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## GASTRODUODENAL ULCERAL BLEEDINGS, DIAGNOSIS AND RISK FACTORS FOR REDUCTION. LITERATURE REVIEW.

**Nazarbek B. Omarov**<sup>1</sup>, <http://orcid.org/0000-0002-6201-8263>

**Kuat K. Zhusupov**<sup>2</sup>, <https://orcid.org/0009-0002-9355-8734>

**Aldiyar E. Masalov**<sup>1</sup>, <https://orcid.org/0000-0002-2844-037X>

**Samatbek T. Abdrakhmanov**<sup>1</sup>, <https://orcid.org/0000-0002-4270-3498>

**Medet A. Auenov**<sup>1</sup>, <https://orcid.org/0000-0002-1809-9091>

**Rustem S. Kazangapov**<sup>2</sup>, <http://orcid.org/0000-0003-1513-7432>

**Daniyar S. Bokin**<sup>3</sup>, <https://orcid.org/0000-0001-7214-2356>

**Zhansaya K. Akhmadieva**<sup>3</sup>, <https://orcid.org/0009-0003-3106-5835>

<sup>1</sup> NCJSC "Semey Medical University", Semey, Republic of Kazakhstan;

<sup>2</sup> Pavlodar Branch of NCJSC «Semey Medical University», Pavlodar, Republic of Kazakhstan.

<sup>3</sup> State Higher Medical College named after D. Kalmataev Semey, Republic of Kazakhstan.

### Summary

**Introduction:** Ulcerative gastroduodenal bleeding (UGDH) is a serious complication of peptic ulcer of the stomach and duodenum, remaining to this day an urgent problem in urgent surgery. The most common causes of acute upper gastrointestinal bleeding (UGIH) are gastroduodenal bleeding of non-variceal origin. YAGDK is observed with greater frequency in men and older people; the prevalence of the complication is 48 - 160 people per 100,000 population. Despite the achievements of medical science and the success of surgical practice, the upward trend in the frequency of ulcerative hyperplasia remains. Thus, the number of patients with ulcerative gastroduodenal bleeding in the period from 2005 to 2015 increased by 1.5 times.

**Aim:** review the literature on endoscopic treatment of gastroduodenal bleeding.

**Search strategy:** The literature search was carried out in search engines: Pubmed, Google Academy, elibrary.ru, as well as manually. The search depth of Pubmed, Google Scholar, elibrary.ru, and also "manually" was not limited. The following filters were used: full text, humans. *Criteria for inclusion* of publications in the review: publications that are in full text access, in Russian and English, bearing statistically verified conclusions. *Exclusion criteria:* duplicate data, abstracts of reports, newspaper publications, personal communications.

**Results:** There are methods for determining the likelihood of rebleeding, including both direct and indirect assessments of blood flow in the ulcer bed. They are based on the use of endoscopic Doppler, endoscopic ultrasound diagnostics, local thermometry of ulcers, impedance measurements of the mucous membrane of the stomach and duodenum. However, their use in general clinical practice is limited.

Ulcer size, volume of blood lost, and hemoglobin level have been found to be important indicators for predicting rebleeding. Even without taking into account their combined effect, these parameters have a confidence of about 90% in predicting recurrent bleeding.

**Conclusions:** In practice, in emergency hospital settings, the use of complex instrumental methods and statistical calculations is difficult due to limited time and availability. This is especially true at night. Therefore, the importance of developing and improving simple, easily applicable, and effective criteria for predicting recurrent upper gastrointestinal bleeding remains high.

**Keywords:** *Gastroduodenal bleeding, endoscopy, ulcer of the stomach, duodenal ulcer, fibrogastroduodenoscopy, endoscopic treatment.*

### Резюме

## ГАСТРОДУОДЕНАЛЬНЫЕ ЯЗВЕННЫЕ КРОВОТЕЧЕНИЯ, ДИАГНОСТИКА И ФАКТОРЫ РИСКА РЕДИЦИВА. ОБЗОР ЛИТЕРАТУРЫ

**Назарбек Б. Омаров**<sup>1</sup>, <http://orcid.org/0000-0002-6201-8263>

**Кuat К. Жусупов**<sup>2</sup>, <https://orcid.org/0009-0002-9355-8734>

**Алдияр Е. Масалов**<sup>1</sup>, <https://orcid.org/0000-0002-2844-037X>

**Саматбек Т. Абдрахманов**<sup>1</sup>, <https://orcid.org/0000-0002-4270-3498>

**Медет Э. Ауенов**<sup>1</sup>, <https://orcid.org/0000-0002-1809-9091>

**Рустем С. Казангапов**<sup>2</sup>, <http://orcid.org/0000-0003-1513-7432>

**Данияр С. Бокин**<sup>3</sup>, <https://orcid.org/0000-0001-7214-2356>

**Жансая К. Ахмадиева**<sup>3</sup>, <https://orcid.org/0009-0003-3106-5835>

<sup>1</sup> НАО «Медицинский университет Семей», г. Семей, Республика Казахстан;

<sup>2</sup> Павлодарский филиал НАО «Медицинский университет Семей», г. Павлодар, Республика Казахстан.

<sup>3</sup> Государственный высший медицинский колледж им. Д. Калматаева, г. Семей, Республика Казахстан

**Введение:** Язвенное гастродуоденальное кровотечение (ЯГДК) является грозным осложнением язвенной болезни желудка и двенадцатиперстной кишки, оставаясь и по сей день актуальной проблемой urgentной хирургии. Наиболее частыми причинами острого кровотечения из верхних отделов желудочно-кишечного тракта (UGIH) являются гастродуоденальные кровотечения не варикозного генеза. ЯГДК с большей частотой отмечается у мужчин и пожилых людей, распространенность осложнения составляет 48 - 160 человек на 100 000 населения. Несмотря на достижения медицинской науки и успехи хирургической практики, тенденция к росту частоты ЯГДК сохраняется. Так количество больных с язвенным гастродуоденальным кровотечением в период с 2005 по 2015 возросло в 1,5 раза.

