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ARTERIAL EMBOLIZATION IN THE TREATMENT OF ULCERAL GASTRODUODENAL BLEEDINGS

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INTRODUCTION

Relevance of the research topic

The relevance of the treatment of ulcerative gastroduodenal bleeding (UGDB) is due to the high incidence of peptic ulcer disease, its complication of bleeding and the high level of overall mortality, the average of which is 11% of cases (Lebedev N.V., Klimov A.E., Persov M.Yu. , Petukhov V.A., 2018; Stanley A.J., Laine L., Dalton H.R. et al., 2017; Peptic ulcer disease affects 1.7 - 5% of the population, and the number of bleedings from chronic ulcers of the stomach and duodenum ranges from 19 to 160 people per 100,000 population (Ivashkin V.T., Maev I.V., Tsarkov P.V. and al., 2020; Lau J.Y., Sung J., Hill C. et al., 2011; Wuerth B.A., Rockey D.C., 2018; The increase in the incidence of DU is largely associated with the use of anticoagulants and non-steroidal anti-inflammatory drugs (NSAIDs) (Mille M., Engelhardt T., Stier A., 2021).

The main problem in the treatment of UGDB is the occurrence of recurrent bleeding. To stop bleeding and prevent its recurrence at a high risk of its occurrence, complex conservative therapy with endoscopic hemostasis is indicated (Chandrasekar V.T., Sharma P., Desai M. et al., 2019; Kubota Y., Yamauchi H., Nakatani K. et al. al., 2021). The effectiveness of therapeutic endoscopy methods for ongoing bleeding ranges from 68% to 100% of cases, with an average value of 92% of cases (Ermolov A.S., Tveritneva L.F., Teterin Yu.S., 2017; Robles-Medrada C., Oleas R., Alcívar-Vásquez J. et al., 2021; Kuellmer A., Mangold T., Bettinger D. et al., 2021).

However, despite therapeutic endoscopy, recurrent bleeding occurs in 14% of patients and sharply worsens treatment results (Kantowski M., Schoepfer A.M., Settmacher U. et al., 2018; Kuyumcu G., Latich I., Hardman R.L. et al. , 2018). The use of repeated therapeutic endoscopy for recurrent bleeding is less effective and is often accompanied by repeated relapse of bleeding. Performing open surgery at the height of recurrent bleeding leads to an increase in mortality to 40 - 60% of cases

(Bagdasarov V.V., Bagdasarova E.A., Chernookov A.I. et al., 2016; Kubyshkin V.A., Sazhin V. .P., Fedorov A.V. et al., 2017). The use of transcatheter arterial embolization (TAE) of the vessels of the stomach and duodenum can stop ongoing bleeding and prevent its occurrence. However, the effectiveness of arterial embolization requires clarification, as does the determination of its role in modern treatment tactics for UGDB.

Degree of development of the research topic

Numerous international and regional recommendations of surgeons and endoscopists for the treatment of ulcerative bleeding and non-variceal bleeding from the upper gastrointestinal tract indicate that the main problem in the treatment of UGDB is the occurrence of recurrent bleeding. The necessary standard of medical care for patients with ulcerative bleeding is to perform diagnostic and, if necessary, therapeutic endoscopy (Russian Society of Surgeons [electronic resource]; Ivashkin V.T., Maev I.V., Tsarkov P.V. et al., 2020; Barkun A.N., Kuipers E.J. et.al., 2019; Sung J.J.Y., Chan F.K.L. et al., 2019; ., Barkun A.N., Saltzman J.R. et al., 2021; Gralnek I.M., Stanley A.J., Morris A.J. et al., 2021).

International recommendations emphasize that in the event of recurrent bleeding, repeat therapeutic endoscopy is indicated rather than surgery or arterial embolization.

According to national clinical guidelines, possible therapeutic measures for recurrent bleeding are: repeated endoscopic hemostasis, embolization of the arteries of the stomach and duodenum, or emergency surgery (Russian Society of Surgeons [electronic resource]).

Meanwhile, for many patients, even the occurrence of recurrent bleeding turns out to be unbearable, much less performing open surgery at the time of its occurrence. In this regard, some surgeons recommend using TAE not only for ulcerative bleeding refractory to endoscopic treatment, but also to prevent its

occurrence (Lau J.Y., Pittayanon R., Wong K-T. et al., 2019; Tong H., Lan T. , Tang C.W., 2020; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021).
According to the literature, rates of technical success, clinical success, rebleeding, mortality and complications after the use of arterial embolization vary widely (Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021; Chevallier O., Comby P-O., Guillen K. et al., 2021; Tong H., Qian S. et al., 2021; ., 2021; Yu Q., Funaki B., Navuluri R. et al., 2021), which requires additional study of the effectiveness of this operation for ulcer bleeding.
Purpose of the study: to improve the tactics of treating ulcerative gastroduodenal bleeding and improve the results of their treatment through the use of transcatheter arterial embolization.

Research objectives

1. To compare the results of treatment of patients with ulcerative gastroduodenal bleeding after open surgery and transcatheter arterial embolization.
2. To study the results of using targeted transcatheter arterial embolization in patients with chronic gastric and duodenal ulcers complicated by bleeding.
3. Formulate indications for the use of transcatheter arterial embolization in patients with ulcerative gastroduodenal bleeding.
4. Improve the tactics of treating ulcerative gastroduodenal bleeding, taking into account the use of targeted arterial embolization.

Scientific novelty

For the first time, indications for the use of targeted transcatheter arterial embolization for ulcerative gastroduodenal bleeding have been formulated, which can significantly improve the results of treatment of this category of patients.
An algorithm for the treatment of chronic gastric and duodenal ulcers has been developed, including the use of targeted arterial embolization.

It has been proven that there are direct and/or indirect signs of bleeding during arrosion of an arterial vessel in a chronic ulcer, detected by angiography of the vessels of the stomach and duodenum, which allows for targeted embolization and increases the effectiveness of endovascular surgery.

Theoretical and practical significance of the work

The theoretical significance of the study lies in the fact that it is shown that the use of endovascular techniques makes it possible to identify an arrozen vessel and stop ongoing bleeding from a chronic gastric or duodenal ulcer using an adhesive adhesive composite for any severity of blood loss. It has been shown that the use of targeted transcatheter arterial embolization for unstable hemostasis is a reliable way to prevent recurrent bleeding.

It has been proven that the use of arterial embolization is the final method of hemostasis for ulcerative gastroduodenal bleeding and is accompanied by a low probability of its relapse.

Indications for the use of targeted transcatheter arterial embolization for bleeding from chronic gastric and duodenal ulcers have been formulated.
A treatment algorithm and practical recommendations for the use of targeted transcatheter arterial embolization for ulcerative gastrointestinal bleeding have been developed.

It has been shown that the use of transcatheter arterial embolization is accompanied by significantly lower postoperative mortality in ulcerative gastroduodenal bleeding, and the use of arterial embolization significantly improves the results of their treatment.

Methodology and research methods.

The dissertation research is based on the method of scientific knowledge, in which patients with bleeding from chronic ulcers of the stomach and duodenum are the

object of study, and the subject of the study is targeted transcatheter arterial embolization of the vessels of the stomach and duodenum as a way to stop ongoing bleeding and prevent its relapse. The use of the principles of consistent application of methods allowed us to analyze modern relevant domestic and foreign sources, justify the relevance of the study, the purpose and objectives of the work. The paper presents data on the results of treatment of patients with ulcerative gastroduodenal bleeding using open surgical interventions and transcatheter arterial embolization, carried out their statistical analysis and formulated the conclusions of the study.

Degree of reliability and testing of results

The validity and reliability of the results of the work are ensured by a sufficient and representative sample size of patients with ulcerative gastroduodenal bleeding, a sufficient number of performed methods for assessing the results of the study, which is confirmed by statistical data processing.

The results of the dissertation work are used in practical activities at the St. Petersburg State Budgetary Healthcare Institution "City Alexander Hospital" and are used in the educational process at the St. Petersburg State Pediatric Medical University and at the Military Medical Academy named after. S.M. Kirov.

The main provisions of the dissertation research were discussed at the scientific and practical conference “Current issues of naval surgery”, dedicated to the 130th anniversary of B.V. Punin (St. Petersburg, 2021), at the international scientific and practical conference “Modern medicine: new approaches and current research” (Moscow, 2021) and at the VII Congress of Surgeons of the South of Russia with international participation (Petrozavodsk, 2021).

Publications

Five printed works have been published on the topic of the dissertation, including two articles peer-reviewed by the Higher Attestation Commission of the Ministry of Science and Higher Education of the Russian Federation.

Personal participation of the author in the study

The author was directly involved in the treatment of patients and performing open surgical interventions in patients with ulcerative gastrointestinal bleeding. The author was directly involved in transcatheter arterial embolization in 17% of patients with ulcer bleeding. In addition, the author collected, sorted data and carried out statistical processing of treatment results in these patients using statistical programs, and also wrote a dissertation research.

Scope of work and structure of the dissertation

The dissertation is presented according to the traditional principle and consists of an introduction, four chapters, a conclusion, conclusions, practical recommendations, and a bibliography consisting of 157 sources, including 46 domestic and 111 foreign works. The dissertation is illustrated with 16 tables and 17 figures.

Provisions for defense

1. When performing an endovascular examination for bleeding from chronic ulcers of the stomach and duodenum, direct and / or / indirect signs of bleeding are always determined.
2. Targeted transcatheter arterial embolization is a highly effective and definitive way to stop ongoing bleeding and prevent its recurrence.
3. The use of targeted transcatheter arterial embolization to stop ongoing bleeding and prevent recurrent bleeding can significantly reduce postoperative mortality and improve the results of treatment of ulcerative gastrointestinal bleeding.

Main scientific results.

1. The use of transcatheter arterial embolization (TAE) of the vessels of the stomach and duodenum can stop ongoing bleeding and prevent its occurrence.

(I.M. Musinov, 2022; A.E. Chikin, G.V. Sandursky, E.Yu. Kachesov Personal contribution is at least 80%).

2. The use of arterial embolization in the treatment of ulcerative hyperplasia was accompanied by technical success in 97.6% of cases.

(I.M. Musinov, 2021; A.E. Chikin, G.V. Sandursky Personal contribution is at least 80%).

3. For the first time, indications for performing targeted arterial embolization in patients with ulcerative gastrointestinal bleeding were formulated. For the first time, an algorithm for the treatment of patients with ulcerative hyperplasia was formulated, and a tactic using TAE was determined to minimize the risk of complications. (I.M. Musinov, 2022; A.E. Chikin, G.V. Sandursky, E.Yu. Kachesov Personal contribution is at least 80%).

4. The author was directly involved in the treatment of patients and performing open surgical interventions, and was directly involved in transcatheter arterial embolization in patients with ulcerative gastrointestinal bleeding. (I.M. Musinov, 2023; A.E. Chikin, G.V. Sandursky, E.Yu. Kachesov. Personal contribution is at least 80%).

5. The use of N-butyl-2-cyanoacrylate is effective for stopping ongoing bleeding and preventing its recurrence in case of ulcerative hemorrhage and practically does not depend on the severity of blood loss,

(I.M. Musinov, 2021; A.E. Chikin, G.V. Sandursky. / I.M. Musinov, 2021. A.E. Chikin, A.E. Ganin, G.V. Sandursky Personal contribution is at least 80%). does not lead to pronounced microcirculatory disorders (I.M. Musinov, 2021; A.E. Chikin, G.V. Sandursky. / I.M. Musinov, 2021. A.E. Chikin, A.E. Ganin, G. V. Sandursky Personal contribution is at least 80%).

6. The author collected, sorted data and carried out statistical processing of treatment results for these patients using statistical programs, and also wrote a

dissertation research (I.M. Musinov, 2021; A.E. Chikin, G.V. Sandursky. / I.M. Musinov, 2021. A.E. Ganin, G.V. Personal contribution is at least 80%).

7. The presented results of the work indicate the high effectiveness of targeted embolization during ongoing bleeding and prevention of its relapse in patients with bleeding from chronic ulcers of the stomach and duodenum. (I.M. Musinov, 2021; A.E. Chikin, G.V. Sandursky. / I.M. Musinov, 2021; A.E. Chikin, G.V. Sandursky. / I.M. Musinov, 2021 . A.E. Chikin, A.E. Ganin, G.V. Personal contribution is at least 80%).

8. When performing TAE, we looked for direct and indirect signs of gastrointestinal bleeding. The technical success of the application was 97.6% of cases, the clinical success was 91.3% of cases. (I.M. Musinov, 2022; A.E. Chikin, G.V. Sandursky, E.Yu. Kachesov Personal contribution is at least 80%).

Chapter 1. TREATMENT OF ULCERAL GASTRODUODENAL BLEEDING (literature review)

1.1. Surgical tactics for the treatment of ulcerative gastroduodenal bleeding

Surgical tactics for the treatment of ulcerative gastrointestinal bleeding have undergone significant changes recently (Loffroy R., Desmyttere A-S., Mouillot T., 2021). The widespread introduction of diagnostic and therapeutic endoscopy into clinical practice, the emergence of powerful antisecretory drugs, methods of endovascular hemostasis and anti-Helicobacter therapy have led to a decrease in operational activity in many hospitals (Karipidi G.K., Zorik V.V., Kanksidi I.V., Savchenko Yu P., 2017; Timerbulatov M.V., Sagitov R.B. et al., 2020; Nelms D.W., Pelaez C.A., Olufajo O.A., Wilson A., Yehayes B. et al. , 2020). At the same time, the level of overall mortality in DU remains high and varies widely - from 3.3% to 32.8% of cases, with an average level of overall mortality - 11% of cases (Musinov I.M., 2007; Kubyshkin V. A., Sazhin V.P., Fedorov A.V. et al., 2017; Lolle I., Møller M.H., Rosenstock S.J., 2016; Barkun A.N., Almadi M., Kuipers E.J. et al., 2019). Overall mortality directly depends on the treatment tactics for ulcer bleeding and surgical activity chosen in the medical institution (Gostishchev V.K., Evseev M.A., 2007; Makshiev, A.E., 2018; Valeev M.V., 2020; Potakhin S. N., 2020). Mortality with active surgical tactics is higher than when using complex conservative therapy with endoscopic hemostasis (Sovtsov S.A., 2018). High postoperative mortality is largely due to the fact that surgical intervention is often performed for recurrent bleeding and in patients with high surgical risk (Narezkin D.V., 2003; Bagdasarov V.V., Bagdasarova E.A., Chernookov A.I. et al., 2016; Lebedev N.V., Klimov A.E., Persov M.Yu., Petukhov V.A., 2018).

Surgical activity in the Russian Federation ranges from 5.6% to 38.2% of cases (Sazhin V.P., Beburishvili A.G., Panin S.I. et al., 2021). At the same time, a relationship can be traced - the higher the operational activity, the higher the mortality rate (Kubyshkin V.A., Sazhin V.P., Fedorov A.V. et al., 2017).

To improve treatment outcomes, numerous international and local recommendations for surgeons and endoscopists have been developed for the treatment of ulcerative bleeding and non-variceal bleeding from the upper gastrointestinal tract (Russian Society of Surgeons [electronic resource]; Barkun A.N., Almadi M., Kuipers E.J. et.al., 2019; Sung J.J.Y., Chan F.K.L. et al., 2019; Laine A.N., Saltzman J.R. et al., 2021; Clinical guidelines are periodically updated, which only emphasizes dissatisfaction with treatment results.

The updated international guidelines for the treatment of non-variceal upper gastrointestinal bleeding contain five sections: section A (resuscitation, risk assessment and management of patients before endoscopy), section B (endoscopic treatment), section C (drug treatment), section D (non-drug and non-endoscopic treatment in a hospital), section E (secondary prevention), as well as an appendix (no statements with recommendations), which is devoted to current unresolved issues in the treatment of bleeding (Barkun A.N., Almadi M., Kuipers E.J. et.al., 2019) . Some points of clinical recommendations from 2019 repeat points from clinical recommendations from 2003 and 2010 (Barkun A., Bardou M., Marshall J.K., 2003; Barkun A.N., Bardou M., Kuipers E.J. et.al., 2010). New and amended 2019 clinical practice guidelines contain the results of consensus group votes and are either “strong” or “conditional” in nature.

The new recommendations of the American College of Gastroenterology for the treatment of bleeding from the upper gastrointestinal tract and ulcerative bleeding (Laine L., Barkun A.N., Saltzman J.R. et al., 2021) contain sixteen points devoted to the treatment of this pathology, which also differ from previously accepted by this board of recommendations (L. Laine L., Jensen D.M., 2012).

The clinical recommendations of the Asia-Pacific Working Group on non-variceal upper gastrointestinal bleeding (Sung J.J.Y., Chiu P.W.Y., Chan F.K.L. et al., 2019) have also changed compared to the recommendations of 2011 (Sung J.J.Y., Chan F.K.L., Chen M. et al., 2011). This group's 2018 clinical practice guidelines include the following sections: preendoscopic, endoscopic, and

postendoscopic management of nonvariceal upper gastrointestinal bleeding, and disallowed claims.

It should be noted that to improve the results of treatment of ulcerative bleeding, recommendations are also accepted by various endoscopic and gastroenterological societies (Ivashkin V.T., Maev I.V., Tsarkov P.V. et al., 2020; Siau K., Hearnshaw S., Stanley A.J. et al., 2019; Gralnek I.M., Stanley A.J., Morris A.J. et al., 2021). Thus, the European Society of Gastrointestinal Endoscopy published in 2021 recommendations for the endoscopic diagnosis and management of upper non-variceal gastrointestinal bleeding (Gralnek I.M., Stanley A.J., Morris A.J. et al., 2021), and the British Society of Gastroenterology - a consensus on the early clinical treatment of acute upper gastrointestinal bleeding. gastrointestinal bleeding (Siau K., Hearnshaw S., Stanley A.J. et al., 2019).

In the Russian Federation, in order to improve treatment results, the Russian Society of Surgeons adopted clinical recommendations for the treatment of ulcerative gastroduodenal bleeding in 2014 (Russian Society of Surgeons [electronic resource]).

All of the above clinical recommendations indicate that the main problem in the treatment of UGDB is the occurrence of recurrent bleeding, which sharply worsens the results of treatment. The necessary standard of medical care for patients with ulcerative gastrointestinal tract is diagnostic and, if necessary, therapeutic endoscopy.

Currently generally accepted is the classification of ongoing bleeding or the degree of stability of hemostasis in an ulcer crater according to the classification of J. Forrest (Forrest J.A.H., Finlarson N.D.S., Sherman D.Z.C., 1974). Chronic ulcers with a high risk of recurrent bleeding include ulcers with ongoing jet (Forrest-Ia) or diffuse (Forrest-Ib) bleeding that was stopped during therapeutic endoscopy, as well as ulcers with a thrombosed artery in the ulcer crater (Forrest-IIa) or a dense fixed clot (Forrest). –II century Chronic ulcers with a low risk of recurrent bleeding include ulcers with a pigmented spot - Forrest-IIc or under white fibrin - Forrest-III.

Endoscopic hemostatic therapy is not indicated for patients with stigmata at low risk of rebleeding. Therapeutic endoscopy is indicated for stream or diffuse bleeding from a chronic ulcer or a visible vessel in its bottom. Detection of a clot in a chronic ulcer requires targeted irrigation to dislodge it, followed by therapeutic endoscopy. The role of endoscopic therapy for clot-adherent ulcers is controversial. Endoscopic hemostasis can be performed, although in some cases intensive therapy with large doses of proton pump blockers is sufficient. At the same time, all clinical recommendations emphasize the need to prescribe large doses of proton pump inhibitors during the first three days after therapeutic endoscopy (Russian Society of Surgeons [electronic resource]; Barkun A.N., Almadi M., Kuipers E.J. et.al., 2019; Sung J.J.Y. , Chiu P.W.Y., Chan F.K.L. et al., 2019; Gralnek I.M., Stanley A.J., 2019; A. J. et al., 2021).

