

# Duodenal Obstruction in The First Month of Life

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## Abstract

**Introduction:** Duodenal obstruction in the 1st month of life is the most common etiology of bowel obstruction. We aim to analyze the causes, clinical and diagnostic spectrum, management and surgical outcome of duodenal obstruction in the first month of life. The method that we used were 26 newborns of duodenal obstruction reviewed by a cross-sectional study for 30 months (January 2017 - Jun 2019). All of the newborns were investigated to the demographic details, causes, clinical presentation, associated anomalies, radiological findings, surgery performed and their outcome. Our results show that of 26 neonates (16 males, 10 females). 17 newborns were presented within the first 3 days of life. The mean gestational age was 36.88 weeks (10 preterms, 16 terms). The birth weight was normal in 16 newborns. Duodenal atresia was the most frequent cause in 9 (35%) neonates followed by the annular pancreas in 8 (31%), malrotation in 6 (23%), congenital duodenal web in 2 (8%) and congenital peritoneal band in 1 (4%). Greenish vomiting was the most common presentation in 38%. Double bubble gases by abdominal x-ray in 65%. Associated anomalies were noted in 58%, cardiac defects being the most frequent 53%. Duodenoduodenostomy was performed in 73%. Feeding intolerance is the most frequent complication in 48%. 4 (15%) neonates died, mostly in malrotation 50%. The commonest cause of death was midgut gangrene in 50%. We concluded that the Duodenal obstruction is a common problem in newborns. Greenish vomiting was the most common warning finding. Associated anomalies were noted in more than half, cardiac defects being the most frequent. Early diagnosis and treatment is key to reduce post-surgical complications and improving outcome.

**Keywords:** Duodenal obstruction, annular pancreas, duodenal atresia.

## Introduction

Duodenal obstruction in the 1st month of life is the most common etiology of bowel obstruction. Its incidence about once/2500 to 10,000 live newborns<sup>[1,2]</sup>. It can lead to complete or partial obstruction of the duodenum due to various intrinsic and extrinsic reasons for obstruction<sup>[3,4]</sup>. Various developmental defects (recanalization or rotation) of foregut lead to duodenal obstruction in the newborns<sup>[5,6]</sup>. The common causes of NDO are DA, CDW, MR of the gut and AP<sup>[2]</sup>.

The clinical presentation of NDO varies depending on anatomical defect type<sup>[1,5]</sup>. Bilious emesis is a common clinical spectrum<sup>[1]</sup>. The helpful diagnostic modalities are plain x-ray of abdomen and upper gastrointestinal contrast x-ray<sup>[5]</sup>. There are many anomalies (cardiac, down syndrome, renal and others) have associated with NDO<sup>[6]</sup>. Timely diagnosis and aggressive resuscitation strategy of NDO is important to maximize the outcome<sup>[7]</sup>. Published studies on duodenal obstruction in the 1<sup>st</sup> month of life are very limited in Iraq. It is therefore important to report our experience in NDO. The main objective was to analyze the causes, clinical and diagnostic spectrum, management and surgical outcome of duodenal obstruction in the first month of life.

## Patients and Method

**Study Design:** Twenty-six newborns of duodenal obstruction were reviewed with across-sectional study

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at the unit of pediatric surgery at Al-Ramadi Children and Maternity Teaching Hospital, Anbar-Iraq for 30 months from January 2017 till Jun 2019. We excluded newborns with the duodenal obstruction which died pre-operatively. All of the newborns were investigated to the demographic details, causes, clinical presentation, associated anomalies, radiological diagnostic findings, surgery performed and their outcome. A complete examination of all newborns was done, the abdominal x-ray was done on all newborns which showed double bubble appearance in 17 neonates, water-soluble (upper gastrointestinal) contrast studies were done when indicated (2 newborns showed partial duodenal obstruction), abdominal ultrasound and ECHO were done when indicated to rule out associated anomalies. Preoperative resuscitations and surgical exploration have been done in all neonates, different surgical procedures undertaken according to the etiology. We defined birth weight as low if there was less than 2.5kg, as normal if it was more than or equal 2.5kg. The term neonate was considered if the gestational age of more than or equal 37 weeks and the preterm neonate was considered if the gestational age is less than 37 weeks. Postoperative care and follow up was provided for all neonates. Written informed consent from the patient's parents has been taken. Ethical approval was obtained from the ethical approval committee at the University of Anbar.

