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Follow-up of the Nutritional Status in the Patients with Postoperative Congenital Diaphragmatic Hernia

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ABSTRACT

Introduction: Failure to thrive (FTT) is a common underlying condition in the patients with congenital diaphragmatic hernia (CDH). The present study aimed to evaluate the nutritional status and growth pattern in the patients with CDH.
Methods: This study was conducted on 146 CDH patients who underwent surgery in Dr. Sheikh Hospital in Mashhad, Iran during April 2006-November 2013. Due to inaccessibility and the lack of cooperation on behalf of some parents, only 61 patients completed the study. Data on the demographic and anthropometric characteristics and postoperative complications were collected.
Results: 61 patients with CDH were enrolled in the study, and 32.7% died within six months after the surgery. Mean age of the subjects was 24.21±30.26 months. According to the Z-score weight-for-height classification following surgery, 7.3% of the patients had severe malnutrition, 4.8% had moderate malnutrition, and 24.3% had mild malnutrition, while 51.2% of the subjects were normal. In addition, the majority of the subjects were within the normal range.
Conclusion: According to the results, the majority of the studied children with CDH had normal growth postoperatively, and few cases experienced reduced growth rate within the early years of life. These findings highlight the need for supplementary calories in order to prevent FTT and other complications in the patients with CDH.

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Introduction

The embryonic development of the gastrointestinal (GI) tract is a complex process, during which several congenital abnormalities may develop. Congenital diaphragmatic hernia (CDH) is an autosomal recessive malformation, which accounts for 8% of congenital malformations (1). CDH is an anomaly caused by the defects in the pleuroperitoneal membrane between the thoracic and abdominal cavities, allowing the abdominal organs to be push into the chest cavity, thereby hindering proper lung development(2).

The early signs and symptoms of CDH include scaphoid-shaped abdomen, cyanosis, respiratory distress, auscultation of bowel sounds in the chest, and displacement of heart sounds (3). According to statistics, approximately 95% of infants become symptomatic within the first hours of life. Delayed presentation of CDH has been reported to occur in 5% of the cases with GI manifestations, such as vomiting and abdominal pain (4).

Failure to thrive (FTT) is an underlying

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condition, which occurs in 69% of the patients with CDH. The main cause of CDH is the increased need for calories due to chronic lung disease (5). FTT is a multifactorial condition. Previous findings have suggested that some of the major contributing factors to CDH are gastro esophageal reflux disease (GERD), inadequate nutritional intake secondary to oral aversion, and neonatal metabolic stress response (6). In addition, neurological delay in the patients with GERD is associated with poor oral nutrition.FTT is possibly associated with irreparable damage to the growth and function of other organs (7).

In the patients with CDH, recovery from surgery is characterized by increased protein catabolism and turnover, which leads to net negative protein and muscle wasting, weight loss, and immune dysfunction (8, 9).

Growth spurts in children often occur during the second year of life. However, approximately one-third of these children have been reported to require a gastrostomy tube to meet their needs (10, 11).

Despite numerous studies focusing on the patients with CDH, the postoperative growth pattern and long-term outcomes in the patients with CDH remain unclear in Iran. The present study aimed to evaluate the nutritional status and growth pattern in CDH patients.

Material and methods

This study was conducted on 146 CDH patients who underwent surgery in Dr. Sheikh Hospital in Mashhad, Iran during April 2006-November 2013.Due to inaccessibility and the lack of cooperation on behalf of some parents, only 61 patients completed the study.

The infants and their parents were recruited at the clinic of Dr. Sheikh Hospital in 2013. Data on demographic variables (e.g., age, gender, and family history of congenital anomalies), postoperative complications, developmental defects, and nutritional status were collected via interviews. In addition, data on the length, weight, and head circumference of the infants at birth were extracted from the medical records of the patients.

The current anthropometric indices were measured based on standardized protocols, and the height and weight of the patients were analyzed based on the Z score in WHO Anthro software (version 3.2.2, January2011). Infants with the Z scores of -1-1 were considered normal, while those with the scores of -1 to -2 were considered to have mild malnutrition, and moderate and severe malnutrition was defined in the infants with the Z scores of -2 to-3 and>-3, respectively. Moreover, the infants with the Z scores of 1-2 were regarded as overweight, those with the scores of 2-3 were considered obese, and those with the scores of >3 were considered severely obese (11).

Data analysis was performed in SPSS version 16.

Results

In total, 61 patients were enrolled in the study, among which 20 cases (32.7%) died within six months after the surgery, and 41 patients (67.2%) survived until the end of the study. Mean age of the subjects was 30.26±24.21 months, and 61% and 92.7% of the patients were male and term neonates upon delivery, respectively. Among the term neonates, 53.7% were born via vaginal delivery, and the others were delivered via cesarean section. Parental consanguinity was reported in51.2% of the studied infants. Mean birth weight of the subjects was 3.15±0.55kilograms, and mean birth length and head circumference were 49.70±2.68and 34.81±1.88centimeters, respectively.

