ORIGINAL ARTICLE

Prognostic Factors for Predicting Mortality in Neonates With Jejunoileal Atresia

Bela Mayvani Rachman[1], IGB Adria Hariastawa[2], Ariandi Setiawan[2]

[1] Paediatric Surgery Division, Department of Surgery, Faculty of Medicine, Universitas Airlangga, Surabaya, East Java, Indonesia
[2] Paediatric Surgery Division, Department of Surgery, Dr. Soetomo General Hospital, Surabaya, East Java, Indonesia.

ABSTRACT

Introduction: Jejunoileal atresia is one of the most common types of gastrointestinal atresia with an incidence rate of 1 in 5000 births, causing neonatal obstruction. While survival rates are high in developed countries, our study investigates the persistently lower survival rates in developing countries. This study evaluates specific prognostic factors linked to mortality at our institution. **Methods:** A retrospective study in a tertiary hospital in Surabaya over a period of 3 years was used to examine factors associated with jejunoileal atresia. The independent variables containing demographic and operative data were extracted from the medical records and analyzed using SPSS 22. **Results:** The study group consisted equally of male and female patients (n=12 each). A high mortality rate of 50% was observed (n=12), notably higher than reports from developed regions. The majority were full-term (n=15, 62.5%), with half (n=12) presenting low birth weight. Delays in surgery over 48 hours were common (n=17, 70.8%), and many had additional anomalies (n=15, 62.5%). Type 1 jejunoileal atresia was prevalent in intraoperative findings, affecting nearly half the cases (n=10, 41.7%). Ileostomies were frequently performed (n=15, 62.5%). Bivariate analysis indicated that low birth weight significantly correlated with increased mortality (p=0.009). **Conclusion:** Our findings reinforce that low birth weight is a critical prognostic factor for mortality in neonates with jejunoileal atresia, suggesting a need for targeted interventions in this demographic.
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Corresponding Author:
Bela Mayvani Rachman, MD
Email: bela.rachman@gmail.com
Tel: +62315020251

INTRODUCTION

Jejunoileal atresia is one of the most common types of gastrointestinal atresia with an incidence rate of 1 in 5000 births, causing neonatal obstruction. Furthermore, about 1 in 3 premature babies can experience jejunoileal atresia with equal prevalence risks for males and females (1, 2). Currently, the pathophysiology of jejunoileal atresia is undetermined. Some researchers suggested that this type of atresia is associated with vascular disruption in intrauterine (1, 3, 4). The emergence of intestinal obstructions similar to those occurring in humans was observed in fetal animals when vascular disruption manipulation was performed on the mesenteric artery and manipulation of disturbances in blood vessel supply was conducted.

Jejunoileal atresia presents as a complicated condition, with around 10% of cases potentially resulting in intestinal failure. The survival rate of jejunoileal atresia in developed countries was reported to be over 90% due to advancements in neonatal intensive care, operative techniques in surgery and the use of total parenteral nutrition (TPN), antenatal diagnosis and neonatal anaesthesia (5). However, these remain challenging in developing countries, resulting in lower survival rates for patients with jejunoileal atresia (6). In Indonesia, the neonatal mortality rate is concerning, with reports indicating about 12.1 deaths for every 1000 live births, accounting for approximately 60,000 neonatal deaths (7-9). Despite this, there is a notable gap in the literature concerning the specific causes of neonatal mortality in Indonesia, particularly in relation to jejunoileal atresia.

Our study is the first to explore and identify prognostic factors directly associated with mortality in neonates suffering from jejunoileal atresia in Indonesia. Conducted at Soetomo General Hospital, Surabaya—a major tertiary care center in the country—this research provides crucial insights into the outcomes of this condition in a developing country setting, which traditionally sees higher rates of mortality for such congenital malformations. The novelty of our study lies in its specific examination of jejunoileal atresia within this demographic, potentially paving the way for targeted

interventions and policy-making aimed at reducing neonatal mortality associated with this condition. This can lead to the development of standardised protocols for managing jejunoileal atresia and could have a significant impact on improving the survival rates of affected neonates in Indonesia and similar settings.

MATERIALS AND METHODS

Retrospective observational studies were used in this work by examining patients' medical records at Soetomo General Hospital Surabaya for 3 years: January 2019 to December 2022. It is important to note that patients with incomplete medical records were excluded from this study. Only neonatal patients diagnosed with jejunoileal atresia were considered. The independent variables included sex, gestational age, birth weight, the timing of surgery, presentation of associated anomalies, type of jejunoileal atresia, and surgery action. The dependent variables in this study were mortality or survival outcomes.

The definition of gestational age is the time between conception and the birth of the baby which is classified into preterm (< 37 weeks) and full-term (≥ 37 weeks) according to the American Academy of Pediatrics (AAP). The age at the time of surgery is divided into two categories: ≤ 48 hours and > 48 hours. The birth weight is divided into three groups: ≤ 1500 grams; 1500 to 2500 grams, and > 2500 grams. The types of atresia determined from intraoperative findings include Jejunoileal Atresia types: 1, 2, 3, and 4, in accordance with the Grosfeld classification.

