Basrah Journal Of Surgery

Bas J Surg, December, 23, 2017

DUODENAL OBSTRUCTION IN CHILDREN: AN EIGHT YEAR EXPERIENCE IN BASRAH

Abbas Abdulzahra Alhasani

MB, ChB, FIBMS, MRCS Glasgow, Pediatric Surgeon, Lecturer, Department of Surgery, College of Medicine, University of Basrah, IRAQ.

Abstract

Duodenum is a common site for congenital anomalies that might result in partial or complete obstruction. Intestinal rotational anomalies that involve the midgut put the duodenum at a potential risk of obstruction.

This is a retrospective hospital record based study displaying an 8 year single center experience in the Basrah center of pediatric surgery. The study enrolled 60 children with congenital duodenal obstruction with a mean age of 2.8 months and a male to female ratio of 1.14:1. Thirty two patients (53.3%) were diagnosed as duodenal atresia and stenosis, while intestinal malrotation was reported in 28 patients (46.7%). Repeated vomiting was the most common presenting symptom, it was bile stained in 60%. Associated congenital anomalies were seen in 23.3% of the study population, Down's syndrome and congenital heart defects were the most commonly reported abnormalities.

Intraoperatively, fenestrated duodenal web was the commonest finding (59.4%) in duodenal atresia/stenosis, which was corrected by a diamond anastomosis in 1.9% of cases and by duodenotomy with web excision in 28.1%. Malrotation was corrected by Ladd's operation in 92.9%. Postoperative complications were reported in one third of the studied population, and the type of surgical procedure used in duodenal atresia/stenosis did not have a significant impact neither on postoperative complications nor on the hospital stay.

Introduction

Duodenum is an interesting part of upper gastrointestinal tract for the majority of pediatric surgeons, due to its unique embryological, anatomical, physiological and pathological characteristics. Congenital duodenal obstruction (CDO) can be the result of intrinsic duodenal pathology or due to extrinsic compression[1] which is ultimately causing either complete or partial obstruction.

Duodenal atresia is the most common cause of CDO[2] and occurs in 1 per 5000 to 1 per 10000 live births[3]; this intrinsic duodenal lesion is believed to be caused by recanalization failure of the developing duodenum, resulting in complete obstruction of duodenal lumen[4].

The extrinsic form of CDO is caused by defects in the development of adjacent structures like malrotation of midgut, Ladd's bands, annular pancreas and pre-duodenal portal vein[5,6].

Intestinal malrotation is a spectrum of malformation in which the bowel is not fixed adequately in a proper way and the base of mesentery is narrow that puts the midgut at a potential risk of volvulus (partial or complete duodenal obstruction) and finally may cause midgut ischemia and gangrene because of compression on superior mesenteric artery[7]. Intraoperative finding of annular pancreas should point to the presence of CDO (partial or complete) in which pancreatic tissues forming a complete ring around the duodenum rather than being located in the medial aspect of the C-shaped duodenum[8].

This study aimed to review children with CDO who were reported in Basrah pediatric surgery center in order to identify the underlying pathology and also

to compare the outcome of the different surgical procedures used in the management.

Patients and Methods

This is a retrospective hospital records based study, displaying an 8 years single center experience in congenital duodenal obstruction (CDO). This study enrolled all cases that were managed for CDO in pediatric surgery center in Basrah starting from October 2008 until October 2016. Patients were studied for demographic criteria, mode of presentation, associated anomalies, intraoperative findings, surgical procedure, hospital stay, postoperative complications and mortality. Patients were divided into four age groups, those who were presented in first 7 days of life (early neonatal period), 8-28 days (late neonatal period), from 29 days to one year of age and those who were aged more one year. Patients were subdivided according to the residency into those who were from Basrah city center, Basrah peripheries and those referred from other governorates. Intraoperative findings, surgical procedures and postoperative complications were reported. According to the hospital stay, patients were distributed in four groups, those who were stayed for up to 5 days, 6-10 days, 11-15 days and those who stayed for more than 15 days.

