

Neonatal Small Bowel Obstruction in Alexandria, Egypt.**H.L. Wella¹, S. M. M. Farahat²,**¹Currently a paediatric surgery trainee, Department of Paediatric surgery-Alexandria University, ²House officer- Alexandria University hospitals.**Correspondence to:** DR. H.L. Wella, E- mail: her_w2002@yahoo.com

Background: *Small bowel obstruction is one of the major causes of morbidity and mortality in surgical newborns. The purpose of this study was to determine causes and surgical outcomes of small intestinal obstruction in neonates.*

Methods: *This prospective study was done at El Shatby Alexandria University paediatric surgery teaching hospital, Egypt between February 2014 and February 2015, involving neonates (≤ 30 days of life) who were operated for acute small intestinal obstruction. Collected data were analysed for patients' and maternal demographic characteristics, clinical presentations, aetiology, management and outcomes.*

Results: *Fifty two newborns were studied, males being 55.8% (29) with the males to females of 1.3:1. The commonest aetiology was intestinal atresia 38.5% (20) followed by intestinal malrotation 21.2% (11). Most of babies presented late to hospital 59.6% (31). Associated anomalies and preoperative medical conditions occurred mainly in low birth weight, premature, late presenters and intestinal atresia newborns. Twelve (23.1%) cases had postoperative complications which occurred frequently among late presenters and the commonest postoperative complication was wound sepsis 52.0% (13/25). Mortality was 21.2% (11) and was high in underweight neonates, $P=0.05$, in prematures, females, newborns with associated anomalies and preoperative medical conditions.*

Conclusion: *Postoperative morbidity and mortality are high in neonatal small bowel obstruction. Late presentation, low birth weight, prematurity, associated anomalies and preoperative medical conditions are the main determinants of adverse outcomes.*

Key words: neonatal, small bowel obstruction, aetiology, morbidity, mortality.

Introduction

Mechanical small bowel obstruction is one of the most common surgical emergencies during the neonatal period¹⁻⁴. A history of polyhydramnios, vomiting, abdominal distention and failure to pass normal meconium in the first 24 hours of life are the common clinical features of small bowel obstruction in neonates^{1,2,5}. Common causes in small intestinal obstruction in neonates include intestinal atresia, malrotation and meconium ileus^{2,3,5}. Small bowel obstruction can lead to three major problems: fluid and electrolyte imbalance and intestinal contents aspiration, translocation of bacteria from the gut into the blood stream and circulatory compromise of the bowel wall. These can cause shock, respiratory and renal failure, local and generalized sepsis, bowel ischaemia and perforation, pneumonia from aspiration and malnutrition. To avoid these events urgent evaluation, efficient and timely resuscitation and interventions are essential¹⁻⁵. The initial resuscitation management is focused primarily on bowel decompression by passage of a gastric tube, administration and maintenance of intravenous fluid and electrolytes balance and antibiotics. Primary surgical correction is the treatment of choice for mechanical small bowel obstruction with techniques depending on the types of condition^{1,2,4,5}.

This study determined aetiologies and outcomes of management of neonatal small intestinal obstruction and emphasized on the aspects strengthening care.

Patients and Methods

A one year prospective survey was conducted at El Shatby hospital- paediatric surgery department in Alexandria Egypt from February 2014 to February 2015. Neonates (newborns \leq 30 days of age) who undergone emergency surgeries for small bowel obstruction were taken into the study conveniently, verbal consent was obtained from parents for all cases. By using a structured questionnaire data collection was done during admission, surgery, postoperative care in ICU/ward and the out patients clinic visits after discharge. Mobile phone communication helped to obtain maternal information for some newborns and follow up of patients. Data collated included sex, birth weight, age, gestational age at birth, maternal co morbidities, type of gestation, maternal age mode of delivery, status of consanguinity, duration of symptoms, clinical features, diagnosis, other associated anomalies and medical conditions, radiological and haematological investigations results at admission, time interval between admission and surgery, surgical treatment, pre and post operative treatments and post operative complications and outcomes. Collected information was analyzed using the SPSS version 20. Fisher's exact and chi-square tests were used for analysis of categorical data and a P value \leq 0.05 was taken as significant. Continuous data were expressed in mean and median. This study was carried out after receiving permission from the hospital management.

