American Journal of Medicine and Medical Sciences 2020, 10(11): 914-918
DOI: 10.5923/j.ajmms.20201011.18

Endoscopic Hemostasis at Gastroduodenal Bleeding of Ulcer Etiology in Children

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Abstract The aim of the research was to study the endoscopic hemostasis results at acute bleedings from gastro-duodenal ulcers in children. The study is based on the analysis of treatment results of 132 children with bleedings from acute and chronic gastric and duodenal ulcers, who were hospitalized to the Department of Emergency Pediatric Surgery of the Republican Research Center of Emergency Medicine from 2005 to 2019. There were 86 boys (65.1%) and 46 (34.9%) girls aged from 9 months to 18 years. Chronic forms of the disease were revealed in 92 (69.6%) cases, the remaining 40 (30.4%) cases were acute forms. Gastric ulcers were found in 9 (6.8%) patients and 6 (4.5%) of them had acute forms of the disease. In 123 (93.1%) patients ulcers were located in the duodenum: acute forms of ulcers were observed in 34 (25.7%) cases and in 89 (67.4%) - chronic ones. Patients with gastrointestinal bleeding were evaluated for their clinical condition upon admission to the clinic and the severity of blood loss was determined. The evaluation of the general condition severity in patients with gastroduodenal ulcerative bleeding was carried out according to the classification of A.I. Gorbashko (1986). Experience shows that the diagnostics should be complex in cases of gastric and duodenal ulcers complicated by bleeding. In this case, the endoscopic research method is of particular importance. Depending on the localization of the bleeding source and its intensity, a differentiated approach should be applied to the choice of endoscopic hemostasis method. The use of the combined method of chipping in combination with argon-plasma coagulation in most cases allows achieving stable hemostasis with ongoing intense bleeding.

Keywords Duodenal ulcer, Endoscopic hemostasis, Gastroduodenal ulcer bleeding, Peptic ulcer disease

1. Introduction

Gastroduodenal ulcer bleeding (GDUB) is one of the most difficult clinical problems in abdominal surgery associated with a high mortality rate and requiring urgent hospitalization [1-3].

Despite the progress of medical science and clinical practice and more than a century history of discussion of the issue, the problem of therapeutic tactics in patients with GDUB remains one of the most actual issues of modern emergency surgery [4-5].

The decrease in the frequency of surgical operations for gastroduodenal ulcer bleeding is currently, first of all, associated with the use of such methods as antacid, anti-Helicobacter ones. But, in spite of this, the frequency of surgeries is still about 33% of all interventions on the stomach and duodenum, and 87.2% of them are emergency and performed in high-risk patients [6-7].

Surgery for GDUB often remains the last and most effective treatment [8-10]. Over the past decades, GDUB surgery has undergone impressive changes and today has been limited mainly by interventions due to severe complications [11-12]. As a result, further searches towards the development of organ-saving methods of surgical intervention of ulcerative gastroduodenal bleedings are justified.

Organ-saving surgeries with vagotomy which are of primary importance in the treatment of gastroduodenal bleeding should be considered the modern stage of the surgical treatment of gastroduodenal bleedings [13-14].

There is a tendency for many surgeons to refuse radical interventions in favor of organ-saving surgeries. New technologies allow to use a low-traumatic version of these operations. The methodology and technique of organ-saving surgeries continues to be improved. Thus, the widespread introduction of modern endoscopic technology into clinical practice which allows stopping bleeding, as well as the use of minimally invasive interventions led to a change in the tactics of treating patients with ulcerative gastroduodenal bleeding and to differentiated determination of indications for surgery [15-16].

Currently, endoscopy has a number of hemostasis methods, different in their effectiveness, reliability, safety and cost. Endoscopic hemostasis (EH) is sometimes the only method of local action on the source of bleeding in case of intolerance to surgery. However, despite the availability of many modern methods of endoscopic hemostasis, they are

Received: Oct. 17, 2020; Accepted: Nov. 18, 2020; Published: Nov. 28, 2020
Published online at http://journal.sapub.org/ajmms

not always effective and often lead to recurrent bleeding. It is known that EH is effective only in some patients, and the period of its stability is calculated by hours [17-18].

