

## **Endoscopic and radiosurgical diagnostics and treatment of biliodigestive bleeding**

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**Key words:** hemobilia, wirsungorrhoea, biliodigestive hemorrhages, double-balloon endoscopy (DBE), video capsule endoscopy (VCE), spiral computed tomography (SCT), X-ray diagnostics and treatment

### **Introduction**

Among profuse abdominal bleeding, bleeding from the hepatopancreatoduodenal region, especially postoperative, is the most difficult and dangerous [3, 9].

Hemobilia complicates the course of various diseases and injuries of the liver, bile ducts and pancreas.

The syndrome is characterized by a triad of symptoms: gastrointestinal bleeding, hepatic (biliary) colic and jaundice. Ordinary gastroduodenal ulcerative bleeding is usually painless (Bergman symptom).

Wirsungorrhagia is a rare complication of pancreatic diseases, sometimes in combination with the pathology of the biliary system, which is manifested by recurrent bleeding from a large or small duodenal papilla. Bleeding arises from a. pancreatoduodenalis superior, varicose veins with wall erosion from the basin of the upper or lower v.v. pancreatoduodenalis.

The term “biliodigestive bleeding” — bleeding from the hepatopancreatoduodenal area — is much broader and includes all bleeding variants into the lumen of the biliary system and further into the gastrointestinal tract, including hemobilia, wirsungorrhagia and bleeding in various diseases and injuries of the major and minor duodenal papilla.

Bleeding into the free abdominal cavity from the vessels of the hepatopancreatoduodenal zone (from a. cystica, gallbladder bed and adhesions) is diagnosed from 0.6–0.9% to 7.9% [4, 6, 7, 8].

With blunt abdominal trauma, hemobilia is most often observed with damage to the intrahepatic bile ducts, and with larger liver injuries, biliodigestive hemorrhages develop only in 4.9% of cases [8].

In general surgical diseases, the frequency of pancreatic-digestive hemorrhages from the hepatopancreatoduodenal region is noted from 0.3% to 1.2% [1, 7].

Postoperative mortality in pancreatic-digestive bleeding is up to 30% in the general group of patients, and in patients over 60 years old — up to 50%, with recurrent postoperative bleeding — up to 86% [3, 5].

The last decades in connection with the increase of military and civil conflicts around the world, the deterioration of the crime situation, including terrorist attacks, the ever-increasing number of accidents, the increase in the number of invasive interventions on the organs of the hepatopancreatoduodenal area, the relevance of the problem is constantly increasing.

**Aim of research** is to find out the most appropriate methods for the topical diagnosis of hemobilia, virsungorrhagia and, in general, pancreato-digestive hemorrhages with extensive use of endoscopic techniques to optimize treatment with a decrease in postoperative mortality.

### **Materials and methods**

Possibilities of topical diagnosis of pancreatic and digestive hemorrhages of the hepatopancreatobiliary area by single and double-ball endoscopy (DBE), video capsular endoscopy (VCE), spiral computed tomography (CT) are analyzed, which turned out to be not high. The use of angiographic techniques and minimally invasive endovascular methods in the diagnosis and stop bleeding become the method of choice [1, 5, 6, 7, 12, 20, 21].

The small intestine is called the “black box” of the gastrointestinal tract due to the complexity of endoscopy (significant mobility and a length of more than 2 m), low effectiveness of traditional X-ray examination with a barium suspension (5-10%).

There is a low effectiveness of topical diagnosis of bilodigestive bleeding, even with DBE, VCE, SCT. According to the modern classification of the entire gastrointestinal tract by localization of bleeding is divided into 3 sections:

- upper (esophagus, stomach, duodenal bulb);
- middle (from the border of the duodenum bulb to the bauhinia flap);
- lower (whole colon and anus).

The frequency of bleeding in the middle section, including hemobilia and virsungorrhagia — up to 10% of the total number of gastrointestinal bleeding [11, 16, 17, 19].

