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CASE REPORT

A Secondary Stenting after Salvage Surgery for Hemorrhage in Pancreatic Resection

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ABSTRACT

Introduction Management of delayed post-operative hemorrhage after pancreatic surgery needs interventional radiology or reintervention according to several clinical criteria (delay from surgery, hemodynamic status, arterial anatomy precluding interventional radiology). Whatever the chosen procedure, re-bleeding after interventional radiology or reintervention is not rare. IR is not possible in case of hemodynamic instability and emergency surgery is very difficult, ligature in adverse local condition during surgery could explain that re-bleeding is not rare notably if the pancreatic anastomosis/remnant is preserved. **Cases** From 2000 to 2015, 899 patients were treated for pancreatic disease in our institution and three of them presented a delayed post-operative hemorrhage. Those three cases, two pancreaticoduodenectomy and one distal pancreatectomy underwent emergency surgery followed by IR to secure the arterial repair either by a covered stent or by transarterial embolization. Secondary IR procedure has been performed between six and 24 hours following surgery. No patient underwent re-bleeding or early postoperative death. **Conclusion** Interventional radiology following post-operative hemorrhage was a safe procedure and might decrease re-bleeding rate after reintervention. This attitude could permit a hemodynamic stabilization of the patient and organized safely a transfer for a stent-placement.

INTRODUCTION

Post-operative hemorrhage (POH) after pancreatic surgery is a life-threatening complication [1, 2, 3]. Its incidence remains between 1.5% and 15% with a mortality rate from 0 to 5% [4]. Delay between surgery and POH defined early POH (≤24 hours or <3 days) and delayed POH (>24 hours or >8 days) [5, 6].

Early post operative hemorrhage is mainly due to technical failure and is essentially treated by reintervention [5] but IR may be used in certain cases.

Delayed POH is generally due to a postoperative pancreatic fistula (POPF) and its exposes to two main issues problems: a) a difficult surgical approach of the bleeding zone increasing with the delay from surgery [7], and b) the necessity to treat the POPF with a high rate of completion pancreatectomy [8]. In this setting, interventional radiology (IR) (angiography with transarterial embolization (TAE) or stent placement) [7, 9], has become the preferred approach in hemodynamically stable patients presenting with delayed POH.

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However, surgery is still indicated for delayed hemorrhage in various situations. Hemodynamic instability is the main indication but other diagnosis requiring surgery such as associated peritonitis, grade C POPF… could benefit from reintervention. Moreover, in non tertiary referral centers, delay from surgery, experience of the IR team, anatomic features of the patient precluding IR, available material for IR (stent, coils, of different size...) are all component to be considered to choose between reintervention or IR.

Reintervention for delayed POH is very difficult and ligature in adverse local condition during surgery could explain that re-bleeding is not rare notably if the pancreatic anastomosis/remnant is preserved. Recurrence of bleeding is elevated, up to 27% [10, 11, 12] after intervention. Thus, hazardous hemostasis could justify another therapeutic option to complete the surgical treatment. We supported that surgery and IR are not exclusive choice and could be complementary procedure. IR could avoid re-bleeding after surgery and secure the surgical ligature.

We reported our experience in management of delayed POH needing surgical treatment immediately followed by IR in order to reduce re-bleeding.

CASES

From 2000 to 2015, 899 patients underwent a pancreatic resection in our department. All clinical, biological and radiologic data were prospectively collected in our database. Patients with delayed postoperative hemorrhage were included and analyzed. We focused on

patients with severe delayed POH with hemodynamic shock needing emergency reintervention.

Hemorrhage was defined using the definition of the ISGPF as postoperative evidence of bleeding in the abdominal drain superior to 300 mL or the nasogastric tube or external bleeding from the gastrointestinal tract.

Hemodynamic shock was defined as hypotension, or rapid heart rate superior to 90/min or both. Management of POH has been standardized in our department since 2007. In case of early postoperative hemorrhage (before postoperative day 3), a reintervention is indicated in most of cases. IR is performed for delayed POH depending of the hemodynamic status.

We decided to focus on patients presenting a delayed POH associated with hemodynamic instability requiring emergency surgery because of the life-threatening situation and the impossibility to securely use an interventional radiologic procedure.

Of the 899 patients, 70 of them (7.8%) presented a postoperative hemorrhage. Obviously, because of hemodynamic shock, an interventional radiologic procedure was not possible. An emergency surgery was performed to stop the bleeding and stabilized the patient. However, at the end of the intervention, because of the adverse local conditions during reintervention, the difficulty to perform a correct and secure hemostasis of the bleeding vessel, the friability of the tissues due to inflammation, we decided to manage them by surgery immediately followed by IR. We report how we particularly managed three cases of delayed hemorrhage.