However, when choosing a method for performing endoscopic hemostasis, the instructions of the clinical recommendations do not coincide (Collection of methodological materials of the “School of Surgery of the Russian Academy of Surgery”. Gastrointestinal bleeding [electronic resource]; Barkun A.N., Almadi M., Kuipers E.J. et. al., 2019; Sung J.J.Y., Chiu P.W.Y., Chan F.K.L. et al., 2019; Laine L., Barkun A.N., Saltzman J.R. et al., 2021;

According to the literature, the effectiveness of therapeutic endoscopy methods for ongoing bleeding ranges from 68% to 100% of cases, on average - 92% of cases (Bagdasarov V.V., Bagdasarova E.A., Chernookov A.I. et al., 2016; Ermolov A.S., Tveritneva L.F., Teterin Yu.S., 2017; Grishaev V.A., 2019; Chandrasekar V.T., Sharma P., Desai M. et al., 2019; , Nakatani K. et al., 2021; Robles-Medrada C., Oleas R., Alcívar-Vásquez J. et al., 2021; At the same time, recurrent bleeding is observed in 5.7 - 52% of patients, depending on the type of endoscopic hemostasis, with an average value of 14% of cases (Sokolova P.Yu., 2015; Ovchinnikov I.F., 2017; Mozharovsky V.V., Mutnykh A.G., Zhukov I.N., Mozharovsky K.V., 2017; Lipnitsky E.M., Alekberzade A.V., Gasanov M.R., Romantsov M.N., Cherednikov E.F. ., Glukhov A.A., Fursov K.O., 2018: Kantowski M., Schoepfer A.M., Settmacher U. et al., 2018; Kuyumcu G., Latich I., Hardman R.L. et al., 2018).

According to international guidelines for the treatment of nonvariceal upper gastrointestinal bleeding, epinephrine injection provides suboptimal effectiveness and should be used in combination with another method. No single method of endoscopic thermal hemostasis is superior to another. For patients with bleeding ulcers and stigmata at high risk of rebleeding, thermocoagulation, sclerosant injection, or clipping is recommended. The use of hemostatic powder TS-325 with ongoing bleeding is possible only as a temporary measure if other methods of hemostasis are impossible. It is not recommended to perform control dynamic endoscopy within 12 hours after the first examination, and in case of recurrent bleeding, the authors, on the contrary, advise the use of repeated endoscopic hemostasis. TAE should be considered as an alternative to surgery only if therapeutic endoscopy is ineffective (Barkun A.N., Almadi M., Kuipers E.J. et.al., 2019).

The American College of Gastroenterology for the treatment of upper gastrointestinal bleeding and ulcer bleeding recommends bipolar electrocoagulation, injection of 96% ethanol or epinephrine in combination with another method of hemostasis (strong recommendation), and clipping, argon plasma coagulation, or monopolar electrocoagulation (conditional recommendation).) for patients with ongoing bleeding and a high risk of rebleeding. In case of active bleeding, the use of hemostatic powder TS-325 is recommended (conditional recommendation). If rebleeding occurs, the authors recommend repeat therapeutic endoscopy rather than surgery or arterial embolization (conditional recommendation). The authors consider the use of over-the-scope clips (OTSC) to be the method of choice for endoscopic hemostasis in case of recurrent bleeding from a chronic ulcer (conditional recommendation). If endoscopic treatment fails, TAE is indicated (conditional recommendation) (Laine L., Barkun A.N., Saltzman J.R. et al., 2021).

According to national clinical guidelines, possible therapeutic measures for recurrent bleeding are: repeated endoscopic hemostasis, embolization of the arteries of the stomach and duodenum, or emergency surgery (Collection of methodological

materials of the “School of Surgery of the Russian Academy of Surgery.” Gastrointestinal bleeding [electronic resource]).

However, if recurrent bleeding occurs, the effectiveness of therapeutic endoscopy is reduced to 75% of cases and the risk of recurrent bleeding increases. Carrying out surgical intervention under these conditions is accompanied by an increase in mortality from an average of 12% of cases to 25% - 60% (Narezkin D.V., 2003; Bagdasarov, E.A. Bagdasarova, A.I. Chernookov et al., 2016; Korovin A. Y., Maskin S.S., Turkin D.V., et al., 2017; Lebedev N.V., Klimov A.E., Persov M.Yu., Petukhov V.A., 2018; , Shushi H., Akihiko I. et al., 2011; Kyaw M., Tse Y., Ang D. et al., 2014).

It is known that within twelve hours after a successful therapeutic endoscopy, recurrent bleeding occurs extremely rarely. Carrying out complex conservative therapy during this period makes it possible to partially compensate for the consequences of acute blood loss (Bagnenko S.F., Musinov I.M., Kurygin A.A., Sinenchenko G.I., 2009). Given the high risk of ongoing rebleeding in some patients, many surgeons now perform delayed surgical intervention aimed at preventing it. Performing a preventive operation can improve the rates of postoperative and overall mortality in patients with ulcerative gastrointestinal tract, compared with the rates of treatment of patients for recurrent bleeding (Repin V.N., Chudinov A.A., Gudkov O.S. et al., 2014; Melnik I.V., 2019).

Some surgeons believe that the indications for performing surgery for ulcerative bleeding are: continued bleeding when therapeutic endoscopy is impossible or ineffective, recurrent bleeding in the hospital, as well as prevention of its occurrence in the absence of positive dynamics from the stigma of bleeding in the ulcer crater (Gostishchev V.K. , Evseev M.A., 2007; Karipidi G.K., Zorik V.V., Kanksidi I.V., Savchenko Yu.P., 2017).

In recent years, a small number of works have been devoted to the choice of method of surgical treatment of chronic gastric and duodenal ulcers in the literature (Korovin A.Ya., Maskin S.S., Turkin D.V. et al., 2017; Lee C.W., Sarosi G.A., 2011 ; Peetsalu A., Kirsimägi U., Peetsalu M., 2014).

Most surgeons for chronic gastric ulcers complicated by bleeding consider distal gastrectomy as the operation of choice, often using the Hofmeister-Finsterer or Roux method (Gostishchev V.K., Evseev M.A., 2007; Korovin A.Ya., Maskin S.S. ., Turkin D.V. et al., 2017).

For a bleeding duodenal ulcer, most specialists perform stem vagotomy with pyloroplasty and suturing or excision of a chronic ulcer, justifying their choice with less trauma, simpler technical execution of this operation compared to gastric resection and better postoperative mortality rates (Schroder V.T., Pappas T.N., Vaslef S.N. et al., 2014). Other surgeons perform gastrectomy, considering it a pathogenetically justified operation, for bleeding duodenal ulcers (Cheynel N., Peschaud F., Hagry O. et al., 2001).

Reducing the scope of surgery for bleeding from a chronic gastric ulcer before stitching it or performing a wedge resection of the stomach is considered a forced operation. Sometimes these operations are supplemented by ligation of the large arteries of the stomach. The serious condition of patients forces the volume of surgery to be reduced only to pyloroplasty with suturing or excision of the ulcer and in case of bleeding from a chronic duodenal ulcer (Kubachev K.G., Khromov V.V., Kachesov E.Yu., Zarkua N.E., 2014; Ganin A.S., 2020).

However, it is not possible to significantly improve the results of treatment by performing surgical interventions aimed at preventing recurrent bleeding, taking into account the significant number of patients at risk of surgical intervention and the severity of pathogenetic changes in the body during acute blood loss (Soloviev I.A., Musinov I.M., Chikin A.E., Ganin A.S., 2018). This forces many specialists to resort to searching for alternative, less traumatic methods of preventing recurrent bleeding and stopping ongoing bleeding.

1.2. The influence of recurrent bleeding on the results of treatment of ulcerative gastroduodenal bleeding.

A large number of works have been devoted to predicting the risk of recurrent bleeding during UGDB (Lebedev N.V., Klimov A.E., Sokolova P.Yu., Tsinoeva

F.I., 2013; Bystrov S.A., Katorkin S.E., Lichman L.A., Lisin O.E., 2018; Timerbulatov S.V., Valeev M.V., 2019; Kim J.S., Kim B.W., Park S.M., 2018; ., Kahan B.C., Guizzetti L. et al., 2019; Uysal Y., Babus S.B., Köse A. et al., 2019). Risk stratification based on various clinical, laboratory and endoscopic data makes it possible to identify high-risk factors for recurrent bleeding, as well as reduce the time of hospital stay for low-risk patients (Sokolova P.Yu., 2015; Petrov Yu.V., 2016; Makshiev A. E., 2018; Park S.M., Yeum S.C., Kim B-W. et al., 2016; Sostres C., Laredo V. et al., 2019;). Preendoscopic and full T.A. scores have been widely used to predict the occurrence of rebleeding. Rockall (Rockall T.A., Logan R.F.A., Devlin H.B. et al., 1996) and the O. Blatchford scale (Blatchford O., Murray W.R., Blatchford M., 2000), which were recommended for use by earlier international recommendations (Barkun A.N., Bardou M., Kuipers E.J. et al., 2010; Laine L., Jensen D.M., 2012).

O. Blatchford scale and pre-endoscopic T.A. scale Rockall are based on the use of clinical and laboratory data only. The O. Blatchford scale includes indicators of hemoglobin, blood urea, pulse, systolic blood pressure, melena, loss of consciousness, the presence of liver disease and heart failure, which are subject to a summed score. Recent clinical guidelines suggest using the O. Blatchford score with scores of one or less to identify patients with a very low risk of rebleeding who can be treated on an outpatient basis (Barkun A.N., Almadi M., Kuipers E.J. et al., 2019; Laine L., Barkun A.N., Saltzman J.R. et al., 2021).

Full scale T.A. Rockall includes indicators of age, shock, concomitant pathology, endoscopic picture of the disease and hemostasis. Depending on the points scored, the prognosis of rebleeding and mortality is determined. However, the above scale turned out to be low-informative for predicting recurrent bleeding in the hospital (Barkun A.N., Almadi M., Kuipers E.J. et al., 2019; Laine L., Barkun A.N., Saltzman J.R. et al., 2021).

Currently, new prognostic scales have been developed to determine the likelihood of recurrent bleeding and unfavorable outcome, exceeding the reliability of the scales of O. Blatchford and T.A. Rockall (Lebedev N.V., Klimov A.E.,

Sokolova P.Yu., Tsinoeva F.I., 2013; Valeev M.V., 2020; Shafaghi A., Gharibpoor F., Mahdipour Z., Samadani A.A. , 2019; Oakland K., Kahan B.C., Guizzetti L. et al., 2019; Kim M.S., Moon H.S., Kwon I.S. However, they all have one or another drawback: they are overloaded with variables, use difficult-to-remember threshold values and complex multi-stage calculation systems, and often do not take into account important criteria. None of the existing scales has 100% specificity and therefore does not fully satisfy specialists (Shabunin A.V., Nechipay A.M., Korzheva I.Yu. et al., 2016; Bystrov S.A., Katorkin S. E., Lichman L.A., Lisin O.E., 2018; Stanley A.J., Laine L., Dalton H.R. et al., 2017; .

Many surgeons have the severity of blood loss, endoscopic signs of a high risk of recurrent bleeding (Forrest-Ia-Ib after successful therapeutic endoscopy, Forrest-IIa-IIc), as well as the diameter of a gastric ulcer more than 2 cm, and a duodenal ulcer more than 1 cm, the location of the ulcer in the cardiac section or body of the stomach along the lesser curvature or on the posterior wall of the duodenum are considered the most important prognostic criteria for the occurrence of recurrent bleeding (Bagnenko S.F., Musinov I.M., Kurygin A.A., Sinenchenko G.I., 2009; Elmunzer B.J., Young S.D., Inadomi J.M. et al., 2008). Hemorrhagic shock, old age and a high comorbidity index, taking NSAIDs and coagulation disorders in the hemostatic system increase the risk of recurrent bleeding (Musinov I.M., 2007, 2016; Tarasov E.E., Bagin V.A., Nishnevich E.V. . et al., 2019; Seewald S., Seitz U., Thonke F. et al., 2001; Elmunzer B.J., Young S.D., Inadomi J.M. et al., 2008. Ultimately, the risk of recurrent bleeding is determined by the dynamics of bleeding stigmas in the ulcer crater after endoscopic treatment during conservative therapy, therefore it is important to quickly and more reliably perform primary endoscopic hemostasis (Musinov I.M., 2007; Timerbulatov Sh.V., Timerbulatov M.V. ., Sagitov R.B. et al., 2020).

National clinical guidelines for the treatment of UGDB recommend esophagogastroduodenoscopy (EGD) for patients with ulcerative bleeding within the first two hours of hospitalization (Russian Society of Surgeons [electronic resource]). According to international recommendations, therapeutic endoscopy

should be performed within 24 hours of admission to the hospital (Barkun A.N., Almadi M., Kuipers E.J. et al., 2019; Sung J.J.Y., Chiu P.W.Y., Chan F.K.L. et al., 2019; Laine L., Barkun A.N., Saltzman J.R. et al., 2021). Although, according to various authors, it has been shown that late performance of therapeutic endoscopy, especially in severe hemodynamically unstable patients, is directly associated with increased mortality (Laursen S.B., Leontiadis G.I., Stanley A.J. et al., 2017; Ren T., Wei J., Han B. et al., 2021).

There is a large number of studies in the literature indicating that injection therapy with an adrenaline solution is less effective in preventing recurrent bleeding compared to coagulation methods, clipping, or its combination with other methods of therapeutic endoscopy (Baracat F.I., Moura E., Bernardo W. et al., 2016; Ljubicic N., Budimir I., Biscanin A. et al., 2012; Shi K., Shen Z., Zhu G. et al., 2017; . Thus, when using only epinephrine solution for therapeutic endoscopy, recurrent bleeding was observed in 52% of cases (Kantowski M., Schoepfer A.M., Settmacher U. et al., 2018).

Some authors report the advantages of one or another coagulation method over other methods of treating ulcer bleeding (Mullady D.K., Wang A.Y., Waschke K.A., 2020).

New innovative OTSC clips are able to strongly compress the arrosive vessel in a callous ulcer, stop ongoing bleeding and prevent its recurrence (Schmidt A., Gölder S., Goetz M. et al., 2018; Kobara H., Mori H., Nishiyama N. et al. al., 2019). Stopping ongoing bleeding when using OTSC clips is possible in 92.4 - 100% of cases, with an average value of 96% of cases and recurrent bleeding in 10% of patients (Wedi E., Fischer A., Hochberger J. et al., 2018; Chandrasekar V.T., Sharma P., Desai M. et al., 2019; Weiland T., Rohrer S., Schmidt A. et al., 2020; - Medrada C., Oleas R., Alcívar-Vásquez J. et al., 2021).

OTSC clamps have demonstrated superiority over other types of therapeutic endoscopy and TAE for ulcer bleeding refractory to endoscopic hemostasis (Kuellmer A., Mangold T., Bettinger D. et al., 2021; Robles-Medronda C., Oleas R., Alcívar-Vásquez J. et al., 2021).

According to other researchers, clipping is less effective than using monopolar coagulation (Toka B., Eminler A.T., Karacaer C. et al., 2019).

The use of Doppler endoscopic examination to visualize the feeding branch of an arrosive vessel with a high risk of recurrent bleeding before endoscopic hemostasis can reduce the likelihood of recurrent bleeding due to a more accurate effect on the stigma of bleeding (Jensen D.M., Ohning G.V., Kovacs T.O. et al., 2016; Kantowski M., Schoepfer A.M., Settmacher U. et al., 2018; Bhurwal A., Patel A., Mutneja H. et al., 2021). However, international guidelines for the treatment of non-variceal bleeding from the upper gastrointestinal tract do not contain recommendations for the use of Doppler endoscopic examination for bleeding (Barkun A.N., Almadi M., Kuipers E.J. et al., 2019).

Performing a second-look EGD in patients with a low risk of recurrent bleeding is not recommended (Satoh K., Yoshino J., Akamatsu T. et al., 2016). Many specialists recommend repeat EGD for patients with a high risk of recurrent bleeding only in case of recurrent bleeding and in case of a high risk of its development (Tsoi K.K., Chan H.C., Chiu P.W., 2010; Park S.J., Park H., Lee Y.C. et al., 2018; Barkun A.N., Almadi M., Kuipers E.J. et al., 2019; Sung J.J.Y., Chan F.K.L. et al., Barkun A.N., Saltzman J.R. et al., 2021; , Lee-Smith W. et al., 2021). According to other authors, within 6 to 12 hours after performing therapeutic endoscopy, a repeat endoscopic examination is indicated in order to identify the dynamics of bleeding stigmas in the ulcer crater and, if necessary, perform a repeat therapeutic endoscopy (Teterin Yu.S., 2015; Melnik I.V., 2019; Ganin A.A., 2020; Marmo R., Rotondano G., Bianco M.A. et al., 2003; Kim S.B., Lee S.H., Kim K.O.

According to modern concepts, the pathogenesis of peptic ulcer disease (PU) comes down to an imbalance between the factors of acid-peptic aggression of gastric contents and the protective properties of the mucous membrane of the stomach and duodenum (Ivashkin V.T., Maev I.V., Tsarkov P.V. et al. ., 2020; Lee C.W., Sarosi G.A., 2011; Yeo S.H., Yang C.H., 2017; O'Morain C.A. et al., 2017; Robinson K., Atherton J.C., 2021). In this case, the decisive role in the development of ulcer belongs to Helicobacter pylori (H. pylori), which produces enzymes

(proteases, phospholipases, urease) and various cytokines that damage the gastric mucosa and cause the death of epithelial cells (Lee C.W., Sarosi G.A., 2011; Kuyumcu G. ., Latich I., Hardman R.L. et al., 2018; Narayanan M., Reddy K.M., Marsicano E., 2018). Contamination of the gastric mucosa with H. pylori leads to antral gastritis, which is accompanied by increased production of enzymes and hydrochloric acid. Overproduction of hydrochloric acid causes duodenitis, gastric-type metaplasia of the duodenal mucosa, which is colonized by H. pylori and can lead to the formation of a peptic ulcer. H. pylori is detected in 90% of patients with duodenal ulcers and 70% of patients with gastric ulcers. H. pylori-negative ulcers are most often caused by the use of anabolic steroids, anticoagulants, nonsteroidal anti-inflammatory drugs (NSAIDs), anticancer drugs and immunosuppressants (Pakodi F., Abdel-Salam O.M., Debreceni A., Mózsik G., 2000; Melcarne L., García-Iglesias P., Calvet X., 2016; Kavitt R.T., Lipowska A.M., Anyane-Yeboa A., Gralnek I.M., 2019; Robinson K., Atherton J.C., 2021; ., Jones N.L., Moss S.F., 2021).

Eradication of H. pylori, the likelihood of detection of which is reduced during bleeding, must be carried out (Malfertheiner P., Megraud F., O'Morain C.A. et al., 2017; Nagashima K., Tominaga K., Fukushi K., et al., 2018; Vörhendi N., Soós A., Engh M.A. et al., 2020; Gralnek I.M., Stanley A.J., Morris A.J. et al. It has been proven that eradication of H. pylori after ulcer bleeding significantly reduces the risk of ulcers and rebleeding in the future (Sverdén E., Brusselaers N., Wahlin K., Lagergren J., 2018; Hung K.W., Knotts R.M., Faye A.S., et al ., 2020).

Elimination of factors of acid-peptic aggression is extremely important for changing the destructive processes occurring in the ulcer crater to reparative ones, which reduces the likelihood of re-bleeding (Shapkin Yu.G., Potakhin S.N., Belikov A.V. et al., 2004; Kubota Y., Yamauchi H., Nakatani K. et al., 2021; Kamal F., Khan M.A., Lee-Smith W. et al., 2021).

