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A very rare cause of acute abdomen in children: Peptic or duodenal ulcer perforations

Peptic or duodenal ulcer in children

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Abstract
Aim: This study aimed to evaluate the general characteristics and treatment methods of gastric or duodenal ulcer perforations in pediatric patients presenting to the emergency department.
Material and Methods: A total of 11 patients under the age of 18 who applied to the emergency department with a preliminary diagnosis of acute abdomen between June 2013 and June 2023, and who were detected to have perforation due to gastric or duodenal ulcer were included in the study. Data about the patients were obtained by retrospectively scanning the hospital automation system records.
Results: The median age of the patients included in the study was 16 years (range: 14-17), and nine (81.8%) were male. At the time of admission to the hospital, ten (90.9%) of the patients had abdominal pain, four (36.4%) had vomiting, and one (9.1%) had confusion. All patients underwent primary repair via therapeutic laparotomy. In eight of the cases (72.7%), the ulcer was localized in the stomach, and in the other three cases, the lesion was in the first part of the duodenum.
Discussion: The findings from our study show that the majority of childhood ulcer perforation cases are seen in boys and at the end of childhood, that they are mostly due to gastric ulcers. Peptic ulcer perforation is a very rare emergency situation that requires attention in pediatric patients who present to the emergency department with acute abdominal symptoms.

Keywords
Child, Ulcer Perforation, Subdiaphragmatic Free Air

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Introduction

Peptic ulcer is a disorder characterized by the disruption of the integrity of the stomach and/or duodenum mucosal layer [1-2]. Factors such as Helicobacter pylori infection, frequent non-steroidal anti-inflammatory use and frequent consumption of certain foods or an increase in stomach acid due to situations such as stress are the main factors in the development of peptic ulcer. As a result of continued exposure to these factors, perforation may develop in the ulcer lesion [1-3].

Gastric or duodenal perforations are a surgical emergency and early diagnosis and treatment are very important. Peptic or duodenal perforations are known to be the cause of acute abdomen in children, especially in the adolescent age group, but they are very rare in children [1-3-5]. Patients usually complain of abdominal pain, but rarely may be accompanied by nausea and vomiting. Since this condition may cause diffuse peritonitis as a result of the leakage of digestive system contents into the abdominal cavity and eventually lead to life-threatening shock, treatment of perforations due to gastroduodenal ulcers requires urgent surgery [5-8].

This study aimed to retrospectively evaluate the general characteristics and treatment methods of gastric or duodenal ulcer perforations in pediatric patients presenting to the emergency department.

Material and Methods

In the ten-year period between June 2013 and June 2023, a total of 11 patients under the age of 18 who applied to the emergency department with a preliminary diagnosis of acute abdomen, and who were detected to have perforation due to gastric or duodenal ulcer were included in the study. Demographic information and clinical, laboratory and radiology findings of the patients were obtained by retrospectively scanning the hospital automation system records.

Patients under the age of 18 who were confirmed to have perforation due to spontaneous peptic or duodenal ulcer were accepted into the study. Patients who were 18 years of age or older or had gastric or duodenal perforation due to trauma or other reasons were not included.

Statistical analysis

In the study, the median ulcer diameter value was calculated based on the measurements of the widest part of the ulcer lesion. All statistical analyzes in the study were done using SPSS 25.0 software (IBM SPSS, Chicago, IL, USA). Descriptive data are given as numbers and percentages. The relationship between continuous variables was tested using Spearman's correlation analysis. The results were evaluated within the 95% confidence interval, and $p<0.05$ values were considered significant.

Ethical Approval

This study was approved by the Ethics Committee of Samsun Education and Research Ethical (Date: 2023-08-09, No: SÜAKAEK-2023/14/12).

Results

The median age of the patients included in the study was 16 years (range: 14-17), and nine (81.8%) were male. At the time of admission to the hospital, 10 (90.9%) of the patients had abdominal pain, four (36.4%) had vomiting, and one (9.1%) had confusion. The median time to onset of symptoms before admission was two days (range: 1-5 days). Free air under the diaphragm was detected in all patients on standing direct abdominal radiograph or computed tomography (Table 1) (Figure 1A and B). All patients underwent primary repair via laparotomy (Figure 2). In eight of the cases (72.7%), the ulcer was localized in the stomach, and in the other three cases, the lesion was in the first part of the duodenum. Median ulcer diameter was 0.6 (0.5-1.0) cm. The median hospital stay was 7 (4-10) days (Table 1).