Results

A total of 52 newborns were recruited into the study. Males accounted for 29 (55.8%) of the cases. The male to female, and the males to females sex ratio was 1.3:1. The median age was 8.5 days (range 5 hours -30 days) and most of neonates aged below 7 days 46.1% (24). The mean birth weight was 2.9(\pm 0.6SD) kilograms (range 1.75-4.5 kilograms) with most of cases weighing more than 2.5 kilograms 76.9% (40/52), $P=0.42$. The majority were born at term (\geq 37 weeks of gestation) 84.6% (44) and the mean gestational age at birth was 38(\pm 1.6SD) weeks (range 35-41weeks), $P=0.44$. [Table1]. Most of mothers aged less than 30 years 88.4% (46/52), about 21.1% (11/52) of neonates were born from consanguineous couples, $P= 1.00$, and 13.5% (7/52) of newborns their mothers had associated co morbid conditions during pregnancy. The majority of babies were singleton 96.1% (50/52) and most were born by caesarean section 65.4% (34/52). Most of children were second born and above (\geq second born rank) 73.1% (38/52) with the peak being in the second born 38.5% (20/52).

The most common condition was intestinal atresia accounting for 38.5% (20) of cases followed by intestinal malrotation 21.2% (11) [Table2]. One child with meconium ileus presented with terminal ileal perforation. The frequency of low birth weight babies ($<$ 2.5 kilograms birth weight) was high among intestinal atresia cases 45.0% (9/20), $P=0.68$. Most of neonates among intestinal atresia 70.0% (14/20) and malrotation 54.5% (6/11) cases were aged below 7 days and this observation was statistically significant, $P= 0.01$. High consanguinity was seen among intestinal malrotation, annular pancreas and meconium ileus newborns. The associated maternal co morbid conditions during pregnancy in the order of frequency included: premature rupture of membranes, pre-eclampsia, diabetes mellitus, and anaemia and they were frequent among newborns aged below one week, low birth weight babies, and among preterm cases ($<$ 37 weeks of gestation), $P\geq 0.5$. Premature mature rupture of membranes occurred in three newborns, two with intestinal atresia and one with meconium ileus.

One child with intestinal atresia and another with intestinal web were delivered by pre-eclamptic mothers. One baby with annular pancreas was born by a diabetic mother and another with intestinal malrotation from anaemic mother. Many of the cases, 59.6% (31/52), presented late to hospital ($>$ 2days of symptoms), $P=0.69$. The median duration of symptoms was 4.5 days and ranged between 5 hours and 26 days.

Table 1. Distribution of Neonates by Patients` Characteristics and Sex

Patients` characteristics	Sex		Total (%)
	Male (%)	Female (%)	
Age (days)			
≤7	14(58.3)	10(41.7)	24(46.1)
8-14	3(25.0)	9(75.0)	12(23.1)
15-21	6(75.0)	2(25.0)	8(15.4)
22-30	6(75.0)	2(25.0)	8(15.4)
Total	29(55.8)	23(44.2)	52(100.0)
Birth weight(kilograms)			
1.5-1.9	1(25.0)	3(75.0)	4(7.7)
2.0-2.4	4(50.0)	4(50.0)	8(15.4)
2.5-2.9	7(50.0)	7(50.0)	14(26.9)
≥3	17(65.4)	9(34.6)	26(50.0)
Total	29(55.8)	23(44.2)	52(100.0)
Gestational age at birth(weeks)			
<37	3(37.5)	5(62.5)	8(15.4)
≥37	26(59.1)	18(40.9)	44(84.6)
Total	29(55.8)	23(44.2)	52(100.0)

± Fisher`s exact test P=0.08 for the age, * Fisher`s exact test P=0.42 for the birth weight, † Fisher`s exact test P=0.44 for gestational age

Most of babies presented late in all age groups and among genders, however, most of children with normal birth weight (≥2.5 kilograms birth weight) 65.0% (26/40) and term newborns 63.6% (28/44), P≥0.23.

