Prognostic factors for mortality in patients with congenital duodenal obstruction at Dr. Moewardi Hospital Surakarta

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Abstract

Background: Congenital duodenal obstruction is the most common congenital abnormalities in newborn. Almost 50% of all cases of congenital abnormalities is duodenal obstruction. Several conditions of congenital obstruction can worsen a patient's prognosis, such as prematurity, low birth weight (LBW), other congenital abnormalities, type of obstruction, and the type of surgery performed.

Objective: To identify prognostic factors for mortality in patients with congenital duodenal obstruction in Dr. Moewardi Hospital Surakarta.

Methods: This study was a retrospective descriptive study with cross-sectional approach. Data of congenital duodenal obstruction patients were taken from inpatient medical records from January 2019 to December 2020 at Dr. Moewardi Hospital, Surakarta. Diagnosis, gestational age, birth weight, type of obstruction, other congenital abnormalities, and surgical procedure performed were also recorded. The data were then processed using SPSS 25.0, and one-way Fisher's Exact test was performed.

Results: From 20 samples of patients with congenital duodenal obstruction, most of them were born at term pregnancy were 13 patients (65%). There were 11 (55%) babies who died. Based on the type of obstruction, total obstruction type were 12 (60%) patients with mortality rate 81.8%. 13 patients (65%) had comorbid congenital abnormalities. The most commonly performed surgical procedure was duodenojejunostomy (45%). Fisher's Exact test also showed statistically significant data ($P = 0.04$).

Conclusion: There were 20 samples with congenital duodenal obstruction. The total obstruction type had the highest mortality rate. Other variables such as gestational age, birth weight, and other congenital abnormalities did not significantly influence mortality in this study.

Keywords
congenital duodenal obstruction, mortality
1 | INTRODUCTION

1.1 | Background

Congenital duodenal obstruction is one of the most common congenital abnormalities in newborns, accounting for 2500 to 10,000 live births and nearly 50% of all cases of intestinal obstruction. Although the mortality cases of congenital duodenal obstruction are only about 5%, this abnormality remains a burden in pediatric surgery.

Congenital duodenal obstruction is divided into total and partial obstruction types. Total obstruction includes duodenal atresia which may be accompanied with annular pancreas. Meanwhile, partial obstruction includes net-type obstruction (perforated diaphragm), anomalies in the Ladd band, annular pancreas, preduodenal portal vein, superior mesenteric artery syndrome, and duplication of cysts. Those two types of obstruction have different mortality rates.

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

Some types of surgery for congenital duodenal obstruction are duodenoplasty, duodenojejunal anastomosis, and duodenoduodenostomy. These types of surgery are thought to also affect the prognosis of mortality in patients with congenital duodenal obstruction.

This study aims to identify prognostic factors for mortality in patients with congenital duodenal obstruction.

1.2 | Research objectives

The aim of this study was to analyze prognostic factors for mortality in patients with congenital duodenal obstruction.

1.3 | Research benefits

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

2 | LITERATURE REVIEW

2.1 | Congenital duodenal obstruction

2.1.1 | Definition

Congenital duodenal obstruction is a case of intestinal obstruction that often occurs in neonates. Congenital duodenal obstruction includes a range of disorders such as duodenal atresia, duodenal stenosis, annular pancreas, duodenal membrane, and preduodenal portal veins.

2.1.2 | Etiology

Congenital duodenal obstruction can be caused by intrinsic or extrinsic etiology of the duodenum. Intrinsic etiology includes atresia, intrinsic stenosis, and web/diaphragm with fenestration. Meanwhile, extrinsic etiology includes malrotation with Ladd band, midgut volvulus, annular pancreas, preduodenal portal vein, superior mesenteric artery syndrome, duplication cyst, and replaced right hepatic artery.

2.1.3 | Epidemiology

Congenital duodenal obstruction is one of the most common congenital anomalies in neonates, reaching 50% of all gastrointestinal disorders which are congenital. Congenital duodenal obstruction occurs in 1 in 2500 to 10,000 live births.

2.1.4 | Pathophysiology

There are intrinsic and extrinsic factors that are thought to cause duodenal malformations. The intrinsic factor that is thought to cause this anomaly is associated with the failure of the recanalization process of the intestinal lumen. This failure of recanalization is known as duodenal atresia.

Recanalization of the abdominal lumen will occur afterward. If there is a failure in this process, the duodenal lumen will experience narrowing. Duodenal obstruction is associated with the incidence of annular pancreatic malformation.

