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Original Article

Comparative Outcomes of the Bishop Koop Procedure and Primary Anastomosis in Jejunoileal atresia

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Abstract

Background: Jejunoileal atresia is a common congenital anomaly of the small intestine. The most widely practiced surgical approach is resection of the dilated and hypertrophied proximal bowel followed by primary anastomosis. However, to mitigate the complications associated with primary anastomosis, the Bishop Koop procedure remains a valuable alternative—particularly in developing countries, where access to advanced NICU care and total parenteral nutrition is often limited.

Methods: A quasi-experimental study conducted at Dhaka Medical College Hospital between July 2017 and June 2019 including 50 pediatric patients with jejunoileal atresia. Participants were randomly selected to receive either Bishop Koop ileostomy (Group A) or primary anastomosis (Group B). Primary outcomes were-operation time, bowel movement time, time to establish oral feeding, duration of hospital stay, and complication rates.

Results: Group A showed significantly shorter less hospital stay duration (8.40 vs 11 days, p=0.004), and fewer complications compared to Group B. The mortality rate in Group A was lower (12% vs. 40%, p=0.024). Anastomotic leakage occurred in 8% of Group A compared to 40% in Group B (p=0.008). In the adjusted bivariate regression analysis model, the likelihood of hospitalization>8 days was determined to be 10 times (95% CI 2.356-46.578) longer in group B than in group A.

Conclusion: Bishop Koop ileostomy is associated with improved outcomes, in respect of less hospital stay duration, less complication and lower mortality. These outcomes making it a preferred approach for high-risk neonates with jejunoileal atresia.

Key words: Bishop Koop procedure, Primary anastomosis, Jejunoilealatesia

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Introduction:

Jejunoileal atresia represents one of the most common causes of neonatal intestinal obstruction.[1] While survival rates for this condition are high (89-90%) in developed countries, still they remain significantly lower in developing countries ranging between 58.3% to 71.5%.[2] This disparity is largely attributed to delayed presentation and diagnosis, which can worsen the patient's condition, as well as limited access to neonatal intensive care units and insufficient parenteral nutritional support. If left untreated, jejunoileal atresia may lead to severe complications such as sepsis and intestinal perforation, necessitating immediate surgical intervention.

Primary anastomosis, a commonly used surgical method, directly connects the dilated proximal and distal segments of the intestine, reestablishing continu

ity in a single operation.[3] However, this approach has a significant risk of complications, particularly including anastomotic leakage and obstruction.[4,5] In contrast, the Bishop Koop ileostomy is an approach that establishes a transient ileostomy to redirect bowel contents away from the anastomosis, thereby reducing pressure at the site and providing the distal intestine with the opportunity to heal and recover. This intervention is associated with fewer complications, quicker recoveries, and often reduced hospital stays in high-risk patients, according to studies.[6-8]

However, there are limited data comparing the outcome and complications of Bishop Koop Ileostomy and Primary Anastomosis. A few previous studies have produced inconsistent outcomes, with some studies advocating for the safety and efficacy of primary anastomosis in specific circumstances, while others underscore the advantages of Bishop Koop ileostomy in reducing postoperative complications.[9,10]

Although Bishop Koop procedure was not performed for JIA primarily, it has been considered as a treatment of choice for different types of atresia for the last few decades. Most of the studies based on the outcome of BK procedure were conducted in developing countries and almost all were on the basis of retrospective data. This two years study aims to address this empirical gap by adopting a quasi-experimental study design comparing the outcomes of Bishop Koop ileostomy and primary anastomosis in neonates with jejunoileal atresia types II and IIIa. Specifically, key postoperative outcomes, including operative time, time to first bowel movement, time to establish oral feeding, hospital stay duration, and complication rates have been thoroughly evaluated.

Materials and Methods

Study Design, setting and sample: The study, designed as quasi-experimental was carried out over 24 months, from July 2017 to June 2019, at the Department of Pediatric Surgery, Dhaka Medical College Hospital. The target population included all pediatric patients diagnosed with jejunoileal atresia. The aim of this study was to evaluate the comparative the outcome of two surgical procedures- Bishop Koop ileostomy and Primary Anastomosis.

