

# Neonatal Intestinal obstruction In Jordan: A Single Center 6 Year Experience

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## Abstract

The purpose of this analysis was to determine the etiology and outcome of patients with neonatal intestinal obstruction treated at Jordan University Hospital (JUH) between the years 2012 and 2018. A similar study was published in regards to the time period between 1973 and 2003. In this paper we will demonstrate how our findings compare to those previously published, as well as those in other developing countries, namely Nigeria, India and Ethiopia. The leading cause was found to be Anorectal malformation followed by Hirschsprung's disease. The mortality was 5%. Moreover, 5% were reported to be still suffering from chronic constipation.

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## Introduction

Neonatal intestinal obstruction is a major cause of surgical admissions in all pediatric hospitals. It is particularly important due to the compromised clinical status that is usually encountered at presentation, the frequent association with congenital anomalies and the propensity for rapid deterioration in that age group.

These patients must be managed at a tertiary center under the combined care of a neonatologist and a pediatric surgeon. Jordan University Hospital (JUH) is a tertiary center with a capacity of 544 beds of which; 32 are

NICU beds and 68 are Obstetric beds. The annual birth rate is 4500-4700 a year, the annual NICU admission rate 1400 a year.

## Methods:

The medical records of neonates admitted between the years 2012 and 2018 were reviewed. Patients with intestinal obstruction were identified. Patients presenting with a picture of intestinal obstruction (bilious vomiting, abdominal distension, and delayed passage of meconium) within the first 60 days of life were included. Patients who were treated initially at another facility prior to referral to JUH were also included, provided that the

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diagnosis was first made during the neonatal period. A total of 59 neonates and infants were identified from which 31 were females, and 28 were males, giving a male to female ratio of 1:1.07.

#### Results:

Anorectal malformations were found to be the leading cause of intestinal obstruction with 17 cases accounting for 28.4% of the total cases. Lagging not so far behind, was Hirschsprung's disease, with 16 cases accounting for 27% of the total cases. Fifteen

per cent of the cases were caused by intestinal atresia with nine cases identified. Incarcerated inguinal hernia and necrotizing enterocolitis, came in next with 2 cases each. Furthermore, single cases of other less common causes were also recorded, of which was a patient who was found to have both Hirschsprung's disease and an imperforate anus, the other cases included; a duodenal diaphragm, an annular pancreas and a case of colonic inertia (Table 1).

**Table 1: The Final diagnosis in neonates with intestinal obstruction between the years 2012 and 2018**

	Number	Percentage	Average Age at diagnosis (days)
Anorectal malformations	17	28.4%	6.17
HD*	16	27%	9.9
Intestinal Atresia	9	15.1%	0.023
Volvulus	4	6.8%	0
Pyloric stenosis	4	6.8%	37
NEC $\infty$	2	3.3	32
Inguinal hernia	2	3.3%	55
HD and imperforate anus	1	1.6%	0
Colonic inertia with mesenteric ischemia	1	1.6%	30
Meconium ileus	1	1.6%	3
Duodenal diaphragm	1	1.6%	16
Annular pancreas	1	1.6%	15

\*Hirschsprung's disease,  $\infty$ Necrotizing Enterocolitis

In regard to the presentation, the average age of symptoms emergence was 11.1 days with 35 patients (59.3%) diagnosed before 1 week of age and 3 patients (4.8%) diagnosed antenatally.

In respect to the main feature of the presentation, a single most prominent symptom was observed in some patients, while in others, a variety of symptoms were detected initially. Abdominal distension was the most observed feature, as it was reported in 14 (23.7%) patients. Another symptom that was frequently reported

was delayed passage or scanty passage of meconium, it was reported in 11 (18.6%) patients. Vomiting was observed in 6 (10.7%) patients. Moreover, vaginal passage of meconium was witnessed in 4 (6.7%) patients.

Some patients presented with more specific findings; two patients were found to have peritonitis, another two presented with an inguinal lump, while one patient was found to have ambiguous genitalia. It is noteworthy to state that in a significant number of patients, it was not possible to identify the specific

presenting symptoms; three patients were diagnosed and treated initially outside JUH, in addition, upon reviewing the records of 14 patients, the initial presentation was reported as "Intestinal Obstruction" without specification of the pertinent symptoms.

