International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)

Journal Home page: www.iscientific.org/Journal.html

Short and long term outcomes management of neonatal intestinal atresia

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Abstract

One of the most frequent causes of intestinal blockage in newborns is intestinal atresia. However, there's a chance that regional, environmental, or ethnic variations account for the broad variation in prevalence. Surgical repair is currently the only treatment available for intestinal atresia. Our study was aiming to evaluate the short term and long-term outcomes of neonatal intestinal atresia. Our retrospective cohort study was performed on all infants surgically treated for intestinal atresia between January 2017 till December 2021 in surgical NICU of Cairo University Pediatric Hospital. The study was approved by the Research Ethics Committee of Faculty of Medicine of Cairo University. Data of these patients was retrieved from medical files and direct interviewing alive patients. As regards to operative findings the common sites of atresia were duodenal 87 (43.3%) atresia, 73 (36.3%) jejunal atresia, 35 (17.4%) ileal atresia, 4 (2%) colonic atresia, 2 (1%) multiple intestinal atresia. There were found associated complications that may present with intestinal atresia especially jejunoileal, volvulated ileum 3 (1.5%), perforated ileum 3 (1.5%) perforation may be idiopathic or due to delayed surgical care, meconium cyst 4 (2%), perforated posterior wall of stomach 3 (1.5%), these complications are rare to be associated with intestinal atresia. We concluded that the early diagnosis and early surgical intervention for intestinal atresia will improve the post-operative outcomes. Hence, we recommend good antenatal care for mothers and the fetuses at risk.

Keywords: Atresia; Neonate, Intestine; Surgery.

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1. Introduction

One of the most frequent causes of intestinal blockage in newborns is intestinal atresia. Based on data from national and international databases on congenital anomalies, the prevalence of duodenal atresia is estimated to be 1 in 5000–10,000 live births globally. Colonic atresia is the least common cause of neonatal intestinal obstruction; the estimated incidence is between 1.8 and 5.0% of all cases of intestinal atresia in the newborns, or 1 in 40,000 live births [1]. However, there's a chance that regional, environmental, or ethnic variations account for the broad variation in prevalence. Intestinal atresia can be sonography used to identify the condition during pregnancy revealed dilated loops of bowel and polyhydramnios, which are caused by the fetus's inability to move consumed amniotic fluid via the digestive tract [2]. Soon after delivery, patients with intestinal atresia will exhibit distention and bilious vomiting. In cases when the atresia is distal, it could require multiple meals for the stomach to fill sufficiently to induce vomiting. X-rays should be used to evaluate patients who throw up. It will show bowel loops that are enlarged and air fluid levels that are compatible with obstruction [3]. There can be free air if there has been a perforation. Surgical repair is currently the only treatment available for intestinal atresia. After a nasogastric tube is inserted to decompress the stomach, patients should be declared non-PO. Patients need to have their fluid loss replaced and should be revived. Any irregularities in electrolytes should be rectified. Laparotomy and reanastomosis of the two blind-ending loops of bowel (by excision of atretic component and anastomosis) are used to repair intestinal atresia. While waiting for bowel function, a

nasogastric tube should be implanted for postoperative stomach decompression [4].

1.1 Aim of work

To evaluate the short term and long-term outcomes of neonatal intestinal atresia.

2. Patients and methods

Our retrospective cohort study was performed on all infants surgically treated for intestinal atresia between January 2017 till December 2021 in surgical NICU of Cairo University Pediatric Hospital. The study was approved by the Research Ethics Committee of Faculty of Medicine of Cairo University. Data of these patients was retrieved from medical files and direct interviewing alive patients. These databases are text-based International Classification of Disease-based, and patients were located by searching for the following diagnoses: Duodenal atresia, jejunal atresia, ileal atresia, jejunoileal atresia, and colonic atresia. Patients were excluded from the study population only if their preliminary diagnosis ruled out intestinal atresia, but it was not confirmed by subsequent evaluation, intestinal atresia patients who died preoperatively also were excluded. No patients who truly had intestinal atresia were excluded because of associated diagnoses, but major comorbidities were noted. The information recorded for each patient included gestational age, gender, age at presentation, presenting symptom, diagnostic tools, location and type of atresia, type of surgical intervention, associated anomalies, and outcome recorded and late morbidities, such as repeat surgeries or hospitalizations. We enrolled the patients who had received surgery for intestinal atresia within the study period and assessed them prospectively.