2. The Aim

The aim of the research was to study the endoscopic hemostasis results at acute bleedings from gastro-duodenal ulcers in children.

3. Material and Methods

The study is based on the analysis of treatment results of 132 children with bleedings from acute and chronic gastric and duodenal ulcers who were hospitalized to the Department of Emergency Pediatric Surgery of the Republican Research Center of Emergency Medicine (RRCEM) from 2005 to 2019. There were 86 boys (65.1%) and 46 (34.9%) girls aged from 9 months to 18 years.

All children were divided into 2 groups on the basis of clinical-anamnestic and endoscopic data. The first group included 40 (30.4%) children with acute ulcers complicated by bleeding. The second group consisted of 92 (69.6%) children with chronic forms of the disease complicated by bleeding. The average age was 8.6 ± 1.3 years in the first group and 8.8 ± 1.4 years in the main group. Gastric ulcers were found in 9 (6.8%) patients and 6 (4.5%) of them had acute forms of the disease. In 123 (93.1%) patients ulcers were located in the duodenum: acute forms of ulcers were observed in 34 (25.7%) cases and in 89 (67.4%) - chronic ones.

The frequency of bleeding from acute ulcers was most common in young children. In children with a chronic course it increased with age, while boys prevailed with a peak detection rate at the age of 14-18 years. Girls significantly less suffered from this pathology: in contrast to the first group, the peak detection rate of peptic ulcer disease in girls of the second group was in the age rate from 11 to 14 years. The data obtained reflect the general patterns of the prevalence of duodenal ulcer depending on age and gender (Tab. 1).

Studying the anamnestic data, it was revealed that ulcers were symptomatic in 40 (30.4%) children. In 8 (6.0%) children vegetative-vascular dystonia was the cause of the ulcer. In 13 (9.8%) cases, the ulcer developed as a result of various allergic diseases (bronchial asthma, allergic rhinitis, atopic dermatitis, food allergy, chronic recurrent urticaria). 9 (6.8%) children suffered from chronic renal failure, 5 (3.7%) patients suffered from liver cirrhosis. Chronic pulmonary pathologies were detected in 3 (2.2%) children and in 2 (1.5%) cases an acute ulcer complicated by bleeding developed after a massive burn. Children in this group often took medications (antibiotics, non-steroidal anti-inflammatory drugs (NSAIDs), hormones). In 86% of patients with chronic forms of the disease, there was a hereditary predisposition and the presence of peptic ulcer disease in parents or close relatives was noted. There was a history of ulcer for more than one year in 62 (46.9%) cases due to which inpatient treatment was repeatedly carried out. And in the remaining 30 (22.7%) cases, children and parents denied a history of ulcer and went to the clinic for the first time.

When analyzing the ways of admission of sick children with a clinic of gastrointestinal bleeding to the RRCEM, it turned out that most often children were got by the ambulance (Tab. 2).

As it can be seen from Table 2, in 106 (80.3%) cases patients were delivered within the first 6 hours from the onset of the disease. In the remaining 26 (19.6%) cases children were delivered within 6-12 hours from the onset of signs of bleeding.

The severity of the clinical symptoms of peptic ulcer disease in children depended on the patient's age, ulcer localization and clinical stage of the disease, individual and gender characteristics of the child (Tab. 3).

