MECONIUM ILEUS; A STUDY AND COMPARISON BETWEEN COMMON OPERATIVE PROCEDURES PERFORMED IN BASRAH

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Abstract

Meconium ileus accounts for 9–33% of all neonatal intestinal obstructions, with an incidence of 1:2500 newborns, representing the third most common cause of neonatal small bowel obstruction after atresia and malrotation. This study aimed to compare various surgical procedures used in the treatment of meconium ileus and to assess their efficacy regarding survival and complications.

A retrospective study was done to all cases of meconium ileus admitted to the neonatal intensive care unit of Basrah hospital of maternity and children and Basrah children specialty hospital during the period of 10 years (2005 to 2015). The medical records of 57 cases of meconium ileus were studied. The comparison included: Mikulicz procedure, Bishop-Koop procedure and resection with primary anastomosis in both simple and complex meconium ileus. The parameters used for comparison were anastomotic leaks, high output diarrhea with dehydration and failure to thrive, sepsis, need for reoperation, wound complications, early adhesions, hospital stay and mortality.

The mean age of presentation of neonates with meconium ileus was 3.9 days. Male to female ratio was 0.9: 1. About 10.5% were preterm. About 33.3% of cases were diagnosed as simple meconium ileus. Intestinal Volvulus is the predominant complications encountered (47.4%). Non-operative treatment was effective in 45.5%. The most common procedures done in our center were Mikulicz procedure (61.5%), followed by Bishop-Koop procedure (30.8%), and resection with primary anastomosis (7.7%). There was a significant association between mortality and high output fistula, anastomotic leaks, sepsis, and reoperation. Predominant complications in Mikulicz procedures were high output fistula (50%) and skin excoriation (53.1%), while in Bishop-Koop procedure were sepsis (75%), reoperation (50%), and adhesions (25%). In primary anastomosis, significant complications were anastomotic leak (75%), sepsis (50%), and reoperation (50%). Mortality was highest in primary anastomosis (75%), followed by Bishop-Koop procedure (62.5%), and lowest with Mikulicz procedure (40.6%). The overall mortality of meconium ileus was high 45.6% (42.9% for simple meconium ileus and 52.6% for complex meconium ileus). All neonates treated non-operatively survived, while the survival rate for those treated surgically was 50%.

In conclusion, resection with stoma creation is superior to primary anastomosis. Mikulicz procedure is the safest procedure to be done with best survival and less complications. Bishop-Koop procedure is of value in a situation where the surgeon is afraid from high output diarrhea so proximal stoma is mandatory.

Introduction

Meconium ileus is one of the most common causes of intestinal obstruction in the newborn, accounting for 9–33% of neonatal intestinal obstructions[1]. It is characterized by the lack of excretion of meconium during the first 48 hours of life, associated with clinical and specific radiological findings of intestinal obstruction[2]. It is the intestinal obstructive variant of cystic fibrosis[3], and it is considered as the earliest clinical manifestation of this genetically recessive lethal disorder[4]. Meconium ileus seems to be more the

result of the presence of viscous mucus in the bowel than of pancreatic insufficiency itself[5], in which, the meconium contains a high amount of protein and becomes extremely thick, causing obstruction of the terminal ileum[6].Two form of meconium ileus can be described, simple and complex meconium ileus[7,8]. Most of cases are simple meconium ileus but complicated meconium ileus is found in about 40% of patients e.g. volvulus, atresia, perforation, or meconial pseudocyst[9]. A contrast enema with water-soluble and hyper or iso-osmolar contrast is the medical treatment of choice for uncomplicated cases[9]. Non-operative management of simple meconium ileus is achieved in about 60% to 70% of newborns[10]. Current short-term operative survival rates of 70% to 100% are reported[10]. Many surgical options have been used in the surgical treatment of meconium ileus including resection with primary anastomosis, Mikulicz ileostomy, Bishop–Koop operation, and Santulli stoma[11].