2.1 Statistical analysis

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using the non-parametric Mann-Whitney test. For comparing categorical data, Chi square (x2) test was performed. Exact test was used instead when the expected frequency is less than 5. P-values less than 0.05 were considered as statistically significant.

3. Results and discussion

This retrospective cohort study provides a contemporary description of the outcomes of infants with intestinal atresia. Intestinal atresia is one of the most common causes of intestinal obstruction in the neonate. The prevalence of duodenal atresia is 1 in 5000 to 10,000 live births [5]. Colonic atresia is the least frequent cause of neonatal intestinal obstruction; the estimated incidence is between 1.8 and 5.0% of all cases of intestinal atresia in the newborns or 1 in 40,000 live births [6]. Although the wide range in prevalence could possibly be due to ethnic, environmental or geographical differences. Our results show high incidence of prematurity and low birth weight in comparison with the other studies, which has a greater impact on morbidity and mortality. These results are similar to the study done by Fares et al., where 26 (51%) of babies had a birth weight of less than 2500 g, and the study done by Burjonrapp et al., where The mean gestational ages were 36 weeks in duodenal atresia, 37 weeks in jejuno-ileal atresia, and 37 weeks in colonic atresia. The mean birth weights were 2,380.5 g (SD 988) in duodenal atresia, 2,814 g (SD 755) in jejuno-ileal atresia, and 3,153 g (SD 527) in colonic atresia ($p = 0.011$) [7, 8]. The early presentation and diagnosis the best outcomes this result similar to the result of a study done by Subbarayan et al. where All cases presented within the first week of life, with the clinical features of intestinal obstruction like bilious vomiting, not passing meconium since birth, abdominal distension. The mean age at presentation was 2.2 days [9]. As regards to pre-operative investigation for neonates with intestinal atresia X-ray was the common and classic investigation performed when intestinal obstruction was suspected, and double bubble sign was the most common finding in duodenal atresia 80 (39.8%) as in the study done by Tsitsiou et al. that suggest If there is no gas distal to the main bubbles, this suggests that the insult occurred in utero, and the diagnosis is duodenal atresia [10].

As regards to preoperative diagnosis the duodenal atresia was easy to diagnose through plain radiograph (X-ray) except in cases suspect with malrotation that need more investigation as upper GIT contrast to confirm the diagnosis. In our study, 78 (89.7%) of duodenal atresia were diagnosed through a plain radiograph and 9 (10.1%) were misdiagnosed with other causes of neonatal intestinal obstruction as jejunal atresia and malrotation. Also, if partial obstruction is suspected due to the presence of distal air contrast study may be needed. From Jejunal atresia patients only 50 (68.5%) were diagnosed through plain radiograph and 23 (31.5%) were misdiagnosed with other causes of obstruction such as duodenal, malrotation and ileal atresia. In ileal atresia 18 (51.4%) patients were diagnosed through plain radiograph and 17 (48.6%) were misdiagnosed with other causes of obstruction such as colonic atresia, jejunal atresia, HSD and meconium ileus. A contrast study may be needed for the evaluation of the site of obstruction and confirmation of the diagnosis. In colonic atresia sensitivity of plain radiograph in diagnosis decreased, only 1 (25%) patient was diagnosed through plain radiograph and 3 (75%) were misdiagnosed with other causes of obstruction as ileal atresia and HSD. Therefore, a contrast study is needed for the diagnosis of colonic atresia and lower obstruction. Therefore, the abdominal radiograph is the first investigation to be ordered in cases of suspected intestinal atresia. It is useful as the sole imaging modality for establishing a diagnosis in certain conditions (as in neonatal intestinal obstruction) and as a guide for further investigations in intestinal atresia and other conditions and this is supported by a study done by Sanjay et al. [11].

Table 1: Distribution of Study Participants by their Demographic and Baseline Characteristics.

