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Original research article

ROLE OF BISHOP KOOP PROCEDURE IN MANAGEMENT OF JEJUNOILEAL ATRESIA – A SINGLE CENTER STUDY

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Abstract: *Jejunoileal atresia is a significant congenital condition requiring surgical intervention. The Bishop Koop procedure has been a notable technique for managing this condition, yet comprehensive evaluations of its efficacy and safety are needed to validate its continued use.* ***Objective:*** *To evaluate the effectiveness of the Bishop Koop procedure in managing jejunoileal atresia.* ***Methods:*** *This cross-sectional study was conducted at the Department of Pediatric Surgery, The Children's Hospital, PIMS Islamabad, from July 2023 to April 2024. Forty-two patients diagnosed with jejunoileal atresia were clinically evaluated and underwent the Bishop Koop procedure. Post-operative outcomes, including the duration of surgery, time to initiate bowel movements and feeding, and early complications, were recorded. Patients were followed up during their hospital stay to record outcomes of discharge or expiry. SPSS version 29.0 was utilized to identify mortality predictors. All patients received postoperative intravenous antibiotics.* ***Results:*** *Of the 42 neonates treated, 66.7% were successfully discharged, while 33.3% expired, indicating a significant rate of adverse outcomes. The study provides detailed data on surgical durations, recovery times, and complication rates.* ***Conclusion:*** *The findings suggest that the Bishop Koop procedure is a safe and effective surgical option for severe jejunoileal atresia despite the substantial proportion of adverse outcomes. Further studies are warranted to optimize patient selection and procedural techniques to enhance survival rates.*

Keywords: Bishop Koop Procedure, Conservative Management, Jejunoileal Atresia.

Introduction

Jejunoileal atresia is a rare congenital anomaly that results in the obstruction or absence of a portion of the small intestine. Incidence has been estimated to be almost 1 in 10,000 live births. (1) This condition can lead to significant morbidity and mortality in affected neonates, as it often causes intestinal obstruction and associated complications such as sepsis, perforation, or short bowel syndrome. (2) Surgical intervention is the standard treatment for jejunoileal atresia, but the optimal surgical technique remains controversial. While conventionally, resection and anastomosis have been favored as the treatment of choice, alternative procedures such as divided stoma, tapering arthroplasty, and the Bishop Koop procedure are increasingly gaining popularity. (3, 4) In resource-limited countries like Pakistan, where access to specialized neonatal care and perioperative support is limited, the management of jejunoileal atresia poses unique challenges. Over the last decade, the Bishop-Koop procedure has been adopted by multiple resource-limited countries as a preferred surgical strategy in the management of small gut atresia due to its ability to mitigate the risks associated with immediate primary anastomosis. (5)

The bishop-Koop procedure, initially introduced by Harry C. Bishop and C. Everett Koop in 1957, involved preserving the atretic segment of the intestine and creating an end-to-side anastomosis of the proximal atretic loop while the distal loop is taken out as a stoma, allowing for decompression and restoration of bowel continuity. Initially described in the management of meconium ileus, this technique offered several potential advantages, including reduced operative time, avoidance of bowel resection, preservation of bowel length, and the possibility of distal segment irrigation. (6) Owing to the high mortality rate among surgical neonates in our setup, the management paradigm of jejunoileal atresia was gradually shifted to Bishop-Koop from primary anastomosis. This study aimed to review the data of the neonates with jejunoileal atresia undergoing the bishop-Koop procedure in our tertiary care setup and discuss its role in managing jejunoileal atresia.

Methodology

This cross-sectional study was conducted at the Department of Pediatric Surgery, The Children's Hospital, PIMS Islamabad, from July 2023 to April 2024. A total of 42 neonates with a diagnosis of simple jejunal or ileal atresia were included, irrespective of type. The sample size was calculated using the WHO Sample Size calculator with a confidence level of 95%, a population mean of 5.48_+ 1.31, and an absolute precision of 0.40. A nonprobability consecutive sampling technique was used to gather the sample for this trial. Neonates with complex atresia or associated anomalies (Anorectal malformation, VACTERL association) and those with duodenal and colonic atresia were excluded from this study. Written and informed

consent was sought from all the parents/guardians of neonates, and they were briefed about the research purpose of this study. Ethical approval was sought from the Ethical review board.