Aims:

To compare various surgical procedures used in the treatment of meconium ileus and to assess their efficacy regarding survival and complications.

Patients and methods

A retrospective study was done to all cases of meconium ileus admitted to the neonatal intensive care unit of Basrah hospital of maternity and children and Basrah children speciality hospital during the past 10 years (2005 to 2015). The medical records of 57 cases of meconium ileus were studied. Information regarding age, gender, gestational age, birth weight, clinical presentation, diagnosis, and types of operative procedures were reviewed. We compared Mikulicz stoma, Bishop-Koop stoma and resection with primary anastomosis in both simple and complicated cases of meconium ileus. The parameters used for comparison were

anastomotic leaks, high output diarrhea with dehydration and failure to thrive, sepsis (confirmed by blood culture and sensitivity or sound clinical features), need for reoperation, wound complications, early adhesions, hospital stay and mortality.

Statistical significance is determined by using the Statistical Package for Social Sciences (SPSS) version 20. $\chi 2$ tests. A P-value of <0.05 was assumed to be significant.

Results

The mean age of presentation of neonates with meconium ileus was 3.9 days (range from 16 hours to 9 days). Male to female ratio was 0.9:1. Six neonates presented with meconium ileus were preterm, representing 10.5% of all cases. The total cases of meconium ileus studied were 57 patients. Of them, 19 cases (33.3%) were diagnosed as simple meconium ileus, while 38 cases (66.7%) were diagnosed as complex meconium ileus. Complications encountered including intestinal volvulus in 18 (47.4%), perforation/peritonitis in 15 patients (39.5%), intestinal atresia in 6 cases (15.8%), and meconium pseudocysts in 3 cases (7.9%). Some patients had more than one complication. Of the simple meconium ileus, only 11 cases treated with gastrographin enema. Five patients only responded to non-operative treatment (45.5%), while 6 patients did not respond to gastrographin enema and demanded operative treatment (54.5%). So that 14 cases (8 cases did not undergo conservative attempts plus 6 cases with failed conservative measures) of simple meconium ileus were treated by surgery. Those were treated by Mikulicz procedure (7 cases), Bishop-Koop procedure (4 cases), or resection with primary anastomosis (3 cases). Of the complicated meconium ileus, 25 cases treated by Mikulicz procedure, 12 cases treated by Bishop-Koop stoma, and 1 case treated by resection with primary anastomosis.
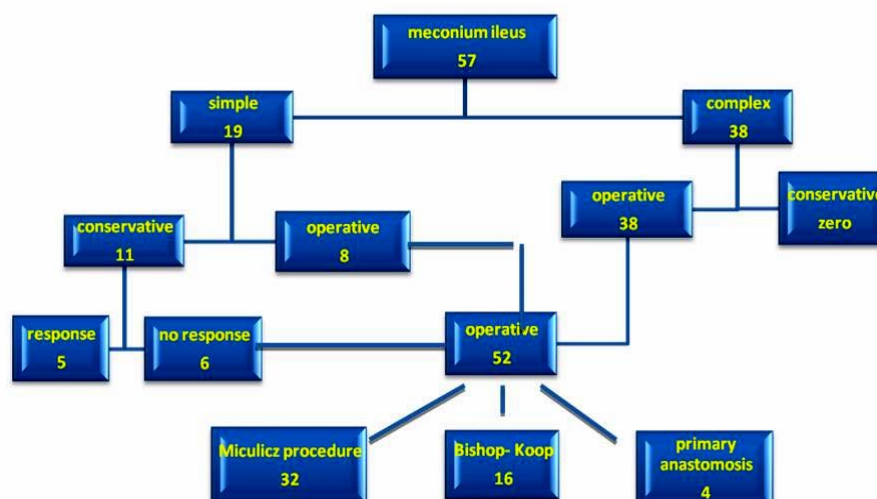
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Diagram 1: Types of Meconium Ileus and Methods of Treatment

