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Modern endovascular treatment strategies in the management of postpancreatectomy haemorrhage in patients with pancreatic cancer

V. M. Kopchak, L. O. Pererva, V. A. Kondratiuk, I. V. Khomiak, O. V. Duvalko, I. A. Mazanovych, V. V. Khanenko, V. I. Trachuk, P. A. Azadov

O. O. Shalimov National Institute of Surgery and Transplantology of NAMS of Ukraine, Kyiv

✉ Liudmyla Pererva: liudmylapererva@gmail.com

V. M. Kopchak, http://orcid.org/0000-0003-0134-7500
L. O. Pererva, http://orcid.org/0000-0002-4030-1030
V. A. Kondratiuk, http://orcid.org/0000-0002-2506-5009
I. V. Khomiak, http://orcid.org/0000-0002-3299-7840
O. V. Duvalko, http://orcid.org/0000-0001-7423-916X
I. A. Mazanovych, http://orcid.org/0000-0002-6825-9735
V. V. Khanenko, http://orcid.org/0000-0003-4548-0039
V. I. Trachuk, http://orcid.org/0000-0002-7663-7011
P. A. Azadov, http://orcid.org/0000-0003-4804-104X

Objective — to determine the occurrence and management of postpancreatectomy haemorrhage in pancreatic cancer patients, as well as to identify effective treatment strategies to improve patient outcomes.

Materials and methods. From January 2010 to December 2022, 878 patients who underwent radical pancreatic resections for malignant tumours were retrospectively analysed.

Patients were divided into two groups. The main group consisted of 500 patients who were treated in the clinic from 2016 to 2022. In the main group, postpancreatectomy haemorrhage occurred in 31 (6.2%) patients. These patients were treated according to our diagnostic and treatment algorithm, using endovascular techniques as the first step of treatment. The comparison group consisted of 378 patients who were treated in our department from 2010 to 2015. In the comparison group, postpancreatectomy haemorrhage occurred in 20 (5.3%) patients. These patients were treated according to standard approaches. The definition of postpancreatectomy haemorrhage proposed by the International Study Group of Pancreatic Surgery was used in our research.

Results. Out of 31 patients in the main group, 16 (51.6%) had endovascular embolisation. A total of 10 patients underwent endovascular occlusion, whereas 5 patients experienced cessation of bleeding with the use of a stent graft. Angiography did not detect the cause of bleeding in 3 (9.7%) individuals in the main group. They underwent laparotomy with subsequent haemostasis. 11 (35.5%) patients underwent open surgical interventions. In the main group, one (3.2%) patient died due to the emergence of infectious complications after laparotomy and subsequent haemostasis. 2 (10%) patients underwent endovascular haemostasis, while 15 (75%) patients underwent relaparotomy with haemostasis. In the comparison group, 6 (30%) patients died after open relaparotomies.

Conclusions. The initial course of action for managing postpancreatectomy haemorrhage involves the implementation of endovascular techniques, wherein stent grafts are used to address bleeding originating from the main blood vessel. The application of advanced treatment strategies that optimised the use of minimally invasive endovascular techniques resulted in a notable decrease in the mortality rate associated with postpancreatectomy bleeding from 30% to 3.2% ($\chi^2=7.3$, $p=0.006$). Ensuring 24/7 access to endovascular treatment, which can be provided exclusively in high-volume centres, is imperative for improving the treatment outcomes of patients with pancreatic and periampullary cancer.

Keywords
postpancreatectomy haemorrhage, endovascular techniques, endovascular embolisation, stent graft.

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Despite improvements in the perioperative care of patients with pancreatic cancer and advances in operative techniques aimed at improving the results of treatment for patients with pancreatic cancer, the level of postoperative complications after pancreatic resections remains high.

Pancreatic resections are demanding surgery, and despite the decrease in mortality rate to 5 % in highly specialised centres, the number of postoperative complications is one of the highest in abdominal surgery and reaches up to 60 %, even in experienced world centres [6, 8—10, 14, 19].

Postpancreatectomy haemorrhage (PPH) is a critical, life-threatening complication that can occur in approximately 10 % of patients [6]. It is the main cause of death after pancreatic resections and is associated with a high mortality rate, ranging from 30 % to 50 % [11, 18].

In 2007, the International Study Group of Pancreatic Surgery (ISGPS) published guidelines to standardise definitions of PPH, allowing for better management of this life-threatening complication.