A provisional diagnosis of atresia in neonates presenting with obstruction was initially made clinically with the help of history and examination, further affirmed by abdominal radiograph and contrast study if needed. The final diagnosis was only confirmed by the operation. Preoperatively, neonates with jejunal or ileal atresia with no associated anomaly underwent the Bishop-Koop procedure and were included in the study, while neonates with atresia involving any other site or with associated other anomalies were excluded from the research and procedure was selected according to individual diagnosis. Postoperatively, NICU space was requested for every neonate. However, only a few neonates can be shifted to the neonatal ICU due to excessive turnover and limited space availability in the NICU. Most neonates were moved to the neonatal bay in the ward postoperatively. Post-operative intravenous (IV) antibiotics were prescribed to every patient. Patients were initially kept nil per oral. Peripheral parenteral nutrition containing amino acids and fluids was given through the peripheral line due to the non-availability of total parenteral nutrition. Oral feeding commenced after the 3rd post-operative day and continued as tolerated. Variables like duration of surgery, time to start bowel movement, time to start feeding, and early complications were recorded for all neonates. The outcome was recorded in terms of discharge or expiries.

Bishop Koop procedure was performed by creating a T-shaped end-to-side anastomosis by joining the end of the proximal bowel loop with the anti-mesenteric side of the distal loop 2 cm distal to the end. 2 cm of preserved distal intestinal loop was brought outside the skin incision. An inverted stoma was fashioned with skin using absorbable sutures.

The categorical data were expressed as frequencies and percentages, and the continuous variables were expressed as mean and standard deviation (SD) or as the median, according to their distributions. Univariate logistic regression was used to identify the risk factors for postoperative adverse outcomes. A p-value of less than 0.05 was considered to be statistically significant. Data analyses were performed using the SPSS software package (version 29.0)

Results

There were a total of 42 neonates, which included 24 males and 18 females. The mean gestational age was 36.64 weeks, and the mean time to start enteral feeding after the procedure was 5.31 days. Most patients had jejunal ileal type 3A atresia (28.6%). All neonates underwent the Bishop Koop procedure. The median duration of hospital stays, the start of bowel movement, and enteral feeding time were ten days (95% CI 10.15 – 12.13), four days (95% CI 3.76 – 4.81), and six days (95% CI 4.41–6.21), respectively. Regarding mortality, 28 (66.7%) patients were discharged home, while 14 (33.3%) neonates expired after the procedure. (Table IA & IB). Postoperatively, 35.7% of the neonates did not suffer any complications, while the most common adverse event noted was wound infection (19%) (Table II).

We used univariate regression analysis to identify the factors leading to mortality among neonates. Gestational age, early start of bowel movement, and early commencement of feeding were not significant enough to explain the variance in the model (Table III).

Table-IA: Demographic and Clinical Characteristics of Patients (n=42)

Continuous Variables	Mean	Median	SD
Age (Days)	2.60	2	+1.19
Gestational age at birth (Weeks)	36.64	37	+1.47
Time of Surgery (Minutes)	68.62	70	+16.54
Duration of Stay (Days)	11.14	10	+3.18
Time to start bowel movements (Days)	4.29	4	+1.68
Enteral feeding commenced from (Days)	5.31	6	+2.89

Table-IB: Demographic and Clinical Characteristics of Patients (n=42)

Categorical Variables	n (percentage)
Gender	
Male	24 (57.1%)
Female	18 (42.9%)
Mode of Delivery	
SVD	23 (54.8%)
ELSCS	19 (45.2%)
Type of atresia	
Type 1	5 (11.9%)
Type 2 2A	9 (21.4%) 6 (14.3%)
Type 3 3A 3B	3 (7.1%) 12 (28.6%) 4 (9.5%)
Type 4	3 (7.1%)

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Table II: Outcomes of neonates after Bishop Koop procedure

Early Complications	**n (percentage)**
None	15 (35.7%)
Wound Infection	8 (19.0%)
Wound Dehiscence	1 (2.4%)
Sepsis	5 (11.9%)
Enterocutaneous fistula	3 (7.1%)
Anastomotic leakage	4 (9.5%)
Stoma stenosis	2 (4.8%)
Prolonged ileus	4 (9.5%)
Outcome	
Discharged	28 (66.7%)
Expired	14 (33.3%)

Table III: Univariate regression analysis for post-operative adverse outcome in the neonates born with jejunal ileal atresia