**Цель:** провести обзор литературы по эндоскопическому лечению гастродуоденальных кровотечений.

**Стратегия поиска:** Поиск литературы осуществлен в поисковых системах: Pubmed, Google Академия, elibrary.ru, а также «ручным способом». Глубина поиска Pubmed, Google Академия, elibrary.ru, а также «ручным способом», не была ограничена. Применялись следующие фильтры: full text, humans. *Критерии включения* публикаций в обзор: публикации, находящиеся в полнотекстовом доступе, на русском и английском языках, несущие статистически выверенные выводы. *Критерии исключения:* повторяющиеся данные, резюме докладов, газетные публикации, личные сообщения.

**Результаты:** существуют методы определения вероятности повторного кровотечения, включающие как прямые, так и косвенные оценки кровотока в язвенном дне. Они основаны на использовании эндоскопической доплерометрии, эндоскопической ультразвуковой диагностики, локальной термометрии язв, импедансометрии слизистой оболочки желудка и двенадцатиперстной кишки. Однако их применение в общей клинической практике ограничено.

Было установлено, что размер язвы, объем потерянной крови и уровень гемоглобина являются важными индикаторами для прогнозирования повторного кровотечения. Даже без учета их совместного воздействия, эти параметры имеют достоверность около 90% при прогнозировании рецидива кровотечения.

**Выводы:** на практике, в срочных условиях стационара, применение сложных инструментальных методов и статистических расчетов затруднено из-за ограниченного времени и доступности. Это особенно актуально в ночное время. Поэтому важность разработки и улучшения простых, легко применимых и эффективных критериев для прогнозирования рецидива кровотечения из верхних отделов ЖКТ остается высокой.

**Ключевые слова:** Гастродуоденальные кровотечения, эндоскопия, язва желудка, язва двенадцатиперстной кишки, фиброгастродуоденоскопия, эндоскопическое лечение.

Түйіндеме

## **ГАСТРОДУОДЕНАЛЬДЫ ОЙЫҚ ЖАРАДАН ҚАН КЕТУ, ДИАГНОСТИКА ЖӘНЕ ҚАЙТАЛАНУ ҚАУПІНІҢ ФАКТОРЛАРЫ. ӘДЕБИЕТКЕ ШОЛУ**

**Назарбек Б. Омаров**<sup>1</sup>, <http://orcid.org/0000-0002-6201-8263>

**Куат К. Жусупов**<sup>2</sup>, <https://orcid.org/0009-0002-9355-8734>

**Алдияр Е. Масалов**<sup>1</sup>, <https://orcid.org/0000-0002-2844-037X>

**Саматбек Т. Абдрахманов**<sup>1</sup>, <https://orcid.org/0000-0002-4270-3498>

**Медет Ә. Әуенов**<sup>1</sup>, <https://orcid.org/0000-0002-1809-9091>

**Рустем С. Казангапов**<sup>1</sup>, <http://orcid.org/0000-0003-1513-7432>

**Данияр С. Бокин**<sup>3</sup>, <https://orcid.org/0000-0001-7214-2356>

**Жансая К. Ахмадиева**<sup>3</sup>, <https://orcid.org/0009-0003-3106-5835>

<sup>1</sup> "Семей медицина университеті" КЕАҚ, Семей қ., Қазақстан Республикасы;

<sup>2</sup> "Семей медицина университеті" КЕАҚ Павлодар филиалы, Павлодар қ., Қазақстан Республикасы.

<sup>3</sup> Д. Қалматаев атындағы Мемлекеттік жоғары медициналық колледжі. Семей, Қазақстан Республикасы

**Кіріспе:** Ойық жаралы гастродуоденальды қан кету (ЯГДК) - бұл асқазан мен он екі елі ішектің ойық жара ауруының күрделі асқынуы, бүгінгі күнге дейінргентті хирургияның өзекті мәселесі болып қала береді. Жоғарғы асқазан-ішек жолдарынан (GIST) жедел қан кетудің ең көп тараған себептері-варикозды емес гастродуоденальды қан кету. Ягдк ерлер мен егде жастағы адамдарда жиі кездеседі, асқынудың таралуы 100000 тұрғынға шаққанда 48 - 160 адамды құрайды. Медицина ғылымының жетістіктері мен хирургиялық тәжірибенің жетістіктеріне қарамастан, ЯГДК жиілігінің өсу тенденциясы жалғасуда. Осылайша, 2005-2015 жылдар аралығында ойық жаралы гастродуоденальды қан кетумен ауыратын науқастардың саны 1,5 есе өсті.

**Мақсаты:** гастродуоденальды қан кетуді эндоскопиялық емдеу туралы әдебиеттерге шолу жасаңыз

**Іздеу стратегиясы:** Әдебиеттерді іздеу жүйелерінде жүзеге асырылады: Pubmed, Google академиясы, eLibrary.ru, сондай-ақ "қолмен". Pubmed іздеу тереңдігі, Google академиясы, eLibrary.ru, сондай-ақ "қолмен", шектелмеген. Келесі сүзгілер қолданылды: fulltext, humans. Басылымдарды шолуға қосу критерийлері: толық мәтінді қол жетімді, Орыс және ағылшын тілдеріндегі, статистикалық тексерілген қорытындылары бар басылымдар. *Ерекшелік критерийлері:* қайталанатын деректер, баяндамалардың қысқаша мазмұны, газет басылымдары, жеке хабарламалар.

