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Malnutrition and Feeding Problems in Children with Esophageal Atresia

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ABSTRACT

Introduction: Esophageal atresia (EA) with or without tracheoesophageal fistula is a congenital malformation characterized by the interruption or obstruction of the esophagus. Neonates affected by EA may present with cyanosis during breastfeeding, sialorrhea, coughing, and respiratory difficulty. EA requires surgical treatment; otherwise, the condition could become life-threatening. Data is scarce regarding the long-term nutritional problems of children with EA. The present study aimed to assess the growth status and nutritional difficulties in children with EA.

Methods: This retrospective study was conducted on 32 children with EA during 2007-2016. The nutritional status and feeding problems of the patients were assessed using a questionnaire.

Results: The most common EA-associated complications were esophageal stricture (84.4%), dysphagia (46.9%), gastroesophageal reflux disease (37.5%), and respiratory infections (25%). The majority of the patients had normal growth parameters, and 96.9% experienced at least one complication or feeding problem associated with EA, including the need to drink water to swallow food (25%), coughing while feeding (34.4%), vomiting (12.5%), and abdominal pain (34.4%). However, no significant associations were observed between feeding problems and growth parameters.

Conclusion: Feeding problems are relatively common in children with EA. Therefore, nutritional consultations must be provided to these patients in order to prevent and mitigate these problems.

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Introduction

Esophageal atresia (EA) with or without tracheoesophageal fistula (TEF) is a congenital malformation characterized by the interruption or obstruction of the esophagus. TEF is defined as the fistulous interconnection between various parts of the esophagus and the trachea (1-3). Neonates affected by EA may present with cyanosis during breastfeeding, sialorrhea, coughing, and respiratory difficulty. EA requires surgical treatment; otherwise, the condition may become life-threatening (4-6). The incidence rate of EA varies from one per 2,500 to one per 4,500 live births in various geographical regions (7). EA/TEF are classified into five categories, and type C (EA with distal TEF) is considered to be the most prevalent type of the disease (8).

Over the past decades, advancement in the diagnosis and treatment of EA/TEF has resulted in the higher survival rate of the patients (90%) (9). The morbidities associated with EA/TEF could be due to gastrointestinal or respiratory complications, such as respiratory infections, gastroesophageal reflux disease (GERD), dysphagia, strictures, and pulmonary aspiration (10-12). These complications may influence growth, feeding patterns, and nutritional status (13). The criteria for distinguishing feeding problems are variable in different regions in the world, while some of the key factors in this regard include prolonged mealtime, choking, vomiting, coughing, and early sense of fullness (14, 15). These feeding problems could lead to growth failure, as well as psychological and social complications (16, 17). According to the

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literature, poor growth is the most common issue in children with EA (12, 15, 18). The management of these patients requires consultation with a group of specialists, such as surgeons, gastroenterologists, endocrinologists, and nutritionists, in order to improve the growth and development of the patients (19).

Data is scarce regarding the long-term nutritional problems of children with EA. Our healthcare center at Namazi Hospital in Shiraz is the major referral center for EA/TEF surgery in the south of Iran. To the best of our knowledge, no studies have been focused on the nutritional status of EA/TEF patients in Iran. The present study aimed to evaluate the growth status and feeding problems in the children with EA undergoing surgery at the mentioned healthcare center.

Materials and Methods

Patients

This retrospective study was conducted on all the children with EA referring to Namazi Hospital in Shiraz, Iran during 2007-2016. In total, 170 neonates were admitted during the study period, and 32 cases underwent at least one surgery and were enrolled in the present study. The other cases had no contact records or refused to participate. The overall mortality rate among the studied patients was 25.88% (n=44).

Demographic Data

Demographic and clinical data of the patients were recorded, including age, gender, type of EA, various complications (e.g., primary or delayed anastomosis, presence of long gap EA), and the associated gastrointestinal and respiratory problems (e.g., fundoplication, tracheomalacia, GERD, dysphagia, pulmonary aspiration risk, strictures requiring dilatations, and chest infections).

Assessment of Feeding Problems

Data on the nutritional status and feeding behaviors of the patients were collected using a questionnaire via interviews at the healthcare center. In case of the patients who could not attend the center for the interviews, the required data were collected via phone call. Moreover, the mealtime behaviors of the patients were determined using the questionnaire designed by Puntis et al. (14). The mentioned questionnaire was translated to Persian by an Iranian native speaker who was fluent in English. The reliability of the questionnaire was confirmed by the experts and gastroenterologists.