Data analyses were performed using IBM SPSS® Statistics 22. Data were tabulated and frequencies and proportions were calculated. Chi square or Fischer exact tests were utilized where applicable to examine the differences between variables. P-value of 0.05 was considered as a significant level.

Results

The total number of study group was 60 children with established diagnosis of congenital duodenal obstruction (CDO) which was caused by duodenal atresia/stenosis in 32 patients (53.3%) and intestinal rotational disorder in 28 patients (46.7%). The mean age was 2.8 months and it ranged from 12 hours to 5 years. Table I shows the demographic characteristics of the study group.

Table I: Characteristics of the study population

	No.	%
Age Groups		
Up to 7 days (Early neonatal)	27	45.0
8-28 days (Late neonatal)	17	28.3
29 days- 1 year	14	23.3
> 1 year	2	3.3
	60	100.0
Gender		
Males	32	53.3
Females	28	46.7
	60	100.0
Residence		
Basrah peripheries	37	61.7
Basrah city center	11	18.3
Other governorates	12	20.0
	60	100.0

The majority of patients (44 patients, 73.3%) were neonates (aged less than 28 days), while 14 patients (23.3%) were diagnosed between the age of 29 days and one year, only 2 patients (3.3%) were reported after the age of one year. Males were reported to be slightly more commonly affected by CDO than females with a male to female ratio of 1.14:1. Most of the patients came from Basrah

peripheries (61.7%), while Basrah city center and other governorates where the residency of 18.3 % and 20% of patients respectively.

Table II displays the clinical presentation. Out of the total number, 36 patients (60%) were initially presented with bile stained vomiting which was equally reported in patients with duodenal atresia and malrotation. Less commonly, non-bilious vomiting was reported in 19 patients (31.7%). Bleeding per rectum and failure to thrive were rare presentations. Two patients with malrotation were incidentally diagnosed during laparotomy for another reason. There was no statistically significant difference between duodenal atresia group and malrotation group regarding the clinical presentation (P value=0.504).

Table II: Clinical presentation of patients with congenital duodenal obstruction.

Clinical presentation	Duodenal atresia & Stenosis		Malrotation		Total		P value
	No.	%	No.	%	No.	%	
Bile stained vomiting	19	59.4	17	60.7	36	60.0	
Non-bilious vomiting	11	34.4	8	28.6	19	31.7	
Bleeding per rectum	1	3.1	1	3.6	2	3.3	0.504
Failure to thrive	1	3.1	0	0.0	1	1.7	
Incidental finding	0	0.0	2	7.1	2	3.3	
Total	32	100.0	28	100.0	60	100.0	

Table III shows the associated anomalies which were reported in the study population. Fourteen patients (23.3%) were suffered from associated congenital malformations, they were reported more frequently in duodenal atresia rather than malrotation patients (28.2% vs. 17.8% respectively). Down's syndrome was the most common associated anomaly which was reported in 18.8% of patients with duodenal atresia, while only in 7.1% of malrotation cases. Congenital heart defects were seen in 5% of the study population and congenital diaphragmatic hernia was reported in two cases of malrotation (7.1%). Less commonly, skeletal malformation was reported in 1.7% of the total number of patients. The deference was not significant statistically (P value=0.266).

Table III: Associated anomalies seen in patients with CDO

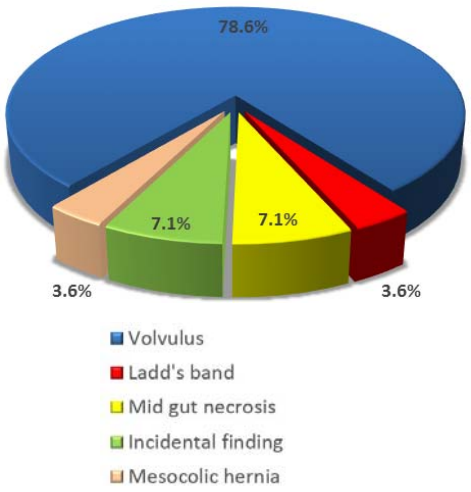
Associated Anomalies	Duodenal atresia & Stenosis (N=32)		Malrotation (N=28)		Total (N=60)		P value
	No.	%	No.	%	No.	%	
Down's syndrome	6	18.8	2	7.1	8	13.3	
Congenital heart disease	2	6.3	1	3.6	3	5.0	
Skeletal anomalies	1	3.1	0	0.0	1	1.7	0.266
Diaphragmatic hernia	0	0.0	2	7.1	2	3.3	
Total	9	28.2	5	17.8	14	23.3	

