

Factors Affecting the Diagnosis of Gastroesophageal Reflux in Pediatric Patients Undergoing Upper Gastrointestinal Fluoroscopy

Üst Gastrointestinal Sistem Floroskopi Yapılan Pediatrik Hastalarda Gastroözofageal Reflü Tanısını Etkileyen Faktörler

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ABSTRACT

Objective: The aim of this study was to evaluate the results of upper gastrointestinal fluoroscopy (UGF) in infants and children and to investigate factors affecting results and the preliminary diagnoses of children referred to the radiology department with suspicion for gastroesophageal reflux (GER) and structural abnormalities of the upper gastrointestinal tract.

Material and Methods: Patients between the ages of 1 month and 18 years who underwent upper gastrointestinal fluoroscopy at the Radiology Department of Dr. Sami Ulus Research and Training Hospital between January 1, 2018 and December 31, 2018 were included in the study. The files of patients were reviewed retrospectively.

Results: Of the 76 patients who underwent upper gastrointestinal fluoroscopy, 46.1% were male and median age was 10 months. These diagnosis were distributed as the following; mild GER in 2.6% (n=2), moderate GER in 18.4% (n=14), and severe GER in 38.2% (n=29). Accompanying anatomic pathologies were: malrotation (5.3%), operated esophageal atresia and diaphragmatic hernia (2.6%), organoaxial volvulus and prepyloric web (1.3%). Reasons of requesting upper gastrointestinal fluoroscopy were persistent vomiting in 40.8% (n=31), intermittent vomiting in 10.5% (n=8), and coughing in 11.8% (n=9). The most common accompanying pathologies were prematurity and growth retardation in 6.6% (n=5). 74.4% the children <1 year of age received a diagnosis for GER, while this ratio was 39.4 in those ≥1 year of age. The incidence of findings conclusive for GER in patients younger than 1 year of age was found to be significantly higher (p=0.002). GER findings were present in 74.2% (n=23) of patients who had persistent vomiting, while they were present in 48.9% (n=22) of patients who underwent upper gastrointestinal fluoroscopy for other reasons. This difference was also statistically significant (p=0.027).

Conclusion: In cases where structural abnormalities is suspected, if the patient is younger than 1 year of age or has persistent vomiting, upper gastrointestinal fluoroscopy may indeed be useful to confirm the diagnosis. However, structural abnormalities were detected in very few of those who were referred to us for UGF investigation. From this point of view, it would be more appropriate for clinicians to recommend UGF in more suitable cases to prevent the overuse of UGF in pediatric patients.

Key Words: Fluoroscopy, Gastrointestinal System, Gastroesophageal Reflux

ÖZ

Amaç: Bu çalışmanın amacı bebeklerde ve çocuklarda üst gastrointestinal floroskopi (UGF) sonuçlarını değerlendirmek, sonuçları etkileyen faktörleri ve olası gastroözofageal reflü (GÖR) ve üst gastrointestinal sistemde olası yapısal anomallilerin tanısını araştırmaktır.

Gereç ve Yöntemler: Dr. Sami Ulus Kadın Doğum, Çocuk Sağlığı ve Hastalıkları Eğitim ve Araştırma Hastanesi Pediatrik Radyoloji Bölümü'nde 1 Ocak 2018 ile 31 Aralık 2018 tarihleri arasında üst gastrointestinal sistem floroskopisi uygulanan 1 ay ile 18 yaş arasındaki hastalar çalışmaya dahil edildi. Hastaların dosyaları retrospektif olarak incelendi.

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Bulgular: Üst gastrointestinal sistem floroskopisi yapılan 76 hastanın% 46.1'i erkek, ortanca yaşı 10 aydı. Bu hastalarda olası tanıları şu şekildeydi: % 2.6 (n=2) hafif GÖR, % 18.4(n=14) orta GÖR ve % 38.2(n=29) şiddetli GÖR tanısı konuldu. Eşlik eden anatomik patolojiler şunlardı: malrotasyon (% 5.3), opere ösofagus atrezisi ve diyafragma hernisi (% 2.6), organoaksiyel volvulus ve prelorik veb (% 1.3). Üst gastrointestinal floroskopi istem nedenleri% 40.8 (n=31) 'de dirençli kusma,% 10.5 (n=8) 'de aralıklı kusma ve % 11.8 (n=9) öksürüktü. En sık eşlik eden patolojiler % 6.6'da (n=5) prematürite ve büyüme geriliğindeydi. 1 yaşından küçüklerin% 74.4'üne GÖR tanısı konulurken, bu oran 1 yaş ve üstü çocuklarda % 39.4'dü. 1 yaşından küçük hastalarda GÖR görülme sıklığı anlamlı derecede yüksek bulundu (p=0.002). Sürekli kusma olan hastaların % 74.2'sinde (n=23) olası GÖR düşündürülen bulgular, diğer nedenlerle üst gastrointestinal floroskopi uygulanan hastaların % 48.9'unda (n=22) olası GÖR düşündürülen bulgular mevcuttu. Bu fark da istatistiksel olarak anlamlıydı (p=0.027).