The ISGPS determines PPH based on three parameters: onset, location, and severity. Onset is classified as early (within 24 hours after surgery) or late (occurring 24 hours after surgery). Localization helps differentiate between intraluminal and extraluminal bleeding. According to the degree of severity, bleeding is divided into two categories: moderate and severe.

There are 3 degrees of postpancreatectomy haemorrhage, depending on the time of onset and severity.

Grade A (early, moderate severity): minor blood loss in which there are practically no changes in the patient's clinical condition and which do not require invasive interventions.

Grade B (early severe bleeding or late moderate bleeding) rarely threatens the patient's life and requires computed tomography (CT), angiography (AG), and esophagofibro-gastroduodenoscopy (EFGDS) with subsequent medical interventions: endoscopic haemostasis, vascular embolization, or relaparotomy (only in case of severe early bleeding).

Grade C (late bleeding, severe degree) threatens the patient's life and requires CT, EFGDS, and medical interventions (endoscopy, angiography, surgical management of bleeding) [18].

Early postpancreatectomy bleeding is associated with technical failures, intraoperative complications, and problems with haemostasis or coagulopathy. In case of early PPH, conservative treatment is recommended. If it is ineffective, immediate reoperation is necessary [1—3, 11, 18].

Late PPH is often associated with other complications after pancreatectomy, such as a postoperative pancreatic fistula. A haemorrhage can occur due to postoperative fluid collection, which can lead to the erosion of blood vessels and bleeding. Additionally, infectious complications or abdominal abscesses can also be the cause of PPH [1—3, 6, 11, 18]. Among all the causes of postpancreatectomy bleeding, pancreatic fistulas are the most common. Recent studies have confirmed that 80 % of patients with postpancreatectomy haemorrhage develop postoperative pancreatic fistulas [4, 5, 7, 12, 13, 15, 16, 20]. They are not only an independent risk factor for the occurrence of late PPH, but their presence also increases bleeding-related mortality by 17 times [15].

Postpancreatectomy haemorrhage requires careful clinical monitoring and urgent treatment. Patients with late bleeding should be treated with minimally invasive endovascular procedures, with angiography as the first option. Recent advancements in endovascular treatment of PPH, including covered stents and embolization techniques, have contributed to a reduced mortality rate. Timely diagnosis and correct treatment can prevent serious and fatal consequences. A multidisciplinary team of experts is essential to ensuring the best treatment 24 hours a day. In our study, we used the definition of PPH developed by the International Study Group of Pancreatic Surgery [18].

Objective — to determine the occurrence and management of postpancreatectomy haemorrhage in pancreatic cancer patients, as well as to identify effective treatment strategies to improve patient outcomes.

Materials and methods

We retrospectively analysed the results of surgical treatment for 878 patients with pancreatic and periampullary cancer who were radically operated on from January 2010 to December 2022 in the Department of Pancreatic and Bile Ducts Surgery at Shalimov's National Scientific Centre of Surgery and Transplantation. All medical records were reviewed and retrospectively analysed. All patients were operated on by a single surgical team under the direction of the Head of the Department. Of these patients, 497 were men (56.6 %) and 381 were women (43.4 %). The patients' average age was 56.8 ± 9.3 years, ranging from 27 to 82 years.

51 patients (5.8 %) experienced postpancreatectomy haemorrhage. Haemorrhage occurred in 42 patients (5.9 %) after pancreatoduodenectomy (PDE), 8 patients (5.6 %) after distal pancreatic resection

(DPR), including one patient after the modified Appleby procedure, and one patient (4.3 %) after a total pancreatoduodenectomy (TPE). Out of the patients who experienced postpancreatectomy haemorrhage, 7 patients (13.7 %) died.

Prior to 2016, the treatment of PPH often involved reoperation with subsequent haemostasis and surgical treatment of other complications. Since 2016, there have been notable changes in our techniques, leading to the development of appropriate strategies for the management of PPH. Patients with grade A PPH receive conservative therapy. In situations of grade B PPH (early severe bleeding), surgical intervention is used if conservative treatment proves ineffective. If a patient has late-grade B PPH and is hemodynamically stable, angiography is the first-line treatment option for diagnosis, followed by endovascular intervention to control bleeding. Reoperation is performed if the patient is hemodynamically unstable or if the initial endovascular intervention is unsuccessful.

To develop an optimal treatment strategy for PPH, we analysed patient treatment results over different periods.