At the same time, the synergistic effect of therapeutic endoscopy and high doses of proton pump blockers in preventing recurrent bleeding during conservative therapy has been proven (Chiu P.W., Joeng H.K., Choi C.L. et al., 2016; Tringali

A., Manta R., Sica M. et al. , 2017; Laine L., Barkun A.N., Saltzman J.R. et al., 2021; Csiki E., Szabó H., Hanák L. et al., 2021;

However, despite complex conservative treatment with various methods of endoscopic hemostasis, recurrent bleeding occurs on average in 14% of patients and sharply worsens the results of treatment (Lebedev N.V., Klimov A.E., Persov M.Yu., Petukhov V. A., 2018; Schmidt A., Gölder S., Goetz M. et al., 2018). Performing surgical intervention under these conditions, especially in patients with high operational risk, is accompanied by high mortality (Bagdasarov V.V., Bagdasarova E.A., Chernookov A.I. et al., 2016; Lebedev N.V., Belozerov G. E., Klimov A.E. et al., 2017; Ganin A.S., 2020).

A number of studies have shown that repeated endoscopic treatment after recurrent bleeding is no less effective than emergency surgery (Chiu P.W., Joeng H.K., Choi C.L. et al., 2016; Schweizer U., Grund K.E., Fundel J. et al., 2019 ; Stanley A.J., Laine L., 2019). Meanwhile, repeated endoscopic hemostasis in the event of recurrent bleeding is effective in approximately 75% of cases (Schmidt A., Gölder S., Goetz M. et al., 2018).

Performing a minimally invasive surgical intervention, accompanied by minimal surgical trauma, in case of recurrent bleeding, repeated recurrence of bleeding, or to prevent their occurrence, can improve treatment results (Kuyumcu G., Latich I., Hardman R.L. et al., 2018; Yu Q., Funaki B ., Navuluri R. et al., 2021). However, the effectiveness of TAE requires additional study.

1.3. The use of transcatheter arterial embolization for the treatment of ulcerative gastrointestinal bleeding

A change in the understanding of the pathogenesis of ulcerative disease, the emergence of modern angiographic technology, instruments and embolic agents with different properties have led to the wider use of TAE in the treatment of ulcerative bleeding (Lebedev N.V., Belozerov G.E., Klimov A.E. et al., 2017; Musinov I.M., Chikin A.S., Kachesov E.Y., 2018; Lau J.Y., Pittayanon R., Wong

K-T., 2019; , Pattonieri V. et al., 2019; Tong H., Lan T., Tang C.W., 2020; Loffroy R., Desmyttere A-S., Mouillot T., 2021; ; Lan T., Tong H., Qian S. et al., 2021).

Currently, there are three types of arterial embolization, which are performed with different embolic agents, which to a certain extent complicates a comparative analysis of the use of TAE with other methods of hemostasis for ulcer bleeding (Chang J.H., Lye T.J., Zhu H.Z. et al., 2021; Mille M., Engelhardt T., Stier A., 2021). Depending on the occlusion of the target vessel, segmental, proximal and local (superselective) embolizations are divided. The choice of embolization level depends on vascular anatomy, angiographic findings, technical ability to perform the procedure, and operator preference. During the segmental procedure, a long section of the artery with its branches and the source of bleeding is embolized. Extensive segmental embolization may be accompanied by ischemia of part of the corresponding organ (Sokolova P.Yu., Lebedev N.V., Klimov A.E., 2014; Kuyumcu G., Latich I., Hardman R.L. et al., 2018).

During proximal embolization, the microcatheter cannot be inserted into a bleeding vessel and therefore only the proximal part of the artery is embolized. Local embolization is superselective, i.e. The artery that is the source of bleeding is directly embolized. Repeated bleeding in this case may occur from other arrozed vessels with the progression of ulcerative alteration (Musinov I.M., Chikin A.E., Ganin A.S., Kachesov E.Yu., 2018; Kyaw M., Tse Y., Ang D. et al., 2014).

When embolizing the gastroduodenal artery, they embolize, as a rule, first the distal and then the proximal part of the artery (sandwich technique), taking into account the presence of pronounced collateral circulation and the likelihood of recurrent bleeding as a result of preserved retrograde blood flow (Kuyumcu G., Latich I., Hardman R.L. et al ., 2018; Mille M., Engelhardt T., Stier A., 2021).

Temporary and permanent embolic agents are currently used as embolic agents when performing TAE. Temporary embolic agents consist of biodegradable substances such as gelatin sponges. Permanent liquids include polyvinyl alcohol, ethylene-vinyl copolymer and N-butyl-2-cyanoacrylate. Permanent solid emboloagents are coils and triacrylic gelatin microspheres. All of the above

substances have different embolic properties and the effectiveness of their use varies (Wong T.C.L., Wong K.T., Chiu P.W.Y. et al., 2011; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021; Loffroy R., Guillen K., Chevallier O., 2021).

It should be noted that direct signs of bleeding—extravasation of the contrast agent during TAE—are observed only in every second patient (Wong T.C.L., Wong K.T., Chiu P.W.Y. et al., 2011). Indirect signs of bleeding - thrombotic vascular occlusion, vascular recalibration, local hypervascularization or aneurysm of the branches of the celiac trunk are more common. To exclude empirical embolization, the source of bleeding during endoscopy is marked with clips, which facilitates the search for the arrozen artery (Padia S.A., Geisinger M.A., Newman J.S. et al., 2009; Song J.S., Kwak H.S., Chung G.H., 2011; Wang Y., Jia P. , 2018). There are no statistically significant differences in the technical and clinical success of empirical and targeted embolization (Yu Q., Funaki B., Navuluri R. et al., 2021).

Complications of TAE are divided into local ones, related to angiography access, and consequences of the operation. Local complications are hematoma or false aneurysm at the site of arterial puncture. Complications of the operation may include damage to the target vessel, ischemia or even necrosis of the organ wall, post-ischemic acute erosions and ulcers, duodenostasis and abscesses of parenchymal organs. Complications after the use of TAE are observed in 0.18 - 18.5% of cases (Sokolova P.Yu., 2015; Ganin A.S., 2020; Wang Y.-L., Cheng Y.-S., Liu L.- Z. et al., 2012; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021). Recently, many authors have noted a low level of complications after arterial embolization - 0.18 - 4.5% of cases (Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021; Yu Q., Funaki B., Navuluri R. et al., 2021).

Surgery or TAE is the standard treatment for ulcer bleeding refractory to endoscopic hemostasis. The advantage of TAE is less trauma, the ability to do without laparotomy, which is especially important in patients in serious condition (Cheung F.K., Lau J.Y., 2009; Katano T., Mizoshita T., Senoo K. et al., 2012; Loffroy R. , Comby P.O., Falvo N. et al., 2019; Tarasconi A., Baiocchi G.L., Pattonieri V. et al., 2019;

The technical success rate of arterial embolization for ulcerative bleeding is 88–100% of cases (Ichiro I., Shushi H., Akihiko I. et al., 2011; Sildiroglu O., Muasher J., Arslan B. et al., 2014; Mille M., Huber J., Wlasak R. et al., 2015; Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018; Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018 ; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021; Loffroy R., Desmyttere A.-S., Mouillot T., 2021).

Clinical success rates for TAE use range from 64.5% to 96.6% of cases (Wong T.C.L., Wong K.T., Chiu P.W.Y. et al., 2011; Wang Y.-L., Cheng Y.-S., Liu L.- Z. et al., 2012; Nikänen T., Peltola E., Kylänpää L., Udd M., 2017; Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018; , Kratovska A. et al., 2019; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021; Lan T., Tong H., Qian S. et al., 2021; ., Mouillot T., 2021; Yu Q., Funaki B., Navuluri R. et al., 2021). At the same time, recurrent bleeding after the use of TAE occurs within a wide range - from 3.4% to 51.8% of cases, with an average of 14.8% of cases (Arrayeh E., Fidelman N., Gordon R.L. et al., 2012; Dixon S., Chan V., Shrivastava V. et al., 2013; Laursen S.B., Hansen J.M., Andersen P.E., Schaffalitzky de Muckadell O.B., 2014; Wu P., Szczesniak M.M., Craig P.I., Choo L. et al., 2014; Mille M., Huber J., Wlasak R. et al., 2015; , 2019; Lan T., Tong H., Qian S. et al., 2021; Loffroy R., Desmyttere A.-S., Mouillot T., Yu Q., Funaki B., Navuluri R. et al. ., 2021).

A meta-analysis by E. Boros, Z. Sipos, P. Hegyi et al. (2021) shows that the use of TAE after successful endoscopic hemostasis significantly reduces the likelihood of recurrent bleeding, reduces the need for repeated endoscopic hemostasis and surgical interventions compared with those patients who underwent only therapeutic endoscopy.

Carrying out TAE in case of ongoing bleeding with the ineffectiveness of therapeutic endoscopy, recurrent bleeding and in the absence of positive dynamics from stigmata of bleeding in the ulcer crater after successful endoscopic hemostasis in patients with high operational risk significantly improves treatment results (Bagdasarov, E.A. Bagdasarova, A.I. . Chernookov et al., 2016; Chikin A.E., Musinov I.M., Ganin A.S., Kachesov E.Yu., 2018; Ljungdahl M., Eriksson L-G.,

Nyman R., Gustavsson S., 2002; Ang D., Teo E.K., Tan A. et al., 2012; Kaminskis A., Ivanova P., Kratovska A. et al., 2019).

According to meta-analyses, the use of N-butyl-2-cyanoacrylate glue as an emboloagent during TAE is accompanied by the best rates of technical success - 95.3 - 98.8% of cases. Clinical success was 64.5 - 88% of cases, with recurrent bleeding in 12.5 - 35.4% of cases, mortality in 15.9 - 21.3% of cases and complications reaching 14.3% of cases (Chevallier O ., Comby P-O., Guillen K. et al., 2021; Loffroy R., Desmyttere A-S., Mouillot T., 2021).

There are studies in the literature indicating better results from the use of other emboloagents for the treatment of ulcer bleeding (Chang J.H., Lye T.J., Zhu H.Z. et al., 2021).

Meanwhile, a number of studies indicate that there is no statistical difference in mortality after the use of TAE or surgery, while noting a significant percentage of recurrent bleeding after arterial embolization (Wong T.C.L., Wong K.T., Chiu P.W.Y. et al., 2011; Kyaw M., Tse Y ., Ang D. et al., 2014). According to I. Darmon, L. Rebibo, M. Diouf et al. (2020), surgical intervention for bleeding from a duodenal ulcer resistant to therapeutic endoscopy was more effective than arterial embolization.

However, most literature sources note that the use of TAE in the treatment of ulcer bleeding is accompanied by less mortality than after the use of surgical aid (Musinov I.M., Chikin A.E., Ganin A.S., Kachesov E.Yu., 2018; Nykänen T., Peltola E., Kylänpää L., Udd M., 2017; Loffroy R., Comby P.O., Falvo N. et al., 2019;). Moreover, there is work showing that repeated use of TAE in case of recurrent bleeding after its initial use in most cases leads to stopping the bleeding and recovery of the patient (Poultsides G.A., Kim C.J., Orlando R. et al., 2008; Wang Y.-L. , Cheng Y.-S., Liu L.-Z. et al., 2012; Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018; , 2019).

Recently, an increasing number of authors have demonstrated the need to improve treatment outcomes with the prophylactic use of arterial embolization after successful therapeutic endoscopy with a continuing threat of recurrent bleeding

(Lau J.Y., Pittayanon R., Wong K-T. et al., 2019; Tong H., Lan T. ., Tang C.W., 2020; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021).

All of the above made it necessary to clarify the effectiveness of arterial embolization for ulcerative gastrointestinal bleeding, to improve the tactics of their treatment, and was the basis for this dissertation research.

Summary

1. Recurrent bleeding that occurs during conservative therapy after therapeutic endoscopy worsens treatment results and remains the main problem in the treatment of ulcerative gastrointestinal bleeding.
2. Open surgical interventions for recurrent bleeding and for the purpose of preventing it are not able to significantly improve the results of treatment of patients with ulcerative bleeding.
3. Arterial embolization is a minimally invasive intervention that can stop ongoing bleeding and prevent its recurrence, which makes it necessary to clarify the effectiveness of its use in ulcerative bleeding.

Chapter 2. MATERIALS AND METHODS OF RESEARCH

2.1. General characteristics of clinical material

This clinical study was carried out at the St. Petersburg State Budgetary Healthcare Institution “City Aleksandrovskaya Hospital”. The clinical material of the study consisted of the results of treatment of 2182 patients with gastroduodenal bleeding of ulcerative etiology, treated in the above-mentioned hospital from 2012 to 2021. Examination and treatment of patients with ulcerative bleeding was carried out taking into account the National Clinical Guidelines for the Treatment of Ulcerative Gastroduodenal Bleeding (Russian Society of Surgeons [electronic resource]).

The purpose of examining patients with UGDB was to assess the clinical condition, the severity of blood loss, identify the location of the chronic ulcer(s) in the stomach or duodenum and the degree of stability of hemostasis. Upon admission to the hospital, all patients underwent a comprehensive examination with verification of the main and concomitant diagnoses.

The localization of the source of bleeding and its characteristics were established during endoscopy. Patients with ongoing bleeding or a high risk of recurrent bleeding according to endoscopic examination underwent therapeutic endoscopy. Subsequently, all patients underwent complex conservative treatment. During treatment, in patients with unstable hemostasis, repeated endoscopy was performed within 12 hours in order to clarify the dynamics of bleeding stigmas in the ulcer crater, which in some cases was supplemented with repeated endoscopic hemostasis. In the absence of positive dynamics of bleeding stigmas in the ulcer crater or recurrent bleeding in the hospital, open surgery or TAE was performed.

Laboratory and clinical data were used to determine the severity of blood loss. If more than twelve hours have passed since the bleeding, then the volume of blood loss was calculated using Moore’s formula: $V = p \times q \times (Ht1 - Ht2) / Ht1$, where V is the volume of blood loss in milliliters; p – patient’s body weight; q is an

empirical number showing the average amount of blood in one kilogram of human body weight (for women - 65 ml/kg, for men - 70 ml/kg); Ht1 – normal hematocrit number (women – 40, men – 45); Ht2 – hematocrit number of the patient.

The severity of blood loss was taken into account according to a four-stage classification, according to which light, moderate, severe and extremely severe blood loss are distinguished (Bagnenko S.F., Musinov I.M., Kurygin A.A., Sinenchenko G.I., 2009).

Mild blood loss (grade 1). The patient's condition is satisfactory. Blood pressure – not lower than 100 mm Hg. Art., increase in heart rate - up to 100 beats/min. The hemoglobin concentration is not lower than 100 g/l, and the number of red blood cells is not lower than 3.5x1012/l. The deficit of circulating blood volume (CBV) is up to 15%, and its relative density is 1.053 – 1.050.

Moderate blood loss (grade 2). The patient's condition is deteriorating. Blood pressure can be reduced to 90 mm Hg. Art., the increase in heart rate reaches 120 beats/min. The hemoglobin concentration is not lower than 80 g/l, and the number of red blood cells is not lower than 2.5x1012/l. The deficit of bcc is up to 25%, and its relative density is 1.050 – 1.045.

Severe blood loss (grade 3). The patient's condition is serious, characterized by loss of consciousness. Blood pressure is below 90 mm Hg. Art., tachycardia – above 120 beats/min. The hemoglobin concentration is from 80 g/l to 60 g/l, and the number of red blood cells is from 2.5x1012/l to 1.5x1012/l. The BCC deficiency reaches 40%, and the determined relative density is below 1.045.

Extremely severe blood loss (grade 4) is characterized by the critical condition of the patient with signs of hemorrhagic shock and tachycardia over 120 beats/min. Often the pulse is determined only in the central arteries. The hemoglobin concentration decreases below 60 g/l, the number of red blood cells decreases below 1.5x1012/l. BCC deficiency is more than 40%, and the relative density of blood is below 1.045. The estimated amount of blood loss is more than 2 liters of blood.

Recurrent bleeding after therapeutic endoscopy was determined according to clinical, laboratory and endoscopic data. The criteria for relapse of hemorrhage

were vomiting of slightly changed blood (coffee grounds), its entry through a gastric tube and (or) melena, as well as general signs of hypovolemia and (or) a decrease in hemoglobin by more than 20 g/l.

To improve the tactics of treating ulcerative bleeding, we compared the results of treatment of 331 patients with open surgical interventions performed for ulcerative bleeding during the analyzed period, who made up the control group and 124 patients of the main group who underwent targeted arterial embolization. Among the patients who underwent TAE, 82 (66%) were at high surgical risk. From the group with open surgical interventions, there were 191 (55.7%) patients ($p>0.05$). Patients with high surgical risk were identified using a scale for assessing acute and chronic physiological changes - Acute Physiology And Chronic Health Evaluation (APACHE II). The latter included patients if they had more than 11 points on the APACHE II scale.

In the control group, among patients with bleeding from chronic gastric ulcers there were 156 (47.1%) people, in the main group 68 (54.8%) people ($p>0.05$). In the control group, chronic duodenal ulcer was the source of bleeding in 175 (52.9%) patients, in the main group in 56 (45.2%) patients ($p>0.05$).

Combined ulcers of the stomach and duodenum were observed in 35 (10.6%) patients in the control group and 18 (14.5%) patients in the main group.

In this case, the analysis took into account bleeding from the chronic ulcer from which the bleeding occurred.

As can be seen in Table 2.1, there were 205 (61.9%) men in the control group, and 83 (66.9%) men in the main group ($p>0.05$). There were 126 (38.1%) and 41 (33.1%) women, respectively ($p>0.05$)

During the analyzed period, elderly patients predominated - 125 (37.8%) patients in the control group and 42 (33.9%) patients in the main group. Senile age was observed in 111 (33.5%) patients in the control group and in 33 (26.6%) patients in the main group. Young patients made up 7.9% and 8.9% of patients in the control and main groups, respectively. Surgical intervention was most rarely performed on centenarians.

Table 2.1 – Distribution of patients in the main and control groups by age and gender.

	Men		Women		Total	
	Control group (%)	Main group (%)	Control group (%)	Main group (%)	Control group (%)	Main group (%)
Young	19 (5,7)	10 (8,1)	7 (2,1)	1	26 (7,9)	11 (8,9)
Average	42 (12,7)	27 (21,8)	26 (7,9)	8 (6,5)	68 (20,5)	35 (28,2)
Elderly	86 (26,0)	31 (25,0)	39 (11,8)	11 (8,9)	125 (37,8)	42 (33,9)
Senile	58 (17,5)	14 (11,3)	53 (16,0)	19 (15,3)	111 (33,5)	33 (26,6)
Centenarians	–	1	1	2 (1,6)	1	3 (2,4)
Total	205 (61,9)	83 (66,9)	126 (38,1)	41 (33,1)	331 (100)	124 (100)

The study was dominated by patients with severe blood loss - 47.4% of patients in the control group and 47.6% of patients in the main group, as well as with extremely severe blood loss - 38.4% of cases and 30.6% of cases, respectively (Table 2.2).

Table 2.2 - Distribution of patients with ulcerative gastroduodenal bleeding according to the severity of blood loss

Heaviness blood	Number of patients		Significance of differences
	Control group (%)	Main group (%)	
Average	47 (14,2)	27 (21,8)	p>0,05
Heavy	157 (47,4)	59 (47,6)	p>0,05
Extremely heavy	127 (38,4)	38 (30,6)	p>0,05
TOTAL:	331 (100)	124 (100)	–

In 82.2% of patients, the size of the ulcerative defect was more than 2 cm in diameter in chronic gastric ulcers and more than 1 cm in chronic duodenal ulcer. The results of comparison of concomitant diseases did not reveal significant differences in nosological forms in the main and control groups of patients (Table 2.3). The most common disease was coronary heart disease (CHD), which occurred in 142 (42.9%) patients in the control group and in 61 (49.7%) patients in the main group. At the same time, atherosclerotic and post-infarction cardiosclerosis was observed in 20.8% of patients in the control group and in 28.2% of patients in the main group, chronic heart failure stage IIA and higher - in 22.6% and 16.9% of patients, respectively. Heart rhythm disturbances were detected in 17.5% of patients in the control group and in 21.8% of patients in the main group.

The other most common disease was hypertension, which was observed in 39.6% of cases in the control group and in 44.3% of cases in the main group of patients.