Diagnosis and Definition of Patients: This study specifically focused the patients diagnosed with jejunoileal atresia types II and IIIa. A combination of clinical evaluation and radiological imaging were used to confirm the presence and type of intestinal obstruction in the diagnosis of jejunoileal atresia among the sample patients in this study. Patients were admitted with symptoms that are frequently associated with atresia, including abdominal distension, bilious regurgitation, and meconium passage. To confirm the diagnosis, the attending pediatric surgeon requested a number of diagnostic imaging tests after the initial clinical evaluation. The abdominal X-ray, which is typically taken in an erect posture, was a critical diagnostic tool.

The study focused exclusively on patients diagnosed with jejunoileal atresia types II and IIIa, confirmed during surgery. Type II atresia is characterized by a fibrous cord connecting a dilated, blind-ending proximal segment to a collapsed distal segment, with an intact mesentery. Type IIIa atresia involves a complete interruption of the bowel without a connecting cord, leaving a V-shaped mesenteric defect between the two ends of the intestine. Patients with other forms of atresia (types I, IIIb, and IV) were excluded from the sample to maintain uniformity in comparing surgical outcomes. Patients were randomly selected and allocated to the intervention groups through an initial lottery system, followed by alternate assignment until each group reached the target sample size of 25 patients. Due to low prevalence of this condition, a total of 50 patients were selected and were allocated into two groups:

Group A: Diagnosed case of jejunoileal atresia and planned for Bishop Koop ileostomy and

Group B: Diagnosed case of jejunoileal atresia and planned for Primary Anastomosis.

Preoperative Evaluation and Treatment

All patients were subjected to an initial physical examination by the attending physician upon admission followed by a secondary evaluation by a resident surgeon or consultant. Baseline diagnostic procedures included complete blood counts, blood grouping and Rh typing, serum creatinine, serum electrolytes, random plasma glucose, C-reactive protein (CRP) testing and abdominal X-rays. Preoperative preparations comprised keeping the patient on nothing per oral, nasogastric decompression, and intravenous fluid. A Standard preoperative antibiotic protocol was maintained along with Vitamin K.

Operative Procedure

Following sufficient resuscitation, patients underwent laparotomy under general anesthesia. The surgery

begins with a supra-umbilical transverse incision, allowing access to the abdominal cavity, where the surgeon locates and assesses the atretic segments. The procedure type for each patient (either Bishop Koop ileostomy or Primary Anastomosis) was pre-decided. In both groups, the procedure completion time was measured using a stopwatch. During surgery, blood transfusion was administered as necessary. Approximately 10-15 cm of the hypertrophied, obstructed bowel is resected to relieve pressure on the proximal segment, and the distal portion is then manually decompressed. Following the resection of the atretic segment in each patient, the surgical procedure went as follows:

A. Bishop Koop Ileostomy:
An anastomosis was done between the end of the proximal bowel and the side of the distal bowel using fine absorbable sutures, typically 5-0 Polyglactin 910, approximately 4-5 cm from the end. The distal ileum is then exteriorized through a small incision in the right iliac fossa to create a stoma, providing a controlled outlet for intestinal contents. This diversion protects the anastomosis from direct pressure, thus minimizing the risk of leakage, a common complication in neonatal bowel surgeries.

B. Primary Anastomosis:
A Cheatle slit is created on the distal length to minimize any size disparity between the two segments. An end-to-end anastomosis was done between proximal and distal gut with fine, absorbable sutures like 5-0 Polyglactin 910, to establish a continuous, tension-free intestinal conduit.

Postoperative Management and Follow-Up
Postoperative care included ongoing nasogastric decompression, intravenous fluid administration, potassium supplementation starting from the second postoperative day, and the continuation of antibiotics and analgesics. Bowel function was monitored, and oral feeding started gradually after confirmation of bowel movement. Six hourly post operative follow up of these patients included vital signs such as temperature, heart rate, respiratory rate, abdominal distension, wound condition, stoma functionality and bowel movement. Patients were discharged upon the establishment of normal oral feeding and bowel movement, and the absence of any symptoms of sepsis. They were advised to attend follow up visits on 2nd and 6th week of discharge. Patients with complications such as anastomotic leakage or obstruction underwent re-laparotomy for enterostomy and peritoneal lavage.

Outcome measured:
The primary outcome measures in this study were designed to evaluate the effectiveness and safety of these two surgical approaches by postoperative recovery and complications. The outcome measures encompassed operation time, time to initial bowel movement, time to commence oral feeding, and total hospital stay, Furthermore, postoperative complications including anastomotic leakage, blockage, and death were meticulously observed due to their influence on patient outcomes and the safety profile of each surgical technique.