The study included 878 patients who received treatment in our department between 2010 and 2022. Patients were divided into two groups. Of these, 500 patients were treated according to our diagnostic and treatment algorithm, while the remaining 378 patients were treated using standard approaches. The two groups were comparable in terms of age, disease stage, ASA status, the presence of concomitant pathology, and degrees of PPH, according to ISGPS.

In the main group, we performed diagnostic angiography before beginning endovascular treatment for PPH.

If the patient's general condition allowed, we performed a multidetector CT before angiography to identify the source of bleeding and evaluate the arterial anatomy. In accordance with our strategy, a CT scan is a necessary component of the diagnostic algorithm for patients experiencing PPH, provided that the patient is in a stable hemodynamic state. CT scans not only allow for the identification of the probable source of bleeding and the determination of blood vessel anatomy, but they also enable the diagnosis of other postoperative complications, such as parapancreatic and other fluid collections, which may not have been previously detected by postoperative ultrasound. If a CT scan showed an arterial aneurysm or active extravasation of contrast agent, we diagnosed bleeding. In such cases, we immediately performed angiography. If angiography revealed bleeding, we proceeded with endovascular treatment. This involved either endovascular occlusion of the blood vessel that was the source of bleeding or endovascular stenting. Endovascular stenting was used to manage bleeding from the main blood vessels, such as the common hepatic artery, right and left hepatic arteries, or superior mesenteric artery (SMA).

Open surgical interventions were performed if endovascular treatment of PPH was technically impossible, or if bleeding could not be stopped using endovascular techniques, or if the patient was hemodynamically unstable.

Results and discussion

Postpancreatectomy haemorrhage occurred in 31 (6.2 %) patients in the main group and in 20 (5.0 %) patients in the comparison group. We identified the degrees of postpancreatectomy haemorrhage according to the ISGPS classification. In the main group, PPH occurred in 27 (6.25 %) patients after PDE and in 4 (5.6 %) patients after DPR. In the comparison group, PPH occurred in 15 (5.1 %) patients after PDE, in 4 (5.7 %) patients after DPR, and in one (7.1 %) patient after TPE.

In the main group, PPH grade A occurred in 4 patients, grade B in 13 patients, grade C in 14 patients. As for the comparison group, PPH grade A occurred in 2 patients, grade B in 3 patients, and grade C in 15 patients.

Postpancreatectomy haemorrhage grade A occurred in 4 patients in the main group, which was stopped conservatively. In the main group, 19 (61.3 %) out of 31 patients underwent angiography as the first stage of treatment. Haemorrhage was diagnosed in 16 (84.2 %) out of 19 patients, requiring endovascular haemostasis. In 3 (15.8 %) patients, the source of bleeding was not found. These patients underwent laparotomy with subsequent cessation of bleeding.

In the main group, 16 (51.6 %) out of 31 patients underwent endovascular treatment for bleeding. Endovascular occlusion was performed in 11 patients: splenic artery (SA) occlusion in 6 patients, dorsal pancreatic artery occlusion in 2 patients, branches of the SMA in 2 patients, and gastroduodenal artery (GDA) occlusion in one patient.

In case of haemorrhage from major blood vessels such as the common hepatic artery and the right and left hepatic arteries, endovascular embolization might not be possible due to severe ischemic complications. In such cases, endovascular stenting was performed, which allowed for the closure of the blood vessel defect without disturbing blood flow. The bleeding was successfully stopped in five patients using a stent graft.

After PDE, a stent graft was placed into the common hepatic artery of two patients in order to prevent bleeding from the gastroduodenal artery stump. In addition, a stent graft was used to close the arterial defect in a patient who was experiencing bleeding from the common hepatic artery (refer to Figs. 1, 2).

Two patients underwent PDE and subsequently received a stent graft in the right hepatic artery. In one case, a patient experienced post-operative bleeding during angiography, and extravasation from the right hepatic artery was diagnosed. The right hepatic artery departed from the SMA via a separate trunk. Due to the high risk of ischemic complications, embolization of the right hepatic artery was deemed dangerous. Following the diagnosis and detection of extravasation, the patient underwent angiography, and a stent graft was promptly installed in the right hepatic artery (refer to Figs. 3, 4). Subsequent control angiography confirmed the cessation of bleeding (refer to Figs. 5, 6).

