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Relationship between sepsis and timing achievement of peristaltic function in congenital duodenal obstruction

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Abstract

Introduction. Intestinal obstruction has been shown to induce bacterial translocation and in turn, would be associated with an increased risk of sepsis. Such a condition would be affecting the achievement of peristaltic and ultimately increased morbidity and mortality. In addition, nosocomial infections that threaten neonates cause sepsis also will affect the achievement of a peristaltic. Thus, the aim of this study was to investigate the relationship between sepsis with timing achievement of peristaltic postoperatively.

Method. This is a cross-sectional study with data obtained from medical records of patients with duodenal obstruction without congenital abnormalities (gastroschisis, omphalocele, and another intestinal atresia) that underwent operations in RSCM during the period of January 2010 to July 2016. Subjects were grouped into sepsis and without sepsis. The association between sepsis and timing achievement of peristaltic, and confounding variables (gestational age, birth weight, congenital abnormalities, conditions of hypoxia and electrolyte imbalance) were analyzed. Data analyzed using univariate, bivariate (Mann Whitney, Chi-Square or Fischer) and multivariate (linear regression) with the significance of <0.05 .

Results. The study enrolled a total of 31 subjects. Period to achieve peristaltic (median value) was 12.5 days in subjects with sepsis and 5 days in those without sepsis. Bivariate analysis between timing achievement of peristaltic were sepsis ($p < 0.0001$), gestational age ($p = 0.004$) and hypoxic conditions ($p = 0.02$). The multivariate analysis showed an association between sepsis and timing achievement of peristaltic ($p = 0.011$, $R^2 = 35.8\%$).

Conclusion. In this study, sepsis was a major factor affecting the achievement of a peristaltic. The time difference to achieved peristaltic between sepsis and without sepsis was significance. Thus, it is necessary to control and prevent sepsis preoperatively and postoperatively that in turn, reducing morbidity and mortality.

Keywords: *congenital duodenal obstruction, timing achievement of peristaltic, bowel motility, sepsis*

Introduction

Congenital duodenal obstruction (CDO) referred to a broad term including a variety of anomalies such as duodenal atresia, duodenal stenosis, annular pancreas, duodenal membrane, and preduodenal portal vein,¹ is the most common anomalies in newborns and infants.² In the pediatric population, the incidence is estimated to be in 20,000 to 40,000 births, with incomplete obstructive lesions including duodenal webs accounting for only 2% of these defects.³

CDO resulted from some embryologic defects in the development of foregut, the failure of recanalization of the duodenal lumen, and pancreatic anomalies.⁴⁻⁶ In CDO, the dilated stomach and first part of the duodenum appeared side by side across the midline of the upper fetal abdomen during prenatal sonography, which is known as the “double-bubble” sign.⁷ This distinguishing feature has brought about great advances in the diagnosis since the later 1970s.⁸

Delayed return of normal duodenal function necessitating a prolonged hospital stays may often follow the operative treatment of neonatal duodenal obstruction.⁹ Achievement of peristaltic as

represents gut function is a goal after surgery in those with congenital duodenal obstruction. If patients could regain peristalsis, initial enteral nutrition may be given earlier; thus, the length of stay of the patients may essentially be reduced.⁹ Achieving peristaltic in congenital duodenal obstruction is associated with earlier diagnosis.¹⁰

Sepsis is the leading cause of death in critically ill patients and is associated with serious problems such as multi-organ failure. One major issue during sepsis and septic shock is severely impaired gastrointestinal function, especially gastrointestinal motility, clinically recognized as the paralytic ileus.¹¹ Impaired gastrointestinal motility, therefore, is one of some reasons why the infections occur during sepsis; yet, the exact mechanism of such phenomenon remains unclear. However, gut-derived mediators were released during peritonitis or sepsis, play an important role in gastrointestinal motility by either local, systemic or neuronal activation. Inflammatory mediators released from the immune cells within the gut wall were drained predominantly through the lymphatic system. Mesenteric lymph mediators from the gastrointestinal tract enter the systemic circulation via the thoracic duct, leading to distant organ impairment, such as septic pulmonary or liver dysfunction.¹¹ To this

date, there are no studies that investigate the effect of sepsis on time to achieve peristaltic. The present study aimed to investigate the effect of sepsis on time to achieve peristaltic.

Method

We used a cross-sectional study design. Subjects were those with congenital duodenal obstruction who underwent surgery at dr. Cipto Mangunkusumo Hospital, Jakarta during the period of January 2010 to July 2016. Those with another congenital intestinal atresia, gastroschisis and omphalocele were excluded. Variables including gestational age, birth weight, age during diagnosis, prenatal

diagnosis, types of surgery, time to surgery, length of stay, other congenital anomalies, and period to achieve peristaltic, hypoxia, electrolyte imbalance, death, and malrotation were recorded. Statistical analysis was performed using SPSS 17.0 for Windows.

Results

A total of 31 subjects were enrolled in the study. Twenty-one subjects (67.7%) were females, and fifteen subjects (48.3%) were premature. The median age during diagnosis was 7 (0–60) days. Subjects characteristics were presented in Table 1. We found that the median time to achieve peristalsis in those with sepsis and those without sepsis were 12.5 and 5 days, respectively (Table 2).