Case #1

A Seventy-eight-year old male with jaundice and weight loss was diagnosed with an intrapancreatic cholangiocarcinoma and underwent pancreaticoduodenectomy with pancreaticojejunostomy. Five days after surgery, he presented a massive POH with hemodynamic shock. Emergency laparotomy revealed a massive bleeding from the stump of the gastroduodenal artery (GDA), which was controlled by direct suture sparing the common hepatic artery. No pancreatic fistula was detected intraoperatively. The pancreatic parenchyma was soft with a small main pancreatic duct with a high risk to develop a POPF. In this setting placement of a stent in order to cover the stump of the GDA **(Figures 1, 2)** was considered to avoid a secondary bleeding. Procedure was performed 24 hours after surgery. The patient eventually developed POPF on postoperative day 9 without bleeding recurrence and was discharged on POD 23.

Case #2

A Sixty-four-year-old man with jaundice, anorexia and weight loss was diagnosed with ampullary carcinoma. Sixth day after PD with pancreaticojejunostomy, he developed POPF. On POD 8, the patient presented a POH with hemodynamic shock. Emergency laparotomy revealed a bleeding arising from the stump of the GDA and controlled by a ligature sparing the common hepatic artery. Completion of pancreatectomy was decided because of the complete disruption of the pancreatic anastomosis. Ligation of the stump of the GDA was performed in fragile tissue due to impregnation of pancreatic juice. Hence stent placement to avoid a recurrent hemorrhage was decided and successfully performed 12 hours later. The patient was discharged on POD 24.

Case #3

A Fifty-three-year-old woman was diagnosed with a pancreatic tail adenocarcinoma and underwent splenopancreactectomy with elective ligation of the main pancreatic duct and overlock on the pancreatic section. Seven days after surgery, she experienced a brutal pain with hemodynamic shock and blood exteriorization from the drain. Emergency laparotomy revealed a bleeding from the stump of the splenic artery, which was ligated. A POPF was detected; obviously form the pancreatic section and drained. However, we decided a TAE, 6 hours after surgery,

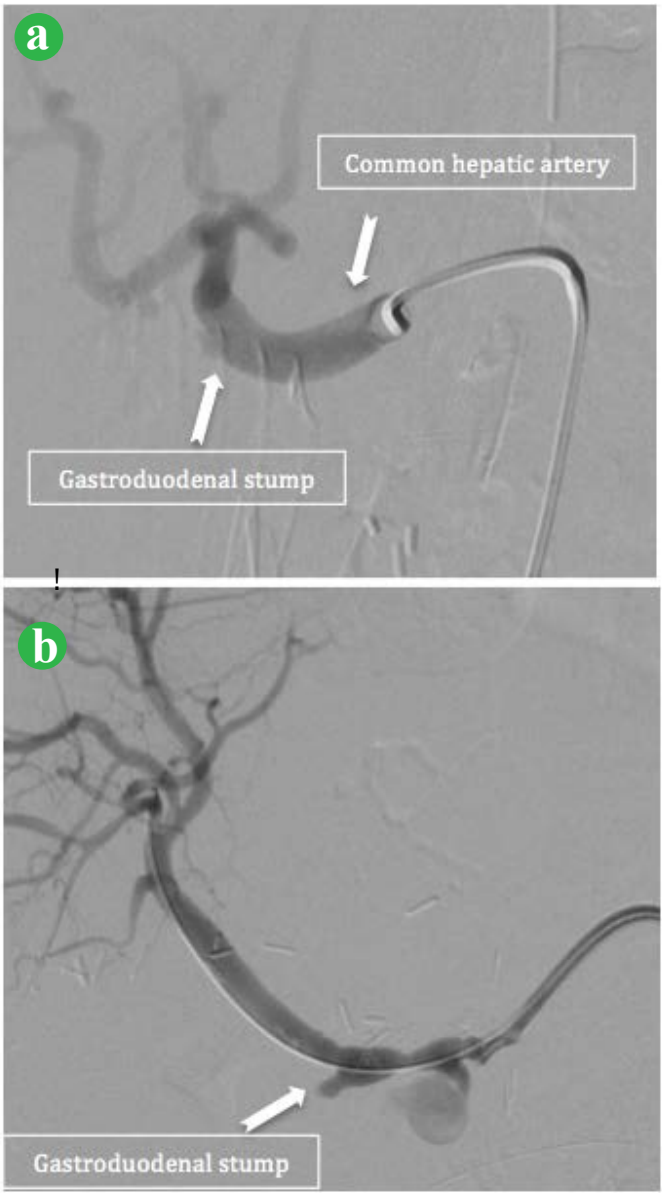

Figure 1. Angiography from the celiac trunk (A) angiography showing the stump of the gastroduodenal artery (GDA).

Figure 2. Stent covering the stump A and B: Covered stent-graft in the common hepatic artery.

of the ligated splenic artery to not expose the patient to another bleeding.

The patient was discharged home 19 days after reintervention.

Interventional Radiology Procedure

Operating procedure was performed under digital subtraction angiography. The Seldinger technique was used to puncture the femoral artery inserted a 6F arterial catheter sheath (Terumo). Then a 5F radiography catheter was used to conduct celiac artery angiography (Terumo, Cobra, Somerset, Cook) and a 0.035-inch ultra-smooth black guide wire to superselect the radiography catheter for hepatic or splenic artery radiography. The target vessel was identified by visualization of irregularity or pseudoaneurysm or active contrast extravasation. In the two first cases, gastroduodenal artery stump was irregular so that a covered stent placement was decided (Abbott). In the third case, an embolization was performed with embolic agents type gelatin sponge (Gelitaspon) **(Table 1)**.

