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Occurrence, Etiologies, and Nutrition Intake in Pediatric Dysphagia

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Purpose : Dysphagia is a medical condition that significantly affects feeding and nutritional intake, thereby impeding pediatric growth and development. With the rising prevalence of pediatric dysphagia, research is essential for a better understanding of its characteristics and management. This study aimed to examine the demographic and clinical profiles of pediatric patients diagnosed with dysphagia, focusing on underlying etiologies and nutritional management (tube feeding). Additionally, the study explored the presence of dysphagia and aspiration using videofluoroscopic swallowing studies (VFSS).

Methods : This retrospective cross-sectional study was conducted at Seoul National University Hospital between January 2011 and December 2018. Medical records of 200 children, aged 0 to 5 years and 7 months, who were referred to the VFSS, were reviewed. Data were analyzed to identify demographic characteristics, etiologies, dysphagia diagnosis rates, the presence of aspiration, and the prevalence of tube feeding.

Results : The etiologies identified were neurological disorders (37.0%), genetic conditions (24.5%), mixed etiologies (18.0%), anatomical abnormalities (5.5%), cardiorespiratory disorders (8.0%), and dysphagia diagnosis without a specific medical diagnosis (7.0%). VFSS results showed that 81.5% of patients were diagnosed with oropharyngeal dysphagia. 33.0% did exhibit aspiration. Regarding nutritional intake, 45.5% of patients relied entirely on tube feeding, and 14% received a combination of oral and tube feeding.

Conclusions : Pediatric dysphagia patients with complex etiologies and comorbidities often require tube feeding for nutritional support and early management of dysphagia. These conditions are frequently associated with additional challenges, such as impaired motor and cognitive development. An interdisciplinary approach is essential for comprehensive diagnoses and effective intervention planning.

Keywords : Dysphagia, prevalence, pediatric, etiology, tube feeding

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Ⅰ. Introduction

Dysphagia is a complex condition that can significantly impair feeding and nutritional intake. As defined by Dodrill and Gosa (2015), dysphagia refers to any disruption in the swallowing sequence, which may occur at any stage of the swallowing process. In pediatric populations, compromised swallowing can hinder adequate nutrition and hydration, leading to adverse outcomes such as impaired growth, developmental delays, and increased morbidity and mortality (Horton et al., 2018). The prevalence of pediatric dysphagia has been rising, a trend attributed in part to improved survival rates among infants with complex medical conditions (Saad et al., 2021). As more children with significant health challenges survive infancy, the need for a comprehensive understanding and management of dysphagia becomes increasingly crucial.

Several demographic studies have explored the prevalence and characteristics of pediatric dysphagia. For instance, Horton et al. (2018) analyzed over six million pediatric admissions from the kids' inpatient database (KID) between 1998 and 2012, identifying a notable increase in dysphagia diagnoses, particularly among premature and low birth weight infants. Similarly, Dewi et al. (2024) examined 40 preterm infants using oral motor assessments and flexible endoscopic evaluation of swallowing (FEES), finding that 25.0% had dysphagia and 15.0% experienced aspiration.

The study also highlighted the high prevalence of comorbidities, including cardiopulmonary (92.5%), gastrointestinal (57.5%), and central nervous system (45.0%) conditions.

In another study, Sadd et al. (2023) evaluated 60 infants with dysphagia, aged 2 to 19 months, and found that 78.0% had comorbidities, such as recurrent chest infections, neurological disorders, gastrointestinal issues, congenital heart disease, and structural laryngeal abnormalities. Aspiration was observed in 60.0% of the infants, with 55.6% experiencing silent aspiration.

Across these studies, common etiologies and comorbidities associated with pediatric dysphagia include prematurity, low birth weight, neurological impairments, gastrointestinal disorders, structural abnormalities, and respiratory conditions. These factors often occur in combination, increasing the complexity of diagnosis and treatment. While previous research has focused on prevalence and demographic characteristics, less attention has been given to the management of dysphagia, particularly in relation to nutritional support.

Tube feeding is a critical intervention for children who are unable to safely consume food orally. When children are entirely dependent on tube feeding, they are classified as NPO (nothing by mouth). As their condition improves, a gradual transition to oral feeding may occur, often involving a combination of oral and tube feeding (Arvedson et al., 2019). The type and duration of tube feeding vary based on clinical needs. Short-term options include oral gastric tubes (OG tubes) and nasogastric tubes (NG tubes), typically used in hospital settings. For long-term nutritional support, percutaneous endoscopic gastrostomy tubes (PEG tubes), jejunostomy tubes (J-tubes), and levin tubes (L-tubes) are commonly used (Arvedson et al., 2019).