Common reasons for delayed presentation were miss diagnosis 64.5% (20/31) and stabilization with delayed investigations at primary facility 51.6% (11/31). The most common complaints were bilious vomiting 96.1% (50/52), abdominal distension 92.3% (48/52) and failure to pass stool 63.5% (33/52). The most frequent findings on general examination were jaundice 38.5% (20/52) and hypothermia 13.5% (7/52). Associated anomalies occurred in 11.5% (6/52) cases. They occurred equally across age groups; however, they were more common in low birth weight neonates, preterm cases and among females, P≥ 0.06. Associated anomalies included situs inversus (2), intestinal malrotation (2), polydactyly (1), diaphragmatic hernia (1), microcephaly (1), and down syndrome (1). Most of these anomalies occurred in intestinal atresia 62.5% (5/8) and these included situs inversus (2), intestinal malrotation (1), polydactyl (1) and Down syndrome (1).

Table 2. Distribution of Cases by Surgical Conditions and Sex

Primary Diagnosis	Sex		Total (%)
	Male (%)	Female (%)	
Intestinal atresia	9(45.0)	11(55.0)	20(38.5)
Intestinal malrotation	5(45.5)	6(54.5)	11(21.2)
Obstructed inguinal hernia	4(100.0)	0(0.0)	4(7.7)
Intestinal web	2(50.0)	2(50.0)	4(7.7)
Meconium ileus	3(75.0)	1(25.0)	4(7.7)
Midgut volvulus	1(50.0)	1(50.0)	2(3.8)
Ileal duplication cyst	2(100.0)	0(0.0)	2(3.8)
Primary adhesions	1(50.0)	1(50.0)	2(3.8)
Annular pancreas	2(100.0)	0(0.0)	2(3.8)
Twisted Meckle`s diverticulum	0(0.0)	1(100.0)	1(1.9)
Total	29(55.8)	23(44.2)	52(100.0)

Fisher`s exact test P=0.41.

A large number of cases had associated preoperative medical conditions 51.9% (27/52) and these included neonatal jaundice occurring in 38.5% (20/52) of babies, septicaemia (revealed by high white cells counts) in 34.6% (18/52), hypothermia in 13.5% (7/52) and pneumonia in 7.7% (4/52) of newborns. These conditions occurred equally across age groups and sex, but they were common among low birth weight, preterm and late presenting children, $P \geq 0.51$. They were also more frequent among intestinal atresia cases 43.7% (20/46), intestinal malrotation 19.6% (9/46) and meconium ileus 13.0% (6/46) cases.

The most commonly done radiological investigations were thoraco-abdominal erect and supine plain x-rays 94.2% (49/52) and gastrografen meal in vague cases 23.1% (12/52). About 94.2% (49/52) of babies used incubators, 25.0% (13/52) received phototherapy, 21.2% (11/52) received oxygen therapy, 9.6% (5/52) received fresh frozen plasma due to abnormal bleeding indices, 7.7% (4/52) required neonatal ventilators, 7.7% (4/52) received blood transfusion, 7.7% (4/52) required parenteral nutrition and 5.8% (3/52) received platelets concentrate due to low blood platelets levels. However most of these children required these treatments postoperatively. The median time interval between admission and start of surgery was 1 day and the range was 4hours to 21 days.

Transverse right upper quadrant incision was the commonest abdominal incision 95.8% (46/52). Bianchi supra umbilical incision was done in two cases of intestinal atresia. A half of cases, 50.0% (26/52), undergone bowel resection due to a segment of bowel being gangrenous or over distended and so inert. Primary anastomosis was done in 53.8% (28/52) of neonates, 6 cases (11.5%) had small bowel stoma and one colostomy.

Table 3. Distribution of Cases According to Diagnosis by Outcomes

Primary diagnosis	Outcomes		Total (%)
	Survived (%)	Died (%)	
Intestinal atresia	13(65.0)	7(35.0)	20(38.5)
Intestinal malrotation	9(81.8)	2(18.2)	11(21.2)
Obstructed inguinal hernia	4(100.0)	0(0.0)	4(7.7)
Intestinal web	3(75.0)	1(25.0)	4(7.7)
Meconium ileus	3(75.0)	1(25.0)	4(7.7)
Midgut volvulus	2(100.0)	0(0.0)	2(3.8)
Ileal duplication cyst	2(100.0)	0(0.0)	2(3.8)
Primary adhesions	2(100.0)	0(0.0)	2(3.8)
Annular pancreas	2(100.0)	0(0.0)	2(3.8)
Twisted Meckel's diverticulum	1(100.0)	0(0.0)	1(1.9)
Total	41(78.8)	11(21.2)	52(100.0)

Fisher's exact test $P=0.95$.