In 1971, H. Hiratsuka first conducted a successful endoscopic examination of the intestine with the advancement of the probe endoscope due to the natural intestinal motility.

In 1997, the technique of Yamamoto's double-ball push enteroscopy was introduced [18].

According to the staff of our clinic [9], out of 37 patients examined, the source of the gastrointestinal tract in video capsular videoscopy was detected in 34 (91.9%) patients. The technique is effective in angiodysplasia, telangiectasia, arteriovenous malformations, Dyelafua ulcers, Crohn's disease, Meckel's diverticulums, small intestinal tumors, aorto-intestinal fistulas [11, 17]. However, the effectiveness of the technique of videocapsular endoscopy of the small intestine with pancreatic-digestive bleeding has not been identified.

With one-and two-ball endoscopy, spiral enteroscopy, push-endoscopy from 32 patients, the source of bleeding was detected in 15 (47%). Thus, the effectiveness of topical diagnosis of

pancreatic-idiopathic bleeding, even with spiral tomography, double-ball and capsular video endoscopy, is not high [10, 13, 15, 16, 17, 19]. Therefore, the use of angiographic techniques and minimally invasive endovascular methods to stop bleeding based on it is often becoming the method of choice [1, 6, 7, 12, 14, 18, 20, 21].

Indications for angiography with gastrointestinal bleeding:

- inability to establish the source and causes of bleeding by the methods of endoscopy and x-ray studies (including SCT);
- endovascular catheter hemostasis in patients with an established source of bleeding.

Main methods of angiographic diagnosis for pancreatic and digestive bleedingx:

1. Celicaography.
2. Upper mesentericography.
3. Percutaneous transhepatic portography.

Absolute angiographic signs of bleeding:

- extravasation of the radiopaque substance (occurs in 10–25% of cases at a rate of blood flow from the damaged vessel to more than 0.5% cm<sup>3</sup>/min);
- occlusion (thrombosis) of the bleeding artery.

Relative signs of bleeding:

- aneurysm vascular dilatation;
- sharp recalibration of arteries;
- local hypervascularization;
- early contrasting veins.

Main methods of endovascular catheter hemostasis in pancreatic-digestive bleeding:

1. Selective intra-arterial infusion of vasoconstrictors.
2. Selective endovascular embolization of arteries and veins.
3. Temporary balloon occlusion.

Contraindications to endovascular intervention in pancreatic-digestive bleeding:

1. Agonal condition of the patient.
2. Intolerance to iodine-containing drugs.
3. Technical impossibility of catheterization of the desired artery.

For the period 2013–2017 X-ray endovascular diagnostic and treatment methods were used in 11 patients with severe recurrent biliodigestive bleeding. Hemorrhages occurred between 2 and 14 days after previous surgery on the organs of the hepatopancreatoduodenal region. The age of patients is from 37 to 72 years old, men are 7 and women are 4.

All-clinical, endoscopic, and ultrasound examinations were performed to assess the severity of bleeding and identify the source. 7 patients underwent multispiral CT scan of the abdominal

cavity and retroperitoneal space, a diagnostic laparotomy was performed on one patient at the “height of bleeding”, and in 3 patients the retroperitoneal hematoma was drained under ultrasound guidance. However, the source of bleeding was not detected.

Due to the ineffectiveness of conservative hemostatic therapy, all 11 patients underwent diagnostic angiography, including selective arteriography of the celiac trunk and superior mesenteric artery with the obligatory obtaining of arterial, capillary and venous phases.

At the time of angiography, the condition in 4 patients was relatively stable, in 5 — severe and in 2 — critical (condition after clinical death and resuscitation, maintaining hemodynamics with adrenomimetics, continuous infusion of blood products and blood substitutes).