Diabetes mellitus was the third most common disease - 11.8% of cases in the control group and 16.9% of cases in the main group of patients. Stage 3-4 obesity was observed in 10.5% and 15.3% of patients, respectively. Other diseases in patients from the compared groups were less common.

Table 2.3 – Frequency of side diseases in patients with bleeding from chronic ulcers of the stomach and duodenum

Accompanying illnesses	Number of patients		Credibility
	Control group (%)	Main group (%)	
IHD: – atherosclerotic and post-infarction cardiosclerosis – chronic heart failure stage IIA and higher – heart rhythm disturbances	142 (42,9) 69 (20,8) 75 (22,6) 58 (17,5)	61 (49,2) 35 (28,2) 21 (16,9) 27 (21,8)	p>0,05 p>0,05 p>0,05 p>0,05
Hypertension stage II-III	131 (39,6)	55 (44,3)	p>0,05
Hemiparesis after stroke	18 (5,4)	11 (8,9)	p>0,05
Cirrhosis of the liver	15 (4,5)	8 (6,5)	p>0,05
Opiate addiction	12 (3,6)	6 (4,8)	p>0,05
Diabetes mellitus type I-II	39 (11,8)	21 (16,9)	p>0,05
Chronic obstructive pulmonary diseases	31 (9,4)	11 (8,9)	p>0,05
Cholelithiasis	21 (6,3)	11 (8,9)	p>0,05
Kidney failure	29 (8,8)	13 (10,5)	p>0,05
Malignant neoplasms	19 (5,7%)	7 (5,6)	p>0,05
Obesity stage 3-4	35 (10,5)	19 (15,3)	p>0,05
Other diseases	78 (23,5)	28 (22,5)	p>0,05

It should be noted that 61 (18.4%) patients in the control group and 23 (18.5%) patients in the main group had a combination of two chronic diseases. In 127 (38.3%) patients in the control group and in 57 (46%) patients in the main group, a combination of three or more nosological forms occurred.

All of the above indicates that the patients in the compared groups were comparable in terms of main clinical indicators.

2.2. Methods of therapeutic endoscopy for ulcerative bleeding.

All patients with clinical gastrointestinal bleeding as quickly as possible, but no later than 2 hours from the moment of admission, underwent endoscopy, which determined the source of bleeding and the degree of stability of hemostasis. Depending on the patient's condition, EGDS was performed in the intensive care unit or endoscopy room. Endoscopy was performed using
endoscopic video system from PENTAX PENTAX EG with video gastroscopes EG-2990i, EG-2990K, EG-2790K, EG-290Kp (Japan).

To stratify patients according to the degree of stability of hemostasis, the J. Forrest classification was used (Forrest J., Finlarson N., Sherman D., 1974) with the following characteristics:

Forrest Ia – spurting bleeding;

Forrest Ib – oozing bleeding (sluggish leakage of blood);

Forrest IIa – visible vessel (visible thrombosed vessel);

Forrest IIb – fixed clot (fixed thrombus or clot);

Forrest IIc – pigmented (black) spot;

Forrest III - an ulcer without stigmas (traces) of previous bleeding.

In case of ongoing bleeding (Forrest Ia-Ib) or unstable hemostasis (Forrest IIa-IIb), therapeutic endoscopy was performed. To carry it out, injection of an adrenaline solution, monopolar diathermocoagulation, argon plasma coagulation, clipping, and a combination of various methods were used. More often, a combination of injection with coagulation techniques was used.

Injection was carried out using injectors from MTW-Endoskopie and Endoflex T25 22-G4 (Germany). The volume of the injected solution depended on the specific source of bleeding and ranged from 2 to 10 ml of adrenaline solution

diluted with saline (1:10000). Injection was carried out from 3-6 points into the area of stigmata of bleeding in a chronic ulcer.

Monopolar diathermocoagulation was performed using an Erbe VIO 200S apparatus from Erbe (Germany) with probes from MTW-Endoskopie or Endoflex 901 80 22-B (Germany). In this case, coagulation was carried out from the periphery to the center of the bleeding source, which increased the effectiveness of the procedure.

For argon plasma coagulation, the Erbe VIO APC2 apparatus from Erbe (Germany) was used. Argon plasma coagulation has a more targeted effect when performed compared to monopolar coagulation, since the spark charge is supplied through the inert gas argon, which ensures that the electrode does not come into contact with the source of bleeding and the coagulation itself is more directed.

For clipping, a multi-charge clipper from Olympas HX5LR1 with titanium endoclips was used.

Repeated endoscopic examination was performed in case of incomplete primary examination, during the control examination and in case of recurrence of hemorrhage, which was accompanied by repeated therapeutic endoscopy.

2.3. Methodology for performing transcatheter arterial embolization for bleeding from chronic gastroduodenal ulcers

Selective TAE was used to stop bleeding in cases of resistance to therapeutic endoscopy, recurrent bleeding, as well as to prevent its occurrence in the absence of positive dynamics from the stigma of bleeding after primary endoscopic hemostasis. Access through the femoral artery for TAE was used in 87 (74.2%) cases, through the brachial artery - in 6 (4.8%) cases, through the right or left radial artery - in 31 (25%) cases (Table 2.4) .

Table 2.4 – Access used for transcatheter arterial embolization

Used access	Number of patients (%)
Right femoral artery	83 (71)
Left femoral artery	4 (3,2)
Right brachial artery	3 (2,4)
Left brachial artery	3 (2,4)
Right radial artery	26 (21)
Left radial artery	5 (4,0)
TOTAL:	124 (100%)

To perform TAE, we used the multifunctional interventional imaging system Innova IGS 530 and Innova 3100 IQ from General Electric (USA). After catheterization of the central artery with 5F or 6F catheters, celiacography and selective angiography of its branches were performed: the splenic, left gastric artery and its branches, the common hepatic artery, the gastroduodenal artery and its branches and the inferior pancreatic-duodenal artery from the superior mesenteric artery system (Figure 2.1).

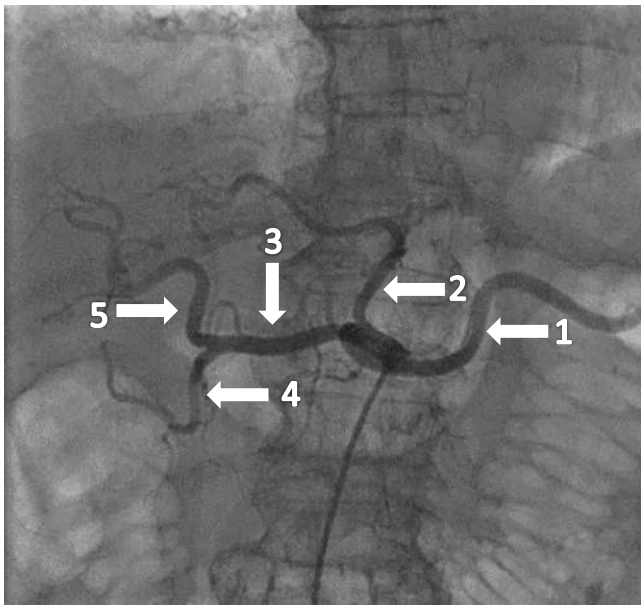

Figure 2.1 – Angiogram of the celiac trunk: 1 – splenic artery; 2 – left gastric artery; 3 – common hepatic artery; 4 – gastroduodenal artery; 5 – proper hepatic artery

During TAE, we looked for direct and indirect signs of gastrointestinal bleeding. A direct sign of bleeding was considered to be leakage (extravasation) of the contrast agent into the cavity of the stomach or duodenum when it was supplied through a catheter during arterial embolization (Figure 2.2).

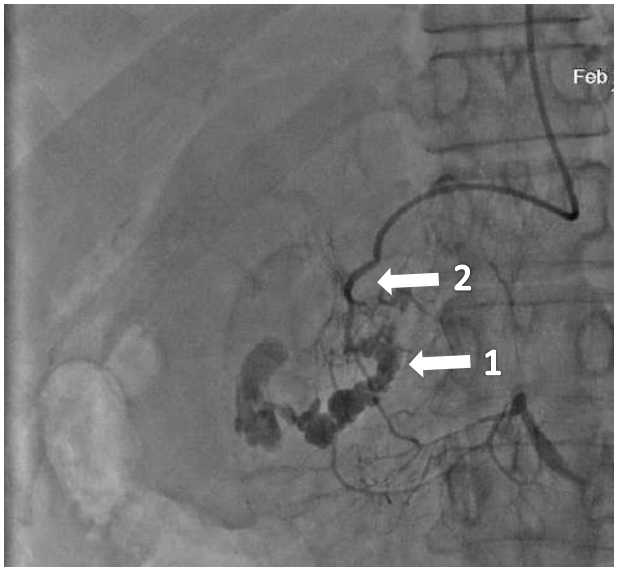

Figure 2.2 – Angiogram of the gastroduodenal artery: 1 – leakage of contrast agent into the lumen of the duodenum; 2 – gastroduodenal artery

Indirect signs included thrombotic occlusion, regional spasm, arterial recalibration, local hypervascularization in the organ wall, or false arterial aneurysm (Figures 2.3 – 2.6).

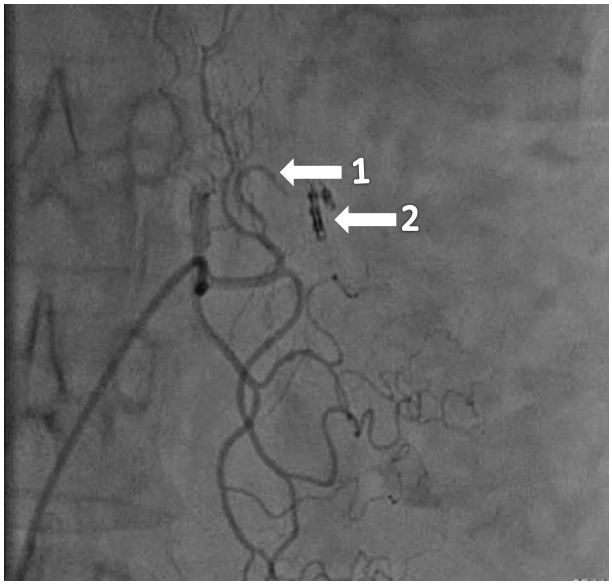

Figure 2.3 – Angiogram of the left gastric artery: 1 – thrombotic occlusion of a branch of the left gastric artery; 2 – clip in a chronic ulcer

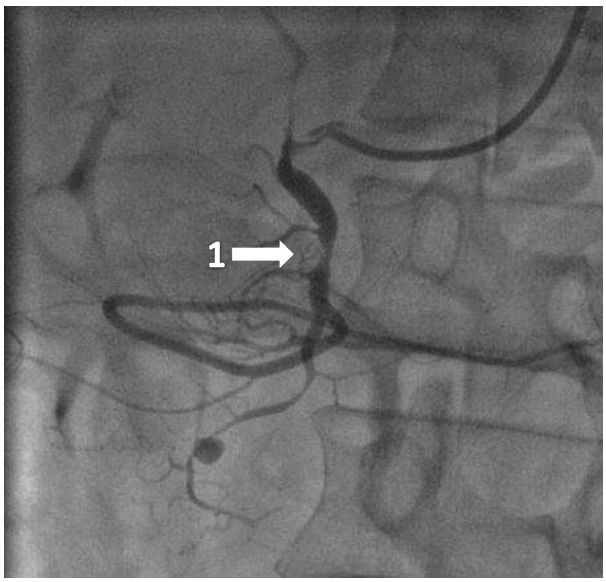

Figure 2.4 – Angiogram of the gastroduodenal artery: 1 – recalibration of the gastroduodenal artery

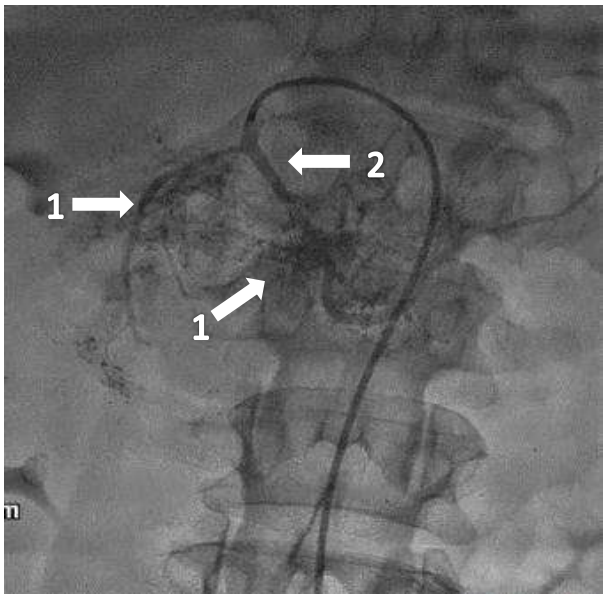

Figure 2.5 – Angiogram of the gastroduodenal artery: 1 – local hypervascularization; 2 – gastroduodenal artery

The presence of a chronic ulcer in the stomach or duodenum leads to a change in the angioarchitecture in the area of its location, which is manifested by indirect signs of bleeding. Searching for direct and indirect signs of bleeding allows you to perform targeted embolization.

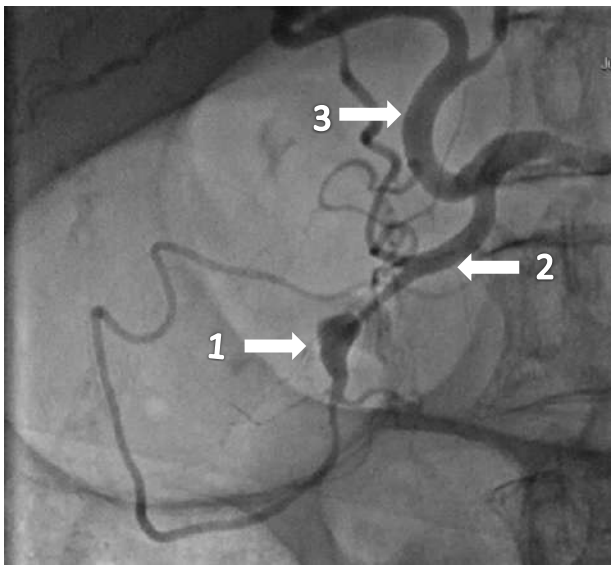

Figure 2.6 – Angiogram of the gastroduodenal artery: 1 – aneurysm; 2 – gastroduodenal artery; 3 – proper hepatic artery

To facilitate the search for the target vessel during EGD, in some cases, clipping of the arrozen vessel was used or a clip was installed directly next to it (Figure 2.7).

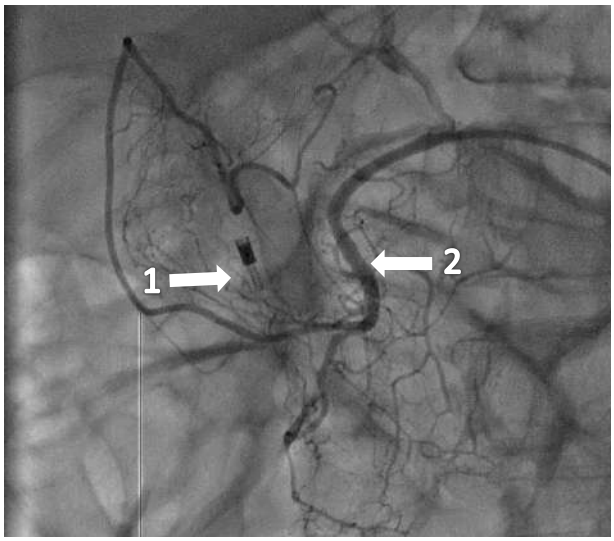

Figure 2.7 – Angiogram of the gastroduodenal artery: 1 – clip in the ulcerative crater; 2 – gastroduodenal artery

When the clip was placed in an ulcer crater next to an arrosive vessel, extravasation of the contrast agent was sometimes observed. In addition, in a number of cases, a combination of direct and indirect signs of ulcer bleeding was determined (Figure 2.8).

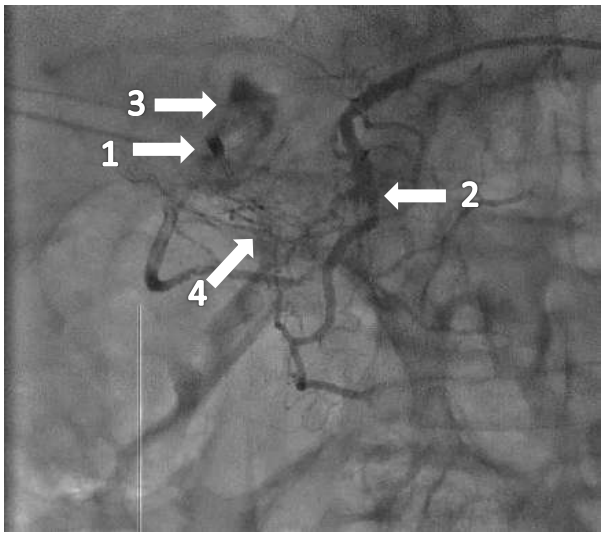

Figure 2.8 – Angiogram of the gastroduodenal artery: 1 – clip in the ulcerative crater; 2 – gastroduodenal artery; 3 – leakage of contrast agent into the lumen of the duodenum; 4 – local hypervascularization

Arterial embolization was carried out with the drug “Histoacryl” (Germany), containing an adhesive adhesive composite based on N-butyl-2-cyanoacrylate, which was diluted depending on the clinical situation with the X-ray contrast agent “Lipiodol ultra-fluid” (France) in a ratio of 1: 1 or 1:2, which made it possible to see the embolized area of the artery during fluoroscopy. The solution was injected through a microcatheter inserted through a guidewire directly into the embolized artery. When introducing the embolisate, the microcatheter was tightened to the required level of embolization.

The technical success of arterial embolization was monitored at the end of the operation by angiography of the celiac trunk and superior mesenteric artery (Figure 2.9).

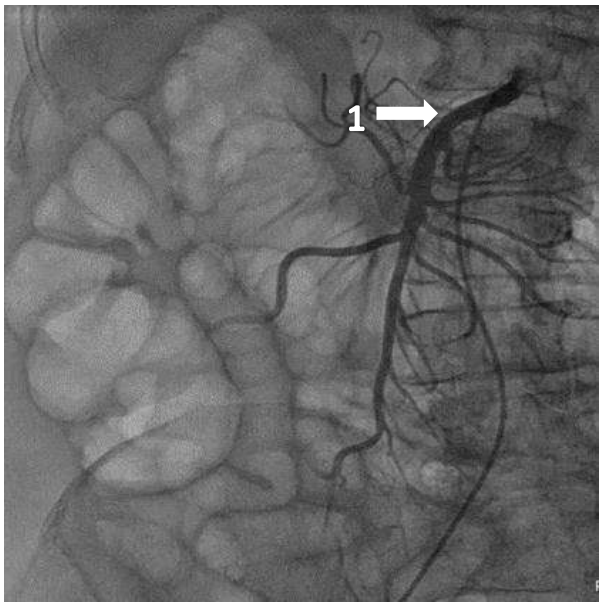

Figure 2.9 – Angiogram of the superior mesenteric artery: 1 – superior mesenteric artery

If signs of bleeding were detected, embolization of the entire artery from the system of which the bleeding occurred was performed.

When using TAE, the following criteria for its effectiveness were used:

1. technical success – cessation of blood supply in the embolization zone;

2. clinical success – absence of recurrent bleeding after successful embolization;

3. recurrence of bleeding after arterial embolization;

4. complications during and after arterial embolization;

5. the need to perform delayed surgical interventions;

6. lethality.

Depending on the location of the ulcerative defect and angiographic signs found during the operation, embolization of the following arteries was performed: left gastric artery, descending branch of the left gastric artery, right gastric artery, right gastroepiploic artery, gastroduodenal artery, as well as superselective embolization. Superselective embolization was understood as embolization of one of the branches of the descending branch of the left gastric artery or a branch of the gastroduodenal artery.