Sonuç: Üst gastrointestinal yapısal anomalilerden şüphelenen durumlardaşüphelenilen durumlarda, hasta 1 yaşından küçükse veya sürekli kusma varsa, üst gastrointestinal sistem floroskopisi tanıyı doğrulamak için yararlı olabilir. Bununla birlikte, önerilen UGF'lerin çok azında anatomik bozukluk tespit edilebilmiştir. Bu bakış açısıyla, klinisyenlerin UGF'yi sadece önemli vakalarda önermeleri uygun olacaktır.

Anahtar Sözcükler: Floroskopi, Gastrointestinal Sistem, Gastroözofageal Reflü

INTRODUCTION

The retrograde passage of gastric content and fluid into the esophagus is defined as gastroesophageal reflux (GER). It is difficult to understand whether GER is physiological or pathological in infants, as it is reportedly present in up to 75% of infants. Therefore, especially in infants with strong suspicion, further investigations may be needed to make this distinction since GER may cause significant complications when it is pathological (gastroesophageal reflux disease, GERD) (1,2). Although incidence in the childhood is unclear, it is reported that 4% of pediatric hospital admissions may be related to GER (3,4). In adults, the frequency of GER ranges between 5-20% (3,5)

There is no specific symptom of GER and no gold standard method for diagnosis (6). It can present with many different clinical symptoms such as heartburn, chest pain, epigastric pain, vomiting, feeding refusal, sleeping, and eating problems (2). The long-term continuation of GERD without treatment leads to tissue differentiation, known as Barrett's esophagus, and can lead to cancer. Therefore, early diagnosis and appropriate treatment are crucial (7). For the definitive diagnosis in patients with these symptoms, upper gastrointestinal x-ray with barium (upper gastrointestinal fluoroscopy, UGF) can be used (6). UGF is a method used to examine the real-time image of the digestive system with contrast medium and it is frequently requested to identify structural abnormalities in the upper gastrointestinal tract (8). Additionally, although UGF is not used in the diagnosis of primary GER, it can be used in the diagnosis of secondary GER for the detection of any underlying anatomical problems (structural abnormalities) that lead to GER or its symptoms. It has come to our attention that clinicians often request UGF in cases which are suspicious for GER at an early age, even though the patients' symptoms may as well be associated with other diseases. This situation may cause overuse of UGF in pediatric patients who are often adversely affected by the procedure.

In children, UGF is often considered as a worrying and disruptive situation by both children and their parents. Therefore, it is

important to know when UGF is absolutely indicated in order to avoid the application of a method that rarely results in a definite diagnosis. As such, the aim of this study was to evaluate the results of UGF in infants and children who were referred to the radiology department for UGF investigation with a suspicion for GER or structural abnormalities of the upper gastrointestinal tract, and to identify factors affecting results and radiological findings that were indicative of GER.

MATERIAL AND METHOD

Ethics committee approval was received from the ethics committee of Dr. Sami Ulus Research and Training Hospital (2019/12). Patients aged between 1 month and 18 years who underwent UGF at the Radiology Department of Dr. Sami Ulus Research and Training Hospital between January 1, 2018 and December 31, 2018 (1 year) were included in the study. The files of the patients were reviewed retrospectively. Age, sex, UGF result, other pathologies, number of clinic visits, reason for requesting UGF, and the specialty of the doctor requesting the UGF, were recorded.

All statistical analyses were performed on SPSS v21 (SPSS Inc., Chicago, IL, USA). Pearson's chi-square test was used to compare categorical variables. A p-value of <0.05 was considered statistically significant.

RESULT

Of the 76 patients who underwent UGF, 46.1% were male and the median age was 10 months. With UGF investigations, 2.6% (n=2) of the subjects were conclusive for mild GER, 18.4% (n=14) had results conclusive for moderate GER, and 38.2% (n=29) were identified to be conclusive for severe GER (as preliminary diagnoses from radiological results). The accompanying anatomic pathologies were: 5.3% malrotation, 2.6% operated esophageal atresia and diaphragmatic hernia, 1.3% organoaxial volvulus and prepyloric web. The number of clinic admissions before the UGF was at least 1 and at

Table I: Summary of Patients' Characteristics.