No complications were observed after the placement of stent grafts. Postpancreatectomy haemorrhage was successfully stopped in all cases without any further ischemic complications.

Only one case (5.6 %) experienced complications after endovascular bleeding, where the patient developed a splenic abscess. The abscess was treated using minimally invasive techniques, including

Figure 1. **Angiography with detection of the zone of extravasation from the gastroduodenal artery stump**

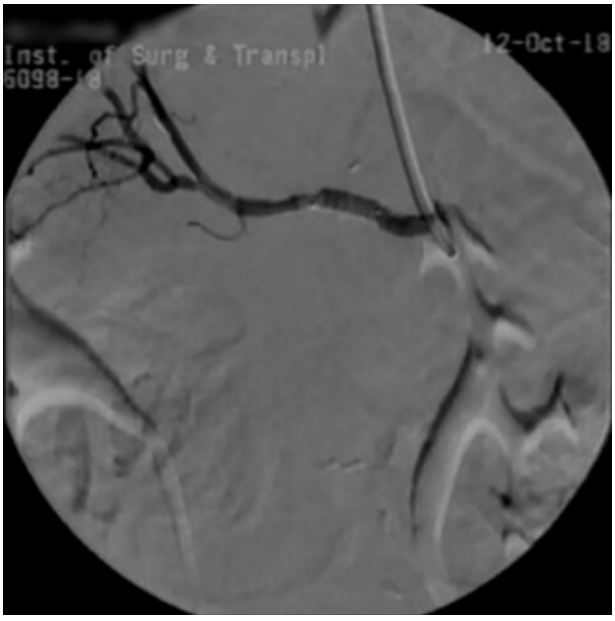

Figure 2. **Control angiography with confirmation of bleeding cessation after placement of a stent graft in the common hepatic artery**

Figure 3. **CT angiography with detection of the zone of extravasation from the right hepatic artery, which originates from the superior mesenteric artery**

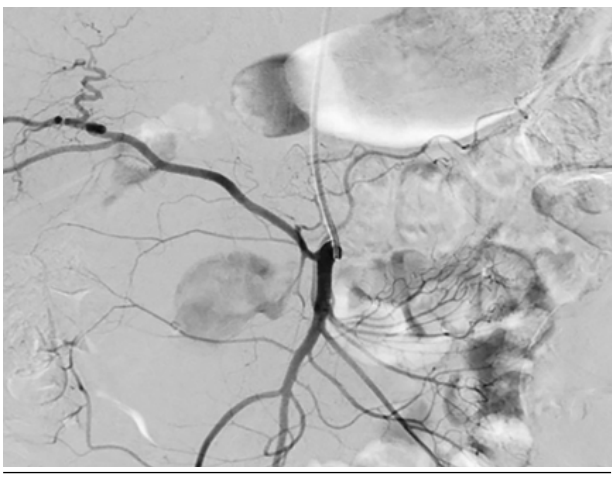

Figure 4. **Angiography with detection of the zone of extravasation from the right hepatic artery**