Tables I&II show the mortality and complications of surgical procedures performed in simple and complex meconium ileus respectively. The best survival was encountered in patients treated with Mikulicz procedures in both simple and complex meconium ileus (71.4%, 56%), followed by Bishop-Koop procedure (50%, 33.3%), and the worst result was with primary anastomosis (66.7%, 100%). High output fistula occurred more frequently in patients treated by Mikulicz stoma in both groups (42.9%, 25%), followed by Bishop-Koop procedure (52%, 16.7%). Anastomotic leaks occurred more frequently in patients treated by primary anastomosis in both groups (66.7%, 100%), followed by Bishop-Koop procedure (25%, 41.7%). Of course, no leak was found in Mikulicz stoma. Sepsis occurred frequently in patients treated with Bishop-Koop procedure, in both groups (75%, 25%) than those treated with Mikulicz stoma (28.6%, 16%), while sepsis affecting (66.7%, 100%) of patients treated with primary anastomosis. Reoperation required in patients treated with primary

anastomosis (66.7%), Bishop-Koop procedure (50%) in simple cases, but in complex cases Bishop-Koop (58.3%), Mikulicz (8%). In simple cases, Adhesive intestinal obstruction was found in one patient treated by Bishop-Koop ileostomy (25%), but in complex case, it is found in one Mikulicz patient (4%) and 3 cases of Bishop-Koop (25%). Wound infection occurred in one case treated by primary anastomosis of simple meconium (33.4%). In complex meconium ileus, it presented in 2 Mikulicz (8%), 4 Bishop (33.3%), and 1 primary anastomosis (100%). Skin excoriation occurred frequently in neonates treated with Mikulicz procedure (57.1%, 52%), followed by Bishop-Koop procedure (50%, 41.7%). No stoma prolapse was faced in this review. Hospital stay for neonates with simple meconium ileus was about 5.2 days in Mikulicz procedure, 7.2 days in primary anastomosis, and 8.3 days in Bishop-Koop procedure. In complex meconium ileus, hospital stay was 10.1 days in Bishop-Koop procedure, 6.8 days in Mikulicz, and 5 days in primary anastomosis (patient died after 5 days).

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Table I: Analysis of simple meconium ileus

	simple meconium ileus (14 cases)			
	Mikulicz (7)	Bishop (4)	Primary anastomosis (3)	Total (14)
High Output Fistula	3(42.9%)	1(25%)	0(0%)	4(28.6%)
Anastomotic Leak	0(0%)	1(25%)	2(66.7%)	3(21.4%)
Sepsis	2(28.6%)	3(75%)	2(66.7%)	7(50%)
Reoperation	0(0%)	2(50%)	2(66.7%)	4(28.6%)
Early adhesion	0(0%)	1(25%)	0(0%)	1(7.1%)
Wound infection	0(0%)	0(0%)	1(33.3%)	1(7.1%)
Skin excoriation	4(57.1%)	2(50%)	0(0%)	6(42.9%)
Mortality	2(28.6%)	2(50%)	2(66.7%)	6(42.9%)
Hospital stay	5.2 days	8.3 days	7.2 days	

Table II: Analysis of complex meconium ileus

	complex meconium ileus (38 cases)			
	Mikulicz (25)	Bishop (12)	Primary anastomosis (1)	Total (38)
High Output Fistula	13(52%)	2(16.7%)	0(0%)	15(39.5%)
Anastomotic Leak	0(0%)	5(41.7%))	1(100%)	6(15.8%)
Sepsis	4(16%)	6(25%)	1(100%)	11(29%)
Reoperation	2(8%)	7(58.3%)	0(0%)	9(23.7%)
Early adhesion	1(4%)	3(25%)	0(0%)	1(2.6%)
Wound infection	2(8%)	4(33.3%)	1(100%)	7(18.4%)
Skin excoriation	13(52%)	5(41.7%)	0(0%)	18(47.4%)
Mortality	11(44%)	8(66.7%)	1(100%)	20(52.6%)
Hospital stay	6.8 days	10.1 days	5 days	