		Count	%
Gender	Male	74	36.8%
	Female	127	63.2%
Birth weight	Mean ± SD (Minimum - maximum)	2201.19±484.82 (1300.00-3600.00)	
	Less than 1.500 kg	9	4.5%
	1500-2500 kg	153	76.1%
	More than 2500 kg	39	19.4%
gestational age	Full term	195	97.0%
	Preterm	6	3.0%
Consanguinity	Yes	13	6.5%
	No	188	93.5%
Antenatal U/S(ultrasonography)	U/S show double bubble sign and polyhydramnios	6	3.0%
	U/S show dilated bowel loops and polyhydramnios	4	2.0%
	Lost	191	95.0.%

Table 2: Distribution of Study Participants by the Congenital Anomalies

Congenital anomalies (other than intestinal atresia)		**Count**	**%**
Cardiac	Yes	29	14.4%
	No	172	85.6%
Malrotation	Yes	12	6.0%
	No	189	94.0%
ARM	Yes	4	2.0%
	No	197	98.0%
Gastroschisis	Yes	5	2.5%
	No	196	97.5%
Down syndrome	Yes	12	6.0%
	No	189	94.0%
TOF	Yes	2	1.0%
	No	199	99.0%
Meckel's diverticulum	Yes	1	0.5%
	No	200	99.5%
situs abdominus inversus	Yes	1	0.5%
	No	200	99.5%
limb anomaly	Yes	2	1%
	No	199	99.0%
undescended testis	Yes	1	0.5%
	No	200	99.5%
annular pancreas	Yes	18	9.0%
	No	183	91.0%
vaginal atresia	Yes	1	0.5%
	No	200	99.5%
IUGR	Yes	3	1.5%
	No	198	98.5%
Hydrocephalus	Yes	1	0.5%
	No	200	99.5%

ARM: Anorectal malformation; **TOF**: tracheoesophageal fistula;
IUGR: Intrauterine growth restriction

Table 3: Distribution of Study Participants by their Preoperative Characteristics.

		Count	%
clinical presentation	bilious vomiting, delayed passage of meconium and abdominal distension	13	6.5%
	bilious vomiting with abdominal distension	39	19.4%
	bilious vomiting huge abdominal distension	2	1%
	bilious vomiting	147	73.1%
postnatal x-ray finding	triple bubble sign	20	10.0%
	Pneumoperitoneum	6	3.0%
	huge, dilated stomach	2	1.0%
	double bubble sign	80	39.8%
	dilated small bowel with air fluid level	84	41.8%
	dilated bowel loops	4	2%
	Lost	5	2.5%
age at presentation (days)	Day1	130	65.0%
	Day2	49	24.5%
	Day3	14	7.0%
	Day4	6	3.0%
	Day5	1	0.5%
postnatal ultrasound	double bubble sign	2	1%
	dilated stomach	4	2.0%
	dilated bowel loops	3	1.5%
	NAD	192	95.5%
pre-operative diagnosis	colonic atresia	7	3.5%
	duodenal atresia	90	44.8%
	gastric outlet obstruction	3	1.5%
	gastric volvulus	1	0.5%
	HSD	4	2.0%
	ileal atresia	27	13.4%
	jejunal atresia	59	29.4%
	Malrotation	8	4%
	meconium ileus	2	1.0%

NAD (no abnormality detected): **HSD** (Hirschsprung's disease)

Table 4: Distribution of Study Participants by their Operative Characteristics

		Count	%
operative finding	duodenal atresia	87	43.3%
	jejunal atresia	73	36.3%
	ileal atresia	35	17.4%
	colonic atresia	4	2.0%
	multiple intestinal atresia	2	1.0%
	Volvolated ileum	3	1.5%
	Perforated ileum	3	1.5%
	Meconium cyst	4	2%
	Perforated posterior wall of stomach	3	1.5%
Types	Type1	67	33.3%
	Type2	46	22.9%
	Type3	15	7.5%
	Type3a	18	9.0%
	Type3b	20	10.0%
	Type4	33	16.4%
	multiple intestinal atresia	2	1.0%
coinciding to previous diagnosis	Matched	147	73.1%
	not matched	54	26.9%

Table 5: Distribution of Study Participants by their Operative procedure.