**Нәтижелері:** ойық жаралы күндегі қан ағымын тікелей және жанама бағалауды қамтитын қайта қан кету ықтималдығын анықтау әдістері бар. Олар эндоскопиялық доплерометрияны, эндоскопиялық ультрадыбыстық диагностиканы, жараның жергілікті термометриясын, асқазан мен он екі елі ішектің шырышты қабығының импедансометриясын қолдануға негізделген. Алайда оларды Жалпы клиникалық тәжірибеде қолдану шектеулі.

Ойық жараның мөлшері, жоғалған қан көлемі және гемоглобин деңгейі қайта қан кетуді болжаудың маңызды көрсеткіштері болып табылды. Олардың бірлескен әсерін ескермесе де, бұл параметрлер қан кетудің қайталануын болжау кезінде шамамен 90% сенімділікке ие.

**Қорытынды:** іс жүзінде, стационардың шұғыл жағдайында күрделі аспаптық әдістер мен статистикалық есептеулерді қолдану шектеулі уақыт пен қол жетімділікке байланысты қиын. Бұл әсіресе түнде дұрыс. Сондықтан жоғарғы асқазан-ішек жолдарынан қан кетудің қайталануын болжау үшін қарапайым, оңай қолданылатын және тиімді критерийлерді әзірлеу мен жақсартудың маңыздылығы жоғары болып қала береді.

**Түйінді сөздер:** Гастродуоденальды қан кету, эндоскопия, асқазан жарасы, он екі елі ішектің ойық жарасы, фиброгастродуоденоскопия, эндоскопиялық емдеу.

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#### Introduction

Treatment of bleeding in the stomach and duodenum is one of the most difficult tasks for surgeons. According to the Russian Society of Surgeons (ROS), from 90 to 160 cases of gastrointestinal bleeding per 100,000 population are registered annually [19].

The problem of gastroduodenal bleeding is relevant not only in Russia, but throughout the world. For example, in the United States alone, more than 300,000 people are hospitalized each year due to the acute form of this disease. From an economic point of view, this problem also becomes significant due to the huge costs of treating patients with gastroduodenal bleeding in various countries [22].

Of the total number of gastroduodenal bleedings, 50-70% are ulcerative [9].

Peptic ulcer of the stomach and duodenum is a chronic relapsing disease in which an ulcerative defect forms on the mucous membrane and submucosal layer due to a local inflammatory and necrotic process. This occurs due to an imbalance between aggressive and protective factors in the stomach [2].

Peptic ulcer disease is a chronic disease that often manifests itself in relapses and most often affects young, working people. Despite the use of modern treatment methods, from 2 to 20% of patients with this disease do not

achieve clinical and endoscopic remission. The progression of the disease is often accompanied by the development of complications, including gastroduodenal bleeding, which occurs in every tenth patient with peptic ulcer disease and accounts for 40 to 51% of all complications [15].

Worldwide, from 5 to 25% of the population experiences peptic ulcer disease. In Russia, more than 3 million people are under observation due to peptic ulcers of the stomach and duodenum. Mortality from this disease varies from 6.0 to 7.1 per 100,000 population in different countries, with the majority of deaths caused by complications of gastroduodenal ulcers [29].

Every year, approximately 70-80 thousand patients with peptic ulcer undergo surgical treatment. In most cases, operations are performed on an emergency basis due to complications. In recent years, the proportion of elective operations for this disease has decreased significantly due to changes in approaches to treatment and the introduction of effective antiulcer drugs into practice [30].

The main part of surgical interventions is associated with the treatment of bleeding from ulcerative lesions in the stomach and duodenum. It is important to note that emergency operations for such bleeding significantly worsen the prognosis for patients. This is confirmed by the high level of postoperative mortality, which in Russia ranges from 20 to 25%, and in elderly patients can reach 50% [7].

**Aim:** Based on the analysis of literature data, to identify the features of etiopathogenesis, diagnosis and development factors for relapse of gastroduodenal ulcer bleeding.

**Research methods:** The following search engines were used to search the literature: Pubmed, Google Academy, eLibrary.ru, and also manually. We chose the following search strategy in PubMed for the topic epidemiology of gastroduodenal bleeding (MeSH Terms: epidemiology; gastrointestinal bleeding; non-variceal bleeding; endoscopic management of gastroduodenal bleeding). The search depth in Pubmed was not limited. The following filters were used: full text, people. A total of 1263 publications were found, 29 of which were relevant to the purpose of our study. Search strategy in Google Scholar: keywords - epidemiology of gastroduodenal bleeding. The given query found 1640 publications, of which 20 corresponded to the purpose of our study. In the process of searching the literature on endoscopic treatment, we chose the following search strategy in PubMed (MeSH Terms: endoscopic treatment of gastroduodenal bleeding). The depth of the search was not limited. This query found 950 publications, of which 9 corresponded to the purpose of our study. Search strategy on eLibrary.ru: keywords – gastroduodenal bleeding, endoscopic treatment. For the given query, we found 540 publications, of which 7 publications corresponded to the purpose of our study. *Criteria for inclusion* of publications in the review: publications in full text access in Russian and English, bearing statistically confirmed conclusions. *Exclusion criteria:* abstracts of reports, newspaper publications, personal communications.

