Non-Surgical Causes of Bilious Vomiting in Neonates Admitted in a Tertiary Center

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Abstract- Bilious vomiting is highly suggestive of an acute and emergent condition among neonates. The aim of this study was to investigate the non-surgical causes of bilious vomiting in neonates admitted to a tertiary center and to compare them with the surgical causes. This cross-sectional study was performed on 80 infants with bilious vomiting who were admitted at the neonatal intensive care unit of a pediatric tertiary center over two years. The demographic characteristics, clinical symptoms and signs, diagnostic assessments, and therapeutic approaches were recorded. The mean age of neonates was 9.07±8.84 days, and 55% of them were males. The most common final diagnosis was: Necrotizing Enterocolitis (NEC), duodenal atresia, Hirschsprung's disease, gastroesophageal reflux disease (GERD), volvulus, sepsis, meconium plug, isolated mal-rotation, metabolic abnormalities, imperforate anus, and Ladd's bands, respectively. Abnormal findings in ultrasound and X-rays were detected in 35% and 46.3%, respectively. About half of the affected neonates were treated non-surgically. Overall, 17.5% of the patients died. Most deaths were seen in infants with NEC. Using multivariable logistic regression analysis, the presence of NEC as an underlying etiology was the only predictor of neonatal death in neonates with bilious vomiting (OR=12.455, 95%CI: 1.365-113.618, *P*=0.025). The most common cause of bilious vomiting was NEC, followed by duodenal atresia. Half of the neonates with bilious vomiting were treated medically without operation.

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Introduction

Bilious vomiting is highly suggestive of an acute and emergent condition among neonates (1). The most common causes include intestinal atresia, midgut volvulus, and any obstruction in the gastrointestinal tract (2). Bilious vomiting may be less worrying in older children because it could be a sign of acute gastroenteritis (3). In neonates with bilious vomiting, it is difficult to decide whether to operate or not due to insufficient clinical findings and imaging evidence (4). In some studies, more than half of these neonates required urgent surgical intervention due to intestinal obstruction or malrotation (3,4). In another study, about two-thirds of the causes of bilious vomiting were benign and only 20% required surgical intervention (5). Some clinical signs, such as lethargy, irritability, and abdominal distention with yellow or green emesis, emphasize the need for surgical management. Imaging modalities are one of the most important tools in assessing and confirming the underlying cause of bilious vomiting. Abdominal X-ray and contrast studies are routinely used for assessment (6). However, there are limitations for X-ray studies in neonates, including radiation hazards, risk of hypothermia, difficult positioning, and being time-consuming (7). On the other hand, some imaging studies have less diagnostic value than clinical examination to identify the causes of bilious vomiting (7). In this regard, it has been shown that a combination of contrast studies and ultrasound can

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effectively improve the predictive value in diagnosing surgical pathology (8,9).

Generally, identifying the cause of bilious vomiting in neonates has a great impact on optimal management and the final prognosis of the disease.

Unfortunately, we have no comprehensive information on clinical characteristics, main causes of neonatal bilious vomiting, and prognosis of its medical or surgical management in our population. Hence, this study aimed to present a clear picture of neonatal bilious vomiting regarding main underlying etiologies and clinical outcome among Iranian affected neonates.

Materials and Methods

This was a cross-sectional study performed on all neonates who suffered from bilious vomiting which were hospitalized in neonatal intensive care units (NICU) at Bahrami hospital in Tehran (Iran) between 2016 and 2018. After obtaining written consent from parents, the demographic information, clinical symptoms and signs, diagnostic assessments, and therapeutic approaches were recorded in the checklist. The data were obtained from their medical records. The final condition of the patients after discharge was followed up and recorded by referring to the clinic or telephone. The study protocol was approved by the ethics committee of Tehran University of Medical Sciences. (Ethics Number: IR.TUMS.REC.1394.1468)

Statistical analysis

The results of quantitative variables were presented as mean and standard deviation (SD) and the categorical variables by frequencies and percentages. The normality of data was analyzed using the Kolmogorov-Smirnov test. Chi-square test or Fisher's test was used to analyze and compare qualitative variables, and T-test or Mann-Whitney U test was used to analyze and compare quantitative variables. The data were analyzed with the statistical software SPSS version 16.0 for windows (SPSS Inc., Chicago, IL). *P* less than 0.05 was considered statistically significant.