## **Results**

False aneurysms and arterial thrombosis of the hepatopancreatoduodenal region were detected in all 11 patients:

- in 4 patients in the basin of the hepatic artery itself, incl. in 3 with signs of extravasation of contrast beyond the aneurysm, which was the cause of hemobilia;
- in 3 patients in the gastroduodenal artery pool;
- in 3 patients in the basin of the superior mesenteric artery;
- in 1 patient in the splenic artery pool (transverse pancreatic artery).

All detected lesions are iatrogenic, i.e. resulting from the surgery.

In all patients, endoscopic and surgical hemostasis was impossible or extremely risky, so they underwent radiographic endovascular occlusion (REO) of the arteries supplying the identified source of bleeding.

### Embolizing agents (devices) used to stop abdominal bleeding

In 11 patients with REO of the hepatic and gastroduodenal arteries, it was carried out by introducing Gianturco-type metal spirals through a super-selectively introduced hydrophilic catheter. In this case, the spirals were inserted both into the adductor and into the outlet part of the vessel, and, if possible, also into the cavity of the aneurysm to ensure its complete shutdown. In 6 cases, in addition to stem embolization of the arteries with spirals, fragments of a hemostatic sponge and synthetic emboli of polyurethane foam with a particle size of 1500–2000 µm were used, which made it possible to achieve a more rapid and reliable hemostatic effect. In two cases with a false aneurysm of the branches of the superior mesenteric artery, it was technically impossible to reach the aneurysm cavity with an ordinary angiographic catheter, and a semi-selective embolization could lead to necrosis of the intestine due to emboli reaching the branches to the target artery. Therefore, we applied a microcatheter, through which electrofusion microspirals (commonly used in interventional neuroradiology) were introduced into the cavity of the aneurysm and into the artery supplying it super-selectively with precision precision.

We present clinical cases of using endovascular interventions.

- Clinical case No. 1. Embolization of a false aneurysm of the lower pancreaticoduodenal artery in acute recurrent abdominal bleeding (Fig. 1).
- Clinical case No. 2. Embolization of the right hepatic and gastroduodenal artery to stop profuse gastrointestinal bleeding in a patient with hemorrhagic shock with the ineffectiveness of traditional surgery methods (Fig. 2).
- Clinical case No. 3. Embolization to switch off a false iatrogenic aneurysm with a high risk of rupture in a patient with contraindications to conventional surgical treatment (Fig. 3).
- Clinical case No. 4. Embolization of the gastroduodenal artery to stop profuse gastrointestinal bleeding in a patient with hemorrhagic shock (Fig. 4).
- Clinical case No. 5. Embolization of the branch of the splenic artery in acute recurrent abdominal bleeding in a patient undergoing surgery for pancreatic necrosis (resection of the tail and body of the pancreas) (Fig. 5).
- Clinical case No. 6. Embolization of a false aneurysm of the right hepatic branch of the superior mesenteric artery in acute recurrent abdominal bleeding (Fig. 6).

### **Conclusions**

Our experience in X-ray surgical diagnostics and treatment of postoperative recurrent bleeding from the arteries of the hepatopancreatoduodenal region by selective angiography followed by transcatheter embolization of the identified source of bleeding indicates high efficiency of this technique, which allows most patients to achieve reliable hemostasis without using highly open risky for the patient repeated open surgeries.

### **Participation of authors:**

V. I. Mamchich — idea of work, drawing conclusions.

S. V. Vereshchagin — collection of clinical material.

M. A. Chaika — collection of clinical material, work with literature, design of the article.

Authors declare no conflict of interest.

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Fig. 1A. On the upper mesentericography the cavity of the false aneurysm (arrow) is contrasted. The previously installed drainage is also visible.



Fig. 1B. Cessation of blood flow after endovascular embolization by electrospiral microspirals.



Fig. 2A. False aneurysm of the right hepatic artery with symptoms of acute bleeding is contrasted (extravasation of contrast from the vessel lumen).



Fig. 2B. Cessation of blood flow after endovascular embolization of the helix.



Fig. 3A. Bagular iatrogenic gastroduodenal artery aneurysm (arrow).