In our study, survival was defined as a patient living beyond the neonatal period, which, according to our institutional protocol, extends to the first 30 days post-birth. This extended definition was chosen to capture late neonatal deaths that are directly attributable to complications arising from jejunoileal atresia and its surgical management. Mortality was correspondingly defined as any death that occurred within this 30-day time frame. The evaluation of patients was conducted throughout this period to ensure a comprehensive assessment of the early postoperative outcomes and the immediate survival post-intervention.

Regarding the surgical procedures, the study evaluated the outcomes associated with bowel anastomosis and ileostomy, with the latter being performed as a double-barrel procedure in accordance with the local policy of our institution. This was due to its relative technical ease and the clinical condition of the patients, as previously mentioned.

The obtained data were examined with the Chi-Square Test using SPSS 23.0. This would allow us to study the sensitivity of independent variables with respect to the outcome of jejunoileal atresia.

The present study received ethical approval from the Research Ethics Committee of Soetomo General Hospital, Surabaya, under the reference number 1397/LOE/301.4.2/VIII/2023.

RESULTS

Table I presents the characteristics and outcomes of paediatric patients diagnosed with Jejunoileal Atresia over a 3-year period. The table displays data on gender distribution, survival and mortality rates, birth weight, term status, associated anomalies, type of jejunoileal atresia, surgical interventions, and correlation between birth weight and mortality. A total of 24 patients were found to have been diagnosed with jejunoileal atresia, with an equal distribution of 12 male and 12 female patients. The outcome resulted in 50% survival and 50% mortality. Fifteen patients (62.5%) were born at full term, while twelve patients (50%) had a low birth weight ranging from 1500 to 200 grams. Fifteen patients (62.5%) exhibited associated anomalies such as cardiac issues (Atrial Septal Defect, Patent Ductus Arteriosus), abdominal wall defects (Gastroschisis, Omphalocele), and limb anomalies (Polydactyly). Seventeen patients (70.8%) underwent surgery more than 48 hours after birth. Based on intraoperative observations, ten patients

Table I: Overview of Characteristics and Outcomes of Pediatric Patients Diagnosed with Jejunoileal Atresia over a 3-Year Period

Characteristic	Outcome			p-value (p<0.05)
	Survived n (%)	Mortality n (%)	Total	
Sex				
Male	6 (50%)	6 (50%)	12 (50%)	1.00
Female	6 (50%)	6 (50%)	12 (50%)	
Gestational Age				
Full-term	9 (75%)	6 (50%)	15 (62.5%)	0.40
Preterm	3 (25%)	6 (50%)	9 (37.5%)	
Birth weight				
< 1500 gram	0 (0%)	4 (33.3%)	4 (16.7%)	0.009*
1500-2500 gram	5 (41.7%)	7 (58.3%)	12 (50%)	
>2500 gram	7 (58.3%)	1 (8.3%)	8 (33.3%)	
Timing surgery				
≤48 hours	4 (33.3%)	3 (25%)	7 (29.2%)	1.00
>48 hours	8 (66.7%)	9 (75%)	17 (70.8%)	
Associated Anomalies				
Present	7 (58.3%)	8 (66.7%)	15 (62.5%)	1.00
None	5 (41.7%)	4 (33.3%)	9 (37.5%)	
Type of Jejunoileal Atresia				
Type I	3 (25%)	7 (58.3%)	10 (41.7%)	0.13
Type II	0 (0%)	1 (8.3%)	1 (4.25)	
Type III	7(58.3%)	2(16.7%)	9 (37.5%)	
Type IV	2 (8.3%)	2 (8.3%)	4 (16.75%)	
Surgery				
Anastomosis	5 (41.7%)	4 (33.3%)	9 (37.5%)	1.00
Ileostomy	7 (58.3%)	8 (66.7%)	15 (62.5%)	

(41.7%) were diagnosed to have jejunoileal atresia type I, and an additional nine patients (37,5%) were identified to have jejunoileal atresia type II. Ileostomy was performed on 62.5% of the patients, while the remaining 37.5% underwent anastomosis. We investigated these characteristics using the Chi-Square Test, revealing that only birth weight exhibited a significant correlation with mortality ($p < 0.009$).

DISCUSSION

The variation in survival rates for jejunoileal atresia between developed and developing countries has garnered significant attention from numerous researchers. While survival rates in developed countries can exceed 90% (10, 11), studies by Chirdan et al. (12) and Akkoyun et al. (13) have reported that survival rates in developing countries lie within the range of 58.3% to 71.5%. Gupta et al. (11) also identified a comparable trend in a developing country, where survival rates for jejunoileal atresia varied between 15.4% and 54.1%. Similarly, we observed a survival rate of approximately 50% at Soetomo General Hospital Surabaya. This observation could potentially be attributed to the time interval between patient transfers to our hospital, as 70.8% of patients underwent surgery more than 48 hours after birth.