Despite the clinical importance of pediatric dysphagia, data on its prevalence and management remain limited, which may hinder effective treatment planning and resource allocation (Bhattacharyya, 2015). To address this gap, the present retrospective cross-sectional study examines the demographic characteristics, etiologies, and management strategies of pediatric patients with dysphagia at Seoul National University Hospital. Specifically, the study analyzes data from 200 patients, aged 0 to 5 years and 7 months who underwent videofluoroscopic swallowing studies (VFSS). The study explores the presence of dysphagia and aspiration, the use of various tube feeding methods, and the broader implications for clinical care.

II. Methods

This study employed a retrospective cross-sectional design to examine the demographic characteristics, etiologies, and management strategies of pediatric patients diagnosed with dysphagia. Data were collected from medical records at Seoul National University Hospital over eight years, from January 2011 to December 2018. The Seoul National University Hospital is a tertiary hospital in South Korea.

1. Subjects

A total of 200 pediatric patients were included in the study. All participants were between birth and 5 years, 7 months and had been referred for a videofluoroscopic swallowing study (VFSS) during the study period. Patients were referred for VFSS based on clinical examination of dysphagia and the medical diagnoses related to dysphagia. Inclusion criteria required that patients had undergone VFSS and had complete medical records available for review.

2. Data collection

Patient data were extracted from electronic medical records and included demographic information, such as gender, chronological age, preterm birth, birth weight, medical diagnosis, and methods of receiving nutrition (feeding tube). Birth weight was sorted into five categories (WHO, 2004): 1) extremely low birth weight, weight $<$ 1.0kg, 2) very low birth weight, 1.0 $\leq$ weight $<$ 1.5kg, 3) low birth weight, 1.5$\leq$ weight $<$ 2.5kg, 4) normal, 2.5 $\leq$ weight $<$ 4.0kg, and high birth weight (macrosomia), weight $\geq$ 4.0kg.

Specific attention was given to identifying the underlying etiologies of dysphagia, which were categorized into 1) neurological disorders, 2) anatomic abnormalities, 3) genetic conditions, 4) cardiorespiratory disorders, 5) unspecified, and 6) mixed etiologies. The unspecified etiology included developmental delays, prematurity, intestinal pseudo-obstruction, and dysphagia without any medical diagnosis. The mixed etiologies were a combination of any two different categories of etiology.

Additionally, the presence of dysphagia and aspiration was determined based on VFSS results. Oropharyngeal

dysphagia was defined as the oropharyngeal dysfunction leading to the inefficient and/or misdirection of the oropharyngeal transition of bolus (Shaker, 2006). Aspiration was defined as a bolus passing below the vocal folds (Park et al., 2010). During the VFSS, thin and thick liquids and puree were presented and the feeding methods were the bottle and spoon. The bolus consistency and feeding methods were varied based on the risk of swallowing safety.

The methods of receiving nutrition were reviewed in the presence of feeding tubes and the types of feeding tubes. The presence of feeding tubes was categorized as full oral feeding (by mouth, PO), partial PO, or exclusive tube feeding (nothing by mouth, NPO). The partial PO was defined as the combination of a feeding tube and oral intake. The types of feeding tubes included the percutaneous endoscopic gastrostomy (PEG) tube, nasogastric tube (NG tube), jejunostomy tube (J-tube), and oral gastric tube (OG tube).

3. Data analysis

Descriptive statistics were used to analyze the frequency of demographic variables, etiologies, dysphagia and aspiration, and feeding methods. The data were summarized using percentages and frequencies to identify trends and patterns within the pediatric dysphagia population. The data analysis was conducted using IBM SPSS Statistics 20 (SPSS Inc., Chicago, IL).

Ⅲ. Results

1. Demographic characteristics

Of the 200 pediatric patients included in the study, 112 (56.0%) were male and 88 (44.0%) were female. The majority of patients (75.0%) were between 0 and 24 months of age. Birth weight data revealed that 59.0% of patients had normal birth weight, 22.5% had low birth weight, 2.5% had very low birth weight, 6.5% had extremely low birth weight, and 2.0% had macrosomia. Birth weight information was unavailable for 7.5% of the sample.