Intraoperative findings of the study population was illustrated in Figure 1. In intestinal malrotation group, volvulus neonatorum with viable bowel was the intraoperative finding which was encountered in more than three quarters of cases (78.6%), but two cases (7.1%) have volvulus and mid gut necrosis, and another two cases were seen during the correction of diaphragmatic hernias. Last two patients were reported to have an isolated Ladd's band in one of them and a right mesocolic hernia in the other one. Among duodenal atresia/stenosis group of patients, duodenal fenestrated webs were seen in 19 patients (59.4%), while typical duodenal atresia was seen in 10 patients (31.3%), 4 of them (12.5%) have an

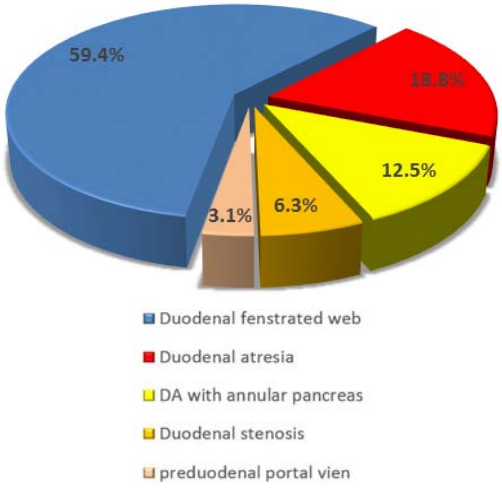
associated annular pancreas. Congenital duodenal stenosis was reported in 2 cases (6.3%), and a single case of pre-duodenal portal vein (1.3%) was reported.

Figure 1: Intraoperative findings of the study population

Intestinal Malrotation



Duodenal Atresia/Stenosis



The operative procedures used to manage CDO were reported and as follows: duodenal atresia was corrected by duodeno-duodenostomy (diamond anastomosis) in the majority of cases (71.9%), while in 9 patients (28.1%) duodenotomy, partial web excision and Heineke–Mickulicz type duodenoplasty was the chosen procedure, while the standard procedure for patients with intestinal malrotation is Ladd's operation which was used in 25 patients (92.9%), the other 3 patients were presented late and gangrenous bowel was found intra-operatively, so only de-torsion of bowel was done in two of them, the third patient was managed by resection of the gangrenous bowel and fashioning of an jejunostomy.

Postoperative complications were reported in 20 patients (33.3%) out of the total number of study populations, 9 of them were belonged to duodenal atresia group (28.1% of this group) and the other 11 patients were within the group of intestinal malrotation (39.3% of this group). Table IV and V shows the reported postoperative complications of each surgical procedure used to manage children with duodenal atresia/stenosis and intestinal malrotation respectively.

Among duodenal atresia/stenosis group, 9 patients (28.13%) were reported to have postoperative complications. The reported complications were prolonged ileus (3 patients), sepsis (3 patients), repeated fit (2 patients) and repeated vomiting (1 patients).

Table IV illustrates that there was no significant statistical difference regarding the occurrence of postoperative complications between the two surgical procedures which were used in the management (P-value was 0.199).

Table IV: Postoperative complications in duodenal atresia/stenosis group

Complications	duodeno-duodenostomy		Duodenotomy & web excision		P value
	No.	%	No.	%	
No complications	18	78.3	5	55.6	0.199
Complications	5	21.7	4	44.4	
Total	23	100.0	9	100.0	

Among patients with intestinal malrotation, 11 patients (39.29%) reported to have postoperative complications in the form of postoperative sepsis (5 patients), prolonged ileus (3 patients), repeated vomiting (1 patient), prolonged jaundice (1 patient) and anemia (1 patient). Table V shows that there is a significant statistical difference in the occurrence of postoperative complications between the two procedures which were used in the management.