Data Collection and Statistical Analysis
Data were collected through a structured questionnaire and check list. Data analysis for this study was conducted using SPSS version 24.0 to ensure a robust statistical evaluation of the collected data. Descriptive statistics, including means and standard deviations, were calculated for continuous variables such as operative time, time to bowel movement, time to establish oral feeding, and hospital stay duration. To compare these continuous variables between the two surgical groups an independent samples t-test was used. Categorical variables, including postoperative complications, gender, and mortality rates, were analyzed using chi-square tests to assess associations between the type of surgery and incidence of these complications. Additionally, univariate and bivariate logistic regression analysis were performed to identify any predictive relationships between surgical method and specific outcomes, adjusting for potential confounding factors. Statistical significance was set at 95% confidence interval with $p < 0.05$ for all tests.

Ethical Considerations
This study was approved by the Ethical Review Committee of Dhaka Medical College Hospital. Informed consent was obtained from all parents or legal guardians of the participants, with the study's objectives and methods clearly explained to guarantee understanding and voluntary participation. All the methods in the present study were carried out following the ethical guidelines of the 1975 Declaration of Helsinki and its later amendment.

Results:

The average age of patients was 4.92 (±2.87) and 6.04(±3.86)daysIn Group A and Group B respectively. Group A patients showed a slightly elevated average weight of 2.63 (±0.53) kg in contrast to 2.44 (±0.44) kg in Group B. Ileal atresia was found in 56.0% patients of

Group A and Type IIIa was more prevalent in Group B (64.0%)(Table I).

Table I: Distribution of the patients' characteristics by two operative groups (N=50)

Attributes	Group A (n=25)	Group B (n=25)
Age (days)		
1 – 5	19 (76.0%)	12 (48.0%)
6 – 10	5 (20.0%)	10 (40.0%)
11 – 15	1 (4.0%)	3 (12.0%)
Mean ± SD	4.92 ± 2.87 (2-4)	6.04 ± 3.86 (1-15)
Gender		
Male:Female	1:0.92	1:0.66
Male	13 (52.0%)	15 (60.0%)
Female	12 (48.0%)	10 (40.0%)
Weight (kg)		
Mean ± SD	2.63 ± 0.53	2.44 ± 0.44
Site of atresia		
Ileum	14 (56.0%)	13 (52.0%)
Jejunum	11 (44.0%)	12 (48.0%)
Type of atresia		
Type II	12 (48.0%)	9 (36.0%)
Type IIIa	13 (52.0%)	16 (64.0%)

One way anova test states that operation time in minutes and hospital stay in days in between two group were found significant (0<0.01). Group A needed more operation time (minutes) but less hospital stay (days) (Table II)

Table II: Compare means between operation time, bowel movement, oral feeding establishment (in POD) and hospital stay (days) in two groups (N=50)

Attributes	Group G-A (n=25) G-B (n=25)	mean±SD	95% CI	P-value
Operative Time in Minutes	G-A	38.88±6.412 (26-54)	36.23-41.53	**<001**
	G-B	30.68±7.793 (18-47)	27.46-33.90	
	Total	34.78±8.187 (18-54)	32.45-37.11	
Bowel Movement in POD	G-A	4.52±1.531 (3-9)	3.89-5.15	0.432
	G-B	3.92±3.463 (0-9)	2.49-5.35	
	Total	4.22±2.667 (0-9)	3.46-4.98	
Establishment of Oral feeding in POD	G-A	6.84±2.173 (0-11)	5.94-7.74	0.257
	G-B	5.60±4.95 (0-15)	3.56-7.64	
	Total	6.22±3.83 (0-15)	5.13-7.31	
Hospital Stay (days)	G-A	8.40±1.871 (6-13)	7.63-9.17	**0.004**
	G-B	11±3.884 (5-21)	9.40-12.60	
	Total	9.7±3.290 (5-21)	8.76-10.60	

one way anova test was conducted, p<0.5 was considered significant

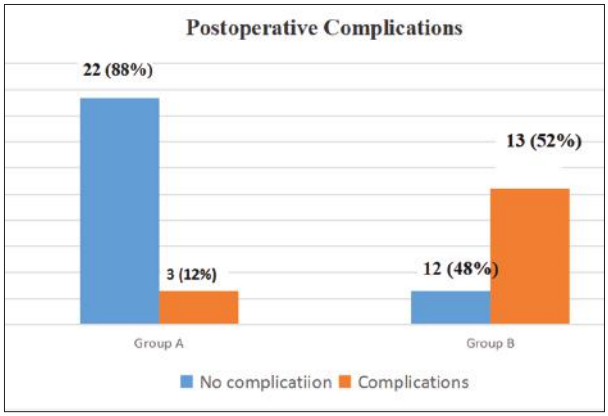

Figure 1: Comparison of post-operative complications between two groups (N=50)

The complication rates highlighted the benefits of the Bishop Koop ileostomy in Group A, where only 12% encountered postoperative problems, in contrast to 52% in Group B (p=0.002)(Figure 1).