Table 1. Subjects' characteristics in the study

Variable	Values
Gestational age, median (min-max)	38 (40-41) weeks
Birthweight, mean \pm SD	2364 \pm 68 g
Age during diagnosis, median (min-max)	7 (0-60) days
Gender, n (%)	
– Males	10 (32.3%)
– Females	21 (67.7%)
Prenatal diagnosis, n (%)	7 (22.5%)
Type of intestinal obstruction, n (%)	
– Type 1 atresia	10 (32.2%)
– Annular pancreas	16 (51.6%)
– Ladd bands	4 (13%)
– Stenosis	1 (3.2%)
Types of surgery, n (%)	
• Side to side duodenoduodenostomy	25 (80.6%)
• Duodenoplasty	1 (3.2%)
• Ladd's procedure	5 (16.2%)
Time to surgery, median (min-max)	6 (0-31)
Length of stay, median (min-max)	24 (8-102)
Other congenital anomalies, n (%)	
• Down syndrome	5 (16.1%)
• Congenital heart defect	8 (25.8%)
Period to achieve peristaltic, median (min-max)	11 (3-47)
Hypoxia, n (%)	7 (22.5%)
Electrolyte imbalance, n (%)	1 (3.2%)
Death, n (%)	10 (32%)
Malrotation, n (%)	4 (12%)

Table 2. Comparison of characteristics between subjects with sepsis and those without sepsis

Characteristic	Sepsis (n = 20)	Without sepsis (n = 11)
– Age at diagnosis, years	6 (0-30)	14 (0-60)
– Time to surgery, days	6 (0-24)	8 (0-31)
– Length of stay, days	23 (14-102)	26 (8-68)
– Time to achieve peristaltic, days	12.5 (5-47)	5 (3-6)

Discussion

Congenital duodenal obstruction is the most common intestinal obstruction of the newborn. The diagnosis is quite simple, with an exception if the obstruction due to the duodenal diaphragm.¹² Duodenal atresia, as well as duodenal stenosis, were the frequent etiologies in congenital obstruction found in 1 per 5,000 to 10,000 live births and predominantly found in baby boys rather than baby girls.¹³ In subjects CDO who underwent surgery, there is often delayed the return of normal duodenal function which further results in prolonged hospital stay.⁹ One goal after operative treatment is the achievement of peristaltic function; if patients could regain peristalsis,

initial enteral diet could be given earlier; thus, the length of stay of the patients could be reduced.⁹ One factor that may affect the time to achieve peristaltic function is sepsis. In the present study, we investigated the effect of sepsis on time to achieve peristaltic function.

We found a significant association between sepsis and the achievement of peristaltic ($p < 0.001$). The most problem encountering in sepsis was the overwhelming response of the immune system that triggered the response of inflammation. The release and recruited inflammatory mediators of the great scale may lead to distant organ dysfunction (respiratory distress, acute kidney

injury, and hepatic failure).¹⁴ Furthermore, through many investigations the intestinal paralysis showed significantly present as the leading factor to various problems in clinical setting (vomiting, aspiration pneumonia, and bacterial translocation).¹⁵ However, the exact underlying mechanism describing this intestinal paralysis has not yet been clearly understood.¹¹

Bardain et al (2014) found that the median time to achieve peristaltic by the administration of enteral diet was 12 days.¹⁶ However, in the study, they did not find a significant association with sepsis. In the study, we found that hypoxia was associated with peristaltic ($p = 0.02$). Hypoxia markedly presents clinically by the history of shock during hospital stays and the history of malformations that leading to hypoxia in subjects with malrotation. It is previously known that intramural intestinal ganglia were sensitive to hypoxia; thus, every single condition that may lead to regional hypoxia may results in segmental gut paralysis due to the effect of oxygen insufficiency on neuronal plexus. Defect of perfusion during shock may contribute to gut paralysis. In the hypoxic gut, intestinal dilatation may presents and minimizing the peristaltic; thereby, the time to achieve peristaltic would be deteriorated.^{17,18}

Inflammatory mediators released by gastrointestinal tract during sepsis may affect gut motility. There are three possible mechanisms explaining the phenomenon: (1) TNF α reacted locally has a direct impact to the smooth muscle or enteric neurons in gut walls, or by inducing neuronal pathway that may inhibit the gut motility. (2) Inflammatory mediators entered the circulatory system through thoracic duct, affecting gastrointestinal tract by direct inhibition of the smooth muscle, activating the neuronal pathway in the gut that in turn, inhibits the gut motility, and (3) inflammatory mediators synergistically and systemically activating the focus of gut motility in the brain leading to inhibited foci. This may impact to paralytic ileus and inhibit the achievement of peristaltic.¹⁰

Our study was limited as a retrospective nature and limited samples. Further studies focused on the peristaltic in those with CDO were required for a better explanation of the exact mechanism.

Conclusion

Sepsis is a major factor that affects the achievement of peristaltic. Thus, it is necessary to control and prevent sepsis both preoperatively and postoperatively to reduce morbidity and mortality in those with congenital duodenal obstruction.

Disclosure

Author disclose there was no conflict of interest.

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