Regarding gestational age, 70.5% of patients were born full-term, while 28.0% were preterm. Prematurity status was not reported for 1.5% of patients. Among the 200 patients, 186 (93.0%) had identifiable medical etiologies.

Table 1. Demographic characteristics of the study population

Subject characteristics	Number (%)
Gender	
Male	112 (56.0)
Female	88 (44.0)
Chronological age (months)	
0~24 months	150 (75.0)
25~36 months	20 (10.0)
37~48 months	7 (3.5)
49~60 months	12 (6.0)
61~72 months	5 (2.5)
73~84 months	6 (3.0)
Birth weight (kg)	
Extremely low birth weight (W < 1.0kg)	13 (6.5)
Very low birth weight (1.0 ≤ W < 1.5kg)	5 (2.5)
Low birth weight (1.5 ≤ W < 2.5kg)	45 (22.5)
Normal (2.5 ≤ W < 4.0kg)	118 (59.0)
High birth weight (macrosomia) (W ≥ 4.0kg)	4 (2.0)
No report	15 (7.5)
Prematurity	
Full-term	141 (70.5)
Preterm	56 (28.0)
No report	3 (1.5)
Etiology	
Neurological disorders	74 (37.0)
Genetic conditions	49 (24.5)
Cardiorespiratory disorders	16 (8.0)
Anatomic abnormalities	11 (5.5)
Unspecified	14 (7.0)
Mixed	36 (18.0)

These were categorized as follows: neurological disorder (37.0%), genetic conditions (24.5%), mixed etiologies (18.0%), cardiorespiratory disorders (8.0%), anatomical abnormalities (5.5%), and unspecified causes (7.0%). Table 1 presents the demographic characteristics of the study population.

2. Dysphagia and aspiration

Videofluoroscopic swallowing studies (VFSS) revealed that 163 patients (81.5%) were diagnosed with oropharyngeal dysphagia, while 37 patients (18.5%) did not meet the criteria for dysphagia. Aspiration was observed in 66 patients (33.0%), whereas 122 patients (61.0%) did not aspirate during the VFSS. Notably, 12 patients (6.0%) could not be evaluated due to refusal to feed during the examination. Table 2 summarizes the VFSS findings related to dysphagia and aspiration.

Table 2. Videofluoroscopic swallowing study findings

Swallowing symptom and diagnosis	Number (%)
Aspiration	
No aspiration	122 (61.0)
Aspiration	66 (33.0)
Can not evaluate	12 (6.0)
Dysphagia	
Oropharyngeal dysphagia	163 (81.5)
No dysphagia	37 (18.5)

Table 3. Management of dysphagia of the study population

Management categories	Number (%)
Tube feeding	
Total NPO	91 (45.5)
No tube feeding (PO)	81 (40.5)
Partial PO	28 (14.0)
Tube type	
Percutaneous endoscopic gastrostomy (PEG)	55 (46.2)
Nasogastric tube (NG tube)	46 (38.7)
Jejunostomy tube (J-tube)	10 (8.4)
Oral gastric tube (OG tube)	8 (6.7)

3. Nutritional management and tube feeding

Analysis of nutritional intake methods showed that 40.5% of patients were exclusively orally fed (PO), 14.0% received a combination of oral and tube feeding (partial PO), and 45.5% were entirely dependent on tube feeding (NPO). Among those who received tube feeding, the types of feeding tubes used were as follows: 55 patients (46.2%) using a PEG, 46 (38.7%) using an NG tube, 10 (8.4%) using a J-tube, and 8 (6.7%) using an OG tube. Table 3 provides a detailed breakdown of feeding methods and tube types used for nutritional management.

Ⅳ. Discussion and Conclusion

The current study examined the demographic characteristics of pediatric patients with dysphagia, including etiologies and the presence of tube feeding. Moreover, the study investigated the presence of dysphagia and aspiration through VFSS. Among the patients, the majority were infants (0~24 months old). This study found that the most frequent comorbidities were neurological disorders (37.0%), genetic conditions (24.5%), and a mix of etiologies (18.0%). Neurological disorders and other comorbidities are highly related to the occurrence of dysphagia in pediatric populations. It is important for clinicians to observe and screen these vulnerable populations closely. Increasing awareness and access to services for pediatric swallowing disorders is necessary because less than 25% of patients have received clinical services (Bhattacharyya, 2015). Furthermore, VFSS data confirmed that the pediatric population who were referred for dysphagia diagnosis showed dysphagia signs predominantly (81.5%). On the other hand, 33.0% of the patients displayed aspiration, while 61.0% did not aspirate. These patients showed other dysphagia signs, like residue or poor lip control. Additionally, 45.5% of the population were reliant on tube feeding for nutritional intake, and 14.0% were managing partially by mouth and tube feeding. The nutritional support for these populations was primarily provided through a feeding tube. This data suggests that clinicians and caregivers need to know more about tube feeding and its management for nutritional support.