Group B had a markedly elevated incidence of anastomotic leakage (40% compared to 8% in Group A, p=0.008) and a prolonged hospital stay, with 80% of Group B patients remaining hospitalized for over eight days (in contrast to 32% in Group A, p=0.001). Mortality rates in Group B were significantly higher at 40% compared to Group A's 12% (p=0.024) (Table III).

Table III: Post-operative complication pattern between two groups (N=50)

Post-operative Complications	Group A (n=25)	Group B (n=25)	p-value
Anastomotic leakage			
Yes	2 (8.0%)	10 (40.0%)	0.008[b]
No	23 (92.0%)	15 (60.0%)	
Obstruction			
Yes	1(4.0%)	3 (12.0%)	0.197[b]
No	24 (96.0%)	22 (88.0%)	
Hospital stay (days)			
5-8 days	17 (68%)	5 (20%)	0.001[b]
>8 days	8 (32%)	20 (80%)	
Mortality			
Yes	3 (12.0%)	10 (40.0%)	0.024[b]
No	22 (88.0%)	15 (60.0%)	

unpaired t testa was done to measure the level of significance, chi-square testb was done to measure the level of significance

In the unadjusted model, group B exhibited 7.667 (95% CI 1.470-39.987), 8.500 (95% CI 2.338-30.908), and 4.889 (95% CI 1.150-20.790) times greater likelihoods of experiencing postoperative complications such as anastomotic leakage, prolonged hospital stay, and mortality; respectively. In the adjusted bivariate regression analysis model, the likelihood of hospitalization was determined to be 10 times (95% CI 2.356-46.578) greater in group B than in group A (Table IV).

Table IV: Univariate and Bivariate logistic regression analysis assessing post-operative complication in two group (N=50)

Attributes	Unadjusted Odds Ratio (UOR) 95%CI	p-value	Adjusted Odds Ratio (AOR) 95% CI	p-value
Anastomotic Leakage				
No	1		1	
Yes	7.667 (1.470-39.987)	0.016	5.030 (0.495-51.140)	0.172
Hospital Stay				
5-8 days	1		1	
>8 days	8.500 (2.338-30.908)	0.001	10.476 (2.356-46.578)	0.002
Mortality				
No	1		1	
Yes	4.889 (1.150-20.790)	0.032	2.557 (0.302-21.643)	0.389

In summary, this study suggests that Bishop Koop ileostomy (Group A) provides better outcomes than Primary Anastomosis (Group B) in terms of shorter recovery times, fewer complications, and reduced mortality, making it a potentially preferable approach for treating Jejunoileal Atresia in pediatric patients.

Discussion:

The outcomes of the current study were operative time, bowel movement, establishment of oral feeding and complications in prospective measures. Type II and type IIIajejunoileal atresia were included because only excision of web followed by repair can be done in type I.[11] and multiple anastomosis might be required in type IV. Also, there is significant loss of length of intestine in type IIIb and type IV.[12]

In this study, ileal atresia (56.0%vs 52%) is more than jejunal atresia (44.0% vs 48%) in Group A and B respectively which differed from the result of a study conducted in Egypt in 2009.[13] This study found that the operative time was significantly longer for Bishop Koop ileostomy (Group A) than for Primary Anastomosis (Group B). The mean operation time of group A and group B was 38.88 ± 6.412 minutes and 30.68±7.793 minutes respectively. A study conducted by Zhang et al. 2016 showed 3 (1.2-4.5) hours as median operative time for this type of operation.[14] In the current study, only the time for completion of the mentioned procedures was considered, not the whole operative procedure. Most importantly the process was measured by stopwatch. This type of time frame was not mentioned in any other studies. The result showed significant statistical difference in operation time between two groups as the p=0.001. As the Bishop Koop procedure required a stoma in addition to anastomosis, about 5-10 minutes more was required compared to primary anastomosis.