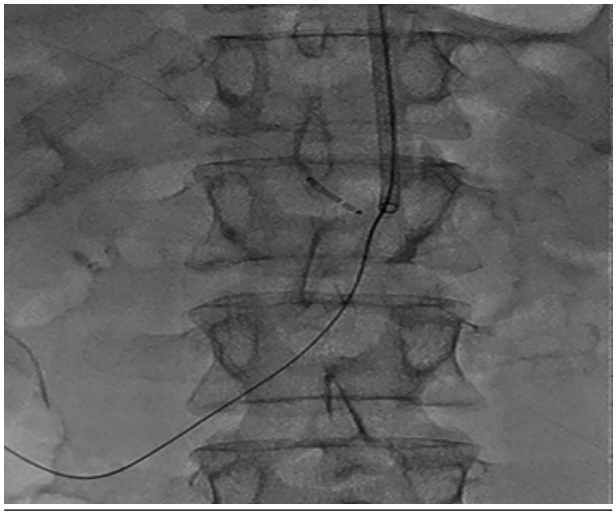

Figure 5. **Placement of a stent graft in the right hepatic artery**

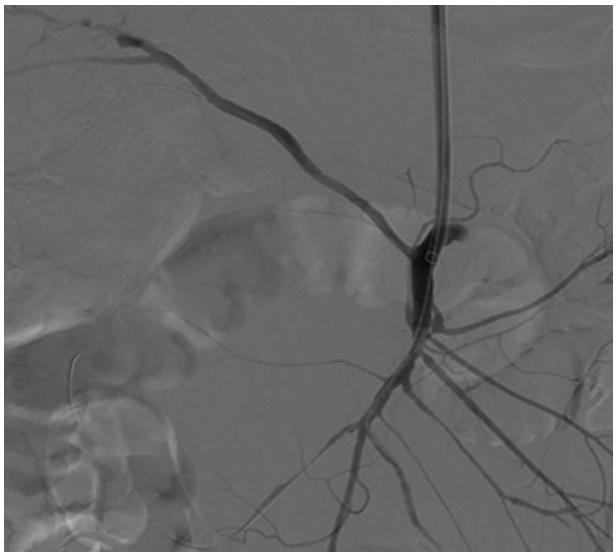

Figure 6. **Control angiography with confirmation of bleeding cessation**

punctures and abscess remediation under ultrasound control. Bleeding was successfully stopped in all patients after endovascular treatment.

13 (35.5 %) patients underwent open surgical interventions in the main group, with successful cessation of bleeding in all cases. Two (18.2 %) patients experienced a recurrence of bleeding, leading to TPE in one case. During relaparotomy, bleeding from the pancreatojejunoanastomosis was diagnosed in one patient, which was stopped intraoperatively. However, bleeding recurred one day after the procedure. The patient underwent urgent surgery to perform a separation of the pancreaticojejunal anastomosis and establish external drainage of the main pancreatic duct.

In the main group, only one patient (3.2 %) died after undergoing a No-touch PDE. During the postoperative period, the patient developed postoperative pancreatitis with infected parapancreatic clusters. On the 9th day after the operation, intraabdominal bleeding occurred, and an urgent relaparotomy was performed. The bleeding was stopped, and a TPE with splenectomy was completed. Finally, an autoarterial prosthetic replacement of the common hepatic artery with a stump of the SA was performed. On the first postoperative day after relaparotomy, thrombosis of the arterial anastomosis occurred. Urgent, repeated surgical intervention was performed, including thrombectomy and sanitation of the abdominal cavity. Vacuum-assisted bandages were then placed and replaced repeatedly, and the abdominal cavity was resanitized and drained. Unfortunately, the patient died.

In the comparison group, bleeding occurred in 20 (5.3 %) patients. Of these, 2 (10 %) patients experienced post-pancreatectomy bleeding, which was managed conservatively. Additionally, 3 patients experienced PPH, with one case being gastrointestinal bleeding that was resolved through endoscopic intervention. Endovascular occlusion of the SA was performed in 2 (10 %) patients.

15 patients (75 %) underwent repeated surgical interventions to stop bleeding. Eventually, bleeding was successfully stopped in all cases. In the comparison group of 20 patients, 6 (30 %) died due to the development of additional purulent-septic complications. The overall mortality rate for bleeding was 13.7 % (7 out of 51).

Following laparotomy to stop bleeding, 26.9 % of patients (7 out of 26) died due to septic complications, including one patient in the main group and six patients in the comparison group.

The application of endovascular techniques for haemostasis did not result in any mortality. Due to our diagnostic and treatment strategies, which extensively use endovascular methods to diagnose and stop bleeding, we have managed to reduce PPH mortality in the main group to 3.2 %. However, the mortality rate in the control group was 30 % ($\chi^2 = 7.3$; $p = 0.006$).

Postpancreatectomy haemorrhage is a life-threatening complication with high mortality rates, even in high-volume centres. It requires immediate and timely treatment. Despite improvements in surgical techniques and the development of modern equipment, postoperative complications, including PPH, have a high incidence even in high-volume centres.

A systematic review by T. A. Maccabe et al. analysed the management of PPH stratified by the ISGPS score. The review included 62 studies conducted between 2008 and 2020, which reported on 10775 pancreatic resections. Bleeding occurred in

608 patients, representing 5.4 % of cases [2]. According to data from the world's leading clinics, PPH after PD may occur in as many as 6—8 % of patients, according to the Mayo Clinic [2]. The Pancreas Institute in Verona reported that PPH occurred in 6.8 % of patients undergoing pancreatic resections [5]. Ageo Central Hospital in Japan published data indicating that PPH after PDE occurred in 8.3 % of patients [7].

According to our data, PPH was observed in 5.8 % of patients. Our findings are comparable. Among those who experienced bleeding, 7 patients died, resulting in a mortality rate of 13.7 %.