### Results

When studying the main causes of gastrointestinal bleeding (GIB), one can highlight their diversity, which leads to the development of many clinical classifications in this area. In the domestic literature, gastrointestinal tract diseases are usually divided into two categories: ulcerative and non-ulcerative [4,37], while foreign authors prefer to classify them as varicose and non-varicose. They also propose to replace the term “peptic ulcer”, introduced by M.P. Konchalovsky in 1922 [26], to the term “peptic ulcer”, which better expresses the etiological role of the acid-peptic factor in its development [62].

ICD-10 has codes for gastric and duodenal ulcers, but does not distinguish between simple peptic ulcers and secondary symptomatic ulcers that occur as a complication of other pathologies [57].

Bleeding not associated with ulcers accounts for 25% to 46% of all cases of gastrointestinal bleeding [3]. Some researchers have noted an increase in the proportion of such cases in recent years by 1.4-1.5 times, which brings them closer to the number of cases with ulcerative bleeding [6]. It is noted that in 20-50% of patients who died after operations on the abdominal organs, acute erosive and ulcerative lesions of the mucous membrane of the stomach and duodenum are found [10].

Non-ulcer bleeding includes rupture hemorrhagic syndrome, also known as Mallory-Weiss syndrome, which accounts for a significant proportion of cases ranging from 27.2% to 44.6% [11]. The second most common is bleeding from varicose veins of the esophagus, which occurs in 15.2% - 41.7% of patients [16]. These types of bleeding have the highest mortality rate, reaching 33–40% [39]. Other causes of non-ulcer bleeding in the stomach and

intestines include the following: Erosive-hemorrhagic gastritis is an inflammation of the gastric mucosa, accompanied by erosions and bleeding. Erosive-ulcerative reflux esophagitis: damage to the esophagus caused by the reverse flow of gastric contents, with possible bleeding. Benign and malignant tumors of the esophagus, stomach, and duodenum: The presence of tumors can cause bleeding. Rare cases such as rupture of an ectatic vessel of the submucosal layer of the stomach (Delafoy's syndrome), angiodysplasia in Randu-Osler syndrome, and Wirsung hemorrhage: bleeding from the pancreatic duct (Wirsung duct). [5, 25]. In recent years, there has been an increase in the frequency of bleeding in rupture hemorrhagic syndrome, malignant tumors of the stomach, and varicose veins of the esophagus [11].

However, ulcerative bleeding still remains in first place among all cases of gastrointestinal bleeding. According to various sources, their share ranges from 40 to 80% of cases [33].

Gastroduodenal bleeding from an ulcer begins with an imbalance between factors that cause damage to the mucous membrane of the stomach and duodenum (aggression factors) and factors that provide protection to this membrane (protective factors). This balance is maintained by the interaction of the nervous and endocrine systems, as well as the ability of the mucous membrane to be resistant to gastric juice. This interaction of factors is illustrated by the “Shay scale” diagram presented in the manual on gastroenterology by N. Bockus (1968) [49]. With the formation of YJ, the proportion of protective factors decreases, and with the formation of YAD, the proportion of aggression factors increases.

Among the protective factors are the mucous barrier of the stomach and duodenum, active regeneration of the epithelium and adequate blood supply [38]. Factors contributing to the development of the disease include acid-peptic exposure, gastrointestinal motility disorders, and Helicobacter pylori infection. The acid-peptic factor depends on the number of parietal cells and the level of their stimulation by gastrin and the vagus nerve. During an exacerbation of peptic ulcer disease, there is an increase in the number of cells producing gastrin and the level of intracellular gastrin, as well as a decrease in the number of cells producing somatostatin [40]. Disorders of the motor function of the gastrointestinal tract lead to unsystematic movement of acidic contents from the stomach to the duodenum [39]. The reverse flow of contents from the duodenum into the stomach disrupts the protective function of the gastric mucous barrier containing bicarbonates. Slowing the release of food from the stomach stimulates increased release of the hormone gastrin [46]. Helicobacter pylori acts mainly through the release of urease, which decomposes urea and reduces the acidity of gastric juice. This leads to the creation of an alkaline environment inside the mucous layer, which facilitates the penetration of bacteria through the protective mucous film into the cells of the gastric mucosa [23].

When the gastric mucosa is infected with Helicobacter pylori, changes occur in the physiology of this organ: the production of somatostatin decreases, the secretion of gastrin and hydrochloric acid increases, gastric metaplasia develops in the duodenum, and an inflammatory reaction

occurs with the release of various toxic products, such as interleukin-8, cytokines and tumor necrosis factor [65].

The etiopathogenesis of acute (stress) ulcers is associated with the influence of 3 groups of factors:

The first group includes factors associated with the development of acute injury syndrome (80% of patients).

Back in 1976, E.S. Ryss in his works identified 4 types of stress ulcers:

- - Cushing's ulcers in patients with pathology of the central nervous system;
- -Curling ulcers in victims with widespread burns;
- -ulcers that occur after severe traumatic operations;
- -ulcers in patients with myocardial infarction, shock, including bacterial-toxic, sepsis [1].

Despite the differences in the pathogenesis of these serious conditions, the process of ulcer formation in them is believed to be based on the same ulceration mechanism, similar to the development of stress ulcers [41]. Centralization of blood circulation leads to hypoxia of important organs, including the wall of the gastrointestinal tract (GIT), especially its mucous membrane, which is most sensitive to lack of oxygen. This process of local ischemia leads to trophic changes and the formation of ulcers [22]. On the other hand, stress increases the activity of aggressive factors, including an increase in acid production by parietal cells, which leads to a decrease in pH levels in the stomach [26].

The second group of factors is associated with taking medications that lead to a decrease in the synthesis of prostaglandins, death of epithelial cells and suppression of regeneration processes. This mainly applies to antiplatelet agents and anticoagulants.