2.1.5 | Classification

Based on the malformation process that occurs, congenital duodenal obstruction is classified into total obstruction and partial obstruction (Figure 1). Mortality in this case was associated with congenital heart disease. The grade of duodenal obstruction is said to have an impact on postoperative outcomes.

Total obstruction

The category of obstruction consists of duodenal atresia types 1 to 3 which may be accompanied by anomalies of the annular pancreas. The manifestations of duodenal obstruction in the total obstruction subgroup were detectable since pregnancy. Surgical procedures in this subgroup tend to be longer, starting from the preparation stage to the postoperative stage. Patients in this subgroup had longer hospital stays, with a higher morbidity rate when compared with the partial obstruction subgroup (Figure 1).
Partial obstruction
The category of obstruction consists of net-type obstruction (perforated diaphragm), anomalies in the Ladd band, annular pancreas, preduodenal portal vein, superior mesenteric artery syndrome, and duplicated cysts. This has an impact on treatment which tends to be slower so that it can increase the morbidity rate.\textsuperscript{3,4}

2.2 | Clinical manifestations

The clinical manifestations found in neonates with congenital duodenal obstruction are not described specifically and cannot narrow down the differential diagnosis significantly. Most of the neonates who present with congenital duodenal obstruction present with the manifestation of \textit{bilious vomiting} and a minority of cases are accompanied by abdominal distension. The clinical manifestations present in patients with late-onset (appearing in the elderly) are often more nonspecific, such as abdominal pain, nausea, vomiting, or diarrhea.\textsuperscript{11}

2.3 | Diagnosis

The diagnosis can be made based on radiological imaging findings. The finding of \textit{true double bubble} (Figure 2) or dilated \textit{multiple bowel loops} is a characteristic feature of imaging congenital duodenal obstruction so that the diagnosis can be made, and management of the patient can be started immediately. If these criteria are included, then the diagnosis can be made.\textsuperscript{11}

2.4 | Management

Exploratory laparotomy is needed immediately in children with manifestations of \textit{bilious vomiting} and proximal abdominal radiograph shows malrotation with or without volvulus midgut.\textsuperscript{11-13} Currently the procedure of choice is currently a duodenoduodenostomy. Treatment of obstruction accompanied by anomalous pancreatic annular should be accompanied by a bypass procedure. The duodenojejunostomy procedure has shown good results in cases refractory to conservative management. Duodenum tissue can be repaired with duodenotomy or duodenoplasty procedures. Postoperative complications that may occur include megaduodenum with functional obstruction, cholestatic jaundice, gastroesophageal reflux, and anastomotic strictures.\textsuperscript{11,14}

3 | PROGNOSIS FACTORS OF MORTALITY

In congenital duodenal obstruction, several conditions can worsen the patient’s prognosis, such as prematurity, low birth weight (LBW), and other congenital abnormalities. In addition, several other factors that are thought to influence patient morbidity and mortality are the type of obstruction and the type of surgery that performed.\textsuperscript{15}

3.1 | Gestational Age

Almost half of the patients with congenital duodenal obstruction are born prematurely. Kumar et al found that preterm pregnancy had a significant effect on child mortality. This is thought to be associated with the incidence of polyhydramnios.\textsuperscript{5,16}
3.2 | Birth weight

Low birth weight (<2500 g), which is also associated with prematurity, has a significant association with congenital mortality of gastrointestinal anomaly congenital disorders.6

3.3 | Accompanying congenital abnormalities

Several congenital disorders are known to be closely related to congenital duodenal obstruction, namely Down syndrome (trisomy 21), congenital heart defects, renal anomalies, esophageal atresia, tracheoesophageal fistula, anorectal malformations, lumbar hernia, and biliary anomalies.2,17

3.4 | Types of obstruction

In a study by Gfroerer et al, total duodenal obstruction is closely associated with lower gestational age, lower birth weight, congenital heart defects, higher morbidity, and more complications compared with partial duodenal obstruction. Mortality is found more in total obstruction, with heart defects as the main cause of death.4

4 | CONCEPTUAL FRAMEWORK

4.1 | Description of the conceptual framework

Congenital duodenal obstruction consists of two types, total and partial obstructions (Figure 3). This disorder is often accompanied by other congenital abnormalities such as down syndrome and congenital heart defects. Some of the risk factors for congenital duodenal obstruction are preterm pregnancy and low birth weight. Several types of surgery can be performed for congenital duodenal obstruction, such as gastrojejunostomy, duodenojejunalostomy, and duodenoduodenostomy.2,18

This study aims to identify the above factors and their influence on mortality prognosis in patients with congenital duodenal obstruction. All data were sourced from treated pediatric patients with duodenal obstruction at Dr. Moewardi Hospital, Surakarta, in January 2019 to December 2020, who were grouped according to the type of obstruction, gestational age, birth weight, and other congenital abnormalities. The data were then processed to see whether the type of obstruction influenced patient mortality.