Results

A total of eighty neonates with bilious vomiting were assessed. The average age was 9.07±8.84 days, and 55.0% of them were male. The mode of delivery was recorded as normal vaginal in 33.8% and 66.3% as cesarean section. The parents were consanguineous in 21.3%. The mean gestational age was 35.57±3.34 weeks. The average length of stay in the hospital was 20.57±16.63 days. Thirty-six neonates (45.0%) were preterm. The mean birth weight was 2403.56±863.66 gr. Abnormal Apgar score at birth was present in 17.5% (n=14), of these neonates, 9 (64.28%) had NEC, 4 (28.57%) duodenal atresia, and 1 (0.07%) sepsis. Unfortunately, 9 of these 14 neonates died.

The most common clinical findings were: only bilious vomiting without other symptoms (30%, n=24), abdominal distention (28.8%, n=23), refractory vomiting (21.3%, n=17), lack of defecation (13.8%, n=11), sepsis (2.5%, n=2), jaundice (1.3%, n=1), grunting (1.3%, n=1), and bloody stool (1.3%, n=1).

The most common final diagnosis was: NEC (23.8%, n=19), duodenal atresia (21.3%, n=17), Hirschsprung's disease (15.0%, n=12), and sepsis (8.8%, n=7).Less common causes were: GERD, mal-rotation, meconium ileus, meconium plug, volvulus, metabolic diseases, Ladd's bands, and imperforate anus. (Table 1) The most common causes of bilious vomiting in term and preterm neonates are summarized in Table 1.

Abdominopelvic ultrasound and thoracoabdominal X-ray were performed in all patients, and abnormal findings were detected in 28 (35%) and 37 (46.3%) patients, respectively. A contrast study was performed in 27 (33.75%) patients (12 upper GI series, 15 barium enema); in 23 (28.75%) cases, it was abnormal (10 upper GI series, 13 barium enema).

In total, thirty-five (43.8%) infants received medical treatment, and 45 (56.3%) were operated on. Fourteen infants (17.5%) died. The final diagnosis of non-surviving neonates were NEC (n=10), duodenal atresia (n=1), sepsis (n=2), and imperforate anus (n=1). Seven of these patients underwent surgical interventions. The medical management included treatment of gastroesophageal reflux disease (GERD), broad-spectrum antibiotics for sepsis and NEC, Intravenous immunoglobulin (IVIG), surfactant, and mechanical ventilation for premature neonates, total or partial parenteral nutrition (TPN, PPN) for fasting patients. The most common postoperative complications were sepsis (n=9, 11.3%), pneumothorax (n=6, 7.6%), anastomotic stricture (n=6, 7.6%), and anastomotic leakage (n=2, 2.5%). Among the causes of biliary vomiting between surviving and non-surviving neonates, only NEC was significantly associated with death (Table 2). Table 2 depicts the frequency of bilious vomiting causes between surviving and non-surviving neonates. After discharge, two infants died, and 11 infants were reoperated.

Table 1. Common causes of bilious vomiting in term and preterm neonates

Cause	Total (n=80)	Preterm neonates (n = 36)	Term neonates (n = 44)	*P*
Duodenal atresia	17 (21.3)	7 (19.4)	10 (22.7)	0.721
Volvulus	2 (2.5%)	2 (5.6)	3 (6.8)	0.999
Mal-rotation	5 (6.3)	3 (8.3)	2 (4.5)	0.653
Meconium ileus	4 (5.0)	2 (5.6)	2 (4.5)	0.999
NEC*	19 (23.8)	16 (47.2)	3 (6.8)	< 0.001
Hirschsprung	12(15.0)	3 (11.1)	9 (20.5)	0.260
Meconium plug	4 (5.0)	1 (2.8)	3 (6.8)	0.623
Imperforate anus	1 (1.3)	0 (0.0)	1 (9.1)	0.372
Sepsis	5 (6.3)	1 (2.8)	4 (5)	0.322
Metabolic	2 (5.6)	0 (0.0)	2 (5.6)	0.999
Ladd's Bands	1 (2.8)	0 (0.0)	1 (2.8)	0.372
GERD**	7 (8.7)	2 (5.6)	5 (6.3)	0.325