The survival rate was 95% with only 3 patients dying. Thirty patients (50.8%) underwent colostomy reversal and doing well till the time of the study. Nineteen (32%) patients were lost to follow up. Three patients (5%) still suffer from chronic constipation. Two patients (3.3%) still have colostomies. In addition, one patient suffered from rectal prolapse.

### **Discussion:**

Intestinal obstruction of the newborn is a common cause for admission to neonatal intensive care units. The incidence is not precisely known but is estimated to be 1 in 2000 live births <sup>(1)</sup>.

The presentation may vary according to the level of the obstruction with vomiting and polyhydramnios being more pronounced in proximal obstructions, which may allow for antenatal diagnosis. In contrast, patients with distal obstructions are more likely to present with abdominal distention and delayed passage of meconium <sup>(2)</sup>. This may explain why most of the patients presented with one main symptom rather than the four cardinal features of intestinal obstruction.

In most reports' anorectal malformations, Hirschsprung's disease and intestinal atresia were the most common causes of intestinal obstruction <sup>(3,4)</sup>, with the leading cause varying in different studies.

### ***Hirschsprung's disease***

Hirschsprung's disease is estimated to have

an incidence of approximately 1 in 5000 live births. It usually exhibits male predominance with the male-to-female ratio generally being 4 to 1. However, in long-segment disease, the ratio is thought to be equal <sup>(5)</sup>.

The underlying pathology of the disease includes incomplete cephalocaudal migration of the intestinal neuroblasts. Traditional reports claimed that more than 90% of patients with Hirschsprung's disease had failed to pass meconium. However, more recent evidence suggests that meconium passage is reported in up to 40% of newborns with Hirschsprung's disease <sup>(6)</sup>.

There are still many limitations in the extent of knowledge of the disease. For instance, the ganglionated normal bowel may eventually be found to harbor as-yet unrecognized abnormalities <sup>(2)</sup>.

### ***Intestinal Atresia***

The incidence of jejunoileal atresia is estimated around 1 in 5000 live births with an equal gender distribution. Approximately one third of the infants affected by the condition are immature <sup>(7)</sup>.

Jejunoileal atresia is rarely associated with extraintestinal abnormalities (<10%). This may be attributed to its late occurrence in the fetal development <sup>(8)</sup>.

In respect to the location of intestinal atresia, in general, the ileum is the most common site, with a percentage of 43.2%, followed by the jejunum with a percentage of (31%). Duodenal atresia account for 20.9% of cases, while colon atresia account for a mere 4.72%. <sup>(9)</sup>

In a 25-year retrospective review, 277 neonates were found to have intestinal atresia. Moreover, Jejunoileal atresia was associated with intrauterine volvulus in 27% of cases and with gastroschisis in 16%, while 11.7% of

patients suffered from meconium ileus <sup>(7)</sup>.

#### **Anorectal Abnormalities**

The incidence of associated anomalies is approximately 50% to 60%, with proximal anorectal malformations being more likely to be associated with other congenital anomalies <sup>(10)</sup>. The most well-known association is VACTERL (vertebral, anal, cardiac, tracheal, esophageal, renal, and limb).

In regard to the management, the primary decision is to determine the necessity of a diverting colostomy. Postoperative follow-up is paramount for these patients, early graded dilation for prevention of stricture formation should continue for a minimum of 4 months after the definitive repair. Constipation is common, and the incidence is more likely to be observed in more distal malformations. Continence is another major concern; this is dependent on the underlying anatomy of the defect. Proximal defects with rectovesical fistulae, bony sacral ratios less than 0.3, and more severe anorectal malformations have a less favorable outcome. Long-term urologic and sexual dysfunction is infrequent but is more likely to be observed with severe defects <sup>(2)</sup>.

#### **Management:**

##### **General measures**

Once the diagnosis of intestinal obstruction is made, treatment must be carried out without delay to avoid the complications which may arise due to the limited physiological reserve in that age group. Oral feedings are held, and gastric decompression is established by inserting a nasogastric tube. Intravenous fluid resuscitation is undertaken, bearing in mind the required fluid deficit brought about by the third space losses in patients with intestinal obstruction.