Fig. 3B. Condition after aneurysm embolization using spirals — the aneurysm is turned off from the bloodstream (arrow).

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Fig. 4A. False aneurysm of the gastroduodenal artery (arrow) is contrasted in a patient with symptoms of acute erosive bleeding through the cavity of the cyst of the pancreatic head (wirsungorrhage).

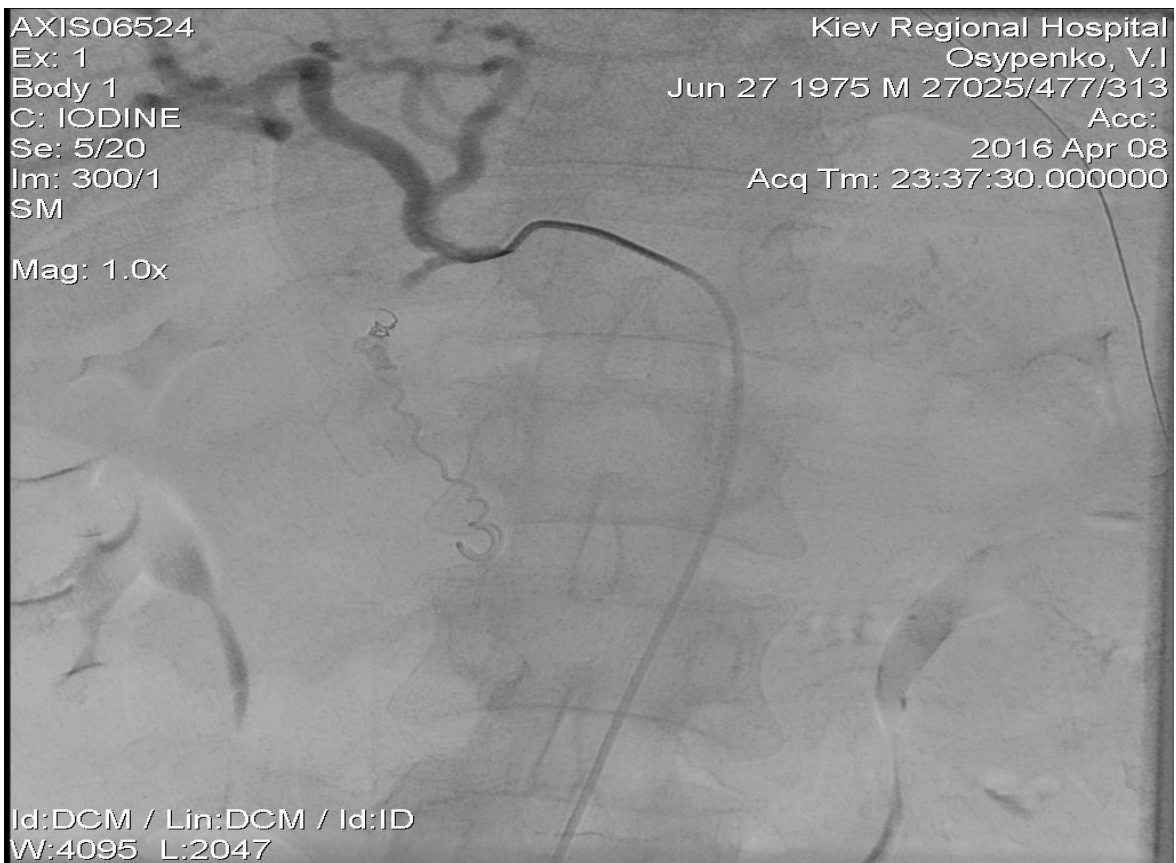


Fig. 4B. Cessation of blood flow after endovascular embolization spirals.



Fig. 5A. Superselective catheterization of the dorsal pancreatic artery: a symptom of occlusion (thrombosis) of the bleeding branch of the artery is seen (arrow).