* Necrotizing Enterocolitis
** Gastro-esophageal reflux disease

Table 2. Frequency of bilious vomiting causes between surviving and non-surviving neonates

Cause	Non-survived group (n = 14)	Survived group (n=66)	*P*
duodenal atresia	2 (14.3)	15 (22.7)	0.722
Volvulus	0 (00.0)	5 (7.6)	0.580
Mal-rotation	0 (00.0)	5 (7.6)	0.580
Meconium ileus	0 (00.0)	4 (6.1)	0.999
NEC*	11 (78.6)	9 (13.6)	< 0.001
Hirschsprung	0 (00.0)	13 (19.7)	0.112
Meconium plug	0 (00.0)	4 (6.1)	0.999
Imperforate anus	0 (7.1)	4 (6.1)	0.999

* Necrotizing Enterocolitis

Discussion

Bilious vomiting in neonates should be considered almost always an emergency condition needing urgent surgical intervention. However, as shown in our survey, about half of the affected neonates were treated medically. As similarly indicated by Godbole *et al.*, (2) and Mohinudden *et al*., (10), about 62% and 54% respectively of patients did not require surgical treatment. Initial physical and imaging assessment along with surgical consultation can determine the superior treatment approach leading to the best outcome. In our study, the mean age of the patients was nine days; however, in other similar studies, this means to age has been reported to vary from 26 hours to 8.7 days. (2,6,7,10). In justifying this difference, it can be stated that our hospital is a referral center for pediatric surgery, and as a result, patients are transferred with delay. We found that the frequency of bilious vomiting in males was slightly higher, similar to previous studies. (6,7,10) In our evaluation, the mean gestational age was 35.5 weeks, while in other studies, it varied from 38 to 40 weeks (2,6,10). This suggests that bilious vomiting might appear at any gestational age.

Fifty-two percent of our patients had non-surgical causes of bilious vomiting. The most common was NEC (about one-fourth of the patients), followed by sepsis. Forty-eight percent had surgical causes; the most common was duodenal atresia, followed by Hirschsprung's disease. It seems that the reason for the high frequency of NEC in our study is the high prevalence of premature infants referred to this center. In Kao's study, (4) surgical causes were found in half of the patients. However, many other authors reported that the most common surgical causes were malrotation (6,10-12), Hirschsprung's disease (2), and duodenal atresia (7). In our study, sepsis, pneumothorax, anastomosis stricture, and anastomosis leak were found as postop complications leading even to death in a number of patients. Nasir reported that an anastomotic leak led to septicemia and death in an affected neonate (13). There is controversy about the preferred diagnostic imaging modalities in these patients. Overall, employing ultrasound combined with abdominal radiography seems to be the most applicable approach.

According to our results, ultrasound had the highest accuracy in detecting NEC, malrotation, and duodenal atresia. In Alehossein *et al*., survey (7), the total

accuracy of ultrasound to detect surgical causes of bilious vomiting was 89%, with the highest for mal-rotation and volvulus. In fact, the assessment by ultrasound seems to be enough for most etiologies of bilious vomiting, and the combination of ultrasound and abdominal X-ray can achieve the final diagnosis accurately. However, some authors revealed that in many cases of bilious vomiting needing surgery, both modalities were shown to be normal. (5,6) It should be noted that, based on imaging findings alone, the surgical causes of bilious vomiting cannot be ruled out.

As the final conclusion, although in all cases of bilious vomiting, surgical causes should be considered, non-surgical causes are not uncommon. In this study, the most common cause of bilious vomiting was NEC, which had the highest mortality and morbidity. We noticed that non-surgical causes were common and accounted for more than half of the cases; these neonates were managed medically.

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