Age	10 months (1 month-15 years)
Gender	
Male	35 (46.1)
Female	41 (53.9)
Gastroesophageal Reflux	
No	31 (40.8)
Mild	2 (2.6)
Moderate	14 (18.4)
Severe	29 (38.2)
Anatomical pathology	
Yes	9 (11.8)
No	67 (88.2)
Number of polyclinic admissions requested for UGF	
1	19 (25.0)
2	16 (21.1)
≥3	41 (53.9)
Reason for requesting UGF	
Persistent vomiting	31 (40.8)
Other	45 (59.2)
Branch of the requesting doctor	
Gastroenterologist	35 (45.1)
Chest disease specialist	17 (22.4)
Intensive care specialist	10 (13.2)
Other	24 (19.3)
Additional pathology	
Yes	22 (28.9)
No	54 (71.1)

Data are given as median (minimum - maximum) for continuous variables and frequency (percentage) for categorical variables. **UGF:** Upper Gastrointestinal Fluoroscopy

Table II: Gastroesophageal reflux incidence according to patients' characteristics.

	Gastroesophageal Reflux		p
	Yes (n=55)	No (n=31)	
Gender			
Male	22 (62.9)	13 (37.1)	0.550
Female	23 (56.1)	18 (43.9)	
Age			
<1 year	32 (74.4)	11 (25.6)	0.002
≥1 year	13 (39.4)	20 (60.6)	
Anatomical pathology			
Yes	40 (59.7)	27 (40.3)	0.812
No	5 (55.6)	4 (44.4)	
Number of polyclinic admissions requested for UGF			
1-2	21 (60.0)	14 (40.0)	0.897
≥3	24 (58.5)	17 (41.5)	
Reason for requesting UGF			
Persistent vomiting	23 (74.2)	8 (25.8)	0.027
Other	22 (48.9)	23 (51.1)	
Requesting doctor			
Gastroenterologist	20 (62.5)	12 (37.5)	0.619
Other	25 (56.8)	19 (43.2)	
Additional pathology			
Yes	21 (60.0)	14 (40.0)	0.897
No	24 (58.5)	17 (41.5)	

Data are given as frequency (percentage). **UGF:** Upper Gastrointestinal Fluoroscopy

most 14, with a median of 3 admission. When the reasons for requesting UGF were examined, 40.8% (n=31) of the children had persistent vomiting, 10.5% (n=8) had intermittent vomiting, 11.8% (n=9) had coughing, 6.6% (n=5) had mild cyanosis while feeding, and 5.3% had esophageal operation and resistant abdominal pain. The most common accompanying pathologies were prematurity and growth retardation in 6.6% (n=5), operated tracheoesophageal fistula in 3.9% (n=3), congenital heart disease, pectus excavatum and hypotonic infant in 2.6% (Table I).

When the frequency of radiological results conclusive for GER were examined according to age groups, 74.4% of those younger than 1 year of age were found to have results conclusive for GER, whereas this percentage was 39.4% among those aged 1 year or older. The incidence of GER-related radiological findings in patients younger than 1 year of age was significantly higher ($p=0.002$). Regarding relationships with clinical findings/symptoms radiological results conclusive for GER were identified in 74.2% (n=23) of patients who had persistent vomiting, and in 48.9% (n=22) of patients who underwent UGF for other reasons. The incidence of UGF results conclusive for GER among those who underwent UGF due to persistent vomiting was significantly higher than that of patients who underwent UGF for other reasons ($p=0.027$, Table II).

DISCUSSION

Gastroesophageal reflux, which is a common condition in the first years of life, should be diagnosed and treated appropriately, especially when pathological. In this study, we aimed to investigate the characteristics of patients who underwent UGF and some variables affecting the preliminary diagnosis of GER because of UGF. These factors are crucial for the determination of necessary UGF procedures in children who are often negatively affected by the procedure. Among patients who underwent UGF for different symptomatic indications, children younger than 1 year of age and those with persistent vomiting received a preliminary diagnosis of GER (as determined by UGF results) at a significantly higher frequency.