Table III shows the overall mortality and complications of meconium ileus procedures. High output diarrhea occur in 36.5% of cases, mostly in neonates treated with Mikulicz procedures. Anastomotic leaks with peritonitis occurred in 17.3%, mostly in patients treated with resection and primary anastomosis. Reoperation was required in 25% of cases especially in patients treated with Bishop-Koop procedure or primary anastomosis. Skin excoriation occurred in 46.2%, especially with Mikulicz procedure. Wound infection and early adhesions occurred in 15.4% and 9.65 respectively. Mortality was highest in primary anastomosis (75%), followed by Bishop-Koop procedure (62.5%), and lowest with Mikulicz procedure (40.6%). The overall mortality of meconium ileus (including those patients treated conservatively) was high (45.6%). All neonates treated non-operatively survived, while the survival rate for those treated surgically was 50%. The mortality rate for simple meconium ileus was 42.9%, and for complex meconium ileus was 52.6%.

Table III: Overall Complications/Operative Procedures Analysis

	Meconium ileus (52 cases)			
	Mikulicz (32)	**Bishop (16)**	**Primary (4)**	**Total (52)**
High Output Fistula	16(50%)	3(18.75%)	0(0%)	19(36.5%)
Anastomotic Leak	0(0%)	6(37.5%)	3(75%)	9(17.3%)
Sepsis	6(18.75%)	9(56.25%)	3(50%)	18(34.6%)
Reoperation	2(6.25%)	9(56.25%)	2(50%)	13(25%)
Early adhesion	1(3.1%)	4(25%)	0(0%)	5(9.6%)
Wound infection	2(6.25%)	4(25%)	2(50%)	8(15.4%)
Skin excoriation	17(53.1%)	7(43.75%)	0(0%)	24(46.2%)
Mortality	13(40.6%)	10(62.5%)	3(75%)	26(50%)

Table IV: Complications/mortality analysis

Criteria	Alive	Died	total	x value	p-value
High output fistula				14.106	0.000
Present	3	16	19		
Absent	23	10	33		
Anastomotic leak				10.884	0.001
Present	0	9	9		
Absent	26	17	43		
Sepsis				12.235	0.000
Present	3	15	18		
Absent	23	11	34		
Reoperation				17.333	0.000
Present	0	13	13		
Not present	26	13	39		
Adhesions				0.221	0.638
Present	2	3	5		
Absent	24	23	47		
Wound infections				5.318	0.21
Present	1	7	8		
Absent	22	22	44		

There was a significant association between mortality and high output fistula (P value=0.000), anastomotic leak (P value=0.001), sepsis (P value= 0.000), and reoperation (P value=0.000). The association was not significant with adhesive intestinal obstruction (P value= 0.638) and with wound infections (P value= 0.21), as shown in Table IV.

Discussion

The mean age of presentation of neonates with meconium ileus was 3.9 days (min= 16 hours, max=9 days). Male to female ratio was 0.9:1 which is similar to other study[12]. Six neonates presented with meconium ileus were preterm representing 10.5% of all cases, similar to other study[9]. Simple meconium ileus accounts for 33.3% of cases which is less than that seen in other studies, 47.1%[13] (58%)[14]. This high percentage of complex cases may be due to ineffective prenatal diagnosis of meconium ileus and the consequent delayed diagnosis and referral. In order of frequency, complications associated with meconium ileus were as follows: intestinal volvulus, perforation/

peritonitis, intestinal atresia, and meconium pseudocysts. Intestinal Volvulus is the predominant complications encountered (47.4%) that is similar to other studies[13-15].

Most authors consider enema reductions as the initial treatment of choice for simple meconium ileus[16,17]. Regarding simple meconium ileus, in this review, only 11 cases were treated with gastrographin enema (1:3 or 4 sodium chloride dilutions). About 45.5% of cases showed satisfactory response to non-operative treatment with complete recovery, relatively similar to other study (40%)[14], 39%[18]. When treated non-operatively, all neonates survived with no complications encountered.