The median follow-up period of the patients was three (0-24) months. A complication such as wound dehiscence and incisional hernia developed in only one case. Risk factors such as drinking carbonated or acidic beverages and stress were detected in two of the patients, and only stress was detected in one of the patients (Table 2).

In the correlation analysis, no significant correlation was found between ulcer diameter and patient age, onset of symptoms and hospitalization duration ($p>0.05$ for each). A significant

Table 1. Symptoms, findings and some characteristics of the patients

Pt. no	Gender /Age (years)	Symptoms	Fever	Bleeding *	Beginning of the symptoms (days)	Free air in radiology **	Ulcer diameter (cm)	Localization	Laparotomy - primary repair	Hosp. day
1	M/15	Abdominal pain, vomiting	-	-	2	+	0.6x0.5	Stomach	+	6
2	M/17	Abdominal pain	-	-	1	+	0.5x0.5	Stomach	+	4
3	M/16	Confusion	-	-	5	+	0.5x0.5	Stomach	+	10
4	M/17	Abdominal pain	-	-	1	+	0.5x0.6	Duodenum	+	6
5	F/14	Abdominal pain	-	-	1	+	0.7x0.8	Stomach	+	7
6	M/12	Abdominal pain	-	-	2	+	0.5x0.7	Stomach	+	8
7	F/16	Abdominal pain, vomiting	-	-	1	+	1.0x0.5	Stomach	+	6
8	M/14	Abdominal pain	-	-	2	+	0.5x0.4	Duodenum	+	8
9	M/17	Abdominal pain vomiting	-	-	1	+	0.5x0.4	Duodenum	+	7
10	M/16	Abdominal pain	-	-	1	+	0.8x0.9	Stomach	+	7
11	M/15	Abdominal pain vomiting	-	-	2	+	1.0x0.6	Stomach	+	8

**Active bleeding, hematochezia and/or melena. *Subdiaphragmatic free air showed by X-ray and/or computerized tomography. M: Male, F: Female, Pt.: Patient, Hosp.: Hospital

Table 2. Some post-op features of the patients

Patient no	Post-op treatment duration(months)	Post-op PPI treatment	Post-op follow up (months)*	Post-op complication	Additional risk factor
1	12	+	24	No	None
2	2	+	2	No	None
3	6	+	24	Opening in the wound, insicional hernia	Stress
4	2	+	0	Unknown	None
5	1	+	1	No	None
6	2	+	3	No	None
7	1	+	0	Unknown	None
8	2	+	3	No	None
9	2	+	2	No	None
10	2	+	3	No	Stress, fizzy drinks
11	2	+	1	No	Stress, fizzy drinks

*In all cases, the patient left the follow-up. PPI: Proton pump inhibitor

Table 3. Findings of some reports and the present study

	Present study	Shen et al. (12)	Yan et al. (8)	Reusens et al. (14)	Emre et al. (10)	Ueda et al. (13)	Yildiz et al. (9)	Hua et al. (11)	Wong et al. (15)	Edwards et al. (16)
n	11	45	20	5	10	32	9	52	17	16
Year	2023	2023	2019	2017	2016	2016	2014	2007	2006	2005
Demographic information										
Male (%)	81.8	77.8	85	60	60	68.8	88.9	76.9	88.2	
Age (years)*	16 (14-17)	13 (0.3-15.4)	6.6 (0.3-14)	11 (3-17)	6.2 (0.1-16)	1.8	13.2 (6-17)	14.2 (2-18)	14 (11-17)	7.6 (0.1-23)
Symptoms and findings										
Abdominal pain (%)	90.9	100	50		60	100		100		
Vomiting (%)	36.4	75.6	65		10	90.6		42.3		
Hematochezia (%)	0		15		10			7.7		
Melena (%)	0		10							
Fever (%)	0	73.3				34.4		11.5		
Confusion/lethargy (%)	9.1					75				
Duration of abdominal pain (hours)*	48 (24-120)		72 (5-120)		77	96 (24-168)	5 (2-5)			
Radiology										
Subdiaphragmatic air in radiology (%)	100	60	80		70		33.3	82.7		
History										
Ulcer diameter (cm)*	0.6 (0.5-1.0)	0.5 (0.2-1.0)	0.6 (0.3-3.0)					0.9		
Gastric perforation (%)	72.7	0	45		0	9.4	100	21.2		
Hospitalization and operation										
Laparotomy surgery (%)	100		35					1.9		
Hospital day (days)*	7 (4-10)	14.4	8 (7-16)	12	11.3				7	
Follow up										
Post-op complication (%)	11.1	2.2	15	20	10	6.3		17.3		18.7
Follow up (months)*	3 (0-24)	8 (6-24)			90		61 (3-94)			