Table V: Postoperative complications in intestinal malrotation group

Complications	Ladd's operation		De-torsion ± bowel resection		P value
	No.	%	No.	%	
No complications	17	68.0	0	0.0	0.023
Complications	8	32.0	3	100.0	
Total	25	100.0	3	100.0	

Table VI shows the hospital stay which ranged between 1 day and 21 days, the mean duration of stay was 9.2±4 days. Thirteen patients (40.6%) of duodenal atresia group and 10 patients (35.7%) of intestinal malrotation group were hospitalized for 6-10 days, while only 5 patients (15.6%) and 4 patients (14.3%) of duodenal atresia group and intestinal malrotation group respectively stayed for more than 16 days in the hospital. Generally, there was no significant statistical difference in the hospital stay between duodenal atresia group and intestinal malrotation group (P-value= 0.461).

Again, there was no significant statistical difference in the means of hospital stay within the group of duodenal atresia between those patients who were managed with diamond anastomosis and those who were subjected to duodenotomy and web excision (P-value=0.876). Noticeably, the mean hospital stay of intestinal malrotation patients who suffered from bowel necrosis was significantly lower than who had viable bowel and managed with Ladd's operation (P-value=0.001).

Table VI: The hospital stay of study population

Hospital stay	Duodenal atresia & Stenosis		Malrotation		Total		P value
	No.	%	No.	%	No.	%	
Up to 5 days	4	12.5	8	28.6	12	20.0	
6 - 10 days	13	40.6	10	35.7	23	38.3	0.461
11 - 15 days	10	31.3	6	21.4	16	26.7	
> 16 days	5	15.6	4	14.3	9	15.0	
Total	32	100.0	28	100.0	60	100.0	

Out of the total number of patients with CDO, mortality reported in 7 patients (11.7%), 4 of them (6.7%) belonged to duodenal atresia group of patients, while 3 patients (5%) suffered from intestinal malrotation. Sepsis was the cause of death in 3 out of 4 patients with duodenal atresia and the 4th patient died because of repeated fit secondary to severe electrolytes disturbance. The major cause of mortality in patients with intestinal malrotation was frank midgut necrosis and subsequent sepsis or short bowel syndrome because of delayed presentation. There was no significant statistical difference in mortality within the group of duodenal atresia/stenosis between those patients who were managed with diamond anastomosis and web excision (P-value=0.417).

Discussion

Out of the major two causes of CDO, duodenal atresia and stenosis was slightly more common than bowel malrotation in which midgut ischemia might complicates

the clinical picture, this finding is consistent with what was reported by Parveen Kumar et al[9], Chhabra R, et al[10] and Grosfeld JL studies[2].

Patients with CDO may present in any age, but those with complete duodenal obstruction at birth e.g. duodenal atresia usually present in the early neonatal period, while patients with intestinal malrotation, duodenal stenosis and duodenal fenestrated web can have less acute clinical picture, so the diagnosis might be delayed. In this study, 14 patients (23.3%) were aged between 30 days and 12 months, and 2 patients (3.3%) were diagnosed after the age of one year. This study reported a male gender predilection (M:F=1.14:1), same finding was seen in Parveen Kumar et al[9] and Kamal et al studies[11].

Bile stained vomiting was the main presenting symptom in patients with CDO, it was reported in 36 patients (60% of the study group). Non-bilious vomiting was seen in 11 patients (34%) with duodenal atresia and stenosis, this is might be due to pre-ampullary location of atresia (around 10% of all duodenal atresia found to be proximal to ampulla of Vatar)[12], or because of partial and less severe duodenal obstruction. In malrotation group, only 8 patients (28.6%) were came with non-bilious vomiting mostly duo to intermittent partial volvulus or extra-duodenal compression by Ladd's bands.