Growth Status

Data on the weight, length/height, and weight for length/body mass index (BMI) were plotted on the growth charts of the Centre for Disease Control (CDC) (2000) in order to obtain the z scores. The growth status of the premature neonates (gestational age <37 weeks) was corrected for gestational age until the age of two years. The children were classified as wasted if the standard deviation (SD) of their weight-for-age z score was <-2, malnourished if the SD of their weight for length/BMI z score was <-2, and stunted if the SD of their length/height for age z score was <-2 (9).

Statistical Analysis

Data analysis was performed in SPSS version 16. The parametric variables were expressed as mean and SD, and the categorical variables were presented as number and percentage. The possible correlations between the variables were evaluated using Chi-square and Spearman's correlation-coefficient.

Results

The majority of the patients in the present study were male (n=23; 71.9%), and premature birth (gestational age<37 weeks) was observed in 18.75% of the cases. The mean age of the patients at the first surgery was 7± 8.3 days. Table 1 shows the demographic data of the patients upon admission. The majority of the children were categorized as type C EA (n=25; 78.1%) (Table 2).

Table 1. Basic and Demographic Characteristics of Children with Esophageal Atresia (EA; n=32)

Parameters	Mean±SD	Minimum	Maximum
Gestational Age (week)	37.5± 2.1	32	44
Birth Weight (g)	2508.7±453.6	1500	3200
Age (month)	66.9±34.9	10	132
Current Weight (kg)	18.8±8	6.5	44
Height	108.6±19.9	71	145

Table 2. Distribution of Esophageal Types in Iranian Children with EA (n=32)

Esophageal Categories (n=32)	N	%
Type A	5	15.6
Type B	1	3.1
Type C	25	78.1
Type D	1	3.1
Total	32	100

The z score of BMI was within the range of -8.02-2.06 (mean: -0.86±1.4). According to the findings, three children had the BMI z scores of less than -3 SD, who were considered to be severely malnourished, while one patients with the BMI z score of >2 SD was regarded as overweight. With respect to the anthropometric measurements, 15.6% of the patients were considered wasted (weight-for-age z score<-2 SD) and malnourished (weight-for-length/BMI z score<-2 SD), while 6.15% of the patients were defined as stunted (length/height for age z score<-2 SD) (Table 3).

Table 3. Anthropometric Measurements in Children with EA (n=32)

Anthropometric Measurements		Frequency N=32 N (%)
Weight-for-age Z Score	>2	0 (0)
	0-2	9 (28.1)
	-2-0	18 (56.2)
	<-2	5 (15.6)
Height/length-for-age Z Score	>2	0 (0)
	0-2	9 (28.1)
	-2-0	21 (65.6)
	<-2	2 (6.25)
Weight-for-length/BMI Z Score	>2	1 (3.44)
	0-2	10 (31.25)
	-2-0	13 (40.6)
	<-2	5 (15.6)

Congenital cardiac problems were observed in 12.5% of the patients. In addition, one patient was born with an imperforate anus. The most common complications of EA were reported to dysphagia (46.9%) and GERD (37.5%). Fundoplication was performed on 6.3% of the patients, and 84.4% of the patients presented with strictures and underwent esophageal dilatation (Table 4).

Table 4. Complications Associated with EA in Iranian Children (n=32)

Complications	Frequency (N=32)	%
Fundoplication	2	6.3
Esophageal Strictures	27	84.4
Tracheomalacia	4	12.5
Dysphagia	15	46.9
GERD[a]	12	37.5
Pulmonary Aspiration	6	18.8
Respiratory Infection	8	25

[a]*Gastroesophageal reflux disease*

In total, 96.9% of the patients experienced at least one mealtime problem, and only one case reported no complications. Moreover, the majority of the patients needed to drink water to facilitate food ingestion (25% needed water for every meal), while 34.4% experienced occasional coughing during meals. Unusual, prolonged mealtime for a minimum of one or two meals per week was also reported in 32% of the patients. Furthermore, 12.5% of the patients experienced vomiting, and 34.4% experienced abdominal pain while feeding. Early sensation of fullness was also denoted in 40.6% of the patients (Table 5). However, no significant correlations were

observed between feeding difficulties, growth parameters, and EA complications.

Table 5. Feeding Problems in Children with EA (n=32)

Feeding Problems	Frequency N=32 N (%)				
	None	Occasional/ Weekly	1-2 Meal/Day	Most of Meals	All Meals
Lengthy Meal	22 (68.8)	4 (12.5)	2 (6.3)	2 (6.3)	2 (6.3)
Refusing Meal	23 (71.9)	3 (9.4)	5 (15.6)	1 (3.1)	0 (0)
Coughing or Choking during Mealtime	9 (28.1)	11 (34.4)	4 (12.5)	7 (21.9)	1 (3.1)
Vomiting during or after Feeds	28 (87.5)	1 (3.1)	3 (9.4)	0 (0)	0 (0)
Abdominal Pain/Heart Burn	21 (65.6)	7 (21.9)	3 (9.4)	1 (3.1)	0 (0)
Early Sensation of Fullness	19 (59.4)	6 (18.8)	2 (6.3)	5 (15.7)	0 (0)
Need for Water after Food Ingestion	5 (15.6)	7 (21.9)	7 (21.9)	5 (15.7)	8 (25)