Table 1. Distribution of patients by sex, age and form of the disease

Ulcer course	Up to 7 years		7-14 years		14-18 years		Total	
	boys	girl	boys	girls	boys	girls		
Acute course	12 (9.0%)	8 (6.0%)	6 (4.5%)	5 (3.7%)	4 (3.0%)	5 (3.7%)	40	30.4%
Chronic course	10 (7.5%)	4 (3.0%)	22 (16.6%)	6 (4.5%)	32 (24.2%)	18 (13.6%)	92	69.6%
Total	22 (16.6%)	12 (9.0%)	28 (21.2%)	11 (8.3%)	36 (27.2%)	23 (17.4%)	132	100%

Table 2. Distribution of patients by the ways and timing of delivery to the RRCEM

Ways/timing of delivery	**Up to 6 hours**	**%**	**6-12 hours**	**%**	**Total**	**%**
By ambulance	62	46.9	10	7.5	72	26.6
By referral from other departments of medical institutions	32	24.2	8	6.0	40	9.7%
By parents	12	9.0	8	6.0	20	
Total	106	80.3	26	19.6	132	100

Table 3. Revealed complaints in children with gastroduodenal bleeding of ulcerative etiology

Patients' complaints	Quantity (n-132)			
Vomiting by "coffee grounds"	Chronic ulcer (n-92)		Acute ulcer (n-40)	
	86	65.1%	30	22.7%
Vomiting by scarlet blood	6	4.5%	10	7.5%
Stomach aches	62	46.9%	30	22.7%
Nausea	88	66.6%	40	30.3%
Black stool	33	25.0%	22	16.6%
Belching	22	16.6%	-	-
Pyrosis	56	42.4%	-	-
Decreased appetite	86	65.1%	32	24.2%
Bloating	8	6.0%	-	-
Weakness	88	66.6%	36	27.2%
Irritability, moodiness	30	22.7%	21	15.9%
Headaches	22	16.6%	30	22.7%
Dizziness	86	65.1%	32	24.2%

The main clinical symptom in both groups was vomiting. Vomiting of unchanged blood of scarlet or dark cherry color is observed at massive bleeding with relatively rapid blood loss. In such a situation, hydrochloric acid does not have time to fully react with a large amount of hemoglobin in the blood. Vomiting by unchanged scarlet blood is an important sign of the rate of blood loss, which is more characteristic for gastric bleeding. Much more often, at bleeding from duodenal ulcers, there is vomiting with a blood derivative (saline hemotin), which looks like "coffee grounds". In our observation, in children with a chronic course of the disease, vomiting like "coffee grounds" was observed in 86 (65.1%) children, with scarlet blood - in 6 (4.5%) children. In children with an acute course of the disease vomiting like "coffee grounds" was observed in 30 (22.7%) cases, with scarlet blood - in 10 (7.5%) patients.

The second cardinal symptom of bleeding from the gastroduodenal zone is melena. Very often, the term melena is understood only as black stool. Formed black stools occur at light bleeding. Actually, melena is a liquid tarry fetid stool and it appears at moderate and significant blood loss. We observed tarry stools in 32 (24.4%) patients admitted in serious condition with a blood hemoglobin index below 60 g / l. In the remaining 23 (17.4%) cases there was black formed stool in patients with moderate severity.

The next symptom was pain syndrome. In children with a chronic form of the disease pains were of varying intensity, localization and duration. In children with symptomatic ulcers, the onset of pain was sudden, acute and localization was in the epigastric region. After signs of bleeding, the pain was stopped. Children with a chronic course of disease are characterized by dyspeptic syndrome (belching with air, food, nausea, heartburn, constipation). Children with an acute course complained more of astheno-vegetative disorders (weakness, sweating and dizziness).

Bleeding was the first manifestation of a gastroduodenal ulcer in 60 (45.4%) patients, a gastroduodenal ulcer within 1 year prior to present bleeding was established in 18 (13.6%) patients, the existence of an ulcer up to 3 years - in 10 (7.5%) patients. A history of ulcers over 3 years occurred in 4 (3.0%) patients. There was no ulcerative history in patients with the acute form of the disease. Ulcerative bleeding in the past was indicated by 8 (6.0%) patients with a long history of ulcers.

According to the localization of the source of ulcerative gastroduodenal hemorrhage, the children were distributed as follows. Bleeding stomach ulcers were found in 9 (6.8%) children: 3(2.2%) children with a chronic form and 6 (4.5%) cases with an acute form. All gastric ulcers were located along the lesser curvature. In the duodenum bleeding ulcers were located in the bulb in 90% of cases and only in 10% of observations they were situated in the postbulbar area.