In our study, we observed no significant gender differences in the incidence of jejunoileal atresia, which is consistent with findings from earlier studies by Sholadoye et al (14) in Nigeria and Siu Uribe et al (15) in Spain. Regarding gestational ages, the distribution of jejunoileal atresia across different gestational ages revealed a higher prevalence in full-term neonates, which constituted 62.5% of our patient cohort. This finding appears to diverge from patterns reported in prior research, where jejunoileal atresia is more commonly associated with preterm births (1, 2). Several factors may contribute to this discrepancy. Firstly, the demography of our patient population and regional differences in the prevalence of risk factors for jejunoileal atresia could influence the gestational age distribution. Secondly, our data encapsulates a 3-year period, which may not be sufficiently extensive to reflect the broader epidemiological trends observed in studies with longer durations.

Furthermore, gestational age did not emerge as a significant prognostic factor for mortality in neonates with jejunoileal atresia. This observation suggests that, within our study context, the timing of the neonatal surgical intervention and the immediate postoperative care might have a more pivotal role in determining patient outcomes than gestational age. It is important to note that variations in study design, population demographics, and healthcare practices may account for the differences in findings between our study and previous works. Therefore, further research is necessary to explore the underlying causes of these differences and their implications on patient management and outcomes.

One of the factors contributing to mortality in jejunoileal atresia patients is the duration of patient referral (14). A similar situation was observed in this study, where 70.2% of patients who came to our hospital underwent surgery after 48 hours. While no statistically significant correlation exists between the duration of surgery and mortality, the notable increase in mortality among patients undergoing surgery > 48 hours could potentially be ascribed to delays in patient referrals caused by the limited availability of NICU facilities and medical specialists in peripheral regions.

Our findings indicate that birth weight holds a significant prognostic value ($p < 0.05$) for mortalities in cases of jejunoileal atresia. Mortality was notably significant among the group of infants with birth weights ranging from 1500 grams to 2500 grams. This discovery aligns with earlier research (16, 17) and can be elucidated by the association between low birth weight and the extended duration of postoperative care, as well as the time required for patients to reach full feeding (16).

A high mortality rate was observed among patients with comorbidities, accounting for 66.7%. The associated anomalies included congenital heart defects such as ASD and PDA, abdominal wall defects like omphalocele and gastroschisis, as well as limb abnormalities. Nevertheless, mortality does not emerge as a significant factor affecting mortality in cases of jejunoileal atresia. Note that the type of jejunoileal atresia was determined during intraoperative evaluation. The most prevalent type of jejunoileal atresia is type I, followed by types III, IV, and II in sequence. The highest mortality rate was observed in jejunoileal atresia type 1, accounting for 58.3%. Several studies conducted by Sholadoye et al. (14) and Saleem et al. (18) show different results, indicating that the most common occurrence of jejunoileal atresia is found in type III. The study by Dalla Vechia (5) indicates that type II is the most commonly found type of atresia. These corroborate our conclusion that the type of atresia does not play a significant role as a prognostic factor for mortality.

In this study, ileostomy was predominantly performed over anastomosis as a critical emergent intervention. The selection of ileostomy as the surgical approach was influenced by the patients' deteriorated clinical condition at the time of their arrival. A significant proportion of patients arrived at the surgical suite with notable delays, often exceeding 48 hours, and were in a septic and catabolic state, requiring rapid surgical resolution. In such scenarios, the shorter duration and potentially reduced physiological stress of an ileostomy procedure were considered more appropriate.

The surgical team consisted of attending surgeons and pediatric surgery residents whose competencies are aligned with senior-level expertise as per the institution's standards. It is pertinent to note that a mortality rate of 66.7% was observed in patients who underwent ileostomy, which could be associated with the development of complications such as Short Bowel Syndrome, as suggested by literature references (6, 14, 15, 18, 19).

The study acknowledges a limitation, particularly in the postoperative complications and the surgeons' skill levels, which were not systematically assessed. While surgical procedure choice did not emerge as a statistically significant prognostic factor for mortality in our cohort, we recognise this as a potential area for future in-depth investigation. Further research could elucidate the impact of surgeon expertise and postoperative management on patient outcomes, which could inform both clinical decision-making and surgical training programs.

It is worth mentioning that this study is retrospective research conducted at a single tertiary hospital, which has limitations in terms of data collection quantity and other factors that have not been comprehensively analyzed. This could result in a limited number of significant prognostic factors affecting mortality in patients with jejunoileal atresia. To obtain statistically more significant results, further research should involve a larger population sample from multiple centres and should incorporate complications and occurrences of Short Bowel Syndrome.

CONCLUSION

This retrospective study at Soetomo General Hospital Surabaya uncovers pivotal insights into jejunoileal atresia in pediatric patients, emphasizing a critical correlation between low birth weight and mortality, thereby marking birth weight as a substantial prognostic factor ($p < 0.009$). Despite exploring variables including gender, gestational age, associated anomalies, and types of atresia, only birth weight emerged as a significant predictor of mortality. The limitations of a single-centre retrospective study necessitate further expansive research to uncover a broader spectrum of prognostic factors and delve deeper into associated complications, ultimately aiming to enhance the management strategies and survival outcomes for this vulnerable demographic.

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