After targeted arterial embolization, patients received complex conservative therapy, including correction of concomitant pathology. Depending on the clinical situation and morphology of the chronic ulcer, control endoscopy was performed on days 1–3 of the postoperative period, as well as before discharge from the hospital.

2.4. Conservative treatment in patients with ulcerative gastrointestinal bleeding

After verification of the diagnosis and achievement of endoscopic or endovascular hemostasis, patients with severe and extremely severe blood loss were sent to the intensive care unit; those with moderate and mild blood loss were treated in the surgical department. The goal of conservative therapy was to correct the volume of circulating blood and oxygen carrier, correct disorders of homeostasis and hemostasis, prevent recurrent bleeding, create optimal conditions for scarring of the ulcer and treatment of concomitant pathologies.

The infusion-transfusion therapy program was drawn up taking into account the severity of blood loss, the patient’s age and the presence of concomitant pathology. Infusion-transfusion therapy began with the administration of crystalloid solutions. In case of hypovolemia up to 10% of the volume of blood volume, infusion treatment was not carried out. With hypovolemia in the range from 10 to 30% of the bcc, the ratio of colloid and crystalloid drugs was 1:1.5, and with severe and

extremely severe blood loss - 1:2. Transfusion of erythrocyte blood components was performed when hemoglobin decreased below 70 g/l. On the second and subsequent days of hospitalization, hemodilution tactics were continued in order to completely correct the consequences of acute blood loss.

Antisecretory therapy was carried out in accordance with domestic clinical guidelines for the treatment of ulcerative dysplasia, approved at the All-Russian Consensus Conference on the adoption of National Guidelines on June 6, 2014 (Voronezh).

2.5. Statistical processing of research results

Statistical processing of the study results was carried out using the application package Statistica for Windows and Microsoft Excel. Microsoft Excel was used to create the data matrix.

To assess differences in quantitative indicators in different groups for independent samples, after checking the distribution of characteristics for compliance with the law of normal distribution using the Shapiro–Wilk test, the hypothesis of equality of two shares was used. Quantitative indicators different from the normal distribution were compared using an analogue of the Student's t-test - the Mann-Whitney U-test.

CHAPTER 3. RESULTS OF TREATMENT FOR ULCERAL GASTROINTESTINAL BLEEDINGS

3.1. Results of treatment of bleeding from chronic ulcers of the stomach and duodenum and the impact of recurrent bleeding on them

From 2012 to 2021, 2182 patients with UGDB were treated in hospital. Of these, 124 (5.7%) patients underwent arterial embolization, 2058 (94.3%) patients underwent conservative treatment with therapeutic endoscopy or open surgery. The overall surgical activity was 20.9% of cases (455 patients). Open surgical interventions for ulcerative bleeding were performed in 15.2% of cases (331 patients), arterial embolization in 5.7% of cases (124 patients). Open surgical interventions were more often performed for chronic gastric ulcers complicated by bleeding - 17.6% of cases (156 patients). For chronic duodenal ulcer complicated by bleeding, open surgery was performed in 13.5% of cases (175 patients).

Overall mortality was 3.3% (73 patients died). Mortality after TAE was observed in 8 (6.5%) patients. Moreover, all deaths occurred in patients at risk of surgical intervention, i.e. mortality in this group was 9.8% of cases. Fatal outcomes in patients without arterial embolization were observed in 65 (3.2%) patients. 55 (16.6%) patients in the control group died, with 39 (20.4%) patients dying in the group with a high risk of surgical intervention. Thus, in the group of patients with a high risk of surgical intervention who underwent TAE and those treated without its use, the differences are statistically significant ($p < 0.001$).

A comparison of mortality in patients with UGDB after open surgery and arterial embolization is presented in Table 3.1.

Table 3.1 – Results of surgical treatment of ulcerative gastrointestinal bleeding

Heaviness blood loss	Control group (n=331)			Main group (n=124)			Credibility differences
	Quantity patients	Mortality		Quantity patients	Mortality		
		Abs.	%		Abs.	%	
Average	47	2	4,3	27	1	3,7	p=0,45
Heavy	157	27	17,2	60	2	3,3	p=0,004
Extremely heavy	127	26	20,5	37	5	13,5	p=0,17
TOTAL	331	55	16,6	124	8	6,5	p=0,003

Postoperative mortality after open surgery was 16.6% of cases versus 6.5% of cases in patients who underwent TAE (p=0.003). High mortality after open surgery was observed in patients with severe (17.2%) and extremely severe blood loss (20.5%). In patients with TAE performed for ongoing ulcer bleeding, its recurrence or prevention of its occurrence, mortality with severe blood loss was 3.3% of cases, with extremely severe blood loss - 13.5% of cases.

The immediate cause of death in the main group in 7 patients with severe or extremely severe blood loss was: in 5 cases, acute cardiovascular failure and in 2 patients - cancer intoxication, which was aggravated by post-hemorrhagic disorders. Death in one patient, who died from acute cardiovascular failure, occurred after open surgery. Another patient with moderate blood loss died from pulmonary embolism. In no case was the death directly related to arterial embolization (Table 3.2).

Table 3.2 - Fatal outcomes in patients with ulcerative gastroduodenal bleeding

Immediate cause of death	Control group (n=331)		Main group (n=124)	
	Abs.	%	Abs.	%
Cardiovascular failure	19	34,5	5	62,5
Acute myocardial infarction	5	9,1	–	–
Acute cerebrovascular insufficiency	4	7,3	–	–
Thromboembolism of the branches of the pulmonary artery	6	10,9	1	–
Cirrhosis of the liver	6	10,9	–	–
Pneumonia, respiratory failure	4	7,3	–	–
Peritonitis	7	12,7	–	–
Cancer intoxication	4	7,3	2	25
TOTAL	55	100	8	100

The most common cause of death in the control group was cardiovascular failure, which occurred in 19 (34.5%) patients. Other immediate causes of death were peritonitis (12.7%), thromboembolism of the branches of the pulmonary artery (10.9%), liver cirrhosis (10.9%), acute myocardial infarction (9.1%), as well as acute cerebrovascular insufficiency, pneumonia and progressive cancer intoxication, which were observed in 7.3% of cases each.

Thus, the use of TAE compares treatment results favorably with open surgical interventions for ulcer bleeding.

Recurrent bleeding in the hospital occurred in 99 (4.5%) of 2182 patients. The occurrence of recurrent bleeding in the hospital worsened the results of treatment of patients with UGDB. It was observed in 5 (62.5%) of 8 deceased patients in the main group and in 21 (38.2%) of 55 patients in the control group ($p = 0.09$).

Most recurrent bleeding in the main and control groups occurred on the first day of hospital stay (Figure 3.1).

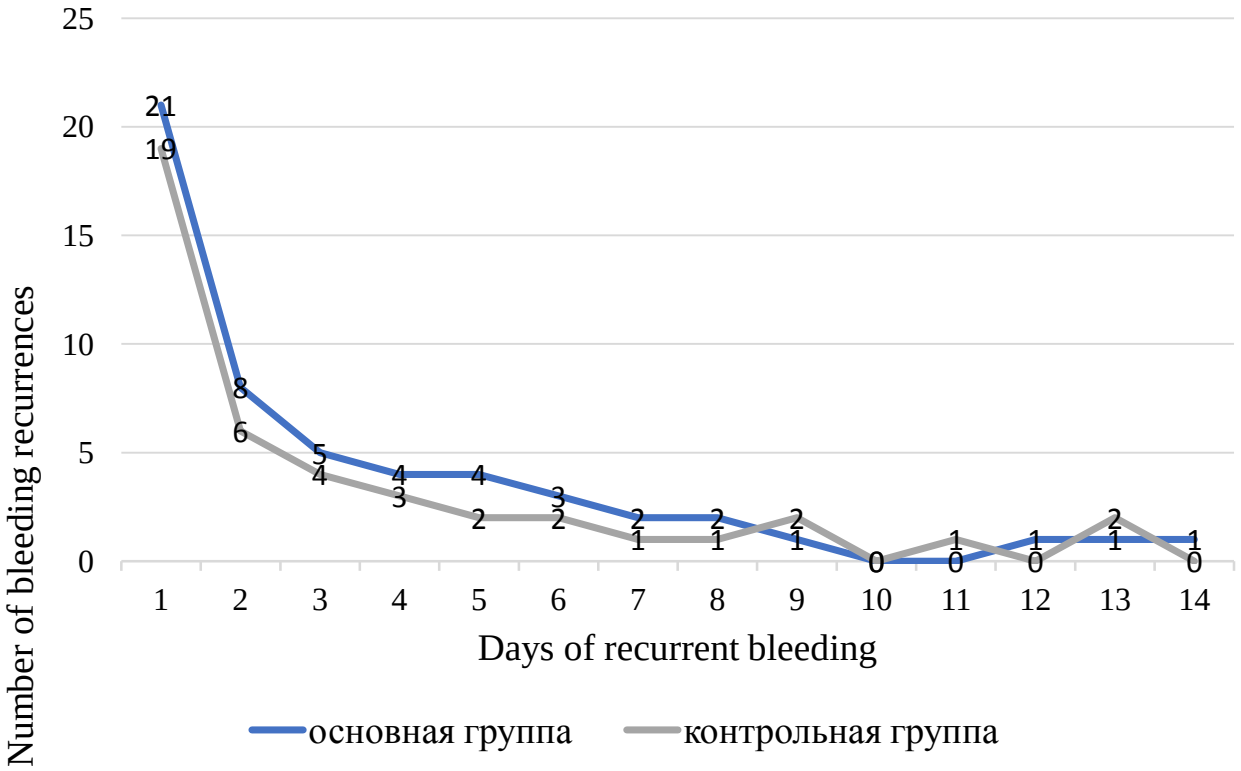

Figure 3.1 – Occurrence of recurrent bleeding from chronic ulcers in the hospital in patients of the main and control groups.

Moreover, in the first 12 hours there were 3 (5.7%) recurrent bleeding in the main group and 2 (4.3%) in the control group, which indicates the high effectiveness of therapeutic endoscopy and anti-ulcerogenic therapy during this period. In total, on the first day of hospital stay, 37 (37.3%) cases of recurrent bleeding occurred, and in the first three days - 63 (63.6%) cases, in the first five days - 76 (76.8%) cases. On the sixth and subsequent days, isolated relapses of bleeding were observed.

In patients of the main group, recurrent bleeding was an indication for surgery in 53 (42.8%) of 124 patients, in patients of the control group - in 46 (13.9%) of 331 patients ($p < 0.001$) (Table 3.3).

Table 3.3 - Indications for surgical intervention for ulcerative bleeding

Indications for the operation	Control group (n=331)		Main group (n=124)		Credibility differences
	Abs.	%	Абbs.	%	
Continued bleeding	75	22,7	20	16,1	p>0,05
Recurrent bleeding	46	13,9	53	42,8	p<0,001
Lack of positive dynamics of bleeding stigmas after therapeutic endoscopy	210	63,4	51	41,1	p<0,001
Total	331	100	124	100	–

In the control group, ongoing bleeding when therapeutic endoscopy was ineffective was an indication for open surgery in 75 (22.7%) patients, in the main group in 20 (16.1%) patients (p>0.05). In the absence of positive dynamics of bleeding stigmas after therapeutic endoscopy, open surgery was more often performed - in 63.4% of cases, arterial embolization - in 41.1% of cases (p <0.001). Thus, when recurrent bleeding occurred, TAE was performed more often. Despite the more severe condition of patients who suffered recurrent bleeding, the results of treatment of patients who underwent targeted arterial embolization were better than patients who underwent open surgery.

The occurrence of most recurrent bleeding on the first day of the posthemorrhagic period, namely between 12 and 24 hours in the hospital, indicates the need to perform control endoscopy 12 hours after the first therapeutic endoscopy and assess the dynamics of bleeding stigmas in the ulcer crater. Complex conservative therapy and therapeutic endoscopy are not able to prevent the occurrence of recurrent bleeding in some patients, which requires targeted prevention of its occurrence by surgery. In this case, it is preferable to perform minimally invasive surgical intervention - arterial embolization, accompanied by minimal surgical trauma.

Types of open surgical interventions for DU are presented in Table 3.4.

Table 3.4 - Open surgical interventions in patients with bleeding from chronic ulcers of the stomach and duodenum

Types of operations	Control group (n=331)			Main group (n=124)		
	Stomach ulcer	Duodenal ulcer	Total	Stomach ulcer	Duodenal ulcer	Total
Gastric resection	84 (25,4%)	46 (13,9%)	130 (39,3%)	3 (18,8%)	—	3 (18,8%)
Stitching or excision of an ulcer	57 (17,2%)	82 (24,8%)	139 (42%)	7 (43,7%)	4 (25%)	11 (68,7%)
Vagotomy with pyloroplasty and suturing of the ulcer	15 (4,5%)	47 (14,2%)	62 (18,7%)	—	2 (12,5%)	2 (12,5%)
TOTAL	156 (47,1%)	175 (52,9%)	331 (100%)	10 (62,5%)	6 (37,5%)	16 (100%)

Open surgical interventions were performed in 16 (12.9%) of 124 patients of the main group: 3 (2.4%) patients with ongoing bleeding when arterial embolization was unsuccessful, another 3 (2.4%) patients with recurrent bleeding in the hospital and 10 (8.1%) for patients in a delayed manner with large chronic ulcers. The most common surgical intervention was suturing or excision of a chronic ulcer, which for duodenal ulcers was performed together with pyloroplasty.

In the control group of patients, in 52.9% of cases, operations were performed for bleeding duodenal ulcers and in 47.1% of cases for chronic gastric ulcers complicated by bleeding. The most common surgical intervention for chronic duodenal ulcer was suturing or excision of the chronic ulcer performed with pyloroplasty - 24.8% of cases. Vagotomy with pyloroplasty and suturing (excision) of a chronic ulcer was performed in 14.2% of cases, and gastric resection – in 13.9% of cases.

The most common surgical intervention for chronic gastric ulcer complicated by bleeding was its resection, which was performed in 25.4% of patients. Vagotomy with pyloroplasty and suturing (excision) of the ulcerative defect was performed when the chronic ulcer was located in the prepyloric part of the stomach in 4.5% of patients.

Thus, overall mortality when using TAE for UGDB was 6.5% of cases versus 16.6% of cases ($p = 0.003$) when performing open surgical interventions. The best results from the use of arterial embolization were also observed in patients with a high risk of surgical intervention - 9.8% of cases versus 20.4% of cases when performing open operations ($p = 0.02$). At the same time, TAE was performed significantly more often in cases of recurrent bleeding, i.e. in more severe patients. The insignificant need for delayed surgical interventions undertaken for large ulcerative defects also indicates the effectiveness of TAE in ulcerative bleeding and that arterial embolization is the final method of hemostasis for ulcerative bleeding. However, all deaths were not directly related to arterial embolization.

In the absence of positive dynamics of bleeding stigmas in the ulcer crater, it is necessary to perform surgery to prevent recurrent bleeding. If the dynamics of bleeding stigmas are weakly positive, repeated therapeutic endoscopy and repeated control endoscopy within 12 hours are indicated in order to clarify changes in the chronic ulcer. If the dynamics of bleeding stigmas are positive, conservative treatment is prescribed. It should be noted that the assessment of changes in bleeding stigmas in the ulcer crater is difficult in some cases due to the short period of time that has elapsed after therapeutic endoscopy and its implicit dynamics. In doubtful cases of assessment of changes, especially after the use of coagulation techniques, and given the high risk of recurrent bleeding, it is necessary to perform surgical intervention. Moreover, the best treatment results are observed when using targeted arterial embolization of the vessels of the stomach and duodenum. The advantages of TAE are minimal invasiveness, less surgical trauma compared to open surgery, and an easier operating period.

All of the above forced us to analyze in more detail the results of using TAE for ulcer bleeding.

3.2. Results of using transcatheter arterial embolization for ulcerative bleeding

The results of the use of selective arterial embolization for ulcerative gastrointestinal bleeding are presented in Table 3.5.

Table 3.5 – Results of using transcatheter arterial embolization for ulcer bleeding

Results	Number of patients with TAE (n=124)	
	Abs.	%
Technical success	121	97,6
Clinical success	115	91,3
Recurrent bleeding	6	5,0
Complications	20	16,5
Deferred operations	10	8,3
Mortality	8	6,5

The technical success of using TAE for ongoing bleeding and to prevent its recurrence in the absence of positive dynamics of bleeding stigmas in a chronic ulcer after primary endoscopy was 97.6% (121 patients) of cases. In 3 (2.4%) cases, hemostasis was not achieved in patients with chronic duodenal ulcer and massive bleeding. In 2 (1.6%) cases, in patients with severe blood loss after recurrent bleeding, it was not possible to perform TAE due to partial obliteration of the mouth of the gastroduodenal artery by atherosclerotic deposits, and in another 1 (0.8%) patient, arterial embolization was not performed due to large diameter of the gastroduodenal artery and the danger of migration of the adhesive adhesive composite into the underlying parts of the vascular bed. All patients underwent urgent surgical intervention: one had truncal vagotomy, supplemented by

pyloroplasty and suturing of the ulcer, the other two had pyloroplasty and suturing of the ulcer.

The clinical success of using TAE in the treatment of ulcer bleeding was 91.3%. Recurrent bleeding after the use of arterial embolization occurred in 6 (5%) patients. All cases of recurrent bleeding were observed after superselective embolization of the branches of the left gastric or gastroduodenal artery: in 4 (66.7%) cases after embolization of one of the arteries of the descending branch of the left gastric artery and 2 (33.3%) cases after embolization of the branch of the gastroduodenal artery . In 3 (50%) cases, after recurrent bleeding, repeat embolization was performed: in 2 patients the entire left gastric artery was embolized and in another patient the gastroduodenal artery was embolized. Two more patients with a chronic ulcer of the body of the stomach underwent urgent surgical intervention: one patient underwent suturing of a chronic ulcer, the other underwent gastric resection according to Billroth-1. A patient with recurrent bleeding from a chronic duodenal ulcer underwent pyloroplasty and suturing of the ulcer.

20 (16.5%) patients experienced complications associated with the use of selective arterial embolization. The most common complication was periulcerogenic ischemia of the gastric or duodenal mucosa, which occurred in 11 (9.1%) patients.
Overall mortality was 6.5% (8 patients died). All deaths were observed in patients with high surgical risk, i.e. mortality in this group of patients was 9.8%. The immediate cause of death in 7 patients with severe or extremely severe blood loss was: in 5 cases, acute cardiovascular failure and in 2 patients - cancer intoxication, which was aggravated by post-hemorrhagic disorders. Death in one patient, who died from acute cardiovascular failure, occurred after open surgery. Another patient with moderate blood loss died from thromboembolism of the branches of the pulmonary artery.

With ongoing stream or diffuse bleeding after ineffective therapeutic endoscopy and with recurrent bleeding, endovascular hemostasis was achieved in 70 (95.9%) of 73 patients (Table 3.6).

Table 3.6 - Indications for arterial embolization for ulcerative gastrointestinal bleeding

Indications	Quantity patients	
	Abs.	%
Continued bleeding with resistance to therapeutic endoscopy	20	16,1
Recurrent bleeding after	53	42,8
Therapeutic endoscopy	51	41,1
Lack of positive dynamics of bleeding stigmas after therapeutic endoscopy	124	100

In most cases - in 53 (42.8%) patients, endovascular hemostasis was performed in case of recurrent bleeding in the hospital, in 20 (16.1%) patients with ongoing bleeding resistant to endoscopic treatment, and in 51 (41.1%) patient in the absence of positive dynamics of bleeding stigmas in the ulcer crater after therapeutic endoscopy. TAE with ongoing bleeding was performed mainly in cases of massive blood loss - in 78.1% (in 57 patients) of cases, in the remaining 21.9% (in 16 patients) of cases - in cases of moderate severity of blood loss.

Endovascular hemostasis was achieved in all 16 (100%) patients with moderate blood loss, in 36 (94.7%) of 38 patients with severe and in 18 (94.7%) of 19 patients with extremely severe blood loss (Table 3.7).