**Statistical Analysis:** IBM's SPSS Statistics (Statistical Package for the Social Sciences) for Windows (version 25, 2017) and Microsoft Excel for Windows (2019) was used for statistical analysis of the collected data. Categorical variables were expressed as frequency and percentage. One sample Chi-square test was used to compare the actual frequency of each subcategory against its expected frequency assuming all subcategories have an equal incidence at presentation. All tests were conducted with a 95% confidence interval. The P-value is generated by the chi-square goodness-of-fit test. The P-value is significant when  $< 0.05$ .

## Results

26 neonates presented with NDO during the study period. Out of 26 neonates, 16 (62%) were males and 10 (38%) were females. The overall male to female ratio was 1.6:1. The age at the time of presentation (1-29) days, 17 (65%) newborns were presented within the first 3 days of life and the rest, 9 (35%) presented after 3 days of life. The mean gestational age was (36.88 weeks) ranged

between 31-41 weeks (10, 38% were preterm and 16, 62% were term). The birth weight of these newborns was normal in 16 (62%) neonates and it was low in 10 (38%) neonates. The mean of hospital stay was 13 days ranged (5-25) days.

The causes of NDO are shown in table (1). Duodenal atresia was the most frequent cause which occurred in 9 (35%) neonates followed by the annular pancreas, which occurred in 8 (31%) neonates. Other causes of NDO were 6 (23%) neonates were malrotation, 2 (8%) neonates were congenital duodenal web and 1 (4%) neonate was a congenital peritoneal band.

**Table (1): Causes of NDO**

Causes	Frequency	Percentage
Duodenal Atresia	9	35%
Annular Pancreas	8	31%
Malrotation	6	23%
Congenital Duodenal Web	2	8%
Congenital Peritoneal Band	1	4%
<b>Total</b>	<b>26</b>	<b>100%</b>

Greenish vomiting was the most common presenting finding, reported in 24 (38%) neonates followed by dehydration in 18 (28%) neonates, jaundice in 10 (16%) neonates, abdominal distension in 7 (11%) neonates, bloody stool in 3 (5%) neonates and milky vomiting in 2 (3%) neonates. (Table 2).

**Table (2): Frequency of signs and symptoms:**

Signs & Symptoms	Frequency	Percentage
Green Vomiting	24	38%
Dehydration	18	28%
Jaundice	10	16%
Distension	7	11%
Bloody Stool	3	5%
Milky Vomiting	2	3%

More than half of newborns (15, 58%) had one or multiple associated anomalies. The majority of these anomalies are cardiac, observed in 8 (53%) newborns and appear to be statistically significant ( $p$  value =  $< 0.001$ ). Anomalies of multiple, renal, skeletal, umbilical hernia and imperforate anus were also detected. (Table 3).

**Table 3: Associated anomalies.**

Anomalies	Frequency	Percentage	P
Cardiac	8	53%	< 0.001
Multiple	3	20%	0.72
Renal	1	7%	0.3
Skeletal	1	7%	0.3
Umbilical Hernia	1	7%	0.3
Imperforate Anus	1	7%	0.3

Radiological findings of NDO, only one newborn had polyhydramnios by prenatal ultrasound, two newborns had PDO (CDW) by water-soluble (upper gastrointestinal) contrast studies and 17, 65% (9=DA, 8=AP) newborns had double bubble gases by abdominal x-ray. While the operative findings of NDO are DA in 9 neonates, AP, in 8 neonates, 6 neonates were MR, 2 neonates were CDW and 1 neonate was CPB.

The surgical repair was performed for 26 neonates (according to a type of anomalies), duodenoduodenostomy

was performed to 19 (73%) neonates (DA=9, AP=8 and CDW=2). Ladd procedure was performed to 7 (27%) neonates.

During the postoperative period, feeding intolerance is the most frequent complication 10 (48%) newborns with statistically significant (p value= < 0.001), death in 4 (19%), wound infection in 3 (14%), sepsis in 2 (10%), dehiscence and aspiration pneumonia each in one newborn. (Table 4).