Discussion

In the present study, we retrospectively investigated the incidence of feeding difficulties and growth parameters in children with EA. The patients had variable feeding problems and growth impairment, and the frequency of EA was higher in the male patients compared to the female patients, which is consistent with the studies by Waterson et al. and Seo et al. (20, 21). With regard to the anthropometric measurements, 15.6% of the patients in the current research were classified as wasted (weight-for-age z score<-2 SD) and malnourished (weight-for-length/BMI z score<-2 SD). Furthermore, 6.15% of the patients were considered to be stunted (length/height-for-age z score<-2 SD).

Few studies have been focused on the nutritional and growth status of children with EA. In a research, Legrand et al. reported suboptimal growth patterns in 39% of the children affected by EA (22). In another study, 48% and 40% of the children with EA weighed less than the 10th percentile in the first and second year of life, respectively (23). In a recent report by Menzie et al., 9% of the children with EA were described as malnourished and stunted, respectively (19). In two other reports, the growth status of EA patients was observed to improve with age (12, 24). Nevertheless, comparison of the mean BMI Z score between the children aged 0-5 and 5-10 years in the present study indicated no significant difference in this regard.

Multiple entities seem to affect growth patterns in the children with EA. The most common factors are the problems associated with feeding activities (prolonged feeding time, choking, coughing, and vomiting while feeding) and various complications (e.g., dysphagia, GERD, and esophageal strictures) (14). On the same note, Menzie et al. stipulated that children with precedent fundoplication and risk of aspiration, as well as those with a history of EA-unrelated surgery were more likely to present with nutritional deficits (19). These problems could particularly contribute to nutritional deficiencies and poor growth within the first years of life (19). Therefore, it is advisable to recruit a multidisciplinary medical counseling team for the proper management of these complications (18). Although most of the patients in the current research had normal-range BMI, weight-for-age, and height-for-age z scores, further studies are required to assess the key influential factors in the growth status of children with EA.

In the current research, gastrointestinal complications were common in the patients, with nearly half of the patients presenting with dysphagia. Moreover, pulmonary infections were observed in 25% of the patients. According to a previous notion on decreasing the incidence of gastrointestinal and respiratory complications in older children with EA (17), our findings also indicated the presence of infections and need for esophageal dilatation in order to remove strictures, which decreased with age in our subjects.

In line with the results of the present study, the most common feeding complications in children with EA have been reported to be dysphagia and GERD, contribution to impaired esophageal motility, postoperative trauma to vagus nerve, and dysfunction of Auerbach's plexus (11). In this regard, the prevalence of GERD has been

estimated at 25-75% in children affected by EA (10, 22), and this complications was reported by 37.5% of our patients. GERD may cause esophageal strictures, pulmonary infections, and Barrett's esophagus, which could lead to dire conditions.

The majority of the patients in the present study had difficulty swallowing without drinking water. Respiratory and gastrointestinal complications (e.g., dysphagia) are considered to be severe challenges in children with EA, as well as their parents. In a report by Legrand et al., 69% of the children with EA were considered to have dysphagia (22), while the incidence of this complication was estimated at 46.9% in the current research. Furthermore, a significant ratio of our patients experienced postoperative esophageal dilatation due to strictures.

Our findings may inspire pediatricians to persuade parents for the closer follow-up and management of feeding difficulties in children with EA. Most of the parents in the current research did not consult with physicians, which may be due to long distances and possibility of missing regular appointments. Although we used a questionnaire to assess mealtime behavior, one of the limitations of our research was the lack of definite criteria for the accurate description of feeding problems in children with EA. In addition, the small sample size might have limited the test power, which is another limitation of the current research.

Conclusion

Although more than half of the patients in the present study had normal-range growth parameters, the majority experienced gastrointestinal complications, contributing to distressful mealtime and adverse impact on their quality of life.

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Conflicts of interest

None declared.