T- Tube insertion just proximal to anastomosis site was done in one case of intestinal atresia and left for 14 days for drainage of some intestinal content to reduce pressure on anastomotic site and allow the overly distended proximal bowel to shrink to its normal size and acquire good function. Abdominal drains were inserted in 65.4% (34/52) of cases. Post operative complications occurred in 23.1%(12/52) newborns with the most frequent postoperative complications being wound sepsis 52.0% (13/25) and wound dehiscence 24.0% (6/25). Others included burst abdomen 12.0% (3/25) and anastomotic leak/breakdown 12.0% (3/25). Postoperative complications occurred equally through age groups and less frequently among cases born to mothers with other co morbid conditions. But they were more frequent among males, normal birth weight, late presenters and term neonates, $P \geq 0.51$.

Most of post operative complications occurred among meconium ileus, intestinal atresia and ileal duplication cyst cases. No child with associated anomalies developed complications. Postoperative complications were less frequent among cases with other medical conditions, $P=0.42$. Mortality was 21.2% (11/52). No child with associated maternal co morbid conditions died. Mortality was higher among underweight neonates 41.7% (5/52) and this observation was statistically significant, Fishers exact test $P=0.05$. It was also high among females, neonates aged less than a week, preterms, early presenters, newborns with associated anomalies and with other medical conditions, $P \geq 0.07$.

A high mortality was seen in intestinal atresia cases 35.0% (7/20), $P=9.47$, [Table3]. Mortality was low among babies with post operative complications, Fisher's exact test $P=1.00$. The median duration of hospital stay was 9 days (range 2-90 days). Prolonged hospital stay was seen among midgut volvulus, meconium ileus an ileal duplication cyst cases.

Discussion

Acute mechanical small bowel obstruction is a common cause of admission and mortality among surgical newborns^{1,5} and males are most commonly affected⁶⁻⁸ as similarly found in this study probably due to their high genetical susceptibility to development of congenital anomalies or their embryos being high vulnerable to the effects of teratogenic substances. In the current study most of the cases presented to hospital within the first week of life as same as it was observed by others authors⁹⁻¹¹, however, the median age at presentation in this study was higher than a week as compared to low median age reported by one author⁷. This difference may be due to the presence of a number of centers capable of resuscitating and conducting appropriate investigations to a suspected neonate in the area of the current study before referral for a specific treatment and so causing a slight delay. The majority of babies had normal birth weight likewise the findings obtained by Homa *et al*⁶ signifying low birth weight to not be a direct risk for developing small bowel obstruction in newborns. But this observation was statistically insignificant in this study. Most of the neonates were delivered at term similar to the results obtained by another surveyor⁶ this illustrates prematurity not to contribute directly to the development of small bowel obstruction in neonates. However, this finding was not statistically significant in this analysis.

Consanguinity is a known risk for developing congenital anomalies particularly in the region of this study^{12,13}. In the present study 21.1% of cases were from consanguineous parents, nevertheless, this observation was not statistically significant. Most of children were second born and above indicating the presence of a high risk of developing small bowel obstruction in neonates after first delivery/pregnant. However, a large prevalence study involving neonates having no small bowel obstruction is needed. Intestinal atresia was the commonest cause of small intestinal obstruction in this survey. The same findings were reported others^{6,8,10,11,14}. On contrary Ameh *et al*⁷ found obstructed inguinal hernia and Saha *et al*⁹ obtained meconium ileus to be the most common causes of small bowel obstruction in their settings. This reflects the variability in the pattern of small bowel obstruction in newborns and so the risk factors among different regions and societies. Most of children presented late in this study as it was similarly found by others^{10,11}, mainly being due to misdiagnosis showing inadequacy in suspicion and clinical acumen among clinicians about early diagnosing a neonate with small bowel obstruction.