**Table 4: Complication of NDO.**

	Frequency	Percentage	P
Feeding Intolerance	10	48%	< 0.001
Death	4	19%	0.76
Wound Infection	3	14%	0.78
Sepsis	2	10%	0.39
Dehiscence	1	5%	0.15
Aspiration Pneumonia	1	5%	0.15
<b>Total</b>	<b>21</b>	<b>100</b>	

Out of 26 neonates in this study, 22 (85%) neonates were survived. Overall, 4 (15%) of the 26 neonates died. The highest mortality was observed in malrotation

2 (50%) deaths, There was a significant association between mortality and malrotation (Odds Ratio=1), DA and AP each in one (25%) death.(Table 5)

**Table 5: Mortality according to the etiologies of the NDO:**

Etiology	Frequency	Percentage	Odds Ratio
Malrotation	2	50%	1
Duodenal atresia	1	25%	0.33
Annular pancreas	1	25%	0.33

The commonest cause of death was midgut gangrene in 2 (50%) with Odds Ratio=1, sepsis and aspiration pneumonia each in 1 (25%) death. (Table 6)

**Table 6: Causes of death:**

Causes of death	Frequency	Percentage	Odds Ratio
Midgut gangrene	2	50%	1
Sepsis	1	25%	0.33
Aspiration pneumonia	1	25%	0.33

## Discussion

NDO is the most frequent etiology of bowel obstruction in the 1<sup>st</sup> month of life<sup>[8,9]</sup>. Among 26 study populations, 16 (62%) were males and 10 (38%) were females. The overall male to female ratio was 1.6:1. There is a male predominance in this study, which agrees with reports of other studies<sup>[6,7,10]</sup> that found (m=16,f=14),(m=193,f=94), (m=56,f=25) respectively. The age at the time of presentation (1-29)days, 17(65%) newborns were presented within the first 3 days of life and the rest, 9(35%), presented after 3days of life, which was similar to the results conducted by other studies<sup>[11]</sup> that found day one of life is the most frequent age of presentation (12 newborns).

In this study, the mean gestational age was (36.88 weeks) ranged between (31-41) weeks, 16 (62%) were term and 10 (38%) were preterm, which agrees with reports of other series<sup>[10,11]</sup> that found (term=79%, preterm=21%), (term=61%, preterm=39%) respectively. The birth weight of these newborns was normal in 16 (62%) neonates and it was low in 10(38%)neonates, these findings confirmatory to the other studies<sup>[11]</sup> were found that 2.15kg was the mean birth weight. The mean of hospital stay was 13 days ranged (5-25)days.

In this series,duodenal atresia was the most frequent cause of DO which occurred in 9 (35%) neonates followed by the annular pancreas which occurred in 8 (31%) neonates. Other causes of NDO were 6 (23%) neonates were malrotation, 2 (8%) neonates were congenital duodenal web and 1 (4%) neonate was a congenital peritoneal band, nearly similar observation was reported by Avci V. et al<sup>[12]</sup>in which the common cause of NDO wasduodenal atresia (10 neonates) followed by the annular pancreas (9 neonates) and congenital duodenal web in 7 neonates, the other study L. Y. Tsai et al<sup>[6]</sup>,Kumar P. et al<sup>[11]</sup>found that the commonest cause of NDO was atresia(16, 23) neonates

respectively,followed by congenital duodenal web (10,8) neonates respectively. Rattan K. N. et al<sup>[10]</sup> in which the common cause of NDO was duodenal atresia (38 neonates) followed by malrotation (33 neonates) and annular pancreas in 4 neonates, while Qiang Shu et al<sup>[7]</sup> were found the common cause of NDO was malrotation (174 neonates) followed by annular pancreas (66neonates), congenital duodenal web (55)neonates and duodenal atresia (9 neonates). This is maybe due to different sample sizes and newborn characteristics.

Greenish vomitus was the typical presentation of NDO reported in 24 (38%) neonates followed by dehydration in 18 (28%)neonates. This result is consistent with Qiang Shu et al<sup>[7]</sup> who found that vomiting was the most common symptom (86%) followed by dehydration (30%), while Rattan K. N. et al<sup>[10]</sup>, Avci V. et al<sup>[12]</sup> found that vomiting was the most common symptom (100%, 75%)respectively,followed by upper abdominal fullness (69%, 38%)respectively, this might be due to recurrent vomiting led to dehydration.