Ulcers were located along the posterior wall of the duodenum in 70% of patients, along the anterior wall in 20%, and in 10% of cases patients had specular ("kissing") ulcers.

The main objectives of the examination of patients with ulcerative bleeding were: clinical assessment of the patient's condition, identification of bleeding source, determination of blood loss severity and hemostasis stability. Patients with gastrointestinal bleeding at admission to the clinic were evaluated for their clinical condition, and the severity of blood loss was determined. We assessed the severity of the general condition in patients with gastroduodenal ulcer bleeding according to the classification of A.I. Gorbashko (1986) (Tab. 4).

Table 4. Distribution of patients according to the severity of bleeding

The patient's condition at admission	Satisfactory		Moderate severity		Severe condition		Total	
	n	%	n	%	n	%	n	%
Total	60	45.4	40	30.0	32	24.2	132	100

As it can be seen from Table 4, in 60 (45.4%) cases the children were admitted in a satisfactory condition. These were mainly children with a chronic course of the disease, while the globular volume deficit was up to 20%, since children with acute ulcers had concomitant pathologies; they were mainly admitted in a severe and moderately severe condition. In children with moderate severity condition the deficit ranged from 20 to 30%, in severe condition the deficit of globular volume was more than 30%. Children were admitted to the department of pediatric surgery or surgical intensive care unit according to indications after preparation for emergency endoscopic examination which is a mandatory element of the diagnostic algorithm for gastroduodenal bleeding. Endoscopic examination for gastroduodenal bleeding should answer several fundamental questions: what is the source of bleeding, where the source of

bleeding is, what is the intensity of bleeding, whether endoscopic hemostasis is possible, and what is the probability of recurrent bleeding. The final stage of the diagnostic algorithm is the formulation of a detailed clinical diagnosis indicating the underlying disease, etiology and source of bleeding, the nature of bleeding, the stability of local hemostasis, the degree of blood loss, concomitant pathologies. Like all other authors, we also follow the classification of J.A. Forrest et al. (1974) in our study (Tab. 5).

Table 5. Distribution of patients with bleeding according to J.A. Forrest classification

Bleeding intensity	Patients quantity	%
IA - blood jet	8	6.0
IB - diffuse bleeding	10	7.5
IIA - a visible vessel at the bottom of the ulcer in the form of a column or tubercle	28	21.2
IIB - thrombus-clot tightly fixed to the bottom of the ulcer	42	31.8
IIC - small-point vessels in the bottom of the ulcer in the form of dark spots	30	22.7
III- mucosal defect with no signs of bleeding	14	10.6
Total	132	100

4. Results and Discussion

Currently, endoscopic hemostasis methods play an important role in the treatment of patients with gastroduodenal bleeding. The introduction of endogemostasis into clinical practice helped to avoid emergency surgeries in many cases, allowing a fundamentally different look at the need for surgical treatment of many patients with gastroduodenal bleeding, at least allowing a delayed operation after appropriate preparation of the patient. More than 50 methods of endoscopic stopping of bleeding have been proposed, new or existing methods of influencing to the source of bleeding in gastroduodenal ulcers appear almost every year.

We use injection, electrocautery and argon-plasma methods of endohemostasis in our Center. The infiltration method remains the most common method of endoscopic hemostasis. There are no absolute contraindications. The mechanism of infiltration hemostasis consists of hydraulic compression of blood vessels, vascular spasm, increased local thrombosis and sclerosis in the immediate vicinity of the hemorrhage source as a result of perifocal injection of drugs. We used 70% ethyl alcohol, 0.1% adrenaline solution for infiltration hemostasis.