The required calorie intake is 100 kcal/ kg

for infants weighing 3 to 10 kg, under normal conditions, 1 ml of water is required to metabolize 1 kcal. This value is inclusive of the insensible water losses from the skin and respiratory tract, in addition to the urinary water loss. Hence, in an awake neonate, calorie and water consumption are considered equal. Therefore, the estimated fluid maintenance for neonates is 100 ml/Kg/day or 4ml/kg/hr. <sup>(11)</sup>

The daily sodium needs are 3 mmol /kg/day, while potassium needs are 1-2 mmol /kg/day. These electrolyte requirements are higher for premature infants, with the sodium requirements being 3-5 mmol /kg/day. The potassium requirements being 2-4 mmol/kg/day this is due to the immaturity of the renal tubular function. Calcium requirements range between 0.8 and 1 mmol/kg/day <sup>(12)</sup>.

While fluid resuscitation and surgical intervention must be carried out promptly, one condition is considered an exception; patients with pyloric stenosis must have their electrolyte deficit corrected prior to surgery.

The targets of preoperative fluid management include dehydration correction, a serum chloride level of 106 mmol/L, a serum sodium level of 135 mmol/L a serum bicarbonate level of 26 mmol/L, a urine chloride level more than 20 mmol/L and urine output > 1ml per kg per hour <sup>(11)</sup>.

In neonates, hypoglycemia during fasting or illness is well recognized, it may be precipitated by several factors <sup>(13)</sup>; neonatal body glucose metabolism relative to the body mass is up to twice as high in comparison to its adult counterpart. Hepatic glycogen stores relative to the body mass are less in neonates than in adults. A glucose-infusion rate between 120 and 250 mg kg per hour is sufficient to prevent hypoglycemia and to avoid lipid mobilization in neonates and infants. <sup>(14)</sup>

The administration of intravenous antibiotics covering aerobic and anaerobic organisms is warranted even with the lack of clinical evidence of infection. This practice stems down from two theories; the first is the risk of mucosal ischemia, as the pressure in the obstructed bowel exceeds the venous pressure, venous obstruction and capillary rupture ensues which ultimately results in hemorrhagic infarction of the mucosa and eventually all the layers of the intestinal wall <sup>(15)</sup>. The second is the possibility of bacterial translocation; cultures of serosal scrapings and mesenteric lymph nodes were intraoperatively obtained from patients with intestinal obstruction without signs of abdominal sepsis, both aerobic and anaerobic bacteria were detected in the cultured specimens <sup>(16, 17)</sup>.

#### ***Surgical considerations***

Surgical management of jejunoileal atresia is governed by several factors, which include the number and location of the lesions, anatomic findings such as volvulus and malrotation and the length of the remaining viable intestine.

After obtaining access to the abdominal cavity, careful inspection of the whole length of the bowel must be carried out. Resection of the dilated and hypertrophied proximal bowel with primary end-to-end anastomosis is the most common surgical approach <sup>(18, 19, 20)</sup>. Multiple atretic segments would require several anastomoses. The extent of the resection depends on the length of the remaining bowel, if the length is adequate, the bulbous hypertrophied proximal bowel should be resected. In cases of meconium peritonitis with significant contamination a temporary stoma may be formed. Enteral feedings can be initiated when the gastric aspirate is clear with

a minimal output and the patient is passing bowel motion. Moreover, all neonates with intestinal atresia must have a Chloride sweat test and a genetic screen for cystic fibrosis <sup>(2)</sup>.

The Ladd procedure has typically been performed for patients with malrotation, the procedure can be performed via the open or the laparoscopic methods. After the peritoneal cavity has been accessed counter clock wise rotation of the bowel is carried out. Ischemic bowel should be warmed for up to 30 minutes and re-assessed for viability. The mesentery is then broadened by excision of cecal peritoneal bands crossing the duodenum (Ladd bands) and by mobilizing the duodenum. The dissection is then carried out to the base of the superior mesenteric artery and vein by incising the anterior mesenteric leaflet. Intrinsic duodenal obstruction should always be ruled out by passing a catheter. An appendectomy is then performed. Finally, the small intestine is placed to the right abdomen and colon is placed to the left abdomen. In cases where ischemia is found to involve an extensive segment of the bowel, closure of the abdomen with plans for a second look procedure to be performed after 24-48 hours is advised <sup>(2)</sup>.

Patients with Hirschsprung's disease can be managed by a single or a staged surgical approach with a leveling colostomy. The presence of ganglion cells must be confirmed by frozen section at the level of resection. In some cases a single-stage procedure should be avoided, namely patients in whom enterocolitis is suspected, in the presence of a significant concomitant disease, long-segment disease, Down syndrome, and cases where expert pathology interpretation is not available <sup>(20)</sup>

#### **Management at our institution**

All the patients were admitted to the NICU

at JUH and were under the joint care of pediatricians and pediatric surgeons.