Associated congenital anomalies were reported more frequently in duodenal atresia rather than malrotation patients (28.2% vs. 17.8% respectively), Chhabra et al[13] and Grosfeld et al[14] studies had reported a higher percentages of associated anomalies particularly in duodenal atresia (more than 50%), this is most likely due to more thorough prenatal and early postnatal screening program to detect even simple anomalies, this is not widely available in many pediatric surgery centers in the developing countries including ours. Down's syndrome was reported in 6 (18.8%) of duodenal atresia group, nearly a similar finding (19.35%) was reported in Parveen Kumar, et al study[9] but in Kamal et al study[11] it was only 8.6%. Congenital heart defects were more common in duodenal atresia patients in comparison with malrotation patients (6.3% and 3.6% respectively), while skeletal anomalies were reported only in duodenal atresia. Two patients with congenital diaphragmatic hernia (7.1%) were incidentally found to have intestinal malrotation, which were corrected at the time of diaphragmatic repair.

Regarding intraoperative findings, this study reported a high prevalence of duodenal web (59.4%) among patients with duodenal atresia/stenosis group, while duodenal atresia, annular pancreas, congenital duodenal stenosis and pre-duodenal portal vein were seen less frequently Figure (I), this differs from what was reported by many studies in which duodenal atresia was the most common finding intraoperatively, Parveen Kumar et al study[9] reported duodenal atresia in 77.4% of CDO, while Mustafawi[14] study reported duodenal web in only 19.5%. this is could be due to atypical and less acute clinical picture of fenestrated duodenal web (partial duodenal obstruction), that in turn force many general surgeons to refer those patients for pediatric surgery center rather than managing them like in cases of typical duodenal atresia, this will result in raising the proportion of duodenal web on the expense of the duodenal atresia. Volvulus neonatorum was seen in 78.6% of malrotation group of patients, and this is typically occurs in the first month of life, a similar finding was seen by Gross RE.[15] and Stewart et al[16] studies. Internal hernia (mesocolic hernia) was reported once, so as the isolated Ladd's bands.

Duodeno-duodenostomy (Diamond anas-tomosis) is currently the preferred surgical procedure for correction of duodenal atresia[17,18] and this was used in 71.9% of patients, while only 9 patients (28.1%) were managed by duodenotomy and web

excision. There was no significant statistical impact on the occurrence of postoperative complications (P value= 0.381) or on the hospitalization period (P value= 0.392).

For patients with malrotation, Ladd's operation which is the standard procedure world-widely[19] was used in the management, except in 3 patients (7.1%) who were poor candidates for this procedure because of significant bowel loss by advanced ischemia. The available surgical options for this situation are either detorsion of the volvulused midgut and closing the abdomen after a discussion with the family, or bowel resection and subsequent long term total parental nutrition waiting for bowel transplantation[7], and this obviously a very complex and unavailable option in our center. There was a significant statistical relation between the procedure used for malrotation and the occurrence of postoperative complication (P value= 0.023) and mortality (all of the 3 patients with gangrenous bowel were died because of sepsis and short bowel syndrome).

This study reported a mortality rate of CDO to be 11.7%, which is comparable to many studies from the developing countries, Rattan et al[20] had reported mortality of 11 (13.5%) out of 81 neonates, Parveen Kumar et al study[9] reported 22.5% mortality and Zamir et al[21] had reported mortality of 58% in a study from Pakistan. In the developed countries, antenatal diagnosis and timely intervention to correct CDO, postoperative outcome is much better than developing countries[22,23].

In conclusion; CDO is a significant surgical problem that needs to be dealt with by a well-equipped pediatric surgical center, as it carries a good outcome. Carful screening to exclude any associated anomalies is important. For duodenal atresia and stenosis, the surgical options for repair are equally effective and safe with comparable results regarding both postoperative complications and hospitalization period, while for malrotation, nothing better than the classical Ladd's operation before any permanent intestinal damage by ischemia.