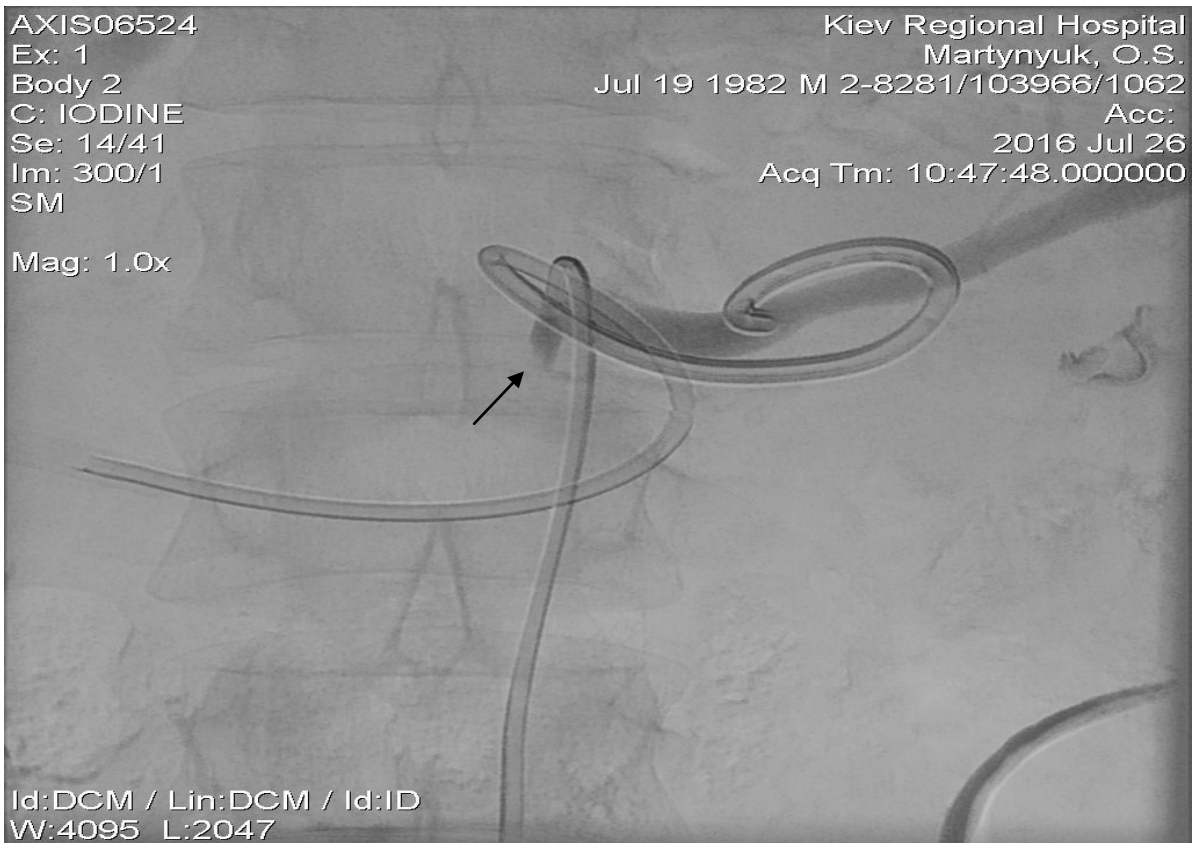


Fig. 5B. Complete cessation of blood flow after endovascular embolization (arrow).



Fig. 6A. On the upper mesentericography the cavity of the false aneurysm of the right hepatic branch of the superior mesenteric artery is contrasted (arrow).