In the present study, it was found that the mean time of bowel movement of group A and group B was 4.52±1.531 days and 3.92±3.463 days after surgery respectively. For BK procedure, functioning of stoma was considered as bowel movement and on the basis of that (along with other clinical parameters) trial feeding was introduced. Comparison between passage of bowel content though stoma and anus might be questionable. But BK procedure was given benefit of doubt for two reasons: a) funneling of anastomotic line can be avoided by wide end to side anastomosis, b) distal exteriorized stoma effectively decompress the raised intraluminal pressure.[15] There was no significant statistical difference in time of bowel movement between two groups (p=0.432).

In this study, Bishop Koop procedure gave the benefit of starting of test feeding early, earliest on 4th POD. On the other hand, test feeding started from 6th Pod onwards in case of Primary anastomosis in contrast to other study result of group A and group B (6.84±2.173 vs 5.60±4.95) didn't match with the result (4±0.67 vs 9.33 ± 2.16) of a study by Eltayeb (2009).[13]

In the current study, postoperative complications which included anastomotic leakage and intestinal obstruction were compared. In group A, In group A, only 2 (8.0%) respondent had anastomotic leakage. On the other hand, in group B, 10 respondents (40.0%) had anastomotic leakage. Findings of other studies showed 16.6% leakage in primary anastomosis was 22.22% and leakage in Bishop Koop procedure in Rahman et al (2012).[13,15] The result of current study demonstrates significant statistical difference in developing anastomotic leakage but not in developing obstruction between two groups. Moreover, there was significant difference is seen in relation to complications in two groups. Re-Laparotomy followed by enterostomy was done in eight patients of Group A and two patients in Group B among those who developed leakage or obstruction.

Reducing duration of postoperative hospital stay was another target. There was significant difference in length of hospital stays among Group A (mean, 8.40±1.871 days) which was shorter than Group B (mean, 11.00 ± 3.88 days). Imran et al (5.78 days) showed much lower duration of hospital stay in Bishop koop group in comparison to present study.[16] This difference was probably due to hospital discharge policy, strict practice of enhanced recovery protocol and the easy access to hospital for further follow-up visits if necessary.

In this study, survival rate was 88.0% in group A after the operative procedure which is close to the result in a study by Imran et al.(89.7%) but superior than Eltayeb (80%) and Rahman et al(77%).[13,16,15] On the other hand 60% survived in Group B which is much higher than the result Eltayebet al (50%) and Rahman et al(0%).[13,15]

Within one week, stool passed through anus and passage of intestinal content through stoma reduced and eventually stopped. So far, distal loop stoma was closed in four patients.

Finally, in the unadjusted model, group B exhibited 7.667 (95% CI 1.470-39.987), 8.500 (95% CI 2.338-30.908), and 4.889 (95% CI 1.150-20.790) times greater likelihoods of experiencing postoperative complications such as anastomotic leakage, prolonged hospital stay, and mortality; respectively. In the adjusted bivariate regression analysis model, the likelihood of hospitalization was determined to be 10 times (95% CI 2.356-46.578) greater in group B than in group A.

From above findings, it can be deducted that Bishop Koop procedure is a safe and effective technique for Jejunoileal atresia, especially in case of marked discrepancy between proximal and distal gut.

Limitations

The study has some limitations. Operations were not performed by single surgeon, which might have an influence on the result. Due to short study period, small sample size was taken and long-time observation could not be performed which may influence the validity of the study.

Conclusion

In summary, this study reinforces the findings from earlier literature that Bishop Koop ileostomy offers advantages in shorter recovery time, reduced postoperative complications, and lower mortality rates compared to Primary Anastomosis in cases of Jejunoileal Atresia. The findings advocate for a careful consideration of Bishop Koop ileostomy, particularly in resourced-limited settings where minimizing postoperative complications and hospital stay is a priority.

Declarations

Ethics approval and consent to participate

Before data collection, all ethical issues were maintained.

Consent for publication

All authors have approved this manuscript for publication.

Availability of data and materials

The datasets supporting the conclusions of this article are included within the article generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author contributions

Conception and design: Fatema Sayeed, Md Ashraf Ul Huq Acquisition, analysis, and interpretation of data: Fatema Sayeed, Md Ashraf Ul Huq

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All authors read and approved the final manuscript.

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