A review by A. Floortje van Oosten and F. Jasmijn Smits analysed data from 14 studies involving 467 patients who experienced postoperative haemorrhage after pancreatic resections between February 2007 and July 2018. According to their findings, PPH occurred in 3 % — 16 % of patients [6]. The overall mortality rate was 21 %, significantly greater than ours [1].

A study by the Mayo Clinic, published by Kengo Asai, revealed that the majority of PPH cases have an arterial origin. Global studies have shown that early bleeding is commonly detected from the surface of the pancreas and pancreaticojejunal anastomoses (41.2 % and 23.6 %, respectively), while late bleeding is more frequently observed from the gastroduodenal artery, common hepatic artery (27.4 % and 21.4 %, respectively), and pancreaticojejunal anastomoses [1, 2]. Late bleeding is usually arterial, with aneurysms present in one-third of patients with PPH, according to Pierpaolo Biondetti [1].

In our study, there were no early PPHs. All bleedings were late and occurred as early as 2—38 days.

Late bleeding is commonly associated with the erosion of blood vessels due to pancreatic fistulas, parapancreatic fluid collection, infectious complications, or intra-abdominal abscesses [1, 20]. Pancreatic fistula is identified as the primary cause of late postoperative haemorrhage. Recent studies have shown that 80 % of patients with bleeding have a pancreatic fistula. Postoperative pancreatic fistula is a reliable risk factor for postoperative bleeding and increases bleeding-associated mortality by 17 times [15]. According to our data, out of 51 patients with PPH, 44 (86.3 %) experienced bleeding in conjunction with a postoperative pancreatic fistula and associated infectious complications.

It is important to consider problems with pancreatojejunoanastomosis when observing postoperative intraluminal bleeding, not just ulcers in the gastrointestinal tract. Bleeding can occur from the cut surface of the pancreas due to pancreatojejunoanastomosis failure, which may result in bleeding through drains or into the gastrointestinal tract. Hemobilia may occur when a pseudoaneurysm is formed after erosion of the common hepatic artery, leading to leakage into the biliary tract. Mortality rates associated with this complication can range from 35 % to 50 % [15].

When encountering intraluminal gastrointestinal bleeding, it is important to consider not only gastrointestinal ulcers and bleeding from gastroenteroanastomosis but also potential issues with pancreaticojejunoanastomosis.

Intraabdominal bleeding can also be caused by venous bleeding, including bleeding from varicose veins associated with portal thrombosis. Bleeding may also occur from the portal vein, superior mesenteric vein, or their branches. It is important to differentiate between arterial and venous bleeding, as endovascular bleeding control is ineffective for external bleeding. In cases of venous bleeding, the main method of treatment is laparotomy with bleeding control. This ensures effective management of the condition. According to our findings, three patients in the main group experienced postoperative venous bleeding, which originated in the portal or superior mesenteric veins. All of these individuals underwent a relaparotomy to stop the bleeding. In terms of localization, our data reveal that the pancreaticojejunoanastomosis, common hepatic, or right hepatic artery are the most prevalent sites of bleeding. This is linked to the development of postoperative pancreatogenic complications, including postoperative pancreatic fistulas.

Pancreatoduodenectomy is known to be one of the most complex abdominal surgeries [3]. Postpancreatectomy haemorrhage showed more than a 6-fold increase in mortality when compared to those not affected, with 64 % and 35 % of them requiring one or multiple interventions, respectively [3]. Reoperation in patients with late PPH is frequently associated with a significant mortality rate [3]. Postoperative adhesions and inflammation, particularly in patients with postoperative pancreatic fistula and other complications, make surgery challenging.

According to our findings, all patients who died from postpancreatectomy haemorrhage underwent reoperation during the first stage of treatment.

In terms of global data on reducing mortality in patients with PPH, the only effective measure is the use of minimally invasive endovascular techniques in the early stages of PPH management. This requires the availability of interventional radiology with angiography within 24 hours, 7 days a week [1—3, 10—12, 15, 18].

A previous meta-analysis has demonstrated that surgical interventions for PPH are associated with

higher rates of morbidity and mortality compared to interventional radiologic approaches, which have shown improved success rates [7]. According to reports, endovascular stenting for PPH has a success rate of between 82 % and 100 %, but due to the high rates of re-bleeding, which range from 7 % to 30 %, careful selection is necessary [7].