5 | RESEARCH METHODOLOGY

This research was a retrospective descriptive study with cross-sectional approach.

5.1 | Study sample

All pediatric patients with congenital duodenal obstruction who admitted to Dr. Moewardi Hospital, Surakarta, in January 2019 to December 2020 were included as the sample.

5.2 | Method of sampling

Data were taken from the medical record of pediatric patients with duodenal obstruction who were treated at Dr. Moewardi Hospital, Surakarta, from January 2019 to December 2020. The medical record data of the patients taken were diagnosis, gestational age, birth weight, and other congenital abnormalities.

5.3 | Data analysis

The research data obtained were processed using SPSS 25.0. To find the effect of the type of obstruction on patient mortality, One-Way Fisher’s Exact test was performed.

5.4 | Inclusion criteria

The inclusion criteria of this study were patients diagnosed with duodenal obstruction based on clinical symptoms and babygram imaging who were treated in Dr. Moewardi Hospital, Surakarta, in January 2019 to December 2020.

5.5 | Exclusion criteria

The exclusion criteria of this study was congenital obstruction other than duodenal obstruction.
5.6 | Research variables

In this study, the variables of the study were the type of obstruction, gestational age, birth weight, and other congenital abnormalities.

6 | RESULTS

The number of duodenal obstruction patients in this study were 20 samples (Table 1).

From 20 samples of duodenal obstruction patients, 13 (65%) were born at term of pregnancy. Patients with normal birth weight were 12 (60%) samples, and 8 (40%) patients had low birth weight. There were 11 (55%) babies who died and 9 (45%) who lived. Patients with total obstruction type were 12 (60%) samples and with partial obstruction type were 8 (40%) samples. Patients with other congenital abnormalities were 13 (65%) babies, and those without other congenital abnormalities were 7 (35%) babies. Patients who had not (refused) surgery were 2 (10%) samples, and duodenojejunostomy was the most performed operation (45%).

In Table 2 was found that more patients with total obstruction died (81.8%) than patients with partial obstruction (18.2%). The results of the comparative test also showed statistically significant data ($P = 0.04^*$) while other variables did not show statistically significant differences in data.

7 | DISCUSSION

Duodenal obstruction is one of the most common causes of infant intestinal obstruction. About half of all intestinal obstructions are caused by intestinal duodenal atresia and the other half by stenosis.\textsuperscript{19,20}

In this study, it was found that 60% of the samples were of the total obstruction type, and as many as 55% of patients with duodenal obstruction died. Brantberg et al held 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. From 11 newborns with total duodenal obstruction, five (45%) died or had substantially impaired neurological development.  

In congenital duodenal obstruction, several conditions can worsen the patient’s prognosis, such as prematurity, low birth weight (LBW), as well as congenital abnormalities of patient. In this study, it was found that the variable that influenced patient mortality was the type of obstruction (P = .04) with an odds ratio of 9. This is consistent with the finding of Gfroerer et al. that the mortality rate was higher in total obstruction with heart defects as the main cause of death.  

The underlying mechanisms of death in patients with duodenal obstruction are still not fully understood, but several studies suggest that asphyxia, bradycardia/asystole, sepsis, increased bile acid levels, to cardiac anomalies were the underlying cause.  

8 | CONCLUSION  

The research results can be concluded as follows:  

1. Total duodenal obstruction type has a higher mortality rate than partial type.  
2. Other variables such as gestational age, birth weight, and other congenital abnormalities did not significantly influence mortality in patients with duodenal obstruction in this study.  
3. The underlying mechanisms of death in patients with duodenal obstruction are still not fully understood, research needed to clarify the mechanism.  

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 for population.  

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CONFLICT OF INTEREST  

The authors declare no conflicts of interest.  

AUTHORS CONTRIBUTIONS  

Nunik Agustriani: designed the study and reported the case. Estiarla: wrote the first draft of the manuscript and managed the literature searches. All authors read and approve the final manuscript.  

ETHICS STATEMENT  

This study was approved by the appropriate ethics committee and performed in accordance with the principles of the Declaration of Helsinki. All authors declare that written informed consent was obtained from the caretaker of patient (mostly their parents) for publication of this research. A copy of written consent is available for review by the Editorial Office/Chief Editor/Editorial Board members of this journal.  

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