Initial assessment with history and physical examination was carried out, a detailed family and antenatal history along with thorough examination would suggest the diagnosis of intestinal obstruction and on some occasions would identify the underlying cause such as in cases with incarcerated hernia or anorectal malformations.

Diagnostic imaging was limited to plain abdomen X-rays; which would suggest the diagnosis of intestinal obstruction and gastrographic contrast studies to assess for the level of obstruction. Where appropriate, ultrasound scan was obtained to identify any associated congenital anomalies.

Blood investigations including full blood count, coagulation studies, kidney function and electrolytes were routinely performed to assess for the presence of complications and further guide the resuscitation process.

Initial management included nasogastric decompression, Intravenous fluid resuscitation, antibiotics, and correction of coagulopathy if present.

The aim is to provide surgical relief of the obstruction. Depending on the provisional diagnosis, and the presence of complications, definitive treatment with restoration of the continuity of the gastrointestinal tract or primary relief with the aim for a staged approach was done.

As for the surgical intervention offered, it varied according to the preoperative and intraoperative findings, In patients with uncomplicated intestinal atresia a simple resection and anastomoses procedure was sufficient, however, in cases where perforation existed, a stoma was often found to be necessary .

For Hirschsprung's disease the initial treatment was stoma creation, specimens from the distal end at the site of bowel resection or diverting stoma and full thickness rectum biopsies were sent for histopathology analysis to confirm the absence of ganglionic cells. Subsequently, pull through procedures were done, the procedure most performed at our institution was a Duhamel pull through. The age at which the procedure was done ranged from 7 months to 18 months with most procedures being done by 1 year. For anorectal malformations, the treatment varied according to the level of the malformation and the presence or absence of a fistula, generally speaking, our patients initially underwent diverting stoma followed by definitive repair; which usually included PSARP (Posterior Sagittal Anorectoplasty) the procedure was performed between 9 months and 1 year with most procedures being done by 6 months of age.

For other less commonly encountered causes of intestinal obstruction the appropriate procedure was done according to the underlying cause, for instance, hernia repair for incarcerated hernia or pyloromyotomy for pyloric stenosis.

#### **Long Term Complications:**

Chronic constipation and anal stenosis are among the long-term complications that may pose a challenge in the long term management and follow up of such patients.

In our review only three patients required regular long-term use of laxatives, however, the true incident of constipation and the frequency of the occasional use of laxatives on non-regular basis was not analyzed in this review.

Anal stenosis is another long term complication, it's more commonly observed following anorectal malformations repair and

pull through procedures. In our practice, these patients routinely undergo daily anal dilatations following the corrective procedure, the parents are counseled regarding the use of the dilators and close follow up at the clinic is undertaken.

In regard to return to theatre, one patient required surgical correction of a rectal prolapse.

### Worldwide experiences

Over the past 20 years similar studies were conducted in some developing nations. In Benin Nigeria, a prospective single center analysis of 71 neonates with intestinal obstruction between the years 2006 and 2008 was done, the male to female ratio was 2.7:1, the leading etiology was found to be anorectal malformations, moreover, the survival rate was 74.6%<sup>(3)</sup>. A study with a similar duration was undertaken in a tertiary center in Ethiopia between the years 2011 and 2013, where retrospective analysis identified 51 neonates with intestinal obstruction, the male to female ratio was 4.1:1, anorectal malformations were also found to be the leading factor in this study; however the survival rate was 80%<sup>(4)</sup>. In India, a 15 year single center retrospective analysis included 298 newborns, the male to female ratio was 1.8:1, however, intestinal atresia was identified as the leading cause in this analysis, and the survival rate was 83.7%<sup>(21)</sup>.

### Neonatal intestinal obstruction in Jordan

A 30 year retrospective analysis of neonates with intestinal obstruction was conducted between the years 1973 and 2003, to our best knowledge this was the first study of this kind in Jordan, 46 neonates were identified, the male to female ratio was 2.5:1, anorectal malformations represented the majority of cases, the survival rate was 93.4%<sup>(22)</sup>.

### Conclusion and recommendations:

Intestinal obstruction is one of the most common causes for neonatal surgical admission.