Table 3.7 - Achieving endovascular hemostasis with ongoing bleeding

Heaviness blood loss	Patients with arterial embolization (n=73)				
	Hemostasis achieved		Hemostasis not achieved		TOTAL (%)
	Abs.	%	Abs.	%	
Average	16	21,9	–	–	16 (21,9)
Heavy	36	49,3	2	2,7	38 (52)
Extremely heavy	18	24,7	1	1,4	19 (26,1)
TOTAL:	70	95,9	3	4,1	73 (100)

The above indicates that the use of N-butyl-2-cyanoacrylate is effective in stopping ongoing bleeding and preventing its recurrence in case of ulcerative hemorrhage and practically does not depend on the severity of blood loss.

When performing TAE, direct signs of gastroduodenal bleeding in the form of leakage of contrast agent into the lumen of the organ were observed in 29.9% (in 37 patients) of cases, indirect signs - in 70.1% (in 87 patients) of cases. Most often, during arterial embolization for ulcerative gastrointestinal bleeding, thrombotic occlusion of the artery was determined - in 41.1% (51 patients) of cases. Regional spasm, vascular recalibration, or local hypervascularization were observed in 27.4% (34 patients) of cases, and only 1.6% (2 patients) of cases were diagnosed with a false aneurysm (Table 3.8).

Table 3.8 – X-ray semiotics for bleeding from chronic gastric and duodenal ulcers

X-ray signs of bleeding	TAE (n=124)		
	Chronic gastric ulcer	Chronic duodenal ulcer	TOTAL
Leakage of contrast agent into the lumen of the organ – cardiac department – body of the stomach – antrum – WDP bulb – post-bulbous department of the duodenum	25 (20,1%) 6 (4,8%) 16 (12,9%) 3 (2,4%) – –	12 (9,8%) – – – 12 (9,8%) –	37 (29,9%)
Thrombotic artery occlusion – cardiac department – body of the stomach – antrum – WDP bulb – post-bulbous department of the duodenum	25 (20,1%) 1 (0,8%) 20 (16,1%) 4 (3,2%) – –	26 (21%) – – – 24 (19,4%) 2 (1,6%)	51 (41,1%)
Regional spasm, vascular recalibration, or local hypervascularization – cardiac department – body of the stomach – antrum – duodenum bulb – post-bulbous department of the duodenum	17 (13,7%) 2 (1,6%) 12 (9,7%) 3 (2,4%) – –	17 (13,7%) – – – 17 (13,7%) –	34 (27,4%)
Formation of a false aneurysm of an artery – cardiac department – body of the stomach – antrum – WDP bulb – post-bulbous department of the duodenum	1 (0,8%) – – 1 (0,8%) – –	1 (0,8%) – – – 1 (0,8%) –	2 (1,6%)
TOTAL:	68 (54,8%)	56 (45,2%)	124 (100%)

Leakage of contrast agent during surgery was most often observed when a chronic ulcer was located in the stomach - in 20.1% (in 25 sick) cases. Most often, this symptom was observed when a chronic ulcer was located in the body of the

stomach - in 16 (12.9%) patients. This fact is explained by the location of the descending branch of the left gastric artery and its large anterior and posterior descending branches in this section and their possible arrosion. In the antrum of the stomach, the leakage of the contrast agent during angiography was determined only in 3 (2.4%) patients, which is explained by the presence in this section of the stomach of smaller vessels that form a denser arterial network.

Leakage of contrast agent in chronic duodenal ulcers was observed in 9.8% (12 patients).

Here is an extract from the medical history.

Patient Sh. (case code 28034), 40 years old, was delivered to the St. Petersburg State Budgetary Healthcare Institution “Alexandrovskaya Hospital” at about 4 o’clock on May 12, 2012, in serious condition with complaints of vomiting of slightly changed blood and the type of “coffee grounds”, black stools, severe weakness and dizziness. The patient had black stools for three days, and the deterioration of his general condition increased. On May 12, 2012, vomiting of slightly changed blood appeared. When examined by a surgeon: the general condition is serious, the skin is pale, pulse 100 beats/min., blood pressure 100 and 60 mm Hg. Art., rectally - melena. Concomitant diseases: chronic viral hepatitis B, HIV, opiate drug addiction since 1994. Blood test on admission: erythrocytes - 1.51x1012/l, platelets - 362x109/l, hemoglobin 37.7 g/l, hematocrit 11.1% activated partial thromboplastin time (APTT) - 21.7 s, prothrombin index according to Quick - 71%, fibrinogen – 2.88 g/l. Upon admission on May 12, 2012, at 04:50, an endoscopy was performed: an ulcer with a diameter of about 2 cm under a loose clot was detected in the duodenal bulb on the anterior wall. There is no blood flow. Hemostasis Forrest 2B. Combined endoscopic hemostasis: injection of adrenaline solution and monopolar coagulation. Conclusion: Chronic ulcer of the duodenal bulb, complicated by bleeding. Hemostasis

Forrest 2B. Condition after combined hemostasis. The patient was started on conservative therapy, including antisecretory drugs, and 1252 ml of erythrocyte suspension and 1200 ml of plasma FFP were transfused.

On 05/12/2023 at about 10:00 a relapse of bleeding occurred. A repeat endoscopy was performed: there was altered blood with clots in the stomach, an ulcer with a diameter of about 2 cm with undermined edges was detected in the duodenal bulb on the anterior wall, covered with a loose thrombus, from under which blood was intensively flowing. Combined endoscopic hemostasis was performed: injection of adrenaline solution and argon plasma coagulation. Hemostasis has not been achieved. Blood leakage persists. A decision was made to perform transcatheter arterial embolization.

8 hours after admission to the hospital, the patient underwent angiography, which determined the release of the contrast agent from the gastroduodenal artery into the lumen of the duodenum (Figure 3.2). Targeted segmental embolization of the gastroduodenal artery was performed with an adhesive adhesive composite based on N-butyl-2-cyanoacrylate (Figure 3.3). On control angiography, contrast enhancement of the gastroduodenal artery is not detected, and there are no signs of leakage of radiocontrast substance into the lumen of the duodenum. There were no complications observed in the postoperative period. The patient underwent complex conservative therapy, including antiulcer treatment, and 626 ml of erythrocyte suspension was transfused. After 6 days, the patient was discharged for outpatient treatment in satisfactory condition at his own request. Blood test at discharge: hemoglobin - 92 g/l, erythrocytes - 3.23x1012/l, platelets - 329x109/l, INR - 1.04, APTT - 25.8 s, prothrombin index according to Quick - 93%, fibrinogen - 2 .83 g/l.

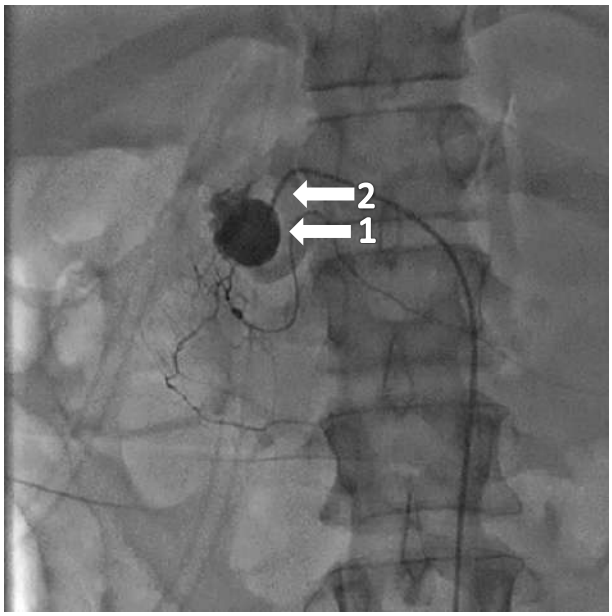

Figure 3.2 – Angiogram of the gastroduodenal artery: 1 – leakage of contrast agent into the lumen of the duodenum; 2 – gastroduodenal artery.

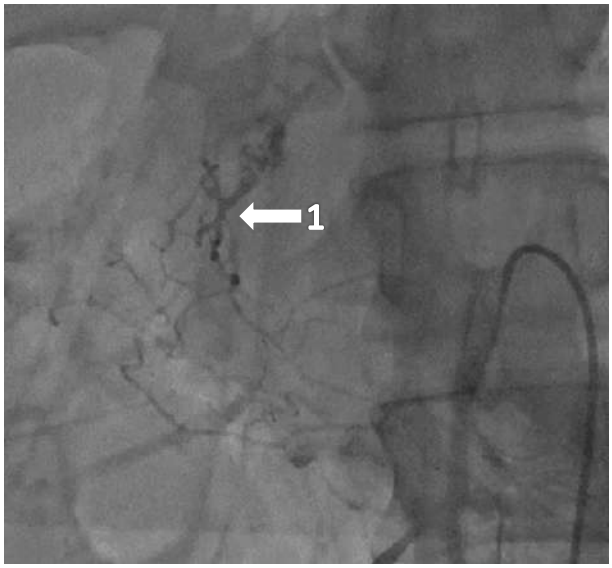

Figure 3.3 – Angiogram of the gastroduodenal artery after embolization: 1 – embolized gastroduodenal artery.

Thrombotic vascular occlusion was observed approximately equally - in 20.1% (in 25 patients) of cases with a chronic ulcer located in the stomach and in 20.9% (in 26 patients) of cases with an ulcer located in the duodenum. Regional spasm,

vascular recalibration, or local hypervascularization were observed in 13.7% (17 patients) of cases with gastric or intestinal ulcers. The most rare occurrence of false arterial aneurysm was one case each in the stomach and duodenum.

Consequently, direct signs of DU occur in every third patient with a chronic gastric ulcer and only in every fifth patient with a chronic duodenal ulcer. In other patients, during angiographic examination, indirect signs of gastrointestinal bleeding are determined. The presence of direct and indirect signs of bleeding in the arterial basin, which was the source of bleeding, makes it possible to perform targeted embolization of the arrosive vessel.

Thus, during angiography, direct or indirect signs of ulcerative hyperplasia are always determined. The presence of an ulcerative defect in the stomach and duodenum is accompanied by changes in local anatomy and angioarchitectonics, which is confirmed during angiographic

research. The presence of a radiopaque clip on or near the vessel that was the source of bleeding in a chronic ulcer greatly facilitates the search for the afferent vessel and the performance of arterial embolization in general. The presence of a clip serves as a guide when searching for an arrosion vessel. When hemostasis is achieved, retrograde blood flow of the X-ray contrast agent is observed in the arterial bed, which confirms that the source of bleeding has been correctly found. When the clip is located at the bottom of the ulcer, there is often a leakage of the contrast agent into the lumen of the organ next to it as a result of squeezing out the blood clot from the vessel with a hyperdynamic effect on the vascular bed during the operation.

Here is an extract from the medical history.

Patient K. (case number 43660), 66 years old, was delivered to the St. Petersburg State Budgetary Healthcare Institution “Alexandrovskaya Hospital” at about 2 o’clock on July 26, 2013, in serious condition with complaints of vomiting of slightly changed blood and the type of “coffee grounds”, black stools, severe weakness and dizziness. The patient had vomiting and black stools for three days,

and the deterioration of his general condition increased. When examined by a surgeon: the general condition is serious, the skin is pale, pulse 110 beats/min., blood pressure 90 and 60 mm Hg. Art., rectally - melena. Background diseases: Chronic alcoholism. Cirrhosis of the liver. IBS. Atherosclerotic cardiosclerosis. Stage 2 hypertension. Blood test upon admission: erythrocytes - 1.46x1012/l, platelets - 230x109/l, activated partial thromboplastin time (APTT) - 23.8 s, Quick prothrombin index - 60%, fibrinogen - 2.6 g/l. Upon admission, an endoscopy was performed, during which a large amount of altered blood with clots was detected in the stomach; a chronic ulcer with a diameter of 4 cm with a deep bottom, undermined edges and a thrombosed vessel protruding by 2 mm was determined on the lesser curvature in the middle third of the body of the stomach. The thrombosed vessel was clipped. Conclusion: Chronic ulcer of the body of the stomach, complicated by bleeding. Hemostasis Forrest 2a. Clipping of a thrombosed vessel. The patient was treated with conservative therapy, including antisecretory drugs, 626 ml of red blood cell suspension and 600 ml of fresh frozen plasma (FFP) were transfused. Considering the presence of a large ulcerative defect, severe blood loss, the presence of underlying diseases and, therefore, a high risk of bleeding, 14 hours after admission the patient underwent segmental embolization of the descending branch of the left gastric artery with an adhesive adhesive composite based on N-butyl-2-cyanoacrylate through the right brachial artery. During angiography, an afferent branch of the left gastric artery was identified with signs of spasm in the area where the clip was applied, beyond which the contrast did not extend. Targeted segmental embolization of the descending branch of the left gastric artery was performed through a microcatheter (Figure 3.4).

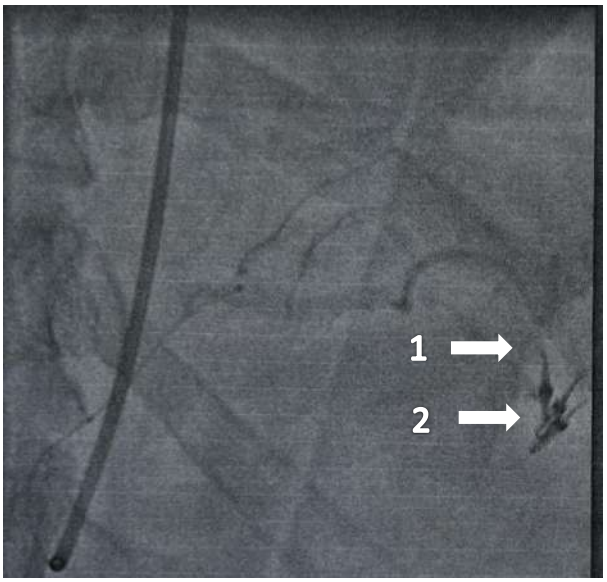

Figure 3.4 – Angiogram of patient K., case history 43660, 55 years old. Bleeding from a branch of the left gastric artery: 1 – embolization of contrast agent through a microcatheter; 2 – clip in the crater of a chronic ulcer

On control angiography, contrast enhancement of the descending branch of the left gastric artery is not detected, and there are no signs of leakage of the radiocontrast substance into the stomach. Contrast enhancement of the embolized area of the artery near the clip is determined (Figure 3.5).

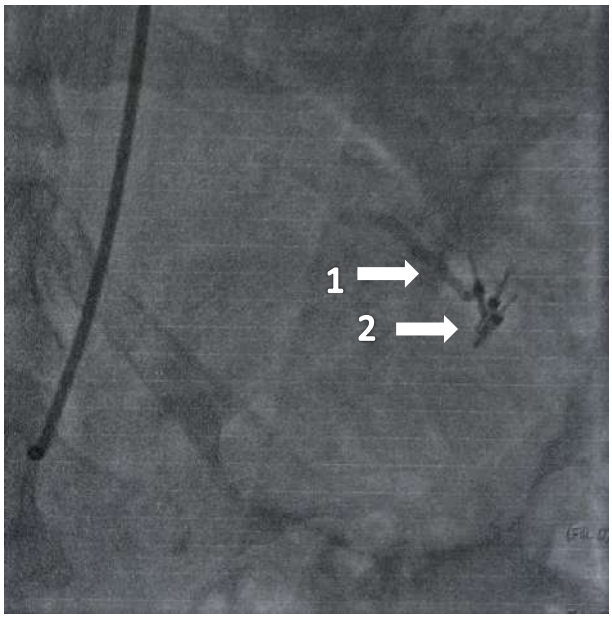

Figure 3.5 – Angiogram of patient K., case history 43660, 55 years old. Bleeding from a branch of the left gastric artery: 1 – embolized area of the left gastric artery; 2 – clip in the crater of a chronic ulcer

There were no complications observed in the postoperative period. The patient received conservative therapy, including antiulcer treatment. 11 days after admission, a control endoscopy was performed, in which the ulcer decreased in size to 3 cm, there was no ischemia around the ulcerative defect. A biopsy was performed from the edges of the chronic ulcer. Blood test at discharge: hemoglobin - 115 g/l, erythrocytes - 4.03x1012/l, platelets - 444x109/l, INR - 1.1, APTT - 20.4 s, prothrombin index according to Quick - 84%, fibrinogen - 3 .0 g/l. On the 16th day after admission, the patient was discharged from the hospital for outpatient treatment in satisfactory condition.

It should be noted that during angiography with a hyperdynamic effect on an arrosive vessel during its thrombotic occlusion, in 24 (47%) of 51 cases, leakage of the contrast agent into the lumen of the stomach and duodenum was observed. The flow of contrast agent into the lumen of a hollow organ confirms the fact that the source of bleeding has been correctly found and allows, if necessary, to perform superselective embolization of the arrosive vessel.

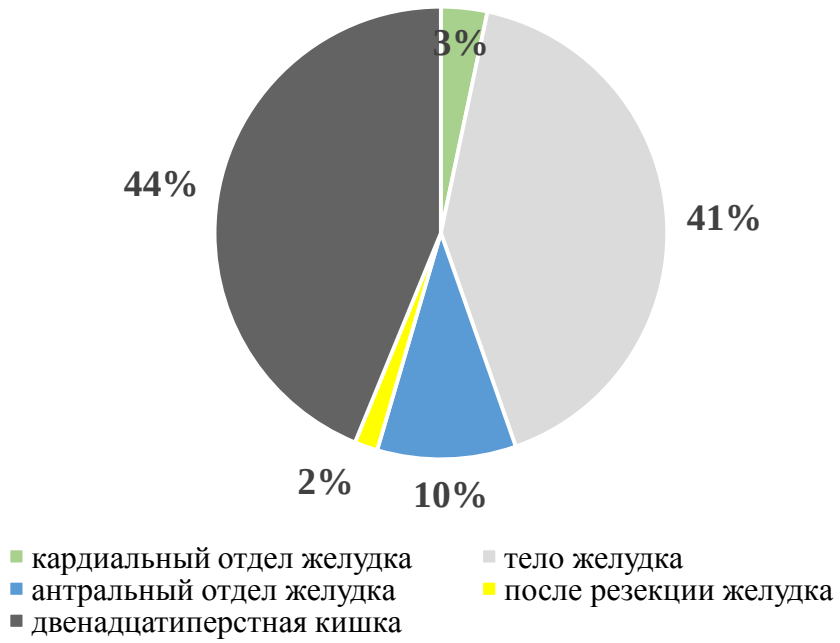

Figure 3.6 – Performing arterial embolization depending on the location of the chronic ulcer

Arterial embolization was performed in 44% of patients with a chronic ulcer located in the body of the stomach, in 3% of patients - in the cardiac region, in 10% of patients - in the antrum, in 41% of patients - with its location in the duodenum, and in another 2% of patients after gastric resection according to Billroth-1 (Figure 3.6).

Table 3.9 – Performing targeted arterial embolization depending on the location of the chronic ulcer in the stomach and the embolized artery.

Localization of ulcers	Number of patients with TAE		Embolized artery		Number of bleeding recurrences	
	Abs.	%	Artery name	Number of cases	Abs.	%
cardiac section	4	5,9	ЛЖА СС	2 2	– –	– –
body of stomach	50	73,6	ЛЖА	26	–	–
back wall	26	38,2	НВ ЛЖА	15	–	–
small curvature	21	31,0	СС	9	4	44,4
front wall	3	4,4				
antrum of the stomach	12	17,6	ЛЖА НВ ЛЖА ЛЖА и ПЖСА	4 3 1	– – –	– – –
back wall	6	8,9	ПЖСА	1	–	–
small curvature	4	5,8	ПЖА	1	–	–
front wall	2	2,9	СС	2	–	–
After gastric resection Billroth-1	2	2,9	СС	2	–	–
TOTAL:	68	100		68	4	5,9

ЛЖА – left gastric artery;
НВ ЛЖА – descending branch of the left gastric artery;
ПЖСА – right gastroepiploic artery;
ПЖА – right gastric artery;
СС – superselective embolization.