According to the research, endovascular techniques are effective in achieving haemostasis in 80—100 % of patients, with significantly lower mortality rates compared to surgical interventions. Roulin et al. reported a significant increase in mortality rates after laparotomies compared to endovascular haemostasis, with mortality rates of 22 % and 47 %, respectively, thus supporting the use of endovascular interventions [16]. Based on our data, endovascular haemostasis was effective in 83.3 % of patients. Out of the 18 patients who underwent angiography, 18 (85.7 %) achieved effective endovascular haemostasis.

Open surgery is considered an alternative approach for treating PPH. However, it is recommended that relaparotomy be performed urgently as the first stage only in patients with massive bleeding and unstable hemodynamics, as well as in patients with pancreatic fistulas who require a TPE or when angiography is unavailable for any reason [10, 18, 19]. A total of 11 patients (35.5 %) in the main group and 15 patients (75.0 %) in the comparative group underwent reoperations as part of our study.

Interventional radiology management with endovascular embolization may not always be safe. Embolization of the hepatic artery can be extremely dangerous and may lead to irreversible, life-threatening consequences. Ischemic complications occur in 30—66 % of cases after embolization of the common hepatic artery (CHA), according to the literature. Occlusion of the CHA can lead to cholangitis, liver abscesses, and fatal liver failure [1]. We did not perform embolization of the CHA, left or right hepatic artery in these patients.

Embolizing the stump of the GDA separately is usually impossible due to its small length. Hur et al. reported that bleeding recurrence is experienced by 100 % of patients, which may also originate from another segment of the common hepatic artery. Angiography is often considered the primary procedure for treating bleeding from the GDA, or common hepatic artery, followed by stent graft placement. It is important to note that subjective evaluations have been excluded from this analysis. While the literature describes complications such as stent thrombosis, dislocation, and recurrence of bleeding, there may also be infectious complications associated with parapancreatic infectious collection near the stent [12, 13, 15, 16]. However, no complications related to stent placement or subsequent bleeding recurrences were observed.

The selection of a treatment method for late bleeding is dependent on the patient's clinical condition. The initial step in treatment is to evaluate the patient's hemodynamic stability. Urgent reoperation is recommended for unstable patients. These patients typically experience severe bleeding, such as active arterial and pancreaticojejunostomy bleeding. Emergency laparotomy is the only life-saving option [4, 5, 12, 13, 15, 16, 20].

The selection of a surgical technique is crucial for emergency procedures, and minimally invasive surgery is often the optimal choice. Performing a TPE can be technically challenging due to altered anatomy, postoperative adhesion processes, and inflammatory changes. This is especially true when bleeding occurs in the presence of a postoperative pancreatic fistula, which can lead to septic complications. According to some authors, special pancreatic drainage is recommended instead of a complete TPE [5].

Due to the significant trauma associated with laparotomy, surgery is not the primary option for hemodynamically stable patients.

Some authors recommend angiographic examination for patients experiencing sentinel bleeding, but in many cases, the source of the bleeding cannot be identified, likely due to its intermittent nature. Angiography has the highest sensitivity as soon as sentinel bleeding is observed. MDCT angiography can reveal the cause, nature, and location of bleeding, providing valuable information for further treatment [15].

If the source of bleeding cannot be determined after the initial diagnosis, it is recommended to perform diagnostic angiography of the abdominal trunk and SMA. This study may reveal direct signs of bleeding, such as active contrast extravasation, or indirect signs, such as spasm or vessel contouring. Diagnostic angiography may be limited in cases of diffuse, venous, or periodic bleeding [4, 12, 13, 15, 16, 20].

In summary, late PPH is a significant complication of pancreatic surgery, with the pancreaticojejunal anastomosis being the most frequent site of bleeding. The mortality rate is high due to diagnostic challenges and sudden onset of bleeding. To achieve low mortality rates, pancreatic resections should only be conducted in highly specialised medical institutions that allow for rapid detection and appropriate management, including round-the-clock availability of endovascular procedures to stop bleeding [5, 7, 10, 17].

Conclusions

The initial course of action for managing postpancreatectomy haemorrhage involves the implementation of endovascular techniques, wherein stent grafts are used to address bleeding originating from the main blood vessel.