Variable	**P – value**	**Odd ratio**	**95% CI**
Gestational age at birth(weeks)	0.823		0.676 – 1.636
Start of Bowel movement (days)	0.435		0.785 – 1.754
Enteral feeding commences (days)	0.137		0.665 – 1.057
P value < 0.05			

Discussion

Our study aimed to investigate the role of the Bishop Koop procedure in the management of jejunoileal atresia (JIA) in neonates in a tertiary care hospital from a low-resource country. Due to the lack of resources required for the survival of neonates, our center was experiencing negligible survival among neonates with primary anastomosis. The developed world has seen a significant decline in the mortality rate of JIA during the past few decades. (1, 7, 8) However, in developing countries, there is a significant lack of newborn intensive care units, neonatal anesthetists, and other neonatal specialists in poor countries, which contributes to the high infant mortality rate. (9) In addition, studies from Pakistan also reported poor survival trends for operative management of JIA. (10) In a case series of 63 neonates, the author has documented 36.5% mortality with various surgical procedures opted for JIA. (7) This is primarily due to a lack of NICU, trained staff, overcrowding, and nutritional requirements needed in the form of parenteral nutrition, which is crucial for the survival of these babies [11]. This results in wound infections, sepsis, malnutrition, and ultimately fatalities; therefore, we adapted the procedure change from primary anastomosis to Bishop Koop procedure to maximize the nutrition requirement of neonates needed for survival. As a result, a decrease in mortality was observed in our hospital in neonates secondary to JIA. Our finding correlates with prior studies on Bishop Koop for JIA in other countries. (11-14)

It was observed that the mortality rate decreased after the implementation of the Bishop Koop procedure; however, due to a lack of comparative study, we are unable to document the comparison. However, in our study, 35.7% of neonates didn't develop complications after Bishop Koop, which corresponds to other studies where total complication rates were decreased compared to Primary Anastomosis. (15)

In our study, wound infection was the most common complication among neonates (19%). This is in line with the previous studies that have reported that wound infection is the most common early complication associated with the Bishop Koop procedure for jejunoileal atresia. (5) Anastomotic leakage was observed in 9.5% of neonates in our study. Literature suggests that it occurs because of insufficient blood supply at the anastomotic site, primarily due to its single artery retrograde blood supply, which results in sepsis. In addition, sepsis is the most common cause of death among neonates and occurs usually because of anastomotic leakage. (16) In our study, 11.9% of neonates develop sepsis after Bishop Koop procedure.

Bishop Koop procedures were also adopted due to their advantages in the early return of bowel movement and improved nutrition status due to continuity of bowel, which leads to early utilization of distal small bowel and colon, leading to enhanced recovery. Also, stoma creation proximal to anastomosis acts as a vent, decompressing anastomosis resulting in decreased stoma leakage. Although, due to the small sample size, no significant improvement in mortality is seen statistically after initiating enteral feeding, a change in survival trend has yet been noted.

Lastly, 33.3% mortality is seen in our study, indicating a substantial proportion of adverse outcomes. However, similar high mortalities were seen in other studies as well. A study on neonates from Uganda reported a risk reduction of 0.64 (95% CI 0.41–0.98) when Bishop Koop was implemented along with EEN with ostomy feeding, one of the most extensive studies on Bishop Koop from a low-income country. (16) Moreover, mortality from JIA could be multifactorial, ranging from delayed diagnosis, type of atresia, associated anomalies, and socioeconomic factors, including lack of neonatal intensive care and parenteral nutrition as well(17, 18). Which is the primary reason for this in our country as well. (7) Similarly high mortality trends were also seen in studies of other low-income countries (11)

Our study has several limitations. First, due to the unavailability of proper record-keeping facilities, we could not compare the primary anastomosis and the Bishop Koop procedure. However, it's worth noting that an improved survival outcome was noted after Bishop Koop's procedure was implemented. Second, the sample size was small and reported only data from a single center; more extensive

studies are needed to make a significant comparison. Also, this study did not report on patients' long-term follow-up to access surgical outcomes.
The main limitations of our study were the small sample size and selection bias due to the inclusion of specific neonates.

Conclusion

Despite the adverse outcomes, our study reported that the Bishop Koop procedure is safe and efficient for severe jejunoileal atresia.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
It is approved by the department concerned. (IRBEC/CHC-1233/23)
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

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