In gastric localization of a chronic ulcer, embolization of the left gastric artery was performed in 32 (47%) cases and was effective when the chronic ulcer was located in the body, cardiac and antral parts of the stomach. Superselective embolization was performed for various localizations of chronic ulcers in 15 (23.4%) cases (Table 3.9).

TAE of the descending branch of the left gastric artery was performed in 15 (30%) of 50 cases when the ulcer was located in the body of the stomach and in 3 (25%) of 12 cases when the chronic ulcer was localized in the antrum of the stomach. In total, in 26.5% of cases with gastric localization of a chronic ulcer complicated by bleeding. In one case, when the ulcer was located in the antrum of the stomach, embolization of the right gastric artery and the right gastroepiploic artery, the right gastroepiploic artery and the right gastric artery was performed. In two cases, embolization of the arrozen artery was performed after gastric resection according to Billroth-1 for bleeding from a chronic ulcer of the gastroenteroanastomosis. Therefore, the search for signs of bleeding from an arrosive vessel allows us to perform targeted embolization, which is especially important when the ulcer is localized in the antrum of the stomach, taking into account the peculiarities of its blood supply.

The performance of TAE for chronic ulcers located in the duodenum is presented in Table 3.10. Embolization of the gastroduodenal artery when a chronic ulcer is located in the duodenum was performed in 40 (75.5%) of 53 patients. In 11 (20.8%) patients, superselective embolization of one of the branches of the gastroduodenal artery was performed. In one patient, the right gastric artery was embolized due to bleeding from its blood supply; in another, the gastroduodenal and descending branches of the left gastric artery were embolized.

Table 3.10 - Performing targeted arterial embolization depending on the location of the chronic ulcer in the duodenum and the embolized artery.

Localization of ulcers	Number of patients with TAE		Embolized artery		Number of bleeding recurrences after TAE	
	Abs.	%	Artery name	Number of cases	Abs.	%
Bulb	51	91,2				
back wall	24	42,9	ГДА	38	–	–
top wall	15	26,8	ПЖА	1	–	–
bottom wall	7	12,5	НВ ЛЖА и ГДА	1	–	–
front wall	5	8,9	СС	11	2	18,2
subbulbous section	2	3,5	ГДА	2	–	–
not completed	3	5,4	–	–	–	–
TOTAL:	56	100	–	53	2	3,8

ГДА – gastroduodenal artery;
ПЖА – right gastric artery;
НВ ЛЖА – descending branch of the left gastric artery;
СС – superselective embolization.

Recurrent bleeding was observed in 4 (5.9%) cases after superselective embolization when a chronic ulcer was located in the body of the stomach and in 2 (3.6%) cases when embolization of a branch of the gastroduodenal artery when the ulcer was localized in the duodenum. Consequently, all recurrent bleeding occurred after local embolization.

In 3 (50%) of 6 cases of recurrent bleeding, repeated arterial embolization was performed: in two cases, the entire left gastric artery was embolized for a chronic ulcer of the body of the stomach and the gastroduodenal artery for a duodenal ulcer. In another 2 (33.3%) patients with chronic gastric ulcer, after recurrent bleeding, the ulcer was sutured in one patient and gastric resection

according to Billroth-1 was performed in another. A patient with recurrent bleeding from a chronic duodenal ulcer underwent pyloroplasty and suturing of the ulcer (Figure 3.7).

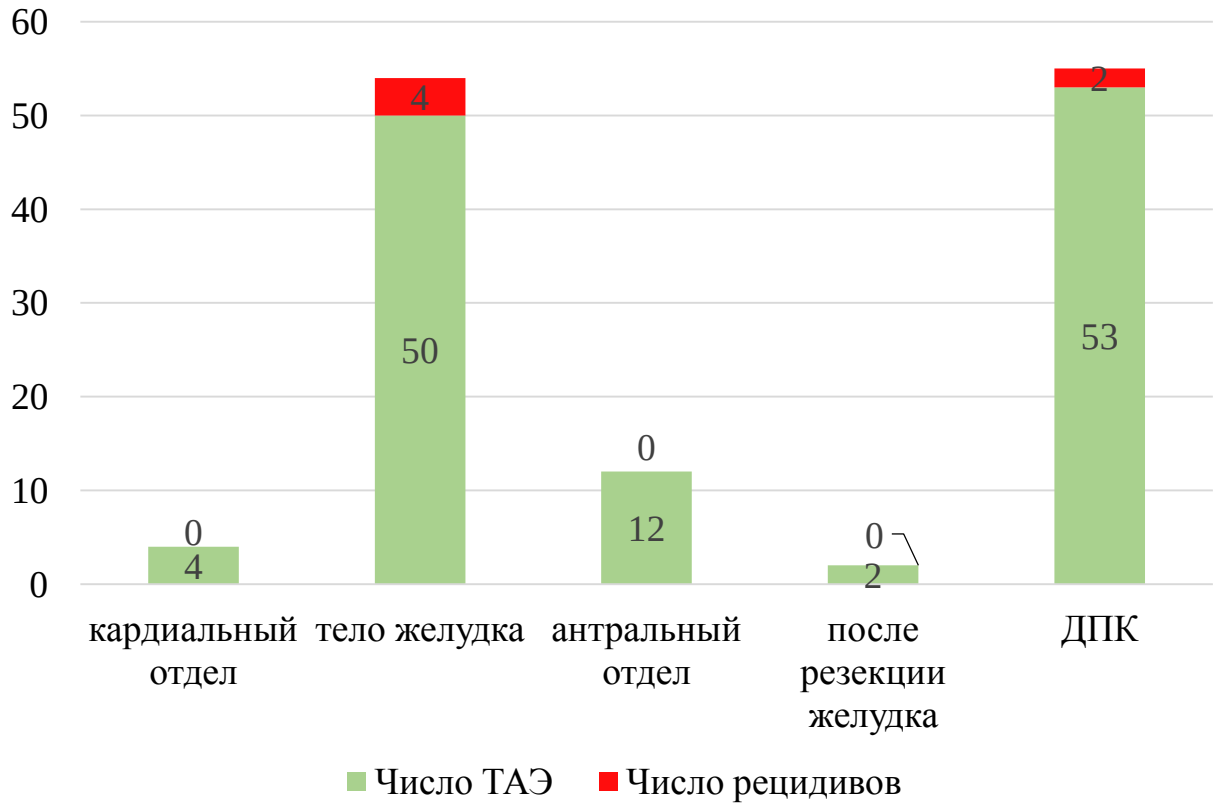

Figure 3.7 – The occurrence of recurrent bleeding after targeted embolization, depending on the location of the chronic ulcer.

Surgical interventions were performed in 16 (12.9%) of 124 patients:

3 (2.4%) patients on an emergency basis with ongoing bleeding when arterial embolization was unsuccessful, another 3 (2.4%) patients with recurrent bleeding in the hospital and 10 (8.3%) patients on a delayed basis with large chronic ulcers . The implementation of delayed surgical interventions depending on the severity of blood loss after successful TAE is presented in Table 3.11.

Table 3.11 – Performing delayed operations after transcatheter arterial embolization

Severity of blood loss	Number of patients with TAE (n=121)	
	Abs.	%
Average (n= 27)	–	–
Severe (n=59)	6	5,0
Extremely severe (n=38)	4	3,3

Delayed surgical interventions after TAE were performed in 8 patients with chronic gastric ulcer and in 2 patients with chronic duodenal ulcer. For chronic gastric ulcers, gastrectomy according to Billroth-1 was performed in 2 cases, suturing of the ulcer was performed in 5 cases, and excision of the chronic ulcer was performed in another patient. In patients with chronic duodenal ulcers, pyloroplasty was performed with suturing of the chronic ulcer, which in one patient was supplemented with truncal vagotomy.

The most common postoperative complication after arterial embolization was periulcerogenic ischemia of the mucous membrane of the stomach or duodenum, which was observed in 7 (5.8%) patients with gastric ulcers and in 4 (3.3%) patients with duodenal ulcers and did not lead to clinical manifestations. Ischemia of the gastric and duodenal mucosa did not occur after superselective embolization. After arterial embolization, in 3 (2.3%) cases, acute ulcers appeared in the area of ischemia of the gastric mucosa, which were determined in another patient in the area of periulcerogenic ischemia in the duodenum (Table 3.12).

Table 3.12 - Complications after performing targeted transcatheter arterial embolization.

Complications	Number of patients with TAE (n=121)	
	Abs.	%
Periulcerogenic ischemia of the mucous membrane	11	9,1
Acute ulcers of the stomach and duodenum	4	3,3
Liver abscess	1	0,8
Unstressed hematoma at the site of femoral artery puncture	4	3,3
TOTAL:	20	16,5

It should be noted that in no case was duodenostasis observed when using TAE. Considering the fact that the embolisate during fluoroscopic examination is determined in the large branches of the embolized artery, as well as a small percentage of complications in the form of ischemia of the mucous membrane and acute ulcers, it can be argued that the use of N-butyl-2-cyanoacrylate, as a rule, does not lead to pronounced microcirculatory disorders.

In one case, after the use of arterial embolization, liver abscesses occurred due to the entry of contrast into the native hepatic artery after rapid tightening of the catheter while simultaneously applying the adhesive adhesive composite. This fact indicates that TAE using N-butyl-2-cyanoacrylate should be performed by a trained vascular surgeon who is well aware of the angioarchitecture of the abdominal vessels.

In 4 (4.6%) of 87 cases of TAE performed through the femoral approach, a non-tension hematoma was observed at the site of surgical access, which did not require additional surgical interventions. In no case was a hematoma observed after the use of manual hemostasis at the puncture site of the radial artery. All of the

above indicates a low percentage of complications after the use of arterial embolization.

Thus, the use of arterial embolization in the treatment of DU in 97.6% of cases was accompanied by technical success of use, in 91.3% of cases - by clinical success, recurrent bleeding occurred in 5% of patients, while in 2.5% of cases it was used to eliminate it repeat TAE. Delayed operations were performed in 8.3% of cases. Mortality was 6.5% and in no case was associated with the use of arterial embolization. Complications occurred in 16.5% of cases and were not life-threatening. The most common complication was periulcerogenic ischemia, which was detected in 9.1% of cases and did not lead to clinically significant functional disorders.

The presented results indicate the high effectiveness of targeted embolization for ongoing bleeding and prevention of its recurrence in patients with bleeding from chronic gastric and duodenal ulcers.

CHAPTER 4. ARTERIAL EMBOLIZATION IN THE TREATMENT OF ULCERAL GASTRODUODENAL BLEEDINGS

4.1. Indications for the use of transcatheter arterial embolization for ulcerative gastrointestinal bleeding

The use of targeted arterial embolization has proven to be highly effective for ongoing bleeding and for the prevention of hemorrhage from chronic gastric and duodenal ulcers. When performing TAE, direct and (or) indirect signs of gastrointestinal bleeding in the area of a chronic ulcer are always determined. Extravasation of the contrast agent was detected in 20.1% of patients with bleeding from a chronic gastric ulcer and 9.8% of patients with a chronic duodenal ulcer. Establishing signs of bleeding is especially important when the ulcer is localized in the antrum of the stomach, when vascular erosion can occur in the territory of the left gastric artery, right gastric artery, right gastroepiploic artery, gastroduodenal artery, or from the systems of two arteries simultaneously. Establishing signs of bleeding allows performing segmental embolization of the target artery or superselective embolization.

The use of targeted TAE with an adhesive adhesive component based on N-butyl-2-cyanoacrylate diluted with a radiopaque agent allowed achieving technical success in 97.6% of cases and clinical success in 91.3% of cases. At the same time, the use of an adhesive adhesive composite together with a radiopaque substance provided not only reliable hemostasis, but also made it possible to see the area of the embolized artery from the basin of which the bleeding occurred, which increases the reliability of the operation.

Recurrent bleeding was observed in 5% of patients and only after superselective embolization. Moreover, in 2.5% of cases, to eliminate it, repeated arterial embolization was successfully used, which involved embolization of a larger artery, i.e. the left gastric artery or its second-order branches for chronic gastric ulcers and the gastroduodenal artery for duodenal ulcers.

Complications after arterial embolization occurred in 16.5% of patients and were not life-threatening. The most common complication was periulcerogenic ischemia, which was detected in 9.1% of cases and did not lead to clinically significant functional disorders.

Catheterization of the target vessel and the introduction of an adhesive adhesive composition that prevents its reflux into the proper hepatic artery are a guarantee of a correctly performed operation. The absence of cases of secondary postischemic duodenal stenosis in the study indicates that the drug used based on N-butyl-2-cyanoacrylate does not cause severe microcirculatory disorders, since the occurrence of duodenal stenosis after TAE is associated precisely with severe disturbances in microcirculation.

Delayed open surgical interventions after arterial embolization were performed in 8.3% of cases and were performed only in patients with large callous ulcerative defects.

Mortality after targeted TAE was 6.5% of cases, occurred in patients with high surgical risk and in no case was associated with the use of arterial embolization. The immediate cause of death in 7 patients with severe or extremely severe blood loss was in 5 cases acute cardiovascular failure, which in one patient occurred during the postoperative period, and in 2 patients - cancer intoxication, which was aggravated by post-hemorrhagic disorders. Another patient with moderate blood loss died from thromboembolism of the branches of the pulmonary artery.

The structure of lethal outcomes indicates that in patients with a high operational risk, recurrent bleeding sharply worsens the results of treatment, and the severity of blood loss after its occurrence is often unbearable. Performing open surgery against the background of recurrent bleeding in patients with severe concomitant pathology is accompanied by extremely high mortality. Meanwhile, the location of a large callous ulcerative defect in the projection of large vessels of the stomach and duodenum, the elderly age of patients, severe concomitant pathology, coagulation disorders against the background of severe blood loss prevent regenerative processes in the ulcer crater during conservative therapy, which

reduces the effectiveness of endoscopic hemostasis. Recurrent bleeding in such patients dramatically worsens the situation and often turns out to be unbearable.

The use of selective arterial embolization makes it possible to stop ongoing bleeding or prevent its recurrence with minimal surgical trauma and any severity of blood loss and localization of a chronic ulcer in the stomach or duodenum, which distinguishes this method from open surgery.

In the study, arterial embolization to prevent recurrent bleeding in the absence of positive dynamics of endoscopic hemostasis was performed within 12 hours to 5 days. The latest embolization for recurrent bleeding was performed on the 14th day of the posthemorrhagic period. The above confirms the low effectiveness of complex conservative therapy in some patients with a high risk of recurrent bleeding and necessitates its targeted prevention using a minimally invasive method.

All of the above allows us to determine the indications for performing targeted TAE in all patients with ulcerative gastrointestinal bleeding:

1) ongoing bleeding with resistance to therapeutic endoscopy;

2) recurrence of bleeding after endoscopic hemostasis;

3) lack of positive dynamics of bleeding stigmas after therapeutic endoscopy.

4) recurrent bleeding that occurred after superselective arterial embolization.

The use of targeted arterial embolization, accompanied by minimal surgical trauma, for the above indications can significantly improve the results of treatment of ulcerative gastrointestinal bleeding.

4.2. Improved tactics for the treatment of ulcerative gastroduodenal bleeding

The results of the study indicate that the main problem in the treatment of ulcerative gastrointestinal bleeding remains the occurrence of recurrent bleeding. Its prevention by various methods of hemostasis is accompanied by different effectiveness, invasiveness, severity of impact on the human body and the likelihood of recurrent bleeding.

Numerous international and regional protocols of surgeons and endoscopists for the treatment of ulcerative bleeding and non-variceal bleeding from the upper gastrointestinal tract, as well as the works of individual authors, differently recommend treatment of the patient in case of ulcerative bleeding (Russian Society of Surgeons [electronic resource]; Ivashkin V .T., Maev I.V., Tsarkov P.V. et al., 2020; Almadi M., Kuipers E.J. et.al., 2019; ; Laine L., Barkun A.N., Saltzman J.R. et al., 2021; Gralnek I.M., Stanley A.J., Morris A.J. et al., 2021).

Since the occurrence of recurrent bleeding ultimately depends on the dynamics of the bleeding stigmas in the ulcer crater, it is the different effects on the source of bleeding that are given the main importance when analyzing the treatment tactics for ulcerative dysplasia based on this work. Determining this dynamics is an extremely important point in the treatment of these patients. It is based on the fact that, depending on the severity of the impact on the human body, endoscopic hemostasis is preferable to prevent recurrent bleeding, then arterial embolization and only if necessary, open surgery.

When a patient with gastrointestinal bleeding is admitted to the hospital, an endoscopic examination to determine the source of bleeding and the degree of stability of hemostasis should be performed as soon as possible, but no later than 2 hours after admission. Considering the fact that in some patients bleeding is ongoing, and most relapses of hemorrhage occur in the first hours after admission to the hospital, increasing the time before performing endoscopy and therapeutic endoscopy is inappropriate and can lead to aggravation of the condition of a particular patient and to worsening the results of treatment of ulcers. gastrointestinal bleeding in general (Figure 4.1).

If the patient’s condition is serious, we consider it necessary to carry out EGDS in the intensive care unit in parallel with intensive care and treatment of concomitant pathologies. To classify JAGDK, it is advisable to use the classification of Forrest J.A.H. /1974/ identifying patients with high and low risk of recurrent bleeding.

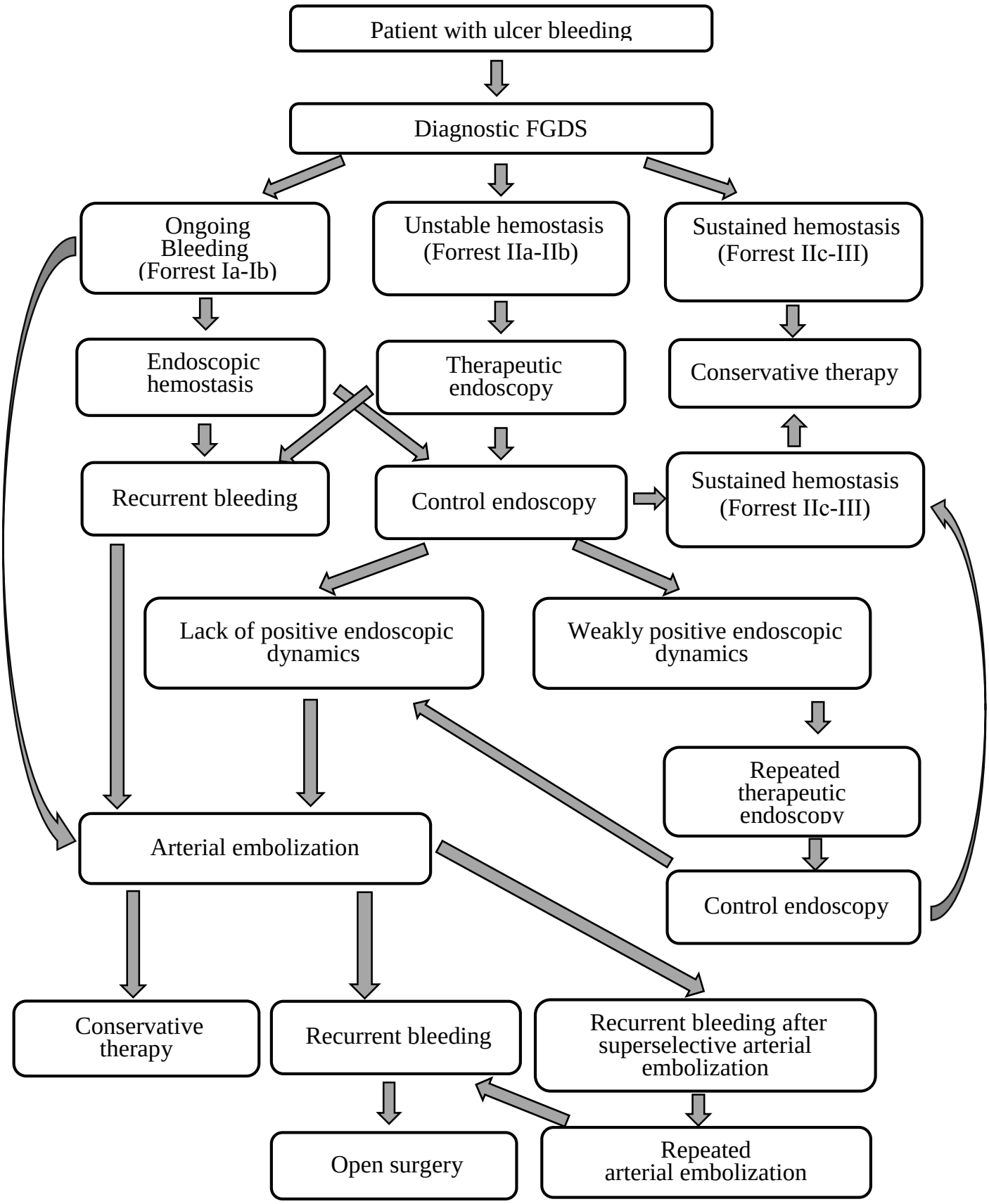

Figure 4.1 – Algorithm for the use of targeted transcatheter arterial embolization for ulcerative gastroduodenal bleeding

A high risk of recurrent bleeding includes cases with ongoing jet - Forrest-Ia or diffuse - Forrest-Ib, bleeding after endoscopic hemostasis, as well as ulcers with a thrombosed artery in the ulcer crater - Forrest-IIa or a dense fixed clot - Forrest-IIb. In this case, therapeutic endoscopy is indicated. When performing therapeutic endoscopy, it is preferable to combine injection with one of the coagulation methods. Endoscopic hemostatic therapy is not indicated for patients with stigmata at low risk of rebleeding.