The third group of factors is associated with decompensation of acute and chronic diseases, which leads to a weakening of the immune system and a decrease in local immunity of the gastrointestinal mucosa. This process is accompanied by deterioration of blood flow, stagnation in the vessels of the gastric mucosa and the formation of acute ulcers such as "creeping necrosis" [55].

However, the division of stress ulcers according to etiopathogenesis can be conditional, since most patients often have a combination of two or all three groups of factors.

Although stress ulcers and gastrointestinal ulcers have different pathogenesis, they share a common mechanism for the onset of bleeding. This mechanism is associated with a violation of the integrity of the mucous membrane, sometimes also muscle, which leads to damage to the vessel wall [37].

With the development of bleeding from an ulcer, platelet aggregation and thrombus formation occur on the collagen of the basement membrane. Usually, this mechanism leads to spontaneous cessation of bleeding. However, a formed thrombus can provide temporary hemostasis for only a few hours if it is not secured with fibrin. Subsequently, the clot is destroyed under the influence of pepsin from gastric juice. Hydrochloric acid plays a key role in this process, since pepsin has mucolytic properties only in an acidic environment (at pH from 1.0 to 5.0) [20].

Thus, the acid content in gastric juice not only prevents the formation of a blood clot, but also contributes to its destruction. Therefore, to prevent rebleeding, it is important not only to maintain gastric acidity above pH 4.0, but also to ensure local

protection of the source of bleeding from the aggressive effects of the gastrointestinal tract environment [20,28].

Repeated bleeding occurs due to the progression of inflammatory and necrotic processes in the ulcerative fossa. Insufficient suppression of the secretion of hydrochloric acid leads to the destruction of blood clots in the exposed vessels at the bottom of the ulcer. There is evidence that blood clots can be squeezed out of the vessel lumen when blood pressure increases, for example, during replacement therapy [37].

Many researchers have noted the unexpected phenomenon of the return of peptic ulcers in the gastrointestinal tract even in the absence of acid-peptic factor activity. This phenomenon is evident when analyzing the pH level of the gastric contents in patients who experience recurrent bleeding from this tract after taking drugs that suppress the secretion of gastric juice [53].

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The stability of the hematopoiesis process also depends on the type of ulcer (acute or chronic) and the strength of the initial bleeding. Therefore, the frequency of unsuccessful attempts to stop bleeding in chronic ulcers reaches up to 15%, while in acute ulcers it ranges from 2 to 5% [42].

Despite extensive scientific research on the causes and mechanisms of development of gastroduodenal ulcers, the influence of these factors on the results of endoscopic hemostasis remains insufficiently studied.

#### **Diagnosis of gastroduodenal ulcerative bleeding.**

Although coffee-ground vomiting and tarry stools (melena) are considered typical clinical signs of gastroduodenal bleeding, their presentation may depend on various factors, such as the location and size of the ulcer, and the intensity of the bleeding. For example, vomiting with impurities of fresh or altered blood is more often observed with ulcers in the stomach, and to a lesser extent in the duodenum. With duodenal ulcers, vomiting may occur once and be less profuse. Tarry stools, a characteristic sign of bleeding from the stomach or duodenum, may appear at various time intervals after the onset of bleeding, including 2, 10, or even 12 hours [49,33].

In 1962, *Voth D.* described a segment of the stomach 1-2 cm wide, located parallel to the greater and lesser curvatures at a distance of 3-4 cm from them. This section of the vascular network is called the "Achilles heel of the stomach." The development of an ulcer in this area is accompanied by a high risk of massive bleeding, which can be manifested by short-term loss of consciousness, convulsions and rapid swelling of the face and ocular conjunctiva. Typical signs of gastric and duodenal ulcers may appear later and often remain in the background [35].

When assessing gastroduodenal ulcer disease (GDU), it is important to consider the patient's age and the presence of concomitant diseases. In elderly patients who are diagnosed with a gastric or duodenal ulcer for the first time, features of the clinical manifestation and course of the disease are observed. *Ivashkin V.T. and Sheptulin A.A.*

(1999) describe this form of development as "late peptic ulcer disease." Elderly people often have chronic somatic diseases, which can worsen microcirculation in the gastric mucosa. Therefore, their ulcerative defects are usually larger in size compared to young and middle-aged people. Clinical manifestations in the elderly are often subtle or atypical, and the course of the disease is more severe. The incidence of complications associated with GDU in the elderly is almost twice as high as in young and middle-aged people [21].

Gastroduodenal bleeding is as life-threatening as other types of bleeding, and assessment of the amount of blood loss plays an important role in medical practice. In 1967, *M. Algover and S. Burri* proposed using a shock index for this purpose. This index is defined as the ratio of heart rate to systolic blood pressure. An increase in the Allgower shock index indicates the progression of blood loss [54].

In 1982, after studying the clinical symptoms of bleeding and hemodynamic parameters based on an extensive study involving many patients with acute bleeding of various origins, the American College of Surgeons proposed a new classification of blood loss, dividing it into four classes:

**Class I:** the patient either has no clinical symptoms or has a rapid heart rate at rest, which corresponds to a loss of less than 15-20% of circulating blood volume (CBV).

**Class II:** orthostatic hypotension or a decrease in blood pressure by at least 15 mm Hg is manifested. Art. when moving from a horizontal to a vertical position, while diuresis is maintained. This class corresponds to a loss of 20 to 25% of the bcc.

**Class III:** The patient experiences hypotension in the supine position, with urination less than 400 ml per day. This corresponds to a loss of 30 to 40% of the bcc.