*[mean or median (range)]. Ulcer diameter is given in the largest diameter of the lesion.

and strong correlation was detected only between the onset of symptoms and the duration of hospitalization (p = 0.007; r = 0.759).

Discussion

Peptic ulcer is an uncommon condition in children. Ulcer-related perforation cases in children are a much rarer and life-threatening clinical emergency [1-3]. In this study, the characteristics of the cases over a ten-year period were examined, some risk factors, the approach to these cases, the course of the cases and their results were revealed.

It has been reported that 60-90% of ulcer-related gastric or duodenal perforation cases in children are seen in men [8-15]. In our study, 81.8% of the cases were found to be male. These findings indicate that male gender may increase the risk of perforation in ulcer cases in children. In studies, the median

ages reported in cases of ulcer-related gastric or duodenal perforation in children range between 6.2 and 14.2 years. It has been reported that most of the cases are between the ages of 14-16, and the number of cases under the age of 6 is very rare (Table 3) [8-12-14-16], compared to early childhood. Similarly, in our study, the median age was determined as 16 years old and all cases were found to be between the ages of 14-17. These findings indicate that the risk of ulcer perforation increases significantly in late childhood.

It has been reported that the most common symptom in cases of ulcer-related perforation in children is abdominal pain, and abdominal pain is observed in almost all cases [8-16]. Yildiz et al. [9] reported that the median duration of abdominal pain in their cases was five hours, but other studies reported that the median duration varied between 72-96 hours [8, 10, 13]. Yildiz et al. [9] in 88.9% of the cases, Hua et al. [11] reported that 55.7% had a history of chronic abdominal pain. In our study, abdominal pain was detected in 90.9% of the patients and the median onset time of symptoms was determined as two days. These findings show that abdominal pain is a typical finding in cases of ulcer perforation in children and that patients are often brought to the hospital days after symptom onset.

Studies have reported that vomiting occurs in 40-90% of cases of ulcer-related perforation in children [8-11-13]. In our study, vomiting was observed in 26.4% of the patients. These findings indicate that vomiting accompanied by abdominal pain may be a warning sign of ulcer perforation in children. It has been reported that hematemesis is observed in 7.7-15% of cases of ulcer perforation in children.8,10,11. Yan et al. [8] reported that melena was observed in two of 20 cases (20%). Melena has not been reported in many studies. [9-16]. In our study, hematemesis and melena, which are signs of bleeding, were not observed in any of the cases. These findings show that bleeding symptoms are seen at a low rate in cases of ulcer perforation in children, and the absence of hematemesis and/or melena cannot exclude the diagnosis of perforation.

Studies have reported that the frequency of fever in cases of ulcer-related gastric or duodenal perforation in children varies widely [11-13]. The incidence of fever was determined by Hua et al. [11] reported it as 11.5%, Ueda et al. [13] reported it as 34.4%, and Shen et al. [12] found it to be 73.3%. In our study, fever was not detected in any case. These findings indicate that fever is not a leading finding in cases of ulcer perforation in children. Ueda et al. [13] reported that lethargy or confusion was observed in 75% of ulcer perforation cases in children. In addition, confusion or lethargy was not reported in other studies [9-12-14-16]. In our study, confusion was observed in one case (9.1%). These findings show that disorders of consciousness such as confusion or lethargy can be seen, although rarely, in cases of ulcer perforation in children.