References

1. Ladd WE. Congenital obstruction of the duodenum in children. N Engl J Med 1931;206:277–83.
2. Grosfeld JL, Rescorla FJ. Duodenal atresia and stenosis: Reassessment of treatment and outcome based on antenatal diagnosis, pathologic variance, and long-term follow up. World J Surg1993;17:301309.
3. Kimura K, Loening-Baucke V. Bilious vomiting in the newborn: Rapid diagnosis of intestinal obstruction. Am Fam Physician 2000;61:2791–8.
4. Moore KL, Persaud TVN. The digestive system. In: The DevelopingHuman. 8th ed. Philadelphia: WB Saunders; 2007. p. 218,233.
5. Schnaufer L. Duodenal atresia, stenosis and annular pancreas. In: Welch RJ, Randolph JG, et al, editors. Pediatric Surgery. Chicago: Year Book Medical; 1986. p. 929.
6. Shawis R, Antao B. Prenatal bowel dilatation and the subsequent postnatal management. Early Hum Dev 2006;82:297–303.
7. M. Sidney Dassinger III, Samuel D, Smith: Malrotation, Ashcraft's pediatric surgery textbook, the 6th edition 2014, chapter 31, p.430.
8. Elliot GB, Kliman R, Elliot KA. Pancreatic annulus: A sign or a cause of duodenal obstruction? Can J Surg 1968;11:357.
9. Parveen Kumar, Chiranjiv Kumar, Prince Raj Pandey, Yogesh Kumar Sarin. Congenital Duodenal Obstruction in Neonates: Over 13 Years' Experience from a Single Centre, Journal of Neonatal Surgery 2016; 5(4):50.
10. Chhabra R, Suresh BR, Weinberg G, et al. Duodenal atresia presenting as hematemesis in a premature infant with Down syndrome .Case report and review of the literature. J Perinatol 1992;12:25–7.
11. Kamal Nain Rattan, Jasbir Singh & Poonam Dalal. Neonatal Duodenal Obstruction: A 15-Year Experience, Journal of Neonatal Surgery 2016; 5(2):13.
12. Shawis R, Antao B. Prenatal bowel dilatation and the subsequent postnatal management. Early Hum Dev 2006;82:297–303.
13. Chhabra R, Suresh BR, Weinberg G, et al. Duodenal atresia presenting as hematemesis in a premature infant with Down syndrome .Case report and review of the literature. J Perinatol 1992;12:25–7.
14. Mustafawi AR, Hassan ME. Congenital duodenal obstruction in children: a decade's experience. Eur J Pediatr Surg. 2008 Apr; 18(2):93-7.
15. Gross RE. Malrotation of the intestine and colon. In: Gross R.E., editor. The Surgery of Infancy and Childhood. Philadelphia: WB Saunders; 1953. p. 192–203.
16. Stewart DR, Colodny AL, Daggett WC. Malrotation of the bowel in infants and children: A 15-year review. Surgery 1976;79:716–20.
17. Spilde TL, St Peter SD, Keckler SJ, et al. Open vs. laparoscopic repair of congenital duodenal obstructions: A concurrent series. J Pediatr Surg 2008;43:1002–5.
18. Escobar MA, Ladd AP, Grosfeld JL, et al. Duodenal atresia and stenosis: Long-term follow-up over 30 years. J Pediatr Surg 2004;39:867–71.
19. M. Sidney Dassinger III, Samuel D. Smith. Malrotation, chapter 31, Ashcraft's Pediatric Surgery the 6th edition. P. 430-438, Elsevier Inc. 2014.
20. Rattan KN, Singh J, Dalal P. Neonatal duodenal obstruction: a 15-year experience. J Neonat Surg. 2016; 5:13.
21. Zamir N, Akhtar J. Neonatal duodenal obstruction: clinical presentation and outcome. J Surg Pakistan (Int). 2013; 18:182-5.
22. Mooney D, Lewis JE, Connors RH, Weber TR. Newborn duodenal atresia: an improving outlook. Am J Surg. 1987; 153:347-9.
23. Niramis R, Anuntkosol M, Tongsin A, Mahatharadol V. Influence of Down's syndrome on management and outcome of patients with congenital intrinsic duodenal obstruction. Clin Genet. 2009;75:180-4.