Bilious vomiting, abdominal distension, and failure to pass meconium were the commonest presenting complaints in this analysis the same like the findings in other studies^{6,11}. However, jaundice was the commonest finding on general examination in this study probably due to a significant number of neonates having septicaemia, and probably ascending biliary system infection due to stasis of intestinal and biliary system contents or presence of increased entero-hepatic circulation in small bowel obstruction increasing serum bilirubin levels¹⁵. There were a slight high number of cases with associated anomalies in this survey (11.5%) when compared to other studies done by Saha *et al*⁹ (2.4%) and Osifo *et al*¹¹ (5.5%) probably due to high consanguinity in this region.

Most of the associated anomalies in this study were seen among intestinal atresia newborns as same as it was reported by other authors^{7,9,11} and also in this analysis these associated anomalies were common among low birth weight, preterm and female babies, stressing for more careful clinical assessment and intraoperative exploration in these cases. Nevertheless, these observations were not statistically significant in this study. Other preoperative medical conditions including: neonatal jaundice, septicaemia, hypothermia and pneumonia occurred in most of the newborns mainly among low birth weight, preterm, and late presenting neonates. These conditions were not found to be associated with development of postoperative

complications but were associated with high mortality as same as it was reported by others^{6-8,11,14}. In this survey these findings were statistically insignificant. Most of babies undergone thoraco abdominal erect and supine plain x-rays and a few vague cases had gastrografen meal x-rays with a contrast given through a nasogastric tube as reported by Saha *et al*⁹. However the actual diagnosis was reached intraoperatively.

The median time interval from admission to surgery was 1 day in this study possibly indicating effective resuscitation, fast and early availability of investigations results and easily availability of a chance in theatre rooms. The abdominal incision of choice among cases in this analysis was transverse right upper quadrant incision as it provides easily adequate access to a large part of small bowel. Bianchi supra umbilical incision is a cosmetic incision which is useful for some neonatal small bowel cases like jejuna and ileal atresia or web cases. Insertion of a T-tube just proximal to the anastomotic site in intestinal atresia to reduce pressure of intestinal contents over anastomosis site and allow the shrinkage and acquisition of normal function of the proximal distended bowel enables preservation of bowel segment which may require resection. However it requires at least 14 days for the tube to be removed and more time for the stoma to close spontaneously. Post operative complications rate was relatively low in this study (23.1%) compared to that reported in other studies done by Saha *et al*⁹ (32.1%) and Osifo *et al*¹¹ (27.8%) possibly due to presence of more late presenters in other studies.

Wound sepsis was the commonest postoperative complication as same as the findings obtained by others^{8,9}. The occurrence of post operative complications was not influenced by prematurity and low birth weight; however, it was more frequent among late presenters and males as similarly as it was reported by Saha *et al*⁹ and Osifo *et al*¹¹ indicating late presentation to be the major risk for developing post operative complications. But these results were not statistically significant in this analysis. In this study the overall mortality was relatively low compared to that reported by other researchers^{9-11,14} possibly due to adequate availability of supportive treatments and facilities like neonatal ventilators, parenteral nutrition and incubators and early presentation of a considerable number of cases.

Mortality was statistically significantly high among under weight babies similar to the observation of others^{6,9,11} possibly due to most of them having associated anomalies and other medical conditions. Mortality was high among females mainly due to high prevalence of associated anomalies among them. A high mortality was also seen among premature babies likewise the findings from other reports^{9,10} possibly due to most of them having associated anomalies and other medical conditions. Mortality was high also among early presenters contrary to the results of the studies done by Homa *et al*⁶, Saha *et al*⁹, and Osifo *et al*¹¹ probably due to most of early presenters in this study being having severe form of small bowel obstruction like type IIIb or IV atresia. It seems in general that the associated anomalies and other medical conditions commonly to influence mortality in this analysis as similarly depicted by Homa *et al*⁶ and Nasir *et al*¹⁴ in their studies. However these observations were not statistically significant in the present study. Mortality was low among cases with postoperative complications implying low influence of post operative complications on mortality. High mortality was seen among intestinal atresia newborns and same observations were obtained by other authors⁸⁻¹¹, this may be explained by the fact that most of the associated anomalies, other medical conditions and high proportion of low birth weight babies being among them. However, Nasir *et al*¹⁴ reported a high mortality meconium ileus cases.