**Class IV:** collapse and impairment of consciousness to a comatose state are observed, which indicates a loss of more than 40% of the blood volume. This category is the most severe in the proposed classification [32].

In 2002 *N.A. Yaitsky* and his colleagues proposed estimating the amount of blood loss based on measurements of systolic blood pressure and heart rate in the patient both in the supine and sitting positions.

- Mild blood loss is characterized by the following indicators: when the patient is measured in the supine position, the systolic blood pressure is 120 mmHg. Art. and higher, and the heart rate is in the range of 70-80 beats per minute. In a sitting position, systolic blood pressure is 100 mmHg. Art. or higher, and the heart rate is 90 beats per minute or less.

- The average degree of blood loss is shown as follows: when measurements are taken in the supine position, the systolic blood pressure is 100 mmHg. Art. and higher, and the heart rate do not exceed 100 beats per minute. In a sitting position, systolic blood pressure is 75 mmHg. Art. and higher, and the heart rate do not exceed 120 beats per minute.

- Severe blood loss is characterized as follows: when measured in the supine position, systolic blood pressure falls below 100 mmHg. Art., and the heart rate exceeds 100 per minute. When sitting, systolic blood pressure drops below 75 mm Hg. Art., and the heart rate exceeds 120 per minute.

Here, blood pressure is used as a rapid method to assess and monitor hemodynamics [47].

In 2001, Professor *A.I. Vorobiev* presented one of the recent Russian classifications of acute blood loss [9]. In his research work, the author emphasizes that clinical parameters such as blood pressure, heart rate, respiratory rate per minute, pulse pressure and the state of the central nervous system, rather than laboratory test results, are critical in assessing the severity of blood loss. Based on these data, he distinguishes four degrees of severity of blood loss: mild, moderate, severe and extremely severe.

- With mild blood loss, blood pressure is normal, the heart rate is less than 100 beats per minute, and the pulse pressure is either normal or elevated. The respiratory rate is 14-20 per minute, with an hourly diuresis of more than 30 ml. The patient may exhibit mild agitation. The volume of blood loss is less than 750 ml, which corresponds to no more than 15% of the total circulating blood volume.

- With moderate blood loss, blood pressure remains normal, but the heart rate exceeds 100 per minute and pulse pressure is reduced. The respiratory rate is 20-30 per minute, and urine output (hourly diuresis) is 20 to 30 ml. The patient may exhibit central nervous system agitation. The volume of blood loss ranges from 750 to 1500 ml, which corresponds to 15% - 30% of the total circulating blood volume.

- Severe blood loss is characterized by decreased blood and pulse pressure, high heart rate (more than 120 per minute) and respiratory rate (30-40 per minute). The volume of urine output (hourly diuresis) is 5-15 ml, and the state of the central nervous system becomes inhibited. The volume of blood loss ranges from 1500 to 2000 ml, which corresponds to 30% - 40% of the total circulating blood volume.

- With extremely severe blood loss, there is a sharp decrease in blood and pulse pressure, a high heart rate (more than 140 per minute) and respiratory rate (more than 40 per minute). The patient has no hourly diuresis, and his condition becomes precomatose. The volume of blood loss exceeds 2000 ml, which is more than 40% of the total circulating blood volume.

It is especially important to take into account the clinical picture of bleeding in the early stages, since even with significant blood loss, the levels of hemoglobin, red blood cells and hematocrit may remain within normal limits due to the lack of development of autohemodilution. Some researchers note that in the first hours after the onset of bleeding, the hematocrit level mainly reflects the volume of infusion therapy administered, and not the degree of blood loss. Only after 6-24 hours does the level of hemoglobin, red blood cells and hematocrit decrease, which allows a more accurate assessment of the amount of blood loss [10].

Laboratory methods play an important role not only in assessing the degree of blood loss, but also in developing further strategies for examining and treating the patient. One of the most common and widely used methods, proposed by *Gorbashko A.I.* in 1974, is based on the assessment of blood volume deficit and classifies blood loss into three degrees: mild degree is characterized by a globular volume deficit of up to 20%, moderate - from 20% to 30%, and severe - more than 30% [34].

In 1997, Professor *P.G. Bryusov* proposed a method for determining the volume of blood loss based on hematocrit, which is based on calculations using a special formula [36].

It is now recognized that the most reliable classifications of the severity of blood loss take into account both clinical and laboratory data.

In modern transfusiology, the degree of blood loss is assessed by the level of consciousness, diuresis rate, indicators of hyperventilation and hemocoagulation, changes in central venous pressure, pulse and mean arterial pressure, as well as arteriovenous oxygen difference [50].

Classification of the severity of blood loss proposed by *Gostishchev V.K. and Evseev M.A.* in 2004, includes the assessment of various clinical and laboratory parameters, such as level of consciousness, blood pressure, heart rate, respiratory rate, hourly diuresis rate, hemoglobin and hematocrit in peripheral blood [17]. According to the authors, the indicators of hemoglobin and hematocrit levels are especially important in cases of blood loss of III and IV severity, when the hemic component of posthemorrhagic hypoxia becomes significant. The hemoglobin level also plays a key role in determining the need for red blood cell transfusion. The authors note that the long-time interval between the onset of bleeding and hospitalization, often exceeding 24 hours, makes it possible to accurately determine the degree of hemodilution based on hemoglobin and hematocrit levels. If hemoglobin and hematocrit levels do not meet clinical criteria, it is recommended that the severity of blood loss be assessed based on the most abnormal parameters [13].

This system for assessing the severity of blood loss can be easily applied in emergency surgery situations. It does not require special studies, and the ability to assess the estimated volume of blood loss directly in the emergency department allows you to quickly determine the need for infusion therapy and hospitalization of the patient in the intensive care unit.