It is critical to be aware that GER is frequently seen in healthy infants as a physiological condition and almost all of these infants recover until the age of 1 years without any treatment (9,10). The incidence of physiological GER has been shown to be increasing due to various facilitating factors encountered in the first year of life. These factors include limited stomach capacity, feeding with fluids, relatively low time spent in the vertical position, and conditions that increase gastric pressure such as crying, indigestion, and overeating (11,12). However, in this age group, it is especially important to distinguish infants with physiological GER (sometimes referred to as "happy spitters") from those that have GERD. If the diagnosis

is physiological GER, no medical treatment may be necessary (13). In our study, the incidence of UGF findings conclusive for GER were significantly higher in patients younger than 1 year of age. The fact that GER frequency shows a plateau during the first year of life and decreases to a normal level after 1 year of age (13), was supported by our study. On the other hand, it was also apparent from our results that close evaluation of patients is essential for the presence of symptoms supporting the diagnosis of GERD; considering the very low frequency of structural abnormalities determined in our study group, it is feasible to advise clinicians that they should refrain from referring pediatric patients for UGF investigation when there is little evidence to suggest structural abnormalities that may cause GER (therefore, leading to a clinical diagnosis of GERD). Furthermore, it is also known that the diagnostic accuracy of UGF before 1 year of age often varies. Some studies emphasize the importance of UGF in diagnosis before age 1, while other report that UGF is insufficient in the first year of life (8,14,15).

Regardless of the primary disease responsible for the pathology, GERD usually presents with a sensation of food or liquid coming up into the mouth (regurgitation) and vomiting (16). Aspiration of the gastric fluid into the airway can cause airway obstruction (difficulty breathing, coughing). GER, and its pathological form, GERD, are associated with various findings, such as eating and drinking disorders, respiratory symptoms, heartburn, or nonspecific findings in the following periods (17,18). In our study, UGF findings conclusive for GER were significantly more frequent in patients with persistent vomiting; however, as mentioned before, structural abnormalities that cause pathological GER (GERD) were very few in our group of patients. UGF is generally recommended in cases where the anatomical cause of symptoms such as dysphagia and vomiting is investigated (14). UGF is not recommended for routine use in the diagnosis or severity of GERD, especially in the absence of symptoms (19). Consistent with these studies, GER was diagnosed more frequently in patients who underwent UGF for persistent vomiting in our study. In a study that supports our results, Dent et al. reviewed 10 studies examining the role of UGF in the diagnosis of GERD, and reported that GERD can be diagnosed in 1 out of every 3 symptomatic cases with UGF results (20). This result also supports our suggestion that clinicians should be wary of the consequences of requesting UGF in patients that do not have significant clinical evidence for GERD. There are also studies reporting that the sensitivity and specificity of UGF are low in diagnosing GERD, and that the UGF results conclusive for GER do not have a significant relationship with GERD diagnosis, symptoms or severity (21-24). In addition, it was noted in these studies that the radiation exposure due to UGF should also be an important concern for pediatric patients.

The results of this study show that the frequency of GERD diagnosis is associated with various parameters that can be

objectively determined from the clinical evaluation. Thus, it is apparent that performing meticulous clinical examination and obtaining detailed history before ordering UGF is critical in patients with GER. These examinations can prevent needless UGF procedures in children, preventing them from being subject to a painful procedure and radiation. It is also noteworthy that the specialty of the UGF-ordering physician had no effect on the frequency of GERD diagnosis, which indicates that UGF should only be ordered after detailed physical examinations.

There are some limitations to be acknowledged. Since the results of patients undergoing UGF at a single center were evaluated retrospectively, the generalizability of the study is limited. Conditions affecting the incidence of GERD, such as obesity, neurological diseases, family history, certain syndromes, and some other diseases (25,26) were not evaluated. Therefore, the incidence of these conditions in our group of patients may have affected the interpretation of results. However, we included all pediatric patients who had been referred to our radiology clinic for UGF investigation for the duration of a whole year, which would have reduced the risk of such influences.

CONCLUSION

Among patients who underwent UGF with various symptoms, children younger than 1 year of age and those with persistent vomiting were diagnosed with GER at a higher frequency. The gender of the patient, other accompanying pathologies, the specialty of the requesting physician, and the number of previous visits did not affect the diagnosis of GERD. In cases with GER, especially if the patient is younger than 1 year of age or has persistent vomiting, UGF may be useful to confirm the diagnosis.

We would also like to note that we did not exclude any patients with regard to underlying diseases and clinical diagnoses, because our aim was to determine the characteristics of pediatric patients that were referred to us for the purpose of UGF investigation due to a suspicion for GER or structural abnormalities of the upper gastrointestinal tract. Although UGF is generally considered to be beneficial in diagnosing GER (especially in early ages), it is evident from our results that structural abnormalities can be detected in very few of the tests. From this point of view, it would be more appropriate for clinicians to recommend UGF in more suitable cases in order prevent overuse of UGF in pediatric patients, especially considering the procedure-related difficulties.

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