References

1. Kovesi T, Rubin S. Long-term complications of congenital esophageal atresia and/or tracheoesophageal fistula. Chest. 2004; 126(3): 915-25.
2. Rayyan M, Rommel N, Tack J, Deprest J, Allegaert K. Esophageal Atresia: Future Directions for Research on the Digestive Tract. Eur J Pediatr Surg. 2017; 27(4): 306-12.
3. Koziarkiewicz M, Taczalska A, Jasinska-Jaskula I, Grochulska-Cerska H, Piaseczna-Piotrowska A. Long-term Complications of Congenital Esophageal Atresia, Single Institution Experience. Indian Pediatr. 2015; 52(6): 499-501.
4. Deurloo JA, Ekkelkamp S, Schoorl M, Heij HA, Aronson DC. Esophageal atresia: historical evolution of management and results in 371 patients. Ann Thorac Surg. 2002; 73(1): 267-72.
5. Ioannides AS, Copp AJ. Embryology of oesophageal atresia. Semin Pediatr Surg. 2009; 18(1): 2-11.
6. Morini F, Conforti A, Bagolan P. Perioperative Complications of Esophageal Atresia. Eur J Pediatr Surg. 2018; 28(2): 133-40.
7. Pedersen RN, Calzolari E, Husby S, Garne E ; EUROCAT Working group. Oesophageal atresia: prevalence, prenatal diagnosis and associated anomalies in 23 European regions. Arch Dis Child. 2012; 97(3): 227-32.
8. Konkin DE, O'Hali WA, Webber EM, Blair GK. Outcomes in esophageal atresia and tracheoesophageal fistula. J Pediatr Surg. 2003; 38(12): 1726-9.
9. Andrassy RJ, Patterson RS, Ashley J, Patrissi G, Mahour GH. Long-term nutritional assessment of patients with esophageal atresia and/or tracheoesophageal fistula. J Pediatr Surg. 1983; 18(4): 431-5.
10. Rintala RJ, Sistonen S, Pakarinen MP. Outcome of esophageal atresia beyond childhood. Semin Pediatr Surg. 2009; 18: 50-6.
11. Little DC, Rescorla FJ, Grosfeld JL, West KW, Scherer LR, Engum SA. Long-term analysis of children with esophageal atresia and tracheoesophageal fistula. J Pediatr Surg. 2003; 38(6): 852-6.
12. Arvedson JC. Assessment of pediatric dysphagia and feeding disorders: clinical and instrumental approaches. Dev Disabil Res Rev. 2008; 14(2): 118-27.
13. Peters RT, Ragab H, Columb MO, Bruce J, MacKinnon RJ, Craigie RJ. Mortality and morbidity in oesophageal atresia. Pediatr Surg Int. 2017; 33(9): 989-94.
14. Puntis JW, Ritson DG, Holden CE, Buick RG. Growth and feeding problems after repair of oesophageal atresia. Arch Dis Child. 1990; 65(1): 84-8.
15. Volkert VM, Piazza CC. Pediatric feeding disorders. Handbook of evidence-based practice in clinical psychology. 2012.
16. Rommel N, De Meyer AM, Feenstra L, Veereman-Wauters G. The complexity of feeding problems in 700 infants and young children presenting to a tertiary care institution. J Pediatr Gastroenterol Nutr. 2003; 37(1): 75-84.
17. Chetcuti P, Phelan PD. Gastrointestinal morbidity and growth after repair of oesophageal atresia and tracheo-oesophageal fistula. Arch Dis Child. 1993; 68(2): 163-6.

18. Ramsay M, Birnbaum R. Feeding difficulties in children with esophageal atresia: treatment by a multidisciplinary team. Dis Esophagus. 2013; 26(4): 410-2.
19. Menzies J, Hughes J, Leach S, Belessis Y, Krishnan U. Prevalence of malnutrition and feeding difficulties in children with esophageal atresia. J Pediatr Gastroenterol Nutr. 2017; 64(4): e100-5.
20. Seo J, Kim DY, Kim AR, Kim DY, Kim SC, Kim IK, et al. An 18-year experience of tracheoesophageal fistula and esophageal atresia. Korean J Pediatr. 2010; 53(6): 705-10.
21. Lacher M, Froehlich S, Von Schweinitz D, Dietz HG. Early and long term outcome in children with esophageal atresia treated over the last 22 years. Klin Padiatr. 2010; 222(5): 296-301.
22. Legrand C, Michaud L, Salleron J, Neut D, Sfeir R, Thumerelle C, et al. Long-term outcome of children with oesophageal atresia type III. Arch Dis Child. 2012; 97(9): 808-11.
23. Schmidt A, Obermayr F, Lieber J, Gille C, Fideler F, Fuchs J. Outcome of primary repair in extremely and very low-birth-weight infants with esophageal atresia/distal tracheoesophageal fistula. J Pediatr Surg. 2017; 52(10): 1567-70.
24. Engum SA, Grosfeld JL, West KW, Rescorla FJ, Scherer LR 3rd. Analysis of morbidity and mortality in 227 cases of esophageal atresia and/or tracheoesophageal fistula over two decades. Arch Surg. 1995; 130(5): 502-8.