This study reported a variety of etiologies and their relation to dysphagia diagnosis and tube feeding. A closer look at some of the specific neurological disorders of this study included hypoxic-ischemic encephalopathy, cerebral palsy, encephalitis, brain tumor, neuromuscular disease, seizure, spinal cord disease, and pachygyria. The population with neurological disorders may experience numerous difficulties in other areas of the body systems because global neural development impacts the body's development and growth. Specifically, lesions within the central nervous system may disrupt global development. Further, several specific genetic conditions, such as Edward syndrome, Down syndrome, DiGeorge syndrome, congenital myopathy, and genetic myopathy, have a significant effect on swallowing difficulties. Lastly, patients with multiple etiologies tend to show more difficulties with swallowing and nutritional intake than others. An example from the mixed category was a patient with a structural abnormality and genetic condition, such as laryngomalacia and congenital myopathy. Given the various, complex etiologies present within this study, the findings reveal the importance of an interdisciplinary approach for each case. Having a team of professionals helps foster a holistic approach to evaluating and developing intervention strategies that can lead to more positive long-term outcomes.

There was a discrepancy between the prevalence of dysphagia diagnoses and the occurrence of aspiration for those individuals who are diagnosed with dysphagia but who do not aspirate. They may be having difficulties with

feeding, such as difficulty with sucking and tongue coordination. In addition to the instrumental examinations, it is necessary to determine the clinical findings that affect swallowing disorders. Understanding the entire swallowing process is imperative because other concerning swallowing challenges, besides aspiration, may be occurring. Furthermore, it is worth knowing that 12 (6.0%) patients within the aspiration group and 37 (18.5%) patients within the dysphagia diagnosis group could not be evaluated. These patients showed the inability to swallow, rejection of the substance, or lack of evidence due to insufficient substance quantity. Edwards et al. (2022) and Saad et al. (2021) suggested more accurate evaluation tools or assessments for identifying vulnerable groups. Furthermore, with more longitudinal research on this population, the long-term impacts of this disorder would be revealed and could be correlated with dysphagia in adulthood (Lefton-Greif, 2008). For future studies, it may be beneficial to analyze sucking performance and bolus transition, as well as examine other components of swallowing physiology and pathophysiology to gather more information that could suggest other swallowing challenges.

Feeding is essential for growth, development, and nutritional intake. 14.0% of patients within this study required feeding assistance, partially by mouth and tube feeding. They may only be able to have a small amount of food orally while obtaining the rest of the necessary nutrients through their tube feeding. These patients may be fed only orally during therapy sessions as a trial or during transition stages. With the help of tube feeding, the clinician can focus on oral and pharyngeal swallowing with trial foods. This study found that a large group (45.0%) of patients rely on tube feeding. It is important to know that collaborative intervention should be based on an understanding of swallowing difficulty, nutritional intake abilities, and the developmental process of the patients.

A deep understanding of dysphagia in the pediatric population, a lack of knowledge on the long-term impacts of this disorder, and interventions on health and development are critical in pediatric dysphagia (Bhattacharyya, 2015; Dodrill & Gosa, 2015; Lefton-Greif, 2008). The prevalence of pediatric dysphagia is increasing. Clinical research and a comprehensive understanding of pediatric dysphagia and its related diseases are still limited. The current study examined demographic information like etiologies, types of management through tube feeding, and the presence of aspiration and dysphagia among pediatric patients with dysphagia. The findings revealed that pediatric dysphagia involves complicated etiologies because the individuals may be experiencing multiple comorbidities and challenges. In addition, these patients are heavily reliant on tube feeding for nutritional intake, so this population requires involvement from multidisciplinary healthcare teams.

A few limitations of the present study are important to consider. First, this study would benefit from incorporating a larger patient population to increase the reliability of conclusions and suggestions. Further, it would be advantageous to conduct a longitudinal rather than a retrospective cross-sectional study to examine and report patient progress and development. Lastly, analyzing different swallowing physiologies would help obtain more detailed information about the patient's swallowing challenges.

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