Electrocoagulation is one of the most widely used methods of endohemostasis. For electrocoogulation, the transformation of high-quality electric current (500 kHz-2 MHz) energy into thermal energy is used at the point where the electrical circuit is closed when the electrodes are in contact with biological tissue. The most formidable complication of this method is the perforation of a hollow organ wall as a result of tissue combustion with the formation of a black scab. In this connection, argon-plasma coagulation (APC) has been widely used since 2012. The main advantages of APC over electrocoagulation are considered to be non-contact exposure and the absence of welding of the coagulation scab to the electrode during APC.

Eight (6.0%) patients were admitted to the hospital with ongoing jet arterial bleeding from an ulcer (F-1A). For this category of patients, we used the combined forms of endohemostasis: injections + argon plasma coagulation. Temporary hemostasis was achieved in 7 (5.3%) cases. In one case this combination was ineffective, and therefore a laparotomy, duodenotomy with suturing of a bleeding duodenal ulcer was performed urgently. In 2 (2.7%) cases with active arterial bleeding the cause was a stress duodenal ulcer, which developed in one case against the background of extensive thermal burns of the body by 90%, and in the second case - against the background of acute liver failure. The combined method of endohemostasis was also applied to these patients with achieving temporary hemostasis. Despite the intensive therapy, these patients had repeated episodes of bleeding which was the reason for the forced surgical intervention for life reasons: laparotomy, duodenotomy with suturing of the ulcer. The postoperative period in a child with an extensive burn of the body was ended by lethal outcome.

In 10 (7.5%) patients diffuse bleeding had a venous nature (F-1B). Using the combined form of endohemostasis (injection + electrocoagulation) it was possible to achieve primary arrest of bleeding in all patients. There was a relapse of bleeding in 3 (3.2%) cases within first 6 hours and it was a reason for repeated endohemostasis. Due to the repeated relapse of bleeding in 2 (2.7%) cases with chronic forms of duodenal ulcers, children were operated on in a delayed emergency. Since these patients had combined complications (bleeding with stenosis of the outlet from the stomach), they were performed laparotomy, gastric resection according to Billroth-I, modified by L.G. Khachiev. In the remaining 5 (5.4%) cases children were operated on after stabilization of the state: the indication for surgery was frequent relapses of peptic ulcer disease, which were not amenable to conservative therapy for three years. All patients were performed gastric resection according to Billroth-I modified by L.G. Khachiev.

The presence of a thrombosed vessel (F-2A) in the ulcer was initially diagnosed in 28 (21.2%) patients. In order to strengthen hemostasis in the ulcer, all patients were performed endoscopic hemostasis by the method of alcohol injection and a complete hemostasis was achieved in 100% of cases. In this type of patients surgeries were performed in 5 (3.8%) cases with chronic forms of duodenal ulcers. In this category of patients, operations were performed in 5 (3.8%) cases with chronic forms of duodenal ulcers. This group of patients were also performed gastric resection according to Billroth-I modified by L.G. Khachiev.

F-2B bleeding occurred in 42 (31.8%) cases. In all cases, endoscopic hemostasis was also performed by the method of

alcohol injection. Control endoscopy, performed one day later, revealed small-puncture thrombi at the bottom of the ulcer in all patients (F-2C). The presence of small-point thrombi in the ulcer according to F-2C was observed in 30 (22.7%) patients. They were not performed endoscopic hemostasis. On control endoscopy, three days later, in 100% of cases we observed that the bottom of the ulcer was completely cleared and covered with fibrin (F-3).

Sixteen patients with Forrest-3 made up 17.3% of the total admissions. Control examination after three days revealed a clear bottom of the ulcer in 98% of cases. In 2% of cases small punctate thrombi appeared at the bottom of the ulcer. There were no signs of recurrent bleeding.

5. Conclusions

Thus, experience shows that in case of gastric and duodenal ulcers complicated by bleeding, the diagnostics should be comprehensive. In this case, the endoscopic research method is of particular importance.

Depending on the localization of bleeding source and its intensity, a differentiated approach should be applied to the choice of endoscopic hemostasis method.

The use of the combined method of injection in combination with argon-plasma coagulation in most cases allows achieving stable hemostasis during ongoing intense bleeding.

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