Conclusion

- Intestinal atresia was the commonest condition, the majority of cases were full term and had normal birth weight, most of babies presented late to hospital.

- The associated anomalies were common among low birth weight and premature babies and other medical conditions were also common among low birth weight, premature newborns and late presenters.
- Postoperative complications are common among late presenters and they do not directly influence mortality. Mortality is high among low birth weight, and premature babies and also among those with associated anomalies and other medical conditions. Intestinal atresia cases have high mortality.

Recommendations

A more careful clinical evaluation and treatment should be paid to intestinal atresia cases, low birth weight, premature and late presenting newborns.

Acknowledgements

Authors would like to sincerely thank the hospital management for the permission to conduct this study. We are also grateful for the assistance in data analysis from Dr. Assem Abdelmoaty (Alexandria University-Egypt) and MS. Joyce Protas (Hubert Kairuki Memorial University-Tanzania).

References

1. Jayawardhene D. Management of intestinal obstruction in the neonate. Sri Lanka J Child Heal. 2004;33(1):18-21.
2. De Silva NT, Young JA, Wales PW. Understanding Neonatal Bowel Obstruction: Building Knowledge to Advance Practice. Neonatal Netw. 2006;25(5):303-18.
3. Vincour DN, Lee EY, Eisenberg RL. Neonatal Intestinal Obstruction. Am J Roentgenol. 2012;198(1):1-10.
4. Sidler D, Debrew M, Lakhoo K. Neonatal Intestinal Obstruction. In: Ameh E A, Bickler S W, Lakhoo K, Nwomeh BC, Poenaru D, editors. Paediatric surgery:A comprehensive text book for Africa Volume II. First Edit. Global HELP Organization; 2011. p. 376-80.
5. Vallicelli C, Coccolini F, Catena F, Ansaloni L, Montori G, Di Saverio S, et al. Small bowel emergency surgery : literature ' s review. World J Emerg Surg. 2011;6(1):1-8.
6. Homa B, Ahmadipour SH, Mohamadimoghadam J, Mohsenzadeh A. The Study of Newborns with Congenital Gastrointestinal Tract Obstruction. JKIMSU. 2014;3(2):101-6.
7. Ameh EA, Chirdan LB. Neonatal intestinal obstruction in Zaria, Nigeria. East Afr Med J. 2000;77(9):510-3.
8. Sowande OA, Ogundoyin OO, Adejuyigbe O. Pattern and factors affecting management outcome of neonatal emergency surgery in Ile-Ife , Nigeria. Glob J Med Surg. 2014;2(3):10-6.
9. Saha AK, Ali MB, Biswas SK, Sharif HMZ, Azim A. Neonatal intestinal obstruction : patterns , problems and outcome. Bangladesh Med J Khulna. 2012;45(1-2):6-10.
10. Ademuyiwa AO, Sowende OA, Ijaduola TK, Adejuyigbe O. Determinants of mortality in neonatal intestinal obstruction in Ile Ife , Nigeria. African J Paediatr Surg. 2009;6(1):11-3.
11. Osifo OD, Okolo JC. Neonatal intestinal obstruction in Benin , Nigeria. African J Paediatr Surg. 2009;6(2):98-101.
12. Shawky RM, Sadik DI. Congenital malformations prevalent among Egyptian children and associated risk factors. Egypt J Med Hum Genet. 2011;12(1):69-78.
13. Al-Ani ZR, Al-Haji SA, Al-Ani, MM, Al-Dulaimy KM, Al-Maraie AK, Al-Ubaidi Bk. Incidence, types, geographical distribution, and risk factors of congenital anomalies in Al-Ramadi Maternity and Children's Teaching Hospital, Western Iraq. Saudi Med J. 2012;33(9):979-89.
14. Nasir GA, Rahma S, Kadim AH. Neonatal intestinal obstruction. East Mediteranean Heal J. 2000;6(1):187-93.
15. Mesic I, Milas V, Medimurec M, Rimar Z. Unconjugated Pathological Jaundice in Newborns. Coll Antropol. 2014;38(1):173-8.