Despite various clinical and clinical laboratory systems for assessing the severity of blood loss, today much attention in the diagnosis of bleeding is paid to endoscopic examination. This method now plays a leading role in determining surgical strategy, especially due to its ability to temporarily or permanently stop bleeding.

When discussing the importance of upper gastrointestinal endoscopic examination (EGD) in gastric and duodenal ulcers, it is necessary to take into account the significant contributions of clinicians who contributed to the development of this diagnostic method. In 1974, *Forrest J.A. et al.* published a paper on "Endoscopy for Gastrointestinal Bleeding", which for the first time identified different categories of patients with varying degrees of bleeding intensity, and also assessed the risk of recurrence for each of these groups. The main signs of fresh bleeding were the detection of black plaque at the base of the ulcer, the presence of a fixed clot or a protruding artery [59].

In 1978, the English scientist *Foster D.N. and colleagues* published an article entitled "Clinical signs of fresh bleeding in the diagnosis and prognosis of upper gastrointestinal bleeding." In this article, the signs of bleeding were divided into groups depending on the time of its occurrence:

- a) fresh bleeding from the injury;
- b) fresh or modified blood clot or "black scab on the lesion";
- c) a prominent vessel found at the base or edge of the ulcer [61].

Previously there were many classifications such as *Vallon A.G. and colleagues (1981)*, *Storey D.W. et al (1981) [62]*, *Wördehoff D. and Gros H. (1982)*, *Wirtz H.J. and colleagues (1984)*, and *Soehendra N. et al (1985)*.

Of interest is the modified classification of signs of gastrointestinal bleeding, proposed by *Rosch V.* in 1986. This system, similar to *D.N. Foster's* classification, mainly reflects the stages of physiological hemostasis, but in more detail. According to this system, all cases of bleeding are divided into certain types:

In the first category, bleeding that continues at the time of examination is divided into the following subtypes:

**Ia** - bleeding of an arterial nature with the release of blood under pressure (jet arrosive bleeding);

**Ib** - bleeding of an arterial nature, leaking from under the formed clot (arterial bleeding leaking from under the clot).

In the second category, bleeding that has stopped at the time of examination is divided into the following subtypes:

**Ila** - detection of a visible thrombosed vessel (visible thrombosed vessel);

**Ilb** - detection of a thrombus tightly attached to the bottom of the ulcer (thromb-clot tightly fixed to the bottom of the ulcer);

**Ilc** - the presence of a dark brown coating of hemosiderin at the bottom of the ulcer (dark brown coating of hemosiderin at the bottom of the ulcer);

**III** - absence of signs of bleeding in the ulcer (ulcer without signs of bleeding).

Currently, this classification is often called the modified *Forrest* classification, and it is widely accepted in clinical practice [51].

With the advancement of technology, endoscopic examination has become of great importance, and nowadays more than 95% of cases require it. Emergency esophagogastroduodenoscopy is considered the main method for diagnosing acute bleeding from the upper digestive tract.

#### **Risk factors for relapse of gastroduodenal ulcer bleeding.**

With the development of endoscopic diagnosis of bleeding, the task of predicting the likelihood of their reoccurrence has become urgent. This issue is especially important, since predicting relapse directly affects the choice of surgical tactics.

Currently, there are no reliable methods to accurately determine when and under the influence of what factors rebleeding may occur.

The literature contains descriptions of both clinical and laboratory factors that are used to assess the risk of rebleeding. For example, researchers such as *Shorokh G.P. and his colleagues (1998)*, identify a number of risk factors, including the patient's age over 60 years, significant blood loss and the presence of concomitant severe diseases. The likelihood of rebleeding is also increased by episodes of collapse, repeated vomiting of blood or its derivatives, as well as recurrent melena [31].

According to *Timen L.Ya.* (2001), the key factors for assessing the risk of rebleeding are the following: hemoglobin level below 50 g/l, shock index above one, as well as the presence of markers of metabolic disorders, such as decompensated metabolic acidosis and decompensated respiratory alkalosis [45].

In the work of *Gorbachev V.N.* (1995) proposed the concept of "wave velocity of blood loss" to predict rebleeding from the upper digestive tract. This term describes the ratio of the total volume of blood loss to the number of visible bleeding episodes and is directly related to the diameter of the bleeding vessel [12]. According to the author, when we talk about high wave velocity of blood loss, we are talking about vessels with a diameter of more than 1 mm, while medium and low wave velocity characterizes vessels with a diameter of up to 1 mm. Gorbachev notes that the probability of re-bleeding with the same blood loss increases with increasing wave speed.

Some researchers, although their number is small, argue that the presence of *Helicobacter pylori* infection in the mucosa may be associated with an increased risk of rebleeding [58].

Many medical specialists, when assessing the risk of rebleeding, rely on endoscopic assessment of bleeding intensity using the modified *Forrest J.A.* classification. For example, researchers, including *Zatevakhin I.I. and his colleagues* (1996), note that with endoscopic signs of initial bleeding corresponding to Forrest classifications Ia,b and IIa, the likelihood of rebleeding is high, while with Forrest classifications IIb,c and III the likelihood of recurrence is low [18]. This can be explained from a physiological point of view: the less time has passed since the start of bleeding, the less effective is the natural cessation of bleeding.