In cases of complex meconium ileus or failed non-operative treatment, surgical intervention is mandatory. The most common procedures done in our center were Mikulicz procedure (61.5%), Bishop-Koop procedure (30.8%), and resection with primary anastomosis (7.7%). The small number of cases treated by primary anastomosis must be interpreted with cautions.

In this review, we tied to study the association between mortality and complications of various surgical procedures to assess their efficacy. There was a significant association for certain parameters including high output diarrhea, anastomotic leaks, sepsis, and reoperation. On the opposite side, the association between mortality and the presence of early adhesion or wound infections was not significant. In our study, we found that complications including anastomotic leak, sepsis, adhesive intestinal obstruction, wound infections and even the need for reoperations (required in cases of anastomotic leaks or in cases of adhesive intestinal obstruction) occur in higher frequency, in both simple and complex meconium ileus, than what are seen in other study[18,19]. Regarding high output diarrhea, it occurred in 21.4% of Mikulicz patients in a study done by A. Karimi and

in 50% of our patients[18]. Similarly, sepsis was seen in 26.7% of A. Karimi study and 34.6% of our patients[18]. In addition, certain surgical procedures have higher complication rate than others. High output diarrhea and skin excoriation occur mostly in neonates treated with Mikulicz procedures. Anastomotic leaks with peritonitis occur mostly in patients treated with resection and primary anastomosis. Reoperation was required especially in patients treated with Bishop-Koop procedure or primary anastomosis. Predominant complications in Mikulicz procedures were high output fistula (50%) and skin excoriation (53.1%), while in Bishop-Koop procedure were sepsis (75%), reoperation (50%), and adhesions (25%). In primary anastomosis, significant complications were anastomotic leak (75%), sepsis (50%), and reoperation (50%).

The overall mortality was very high (45.6%) in comparison with other studies where the survival was between 85-100%[13-15]. The best survival was encountered in patients treated with Mikulicz procedures in both simple and complex meconium ileus, followed by Bishop-Koop procedure, and the worst result was with primary anastomosis. Since primary anastomosis cases have higher rate of complications and deaths than resection with stoma creation, we prefer stoma creation rather than primary anastomosis in both simple and complex meconium ileus. Resection with stoma creation is the safer procedure, preventing peritonitis due to anastomotic leakage but the need later on for closure of stoma being a relative disadvantage[18,20], although closure of stoma can be done later on as an elective safe procedure. Since high output diarrhea with failure to thrive occurred more frequently in patient treated with Mikulicz stoma (50%); furthermore, it is significantly associated with mortality (P value=0.000), Bishop-Koop procedure can be used in a situation where enterostomy is not desirable due to

very proximal stoma but anastomotic leak is still an important complication[20]. Bishop-Koop procedure has been widely used[17,21,22]. Escobar et al. suggests that resection with primary anastomosis should only be used in case of atresia, resection with enterostomy being preferable in complex meconium ileus patients[23]. In this review, resection with stoma creation has lower mortality and complication rate than primary anastomosis; furthermore, Mikulicz stoma seems to be better than Bishop-Koop stoma in the term of survival and complications (apart from high output diarrhea and skin excoriation), which is similar to other study[18], so that Mikulicz procedure is the best procedure to be done in our center.

In conclusion, resection with stoma creation is superior to primary anastomosis. Furthermore, Mikulicz procedure is the safest procedure to be done with best survival and less complications. It is obvious that, high output fistula is significantly associated with mortality and it is the commonly occurred with Mikulicz procedure so that in a situation, where the surgeon afraid from this complications (i.e. proximal stoma is mandatory), it is preferable to use another procedures. Alternatively, we have to close the stoma as soon as possible if Mikulicz procedure has been done. Total parenteral nutrition is, of course, of value in those patients.

Resection with primary anastomosis should be used with caution, both in patients with simple and with complex meconium ileus, although, a large prospective multicenter studies seem to be warranted to better identify its results.

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