We recommend that these patients are referred to a center where neonatal intensive care unit, a pediatric surgery service and a pediatric anesthetist are available to achieve favorable outcomes. Moreover, early pediatric surgery team involvement should be considered for any patient with delayed passage of meconium as bowel ischemia and perforation, which may be brought about by a delay in seeking pediatric surgery input, have a significant detrimental effect on the overall outcome.

We advise that patients undergo initial resuscitation and to have empiric intravenous antibiotics administered early on, as bacterial translocation and possible ischemic injury to the bowel can be the source of neonatal sepsis, which will significantly affect the mortality rate<sup>(15, 16, 17)</sup>.

Prompt obstruction relieving surgery should be offered as soon as the diagnosis is made to avoid complications of intestinal obstruction except in the few cases where conservative management is deemed appropriate, namely, meconium ileus, which can be treated with hyperosmolar water soluble enemas. Conservative management is only considered with patients who are hemodynamically stable and lack signs of peritonitis or neonatal sepsis. Surgical treatment is to be done in a single or staged manner.

We advise for regular follow up at the pediatric surgery clinic. Most patients with anorectal malformations require serial anal dilatations, this is usually done at home, but often some patients require examination under anesthesia with dilatation prior to having

dilatation at home started.

Jordan university Hospital is a tertiary referral center, however, in our study the number of patients is considered low in comparison to the presumable number of patients with neonatal intestinal obstruction nationwide. This may be explained by the fact that only patients with a government university insurance or those who are granted Royal Court exemptions, have financial coverage for treatment at JUH. These

results in most patients being transferred to other tertiary centers, namely, those of the Ministry of Health and Royal Medical Services. Furthermore, in our study the male to female ratio was almost equal with the latter group being slightly larger, this finding was interesting as most studies reported a male predominance; further national studies are needed to determine whether this finding would be reproducible in other tertiary centers in Jordan.

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## الانسداد المعوي لدى الأطفال حديثي الولادة في الأردن: (تجربة ست سنوات في مركز رعاية من الدرجة الثالثة).

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### الملخص

**الهدف من الدراسة:** تحديد أسباب ونتائج حالات الانسداد المعوي لدى الأطفال حديثي الولادة من خلال دراسة الحالات التي تم علاجها في مستشفى الجامعة الأردنية بين العامين 2012 و 2018 ومقارنتها بنتائج دراسة سابقة مماثلة ما بين العامين 1973 و 2003 ومقارنتها مع نتائج دراسات مماثلة في دول أخرى.

**منهجية البحث:** بحث استعادي حيث تمت مراجعة السجلات الطبية لحالات الانسداد المعوي لدى الأطفال حديثي الولادة من خلال متابعة الأعراض التي تشمل الاستفراغ الذي يحتوي العصارة الصفراوية وانتفاخ البطن وتأخر التبرز لدى الأطفال حديثي الولادة، ولغاية عمر 60 يوم. وتم تحصيل 59 حالة من حديثي الولادة ممن تنطبق عليهم الشروط، وكانت نسبة الذكور إلى الإناث 1:1.07. **النتائج:** شارك في الدراسة 59 مريض كانت أعمارهم محصورة بين 1 إلى 60 يوم. وقد وجد أن تشوهات الشرج والمستقيم شكلت الجزء الأكبر من الأسباب حيث وصل عدد الحالات إلى 17 حالة بنسبة 28.4% يليها مرض هيرشبرونغ 16 حالة بنسبة 27%، 9 حالات رتق معوي (15%) والباقي حالات احتناق فتق اربي و التهاب معوي قولوني ناخر.

**الاستنتاج:** يعتبر الانسداد المعوي أحد أهم الأسباب لدى الحالات الجراحية لدى حديثي الولادة، ويجب علاج تلك الحالات في مركز متخصصة تضم وحدات الخداج وجراحة الأطفال وتحديد الأطفال، ونوه بضرورة إشراك جراح الأطفال بخصوص الرأي الطبي بما يخص حالات تأخر التبرز من حديثي الولادة لتفادي مضاعفات الانسداد المعوي التي تشمل نقص تروية الأمعاء، ونخرها. **الكلمات الدالة:** الانسداد المعوي، حديثي الولادة، الشعب الأردني، تشوهات الشلرج والمستقيم، مرض هيرشبرونغ.