10.1111/ped.13320
14. Gfroerer S, Theilen TM, Fiegel HC, Esmaeili A, Rolle U. Comparison of outcomes between complete and incomplete congenital duodenal obstruction. World J Gastroenterol. 2019;25(28):3787-3797. https://doi.org/10.3748/wjg.v25.i28.3787
15. Estiarla, Nunik A. Prognostic factors for mortality in patients with congenital duodenal obstruction at DR. Moewardi Hospital Surakarta. Precis Med. 2021;10:26–32. https://doi.org/10.1002/prm2.12034
16. Brantberg A, Blaas H-GK, Salvesen KÅ, Haugen SE, Møllerløkken G, Eik-Nes SH. Fetal duodenal obstructions: increased risk of prenatal sudden death. Ultrasound Obstet Gynecol. 2002;20(5):439-446. https://doi.org/10.1046/j.1469-0705.2002.00831.x