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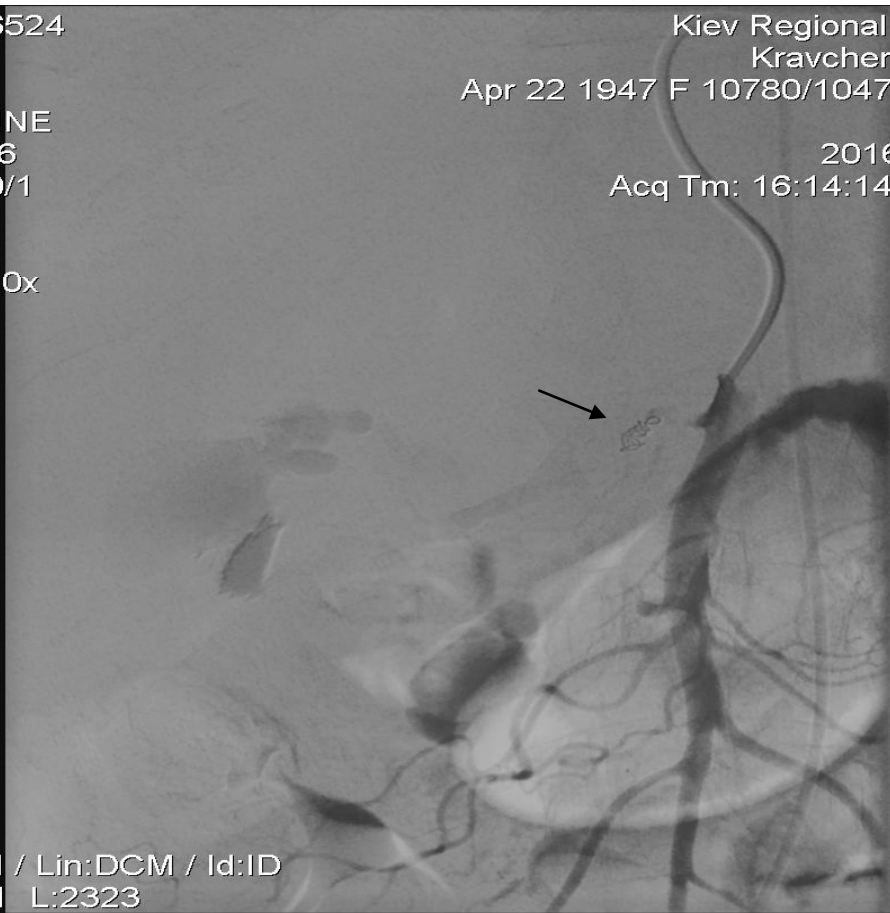


Fig. 6B. Complete cessation of blood flow after endovascular embolization with polyurethane foam particles and helix (arrow).

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**Key words:** hemobilia, wirsungorrhea, biliodigestive hemorrhages, double-balloon endoscopy (DBE), video capsule endoscopy (VCE), spiral computed tomography (SCT), X-ray diagnostics and treatment

**Aim of research** is to find out the most suitable techniques for topical diagnosis of hemobilia, wirsungorrhea and, in general, biliodigestive bleeding with a broad introduction of endoscopic techniques in order to optimize treatment and reduce postoperative mortality.

**Materials and methods.** Opportunities for topical diagnostics of biliodigestive hemorrhages of the hepatopancreatobiliary area by single and double-balloon endoscopy (DBE), video capsule endoscopy (VCE), spiral computed tomography (SCT), were found to be not prospective. Use of angiographic techniques and minimally invasive endovascular techniques in the diagnosing and stopping of bleeding becomes a method of choice.

**Results.** In 11 patients with biliodigestive bleeding, the source was topically diagnosed and thrombosis of false aneurysm and its arterial branches with persistent haemostatic effect was achieved upon endogenous-venous occlusion. One patient died because of the outbreak of multiple organ failure upon liver abscess.

**Conclusion.** X-ray surgical diagnostics and treatment of postoperative recurrent bleeding from arteries of the hepatopancreatoduodenal area by selective angiography, followed by percutaneous embolization of the revealed source of bleeding, confirms high effectiveness of the technique. A reliable hemostasis was achieved in 11 patients with one fatal outcome due to sepsis in a patient with extensive liver abscess.