Subsequently, patients with severe and extremely severe blood loss are treated in the ICU, and patients with mild and moderate blood loss are treated in the surgical department. All patients undergo complex conservative therapy aimed at correcting blood volume, other disorders of homeostasis and hemostasis, preventing recurrent bleeding, treating chronic ulcers and concomitant pathologies. All patients with a high risk of recurrent bleeding are prescribed large doses of PPI - 80 mg of omeprazole or a similar drug intravenously as a bolus, followed by its administration at 40 mg 3 times a day or with a continuous infusion of 8 mg per hour for 3 days, followed by transfer to oral administration 40 mg 2 times a day. Patients with a low risk of recurrent bleeding are advised to immediately take oral PPI 40 mg 2 times a day. With adequate conservative therapy according to the principles described above, recurrent bleeding in the presence of endoscopic signs of stable hemostasis in a chronic ulcer does not occur. Therefore, repeat (second-look) EGD is not required in patients with a low risk of recurrent bleeding, and the goal of conservative therapy is to achieve stable hemostasis in a chronic ulcer.

If there is a high risk of recurrent bleeding within 6 to 12 hours after therapeutic endoscopy, a repeat endoscopic examination is indicated to identify the dynamics of bleeding stigmas in the ulcer crater. In case of weakly positive endoscopic dynamics, repeated therapeutic endoscopy is indicated within 12–24 hours, followed by assessment of the dynamics of bleeding stigmas in a chronic ulcer during repeated control endoscopy.

If there is resistance to therapeutic endoscopy with ongoing bleeding, recurrent bleeding and the absence of positive dynamics in the ulcer crater of

stigmata bleeding, targeted arterial embolization is indicated. TAE of the arteries of the stomach and duodenum is a minimally invasive intervention, accompanied by significantly less surgical trauma compared to open surgery, an easier postoperative period and the final method of hemostasis for bleeding from chronic ulcers.

In case of recurrent bleeding, which in our study was observed only after superselective arterial embolization, either repeat TAE with segmental embolization of the afferent artery or open surgery is indicated.

The pathogenesis of peptic ulcer disease comes down to an imbalance of aggression and defense factors. At the same time, it is now recognized that the main role in the appearance of chronic gastric and duodenal ulcers belongs to H. pylori, which, as a result of its vital activity, damages epithelial cells, which leads to hypersecretion of hydrochloric acid, gastritis, duodenitis, metaplasia and dysplasia of the mucous membrane. Excessive colonization with H. pylori can lead to the death of a significant number of epithelial cells, chronic inflammation and the formation of ulcers. In this regard, the main task in surgical intervention for ulcerative bleeding is to eliminate the source of hemorrhage. Therefore, stitching or excision of a chronic ulcer, which is a source of bleeding, in the stomach and duodenum can be considered a complete and sufficient surgical intervention for ulcerative gastrointestinal tract. Considering the availability of modern antisecretory drugs, we consider performing vagotomy for bleeding from a chronic duodenal ulcer or prepyloric stomach to be inappropriate.

It is better to stitch a chronic ulcer with interrupted sutures, capturing the bottom of the ulcerative defect. The juxtaposition of the edges of the ulcer should not be accompanied by significant tension on the sutures when tying in order to avoid their cutting through. For large, more than 2 cm, ulcerative defects located on the posterior wall of the duodenal bulb after suturing the bleeding vessel, it is advisable to use the keel formed during Finney pyloroplasty to close the defect on the posterior wall.

After suturing the arrozed vessel in a chronic gastric ulcer, we also close it with interrupted sutures so that the tension of the sutures is minimal. More reliable

elimination of the source of bleeding in the stomach is achieved by excision of the ulcer or its resection. When resection of the stomach, not only the source of bleeding is reliably eliminated, but also the metaplastic mucous membrane.

The use of such tactics can improve the results of treatment of ulcerative bleeding from chronic gastric and duodenal ulcers.

CONCLUSION

Recently, due to the widespread introduction of therapeutic endoscopy and the improvement of conservative therapy, significant progress has been made in the treatment of ulcerative gastrointestinal bleeding. However, despite all the methods of endoscopic hemostasis used, recurrent bleeding that occurs during conservative therapy in approximately 14% of patients sharply worsens the results of treatment of bleeding from chronic gastric and duodenal ulcers. The use of repeated therapeutic endoscopy for recurrent bleeding is less effective and is often accompanied by repeated relapse of bleeding. Performing open surgery at its height leads to an increase in mortality to 40–60% of cases.

The relevance of the problem is emphasized by the development of numerous international and local recommendations for surgeons and endoscopists for the treatment of ulcerative bleeding and non-variceal bleeding from the upper gastrointestinal tract (Russian Society of Surgeons [electronic resource]; Ivashkin V.T., Maev I.V., Tsarkov P. V. et al., 2020; Barkun A.N., Kuipers E.J. et.al., 2019; Sung J.J.Y., Chan F.K.L., Siau K., Hearnshaw S. et al. ., 2019; Laine L., Barkun A.N., Saltzman J.R. et al., 2021; Clinical guidelines are periodically updated, which only indicates dissatisfaction with the results of treatment and the search for new ways to improve these results.

According to national clinical guidelines, possible therapeutic measures for recurrent bleeding are: repeated endoscopic hemostasis, embolization of the arteries of the stomach and duodenum, or emergency surgery (Russian Society of Surgeons [electronic resource]). The use of TAE of the vessels of the stomach and duodenum can stop ongoing bleeding and prevent its occurrence. However, according to the literature, rates of technical success, clinical success, rebleeding, mortality and complications after the use of arterial embolization vary widely (Spiliopoulos S., Inchingolo R., Lucatelli P. et al., 2018; Chang J.H., Lye T.J., Zhu H.Z. et al., 2021;

Chevallier O., Comby P-O., Guillen K. et al., 2021; Lan T., Qian S. et al., 2021; T., 2021; Yu Q., Funaki B., Navuluri R. et al., 2021),

This study is devoted to studying the effectiveness of arterial embolization and its role in modern treatment tactics for ulcerative gastrointestinal tract.

This study compared the results of treatment of 331 patients with open surgical interventions who were hospitalized at the St. Petersburg State Budgetary Institution "Alexandrovskaya Hospital" from 2012 to 2021 for ulcer bleeding, and formed a control group, with 124 patients of the main group who underwent targeted arterial embolization Among the patients who underwent TAE, 82 (66%) were at high surgical risk. From the group with open surgical interventions, there were 191 (55.7%) patients ($p>0.05$).

Overall mortality when using TAE for ulcerative angiography was 6.5% of cases versus 16.6% of cases ($p=0.003$) when performing open surgical interventions. The best results from the use of arterial embolization were also observed in patients with a high risk of surgical intervention - 9.8% of cases versus 20.4% of cases when performing open operations ($p = 0.02$). At the same time, TAE was performed significantly more often in cases of recurrent bleeding, i.e. in more severe patients. Open surgical interventions for recurrent bleeding were performed in 13.9% of patients, and arterial embolization in 42.8% of patients ($p <0.001$).

Recurrent bleeding in this study occurred in 99 (4.5%) of 2182 patients with ulcer bleeding. The occurrence of recurrent bleeding in the hospital worsened the results of treatment of patients with DU. It was observed in 5 (62.5%) of 8 deceased patients in the main group and in 21 (38.2%) of 55 patients in the control group.

Most recurrent bleeding in the study and control groups occurred on the first day of hospital stay. Moreover, in the first 12 hours there were 3 (5.7%) recurrent bleeding in the main group and 2 (4.3%) in the control group, which indicates the high effectiveness of therapeutic endoscopy and anti-ulcerogenic therapy during this period. In total, on the first day of hospital stay, 37 (37.3%) cases of recurrent bleeding occurred, and in the first three days - 63 (63.6%) cases, in the first five days - 76 (76.8%) cases. On the sixth and subsequent days, isolated relapses of

bleeding were observed. The latest relapse of bleeding was observed on the fourteenth day of hospital stay.

The technical success of using TAE for ongoing bleeding and to prevent its recurrence in the absence of positive dynamics of bleeding stigmas in a chronic ulcer after primary endoscopy was 97.6% (121 patients) of cases. In 3 (2.4%) cases, hemostasis was not achieved in patients with chronic duodenal ulcer and massive bleeding. In 2 (1.6%) cases, in patients with severe blood loss after recurrent bleeding, it was not possible to perform TAE due to partial obliteration of the mouth of the gastroduodenal artery by atherosclerotic deposits, and in another 1 (0.8%) patient, arterial embolization was not performed due to large diameter of the gastroduodenal artery and the danger of migration of the adhesive adhesive composite into the underlying parts of the vascular bed. All patients underwent urgent surgical intervention: one had truncal vagotomy, supplemented by pyloroplasty and suturing of the ulcer, the other two had pyloroplasty and suturing of the ulcer.

When performing TAE, direct signs of gastroduodenal bleeding in the form of leakage of a contrast agent into the lumen of the organ were observed in 29.9% of cases, indirect signs - in 70.1% of cases. Most often, during arterial embolization for ulcerative gastrointestinal bleeding, thrombotic occlusion of the artery was determined - in 41.1% of cases. Regional spasm, vascular recalibration, or local hypervascularization was observed in 27.4% of cases, and only 1.6% of cases were diagnosed with a false aneurysm.

Thus, during angiography, direct or indirect signs of DU were always determined. The presence of an ulcerative defect in the stomach and duodenum is accompanied by changes in local anatomy and angioarchitectonics, which is confirmed during angiographic

research and allows for targeted embolization.

Of 121 patients, in 44% of patients, arterial embolization was performed when the chronic ulcer was located in the body of the stomach, in 3% of patients - in the cardiac region, in 10% of patients - in the antrum, in 41% of patients - when it was

located in the duodenum, and in another 2% of patients after gastric resection according to Billroth-1. Achieving hemostasis did not depend on the severity of blood loss and was effective in cases of ongoing bleeding and in preventing its resumption.

In case of gastric localization of a chronic ulcer, embolization of the left gastric artery was performed in 47% of cases and was effective when the chronic ulcer was located in the body, cardiac and antral parts of the stomach. Superselective embolization was performed for various localizations of chronic ulcers in 23.4% of cases. TAE of the descending branch of the left gastric artery was performed in 26.5% of cases with gastric localization of a chronic ulcer. In one case, when the ulcer was located in the antrum of the stomach, embolization of only the right gastric artery and only the right gastroepiploic artery, the right gastroepiploic artery and the right gastric artery was performed. In two cases, embolization of the arrozen artery was performed after gastric resection according to Billroth-1 for bleeding from a chronic ulcer of the gastroenteroanastomosis.

Embolization of the gastroduodenal artery when a chronic ulcer is located in the duodenum was performed in 75.5% of patients. In 20.8% of patients, superselective embolization of one of the branches of the gastroduodenal artery was performed. In one patient, the right gastric artery was embolized due to bleeding from its blood supply; in another, the gastroduodenal and descending branches of the left gastric artery were embolized. Therefore, the search for signs of bleeding from an arrosive vessel allows us to perform targeted embolization, which is especially important when the ulcer is localized in the antrum of the stomach, taking into account the peculiarities of its blood supply.

The clinical success of using TAE in the treatment of ulcer bleeding was 91.3% (115 patients). Recurrent bleeding after the use of arterial embolization occurred in 6 (5%) patients. All cases of recurrent bleeding were observed after superselective embolization of the branches of the left gastric or gastroduodenal artery: in 4 (66.7%) cases after embolization of one of the arteries of the descending branch of the left gastric artery and 2 (33.3%) cases after embolization of the branch

of the gastroduodenal artery . In 3 (50%) cases, after recurrent bleeding, repeat embolization was performed: in 2 patients the entire left gastric artery was embolized and in another patient the gastroduodenal artery was embolized. Two more patients with a chronic ulcer of the body of the stomach underwent urgent surgical intervention: one patient underwent suturing of a chronic ulcer, the other underwent gastric resection according to Billroth-1. A patient with recurrent bleeding from a chronic duodenal ulcer underwent pyloroplasty and suturing of the ulcer.

Delayed surgical interventions after TAE were performed in 10 (8.3%) patients with large chronic ulcers.

20 (16.5%) patients experienced complications associated with the use of selective arterial embolization. The most common complication was periulcerogenic ischemia of the gastric or duodenal mucosa, which occurred in 11 (9.1%) patients.

Overall mortality was 6.5% (8 patients died). All deaths occurred in patients with high surgical risk. The immediate cause of death in 7 patients with severe or extremely severe blood loss was: in 5 cases, acute cardiovascular failure and in 2 patients - cancer intoxication, which was aggravated by post-hemorrhagic disorders. Death in one patient, who died from acute cardiovascular failure, occurred after open surgery. Another patient with moderate blood loss died from thromboembolism of the branches of the pulmonary artery. Thus, there were no deaths directly related to TAE in the study.

Analysis of the presented data allows us to conclude that targeted arterial embolization of the vessels of the stomach and duodenum for chronic gastroduodenal ulcers complicated by bleeding is highly effective, does not depend on the severity of blood loss, is the final method of hemostasis and is accompanied by a low number of complications and mortality.

All of the above allows us to determine the indications for performing targeted TAE in all patients with ulcerative gastrointestinal bleeding:

1) ongoing bleeding with resistance to therapeutic endoscopy;

2) recurrence of bleeding after endoscopic hemostasis;

3) lack of positive dynamics of bleeding stigmas after therapeutic endoscopy.

4) recurrent bleeding that occurred after superselective arterial embolization.

In the absence of positive dynamics of bleeding stigmas in the ulcer crater, it is necessary to perform surgery to prevent recurrent bleeding. If the dynamics of bleeding stigmas are weakly positive, repeated therapeutic endoscopy and repeated control endoscopy within 12 hours are indicated in order to clarify changes in the chronic ulcer. With positive dynamics of bleeding stigmas, i.e. the occurrence of stable hemostasis - conservative treatment. It should be noted that the assessment of changes in bleeding stigmas in the ulcer crater is difficult in some cases due to the short period of time that has elapsed after therapeutic endoscopy and its implicit dynamics. In doubtful cases of assessment of changes, especially after the use of coagulation techniques, and given the high risk of recurrent bleeding, it is necessary to perform surgical intervention. Moreover, the best treatment results are observed when using targeted arterial embolization of the vessels of the stomach and duodenum. The advantages of TAE are minimal invasiveness, less surgical trauma compared to open surgery, and an easier operating period.

In case of recurrent bleeding, which in our study was observed only after superselective arterial embolization, repeat TAE with segmental embolization of the afferent artery or open surgery is indicated.

CONCLUSIONS

1. Overall mortality when using transcatheter arterial embolization for ulcerative gastroduodenal bleeding was 6.5% of cases versus 16.6% of cases ($p = 0.003$) when performing open surgical interventions. The best results from the use of arterial embolization were also observed in patients with a high risk of surgical intervention - 9.8% of cases versus 20.4% of cases when performing open operations ($p < 0.001$).

2. Technical success of targeted arterial embolization was 97.6% of cases, clinical success – 91.3% of cases. Recurrent bleeding was observed in 5% of patients, while in 2.5% of cases, repeated arterial embolization was used to eliminate it. Postoperative complications occurred in 16.5% of patients, of which 9.1% of patients experienced periulcerogenic ischemia of the gastric or duodenal mucosa. Delayed operations were performed in 8.3% of patients. Mortality was 6.5% of cases, observed only in patients with high surgical risk and was not associated with the use of arterial embolization.

3. Indications for the use of targeted transcatheter arterial embolization in patients with ulcerative gastroduodenal bleeding are: ongoing bleeding with resistance to therapeutic endoscopy, recurrent bleeding after endoscopic hemostasis, lack of positive dynamics of bleeding stigmas after therapeutic endoscopy and recurrent bleeding that occurred after superselective arterial embolization.

4. Targeted transcatheter arterial embolization is the final method of hemostasis for bleeding from chronic gastric and duodenal ulcers, and its use significantly improves the results of treatment of this category of patients.

PRACTICAL RECOMMENDATIONS

1. Upon admission to the hospital of a patient with ulcerative gastrointestinal bleeding, a comprehensive examination is indicated to determine the severity of blood loss and the degree of stability of hemostasis based on endoscopic signs.

2. In case of unstable hemostasis (Forrest Ia-Ib and Forrest IIa-IIc), it is necessary to perform therapeutic endoscopy followed by control endoscopy and determination of the dynamics of bleeding stigmas in a chronic ulcer.

3. If the dynamics of bleeding stigmas are weakly positive, repeated therapeutic endoscopy and repeated control endoscopy within 12 hours are indicated in order to clarify changes in the chronic ulcer. If stable hemostasis occurs (Forrest IIc-III) - conservative treatment. If the dynamics of bleeding stigmas are negative, it is necessary to perform surgical intervention, preferably transcatheter arterial embolization.

4. Before performing arterial embolization, it is necessary to clarify the source of blood supply to the arterial vessel in a chronic ulcer based on direct and/or indirect signs of bleeding, which are determined during angiography.

5. Indications for performing targeted arterial embolization in patients with ulcerative gastrointestinal bleeding are ongoing bleeding with resistance to therapeutic endoscopy, recurrent bleeding after endoscopic hemostasis, lack of positive dynamics of bleeding stigmas after therapeutic endoscopy and recurrent bleeding that occurred after superselective arterial embolization.

6. The use of N-butyl-2-cyanoacrylate with a radiopaque agent as an embolic agent increases the reliability of endovascular surgery, since it allows one to see the embolized area of the artery during control fluoroscopy.

7. To clarify changes in a chronic ulcer, stomach and duodenum after arterial embolization, control endoscopy within twelve hours is recommended.

LIST OF ABBREVIATIONS

APTT – activated partial thromboplastin time

GB – hypertension

Duodenum - duodenum

Gastrointestinal tract - gastrointestinal tract

IHD – coronary heart disease

PPI – proton pump inhibitor

INR – international normalized ratio

NSAIDs – non-steroidal anti-inflammatory drugs

ICU - intensive care unit

BCC – volume of circulating blood

FFP – fresh frozen plasma

CVD – cerebrovascular disease

EGDS – esophagogastroduodenoscopy

PU - peptic ulcer

UGDK - ulcerative gastroduodenal bleeding

H. pylori – Helicobacter pylori

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