In this study, more than half of newborns (15, 58%) had one or multiple associated anomalies, which seems to be higher than the results of other studies<sup>[6,7,10,12]</sup> that found the associated anomalies are [57%, 50%, 27%, 50%] respectively. The majority of these anomalies are cardiac, observed in 8 (53%) newborns and appear to be statistically significant (p value= < 0.001). This result is consistent with other studies<sup>[7,10,13]</sup> who found cardiac anomalies were the most common defect (32%, 7%, 48%) respectively.While in the other studies Kumar P. et al<sup>[11]</sup>, Avci V. et al<sup>[12]</sup> found that trisomy 21 it was higher associated anomalies(32%,69%) respectively, this might be due to difference in sample size and newborn characteristics.

Radiological findings of NDO, by prenatal ultrasound only one newborn had polyhydramnios, by water-soluble (upper gastrointestinal) contrast studies

two newborns had PDO (CDW) and by abdominal x-ray 17,65% (9=DA, 8=AP) newborns had double bubble gases. Kumar P, et al<sup>[11]</sup> in their study found that among 31 newborns, the polyhydramnios was observed in one neonate. On the other hand, Qiang Shu et al<sup>[7]</sup>, Kumar P, et al<sup>[11]</sup>, Avci V. et al<sup>[12]</sup> found that among (287, 31, 32) newborns respectively, double bubble appearance was observed in (143, 31, 24) newborns respectively, this might be due to difference in sample size and causes of obstruction.

The surgical repair was performed on all newborns, according to a type of defects, diamond duodenoduodenostomy was the preferred procedure in DA, CDW and AP<sup>[14,15]</sup>, It was performed to 19, 73% neonates (DA=9, AP=8 and CDW=2), Ladd procedure was performed in 7, 27% neonates. Few studies evaluate NDO postoperative complication, in this study feeding intolerance is the most frequent complication (10, 48%) newborns with statistical significant ( $p$  value = < 0.001) followed by death (4, 19% newborns) and wound infection (3, 14% newborns), while other studies<sup>[7,13]</sup> found that the most frequent complication is wound infection (7,3) newborns respectively followed by dehiscence (3,1) newborns respectively, this might be due to reasons related to NDO and chronic intrauterine duodenal obstruction led to dilatation of duodenum and stomach that lead to dysmotility<sup>[13]</sup>.

Out of 26 neonates in this study, 22 (85%) neonates were survived. Overall mortality was 4 (15%), which was in between reported international publication Kaddah SN, et al<sup>[4]</sup>, Rattan K. N. et al<sup>[10]</sup>, Kumar P. et al<sup>[11]</sup>, Avci V. et al<sup>[12]</sup> and Erickson J et al<sup>[16]</sup> were observed a mortality of (21%, 13.5%, 22.5%, 9%, and 22.5%) respectively. Prematurity, sepsis, post-surgical complications, associated anomalies, and pneumonia are contributing factors to high mortality in newborns with duodenal obstruction<sup>[17,18]</sup>. In this study the highest mortality was observed in malrotation 2(50%) deaths, our opinion, there was a significant association between mortality and malrotation (Odds Ratio=1), while Kaddah SN et al<sup>[4]</sup> found that the highest mortality was observed in newborns of duodenal atresia (27%) this might be due to a different distribution of associated anomalies. In this study the commonest cause of death was midgut gangrene 2(50%) deaths followed by sepsis and aspiration pneumonia each in 1(25%) death, while in the other studies Qiang Shu et al<sup>[7]</sup> were observed 50% of death result of bowel necrosis and sepsis, Avci V. et al<sup>[12]</sup> were observed that sepsis and cardiac defects are the

most frequent cause of mortality, Rattan K. N. et al<sup>[10]</sup>, Kumar P. et al<sup>[11]</sup> were observed that sepsis was the most frequent cause of mortality (50%, 39%) respectively, this might be due to different presentation time and distribution of associated anomalies. Our opinion that early diagnosis and treatment of NDO is key to reduce post-surgical complications and to improving outcome.

## Conclusion

DO is a common problem in newborns. NDO presentation can be varied, but greenish vomiting was the most common warning finding. Associated anomalies were noted in more than half of newborns, cardiac defects being the most frequent. The important investigation work-up of NDO was a plain abdominal x-ray. Early diagnosis and treatment of NDO is key to reduce post-surgical complications and improving outcome.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval MOH and MOHSER in Iraq.

**Conflict of Interest:** Non

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