		Count	**%**
Operative procedure	lap duodenoduodenostomy	18	9.0%
	lap duodenoduodenostomy and vaginostomy	1	0.5%
	open duodenoduodenostomy	55	27.4%
	open duodeno-duodenostomy and Ladd's procedure	9	4.5%
	open duodeno-duodenostomy and colostomy	1	0.5%
	open duodenoduodenostomy and repair of posterior wall of stomach	2	1.0%
	open duodenoduodenostomy, colostomy and Ladd's procedure	1	0.5%
	resection of atretic part and anastomosis	68	33.8%
	resection of atretic part and anastomosis and Ladd's procedure	1	0.5%
	resection of atretic part and anastomosis and colostomy	5	2.5%
	resection of atretic part and anastomosis and closure of abdominal wall	1	0.5%
	resection of atretic part and anastomosis and Meckel's diverticulum resection and anastomosis	1	0.5%
	resection of atretic part and anastomosis and repair of posterior wall of stomach	1	0.5%
	resection of atretic part and anastomosis and silo application	3	1.5%
	resection of atretic part and anastomosis ileostomy and mucous fistula	1	0.5%
	resection of atretic part and anastomosis skin closure	1	0.5%
	resection of atretic part and anastomosis with ileostomy	4	2.0%
	resection of atretic part and anastomosis with tapering	21	10.4
	resection of atretic part and anastomosis with tapering and Ladd's procedure	1	0.5%
	web excision and jejunoplasty	6	3.0%

Table 6: Distribution of Study Participants by their Postoperative complications and outcomes.

		Count	%
Short term complications	Leakage	16	8.0%
	Obstruction	17	8.5%
	Sepsis	29	14.4%
	burst abdomen	1	0.5%
	wound infection	2	1.0%
	short bowel syndrome	1	0.5%
	incisional hernia	1	0.5%
	enterocutaneous fistula	1	0.5%
	intracranial hemorrhage	1	0.5%
Long term complications	short bowel syndrome	1	0.5%
	adhesive intestinal obstruction	2	1.0%
	Discharged	144	71.6%
	Dead	57	28.4%

Table 7: Distribution of Study Participants by their Postoperative complications and outcomes.

	Mean	Standard Deviation	Median	Minimum	Maximum
days left post-operative NPO (ileus)	11.73	7.43	10.00	1.00	35.00
hospital stay (days)	20.78	12.14	19.00	1.00	65.00

The main role of abdominal ultrasound was for screening and evaluation of associated anomalies with intestinal atresia as renal and vertebral anomalies and confirmation of suspect diagnosis only 9 (4.5%) had abdominal ultrasound and (95.5%) lost, 2 cases (1%) confirmed the suspect diagnosis (duodenal atresia). Preoperatively 90 (44.8%) diagnosed duodenal atresia, 59 (29.4%) jejunal atresia, 27 (13%) ileal atresia, 7 (3.5%) colonic atresia, 8 (4%) malrotation 3 (1.5%) gastric outlet obstruction, 4 (2%) HSD, 2 (1%) meconium ileus 1(0.5%) gastric volvulus. As regards to operative findings the common sites of atresia were: duodenal 87 (43.3%) atresia, 73 (36.3%) jejunal atresia, 35 (17.4%) ileal atresia, 4 (2%) colonic atresia, 2 (1%) multiple intestinal atresia, which is similar to study done by Burjonrappa et al. were a total of 130 atresia were repaired during the study period, There were 59 (45.5%) duodenal, 63 (48.5%) jejuno-ileal and 8 (6%) colonic atresias [8]. There were found associated complications that may present with intestinal atresia especially jejunoileal, volvulated ileum 3 (1.5%), perforated ileum 3 (1.5%) perforation may be idiopathic or due to delayed surgical care, meconium cyst 4 (2%), perforated posterior wall of stomach 3 (1.5%), these complications are rare to be associated with intestinal atresia. This is similar to the study done by Chan et al [12].

4. Conclusion and recommendations

We concluded that the early diagnosis and early surgical intervention for intestinal atresia will improve the post-operative outcomes. Hence, we recommend good antenatal care for mothers and the fetuses at risk, good preparation for delivery in well-equipped health care center, prompt neonatal referral to NICU. Also, we recommend applying strict infection control rules and proper management of preoperative complications. Further studies are needed to predict risk factors of postoperative mortality in surgical NICU.

Acknowledgement

The authors are grateful for the patients without whom this study would not have been done.

Funding

None.

Conflicts of interest

The authors affirm that they have no conflicts of interest.

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