It has been reported that there is free air under the diaphragm on radiological imaging in a significant portion of ulcer perforation cases in children. This rate was found to be between 60-83% in studies (Table 4) [8, 10-12]. In our study, air was detected under the diaphragm in all cases. These findings show that the presence of air under the diaphragm is a typical finding in cases of ulcer perforation in children.

In the studies conducted, the median diameter of the ulcer lesion in cases of ulcer-related perforation in children was determined as 0.5 cm by Shen et al. [12], as 0.6 cm by Yan et al. [8], and as 0.9 cm by Hua et al. [11], and they reported that the diameter could reach up to 3 cm in these cases. In our study, the median ulcer diameter was found to be 0.6 (0.5-1.0) cm. These findings show that the diameter of the lesion varies between 0.5-1 cm in the majority of cases of ulcer perforation in children. In the correlation analyzes performed in our study, no significant correlation was found between ulcer diameter and age, onset of symptoms and duration of hospitalization. These findings indicate that whether the diameter of the ulcer lesion is large or not does not directly affect the duration of hospitalization, is not directly related to age, and does not directly affect whether there is a delay in admission to the hospital, probably because it does not directly affect the severity of symptoms.

In cases of ulcer perforation in children, the distribution of gastric or duodenal ulcers is very variable. While some studies did not report any ulcers in the gastric region as localization, [10-12] Yildiz et al. [9] reported that all cases were gastrically localized. In some studies, the perforation rate due to gastric ulcer has been reported to be between 9-45% [8, 11, 13]. In our study, the gastric ulcer rate was found to be 72.7%. These findings show that gastric ulcer perforation is much more common in children than duodenal ulcer perforation.

Hua et al. [11] reported that laparoscopic surgery was performed in only 1.9% of ulcer perforation cases in children, while Yan et al. [8] reported that laparoscopic surgery was performed in 35% of the cases. Reusens et al. [14] reported that the median operation time in these cases was 70 (55-115) minutes. In our study, primary repair was performed by laparotomy in all cases.

Studies have reported that the median hospital stay in cases of ulcer perforation in children varies between 7 and 15 days (Table 4) [8-10-12-14-15]. In our study, the median hospital stay was 7 (4-10) days. Our study also found a significant and strong correlation between the onset of symptoms and the duration of hospitalization. This finding indicates that prolonged hospital admission time causes the clinical condition to progress and the recovery time after the operation to be prolonged. The median follow-up period in cases of ulcer perforation in children varies greatly depending on the case (Table 4) [9-10-12]. This period was reported as eight months by Shen et al. [12], as 61 months by Yildiz et al. [9], and as 90 months by Emre et al. [10]. In our study, the median follow-up period was three (0-24) months. This finding shows that the patients in our study discontinued follow-up too early. This may be due to sociocultural differences depending on the place where the study was conducted. Studies have reported various complication rates ranging from 2.2% to 20% in cases of ulcer perforation in children, ranging from wound infection to death (Table 4) [8-10-14, 16]. In our study, wound dehiscence and incisional hernia were observed in only one case. These findings show that the rate of complications in ulcer perforation cases in children is not high, but follow-up is critical. This finding also indicates that laparotomy repair, hospital stay and post-operative treatment are mostly effective in these cases.

Limitation

There are some limitations in our study. Although our study covered a ten-year period, the limited number of patients

prevented comparisons between gastric and duodenal cases. In addition, the fact that the follow-up of the cases was stopped too early resulted in the inability to obtain information on whether complications developed in the long term.

Conclusion

The findings obtained from our study show that the majority of ulcer perforation cases in childhood are seen in boys and at the end of childhood, that they are mostly due to gastric ulcers, that abdominal pain and vomiting are important symptoms, that free air under the diaphragm is a typical finding, that the ulcer diameter is mostly 0.5-1. cm, patients are generally discharged within a week, and primary repair with laparotomy and subsequent treatment with PPI is highly successful.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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