The application of advanced treatment strategies that optimised the use of minimally invasive endovascular techniques resulted in a notable decrease in the mortality rate associated with postpancreatectomy bleeding from 30 % to 3.2 % ($\chi^2 = 7.3$; $p = 0.006$).

Ensuring 24/7 access to endovascular treatment, which can be provided exclusively in high-volume centres, is imperative for improving the treatment outcomes of patients with pancreatic and periampullary cancer.

Declaration of interests

The authors declare that they have no conflicts of interest.

Authors contributions

V. M. Kopchak, L. O. Pererva, V. A. Kondratiuk, I. V. Khomiak, O. V. Duvalko: conceptualization, methodology, writing review and editing; L. O. Pererva, I. A. Mazanovych, V. V. Khanenko, V. I. Trachuk, P. A. Azadov: formal analysis, investigation, writing, original draft preparation; L. O. Pererva: statistical analysis; V. M. Kopchak: supervision.

All authors have read and approved the final manuscript.

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Сучасна тактика з використанням ендоваскулярних методик в лікуванні постпанкреатектомічних кровотеч у хворих зі злоякісними пухлинами підшлункової залози

В. М. Копчак, Л. О. Перерва, В. А. Кондратюк, І. В. Хомяк, О. В. Дувалко, І. А. Мазанович, В. В. Ханенко, В. І. Трачук, П. А. Азадов

Національний науковий центр хірургії та трансплантології імені О. О. Шалімова НАМН України, Київ

Мета — оцінити частоту виникнення та результати лікування постпанкреатектомічних кровотеч у пацієнтів зі злоякісними пухлинами підшлункової залози та розробити оптимальні стратегії в лікувальній тактиці для поліпшення результатів лікування.

Матеріали та методи. Ретроспективно проаналізовано результати лікування в період із січня 2010 до грудня 2022 року 878 пацієнтів, які перенесли радикальні резекції підшлункової залози з приводу її злоякісних пухлин. Пацієнтів розподілили на дві групи. В основній групі 500 хворих перебували на лікуванні в клініці в період з 2016 до 2022 р. У цій групі постпанкреатектомічна кровотеча виникла в 31 (6,2 %) хворого. Лікування пацієнтів проводили за розробленим нами алгоритмом діагностики та лікування з пріоритетним застосуванням ендоваскулярних методів на першому етапі лікування. У групі порівняння 378 пацієнтів перебували на лікуванні в період із 2010 до 2015 р. У цій групі постпанкреатектомічна кровотеча виникла у 20 (5 %) хворих. Пацієнтів лікували згідно зі стандартними підходами. Постпанкреатектомічні кровотечі визначали відповідно до International Study Group of Pancreatic Surgery.

Результати. Ендоваскулярну емболізацію виконано у 16 (51,6 %) пацієнтів основної групи, ендоваскулярну оклюзію — 11, кровотечу зупинено за допомогою стент-графту в 5 пацієнтів. У 3 (9,7 %) хворих джерело кровотечі за даними ангіографії не виявлено, їм виконали лапаротомію з подальшим гемостазом. Відкриті оперативні втручання проведено 11 (35,5 %) хворим. В основній групі 1 (3,2 %) хворий помер після лапаротомії з гемостазом від розвитку інфекційних ускладнень. У групі порівняння ендоваскулярний гемостаз виконано 2 (10,0 %) хворим, гемостаз за допомогою ендоскопії — 1 (5,0 %), релапаротомію з подальшим гемостазом — 15 (75,0 %). У цій групі 6 (30 %) пацієнтів померли після відкритих релапаротомій.

Висновки. Ендоваскулярні методи постпанкреатектомічної кровотечі необхідно застосовувати на першому етапі лікування з установленням стент-графтів при кровотечі з магістральних судин. Летальність при постпанкреатектомічних кровотечах статистично значущо знизилася з 30,0 до 3,2 % ($\chi^2 = 7,3$; $p = 0,006$) завдяки застосуванню нової лікувальної тактики, що передбачає максимальне використання малоінвазивних ендоваскулярних методик. Для поліпшення лікування хворих зі злоякісними пухлинами підшлункової залози та періампулярної зони з постпанкреатектомічною кровотечею необхідний постійний доступ до ендоваскулярних методик із можливістю проводити ендоваскулярні втручання в режимі 24/7, що можливо у високоспеціалізованих центрах.

Ключові слова: постпанкреатектомічна кровотеча, ендоваскулярні методики, ендоваскулярна емболізація, стент-графт.

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