The main postoperative GI complications in the patients were diarrhea (4.9%), constipation (24.4%), vomiting (4.9%), cough (12.2%), and abdominal pain (2.4%). On the other hand, 51.2% of the patients experienced none of the mentioned symptoms (Figure 2). With regard to the appetite of the infants after the surgery, 19.5% were reported to have poor appetite, 2.4% had moderate appetite, and 78% had normal appetite. According to the postoperative Z-score weight-for-height classification, 7.3% of the subjects had severe malnutrition, 4.8% had moderate malnutrition, and 24.3% had mild malnutrition, while 51.2% of the subjects were normal. Moreover, 9.7% of the infants were overweight, and 2.4% were obese (Table 1).

Table 1. Comparison mean and standard error (SE) of aflatoxin B_1 between different treatments of peanut

Variables	Mean±SD/%
Age (year)	30.26±24.21
Birth Weight (kg)	3.15±0.55
Birth Length(cm)	49.70±2.68
Head Circumference at Birth (cm)	34.81±1.88
Male	61
Preterm	7.3
Vaginal Delivery	46.3
Parental Consanguinity	51.2
Associated Gastrointestinal Complications	
Diarrhea	4.9
Constipation	24.4
Vomiting	4.9
Abdominal Pain	2.4
None	63.4
Postoperative Malnutrition	
Severe Malnutrition	7.3
Moderate Malnutrition	4.8
Mild Malnutrition	24.3
Normal	51.2
Overweight	9.7
Obese	2.4

The Z scores of weight for the current age, height for the current age, body mass index for the current age, and head circumference for the current age are presented in Table2. Accordingly, the majority of the subjects were within the normal range in this regard.

Table 2. Anthropometric Assessment for Current Age of Patients with Postoperative Congenital Diaphragmatic Hernia

Head Circumference for Current Age	Body Mass Index for Current Age	Height for Current Age	Weight for Current Age	Z Score
8.3%	5.5%	4.8%	4.8%	≥-3SD
2.7%	5.5%	9.7%	9.7%	-2SD to -3SD
30.5%	25%	29.2%	26.8%	-2SD to -1SD
33.3%	47.2%	46.3%	58.5%	-1SD to +1SD
22.2%	16.6%	4.8%	-	+2SD to +1SD
-	-	2.4%	-	+2SD to +3SD
2.7%	-	2.4%	-	≥+3SD

Discussion

Poor growth rate in the early years of life is a highly common finding in the neonates with CDH. Therefore, the nutritional and growth status of these children should be followed-up through continuous and accurate nutritional observation and management. In order to improve FTT and reach the optimal growth status in these infants, supplementary calories should be incorporated into their daily dietary intake to meet their needs (6).

According to the results of the present study, 7.3% of the infants with CDH had severe malnutrition, 4.8% had moderate malnutrition, and 24.3% had mild malnutrition, while the others (51.2%) were normal. Furthermore, 9.7% of the subjects were overweight, and 2.4% were obese. In terms of age, only 16.6% of the infants aged 0-12 months had moderate malnutrition, and 16.6% had severe malnutrition. These findings are inconsistent with the results of the previous studies in this regard.

In a study, Lisette et al. investigated the growth status of the infants with CDH within the first year of life. The obtained results indicated that poor growth, FTT, and GERD (38%) were highly prevalent in these infants within the first year of life. However, this condition improved through proper management and continuous follow-up (10). On the other hand, the findings of Christopher et al. confirmed FTT in 56% of the children within the first six months of life, while it persisted in only 19% of the infants during the first year of life (6).

According to the findings of the current research, half of the sample population had normal weight-for-height Z scores. Furthermore, 24.3% had mild malnutrition, 4.8% had moderate malnutrition, and 7.3% had severe malnutrition. In a similar study, Muratore et al. reported that approximately 60% of the patients with CDH had GERD. Moreover, 56% of these neonates weighed less than the 25thpercentile during the first year of life due to the lack of energy and reflux disease, due to which a gastrostomy tube was inserted in33% of the subjects (6).

According to the study by Fasching et al., more than 40% of the patients with CDH weighed less than the 5thpercentile during the first year of life (12). Consistently, Haliburton et al. reviewed 116 patients and observed that the anthropometric Z scores were below zero, without significant variation across the age cohorts. In addition, FTT occurred during infancy in 25% of the patients, while it persisted until

the age of seven in 60% of the infants (13).

Since this was the first study regarding the subject matter in Iran, the nutritional status of the infants was evaluated based on growth indices (length, weight, and head circumference), and data on postpartum complications were collected using a questionnaire. Given the importance of calories, macronutrients, and micronutrients in the daily diet of the infants with CDH, it is recommended that counseling and follow-up be provided to these patients in multidisciplinary clinics.

Conclusion

According to the results, a small number of the infants with CDH had a poor growth rate within the early years of life, which highlights their need for supplementary calories in their daily diet in order to improve FTT and prevent other complications, such as constipation, abdominal pain, and diarrhea. Moreover, the regular assessment of nutritional status is essential to determining the increased risk of malnutrition in these infants, and studies involving long-term nutritional follow-up are required to evaluate the survival rate of CDH patients postoperatively.

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Conflict of interest

None of the authors had any personal or financial conflicts of interest.

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