When assessing the risk of rebleeding, it is important to take into account the endoscopic features of the source of bleeding. For example, it is considered that the location of the ulcer on the lesser curvature of the stomach, in the subcardial region, on the posterior wall of the duodenal bulb or in the postbulbar region is considered unfavorable from the point of view of prognosis [63]. These parameters also include increased size of the ulcer, exceeding 1 cm for duodenal ulcers and 2 cm for gastric ulcers [42]. For example, *Pantsirev Yu.M. and his colleagues* (2003) point out the importance of taking into account not only the size of the ulcer, but also the diameter of the bleeding vessel. Thus, in the presence of a gastric ulcer with a diameter of more than 1 cm or a duodenal ulcer with a diameter of more than 0.7 cm, as well as a thrombosed vessel with a diameter of 1.5-2 mm, the risk of bleeding is considered high [27]. Some researchers also note that in patients with gastric and duodenal ulcers, the risk of rebleeding increases if other complications such as stenosis or penetration are present [52].

*Yaitsky N.A., Sedov V.M. and Morozov V.P.* (2002) describe signs of unstable hemostasis during endoscopic examination, including traces of blood in the cavity of the stomach and duodenum, red or brown blood clots with bleeding from underneath them. They also mention loose red jelly-like clots, thrombosed and pulsating vessels at the bottom of the ulcer, as well as deposits of hematin hydrochloride [47].

*Fedorov E.D. and colleagues* (2001) note that the detection of new vessels at the bottom of the ulcer on

subsequent endoscopic examinations may portend the possible occurrence of rebleeding [43].

Many scientists believe that predicting the likelihood of upper gastrointestinal bleeding recurrence based on individual clinical, laboratory, or endoscopic findings is not accurate enough. They propose to use statistical analysis of a set of clinical, laboratory and endoscopic data, as well as hemostasis methods.

*Fedorov E.D.* (2002) proposed the use of a complex diagnostic indicator based on taking into account various clinical (such as gender, age, concomitant diseases, anamnesis, nature of clinical manifestations and duration of the disease) and endoscopic risk factors for relapse (for example, location, size, and depth of the ulcer). If the score is equal to or greater than 0, then there is a risk of bleeding, and if it is less than 0, then there is no risk of rebleeding. This approach has demonstrated a prediction accuracy of 95.1% [44].

Methods are available to assess the likelihood of recurrent bleeding, which include both direct and indirect methods of measuring blood flow to the area of ulcers. These approaches are based on the use of endoscopic Doppler, endoscopic ultrasound diagnostics, local thermometry of ulcers, impedance measurements of the gastric and duodenal mucosa [62]. However, their use in general clinical practice is limited.

Ulcer size, volume of blood lost, and hemoglobin levels have been found to play important roles in predicting the possibility of rebleeding. Even without taking into account their relationship, these factors provide an accuracy of about 90% in predicting the likelihood of recurrent bleeding [31].

**Conclusions:** With limited time and availability, especially at night, the application of complex methods and statistical calculations in hospital emergency situations is difficult. Therefore, it is important to work to develop and improve simple, accessible, and effective criteria for predicting recurrent upper gastrointestinal bleeding.

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#### Контактные данные авторов:

**Омаров Назарбек Бакытбекович** - к.м.н., доцент кафедры госпитальной хирургии НАО «Медицинский университет Семей». Адрес: г. Семей, улица Шевченко 56, тел. Тел. +77015368081. E-mail: omarov.n83@mail.ru

**Жусупов Куат Кабиоллаевич** – Магистрант 2-го года обучения по специальности «Медицина», Павлодарский филиал НАО «Медицинский университет Семей». Адрес: Республика Казахстан, 140100, г. Павлодар, ул. Суворова 66. Тел.: +77023379646 e-mail: kuatorcid@mail.ru

**Масалов Алдияр Ерланович** – PhD докторант 3-го года обучения, кафедры госпитальной и детской хирургии НАО «Медицинский университет Семей». Адрес: г. Семей, улица Дулатова 141 кв.40. Тел.: +77023379646. E-mail: Aldiyar\_masalov@mail.ru

**Абдахманов Саматбек Турысбекович** – Доктор PhD, ассистент кафедры госпитальной хирургии НАО «Медицинский университет Семей». Адрес: г.Семей, улица Дулатова 141 кв.40. Тел.: +770723379646. E-mail: dr.samatbek@mail.ru

**Әуенов Медет Әуенұлы** – Доктор PhD, ассистент кафедры госпитальной хирургии НАО «Медицинский университет Семей». Адрес: г. Семей, улица Кабанбай Батыра 42 кв. 169. Тел.: +77751341486. E-mail: medetaizat15@mail.ru

**Казангапов Рустем Сейсенбекович** – Доктор PhD, ио доцента кафедры хирургии Павлодарского филиала НАО «Медицинский университет Семей», тел. 8707 505 22 50, e-mail: rustem.kazangapov@bk.ru, г. Павлодар, Республика Казахстан;

**Бокин Данияр Санжарович** - Государственный высший медицинский колледж им. Д. Калматаева, г. Семей, Республика Казахстан. Адрес: г.Семей, улица Дулатова 141 кв.40. Тел.: +77055005192. E-mail: bokin\_d@bk.ru

**Ахмадиева Жансая Кабылкаевна** - Государственный высший медицинский колледж им. Д. Калматаева, г. Семей, Республика Казахстан. Адрес: г.Семей, улица Ешекеева дом 61. Тел.: +77076178471. E-mail: akhmadieva90@inbox.ru

#### Контактная информация:

**Zhusupov Kuat Kabiollaevich** – 2nd year master's student in the specialty "Medicine", Pavlodar branch of NCJSC "Semye Medical University", Pavlodar, Republic of Kazakhstan.

**Postal address:** Republic of Kazakhstan, 140100, Pavlodar, st. Suvorov 66.

**e-mail:** kuatorcid@mail.ru

**Tel.:** +77023379646