None of the three patients presented re-bleeding. Hospital stay was 18, 16 and 19 days respectively. All the cases were respectively followed 25, 39 and 16 months.

The first patient died after 25 months because of a recurrence of his pathology.

DISCUSSION

Arterial bleeding occurs as a result of inflammatory vascular erosion related to pancreatic juice or bile leaking from an insufficient anastomosis and/or due to local infection [13]. It has been proven that in case of POH a prompt treatment either by IR or surgery is necessary because it is very unlikely that a patient with a pancreatic leak-related hemorrhage will be treated successfully with conservative measure [14, 15].

When POH is related to a POPF, recurrence of bleeding is elevated, up to 27% [10, 11, 12] after reintervention and up to 18% after IR [10, 11, 12, 16, 17, 18] notably if it was choose a conservative treatment of the pancreatic anastomosis (IR or reintervention without completion of the pancreatectomy). Pottier *et al*. showed that after a first endovascular procedure for delayed POH, the reebleding rate is high and 25% of the patient will experienced a novel hemorrhage following the IR procedure [19]. Completion of pancreatectomy is sometimes decided due to total disruption of the pancreatic anastomosis or septic local condition. However, conservation of the pancreatic anastomosis or the pancreatic remnant should be considered and was successfully reported during reintervention for POH in around 40% of cases in the literature [20, 21]. Consequently, a pancreatic surgeon faced a dilemma: completion of the pancreatectomy to avoid another dramatic bleeding or conservation of the pancreatic anastomosis/remnant with high risk of re-bleeding. However, completion pancreatectomy is often difficult, due to bad local condition, with a high morbidity and mortality [8]. We showed that reintervention completed by IR should be a serious option to preserve,

Table 1. Resume of the cases.

	Case #1	Case #2	Case #3
Sex	M	M	F
Age	78	64	53
Pancreatic resection	PD*	PD*	DP°
Fistula	no	yes	yes
Sentinel bleeding	no	no	no
Hemodynamic instability	yes	yes	yes
Origin of bleeding	GDA**	GDA**	Splenic artery
Completion of pancreatectomy	no	yes	no
Delay between surgery and endovascular treatment	24 hours	12 hours	6 hours
Embolisation / stent	Covered stent	Covered stent	Embolisation
Hospital stay (days)	18	16	19
Follow up	25 months	39 months	16 months
Current status	Not alive	Alive	Alive

° distal pancreatectomy; ** gastroduodenal artery; * pancreaticoduodenectomy

when appropriate, the pancreatic remnant, and to decrease the risk of re-bleeding.

However, we have to highlight several points. First, we did not know if these 3 patients would have experienced a re-bleeding if we only perform a reintervention. But, again, re-bleeding after re-intervention is not rare and usually arises from the same vessel. Moreover, we could not measure a subjective point: the local condition of the vessel control. Indeed, ligaturing a vessel that was in contact with pancreatic juice did not provide an experienced pancreatic surgeon a satisfaction. Sensation of fragility and suspicion of failure of this ligation are not measurable but strongly impacted us to going further than sole reintervention. Second, we supported that leaving a long stump of the GDA, when oncologically possible, is a crucial point during PD [22]. Thus, during reintervention, we could easily made a new ligature of the GDA without injury/stenosis of the common hepatic artery. Moreover, stent placement during IR was easy and safe. Third, IR after reintervention should not provoke specific morbidity. We did not experience IR-related morbidity in our 3 patients. However, it will not be supportable to have an arterial disruption or thrombosis to prevent a hypothetic risk. We supported that IR had to be performed in the presence of the pancreatic surgeon to choose or not to achieve the stent placement. For example, if anatomy of the celiac trunk did not permit radiologist to place a stent, they could decide to make a TAE of the hepatic artery [9, 23, 24, 25, 26]. This should not be achieved to not expose the patient to hepatic ischemia and related morbidity: the pancreatic surgeon had to be in the IR room to stop the procedure because the pancreatic surgeon is the most aware physician of post pancreatectomy morbidity. Fourth, IR was performed several hours following the reintervention but we did not have recommendation about the maximum delay between reintervention and IR. Delay between surgery and IR was from 6 to 24 hours, depending on hemodynamic status after surgery. We supposed that IR had to be achieved after patient hemodynamic stabilization and during the first post reintervention day because re-bleeding could occurs from this date. In certain centers distant from a department specialized in endovascular treatment, a delayed support could be fatal for the patient. Theses cases of life-threatening complication illustrate. However, a re-laparotomy first could permit a hemodynamic stabilization of the patient and organized safely a transfer for a stent-placement. The importance of centralization in high volume center [27].

This procedure has never been described in the literature to our knowledge. We advocate an algorithm's management in **Figure 3**. In case of POH, first consideration should be the hemodynamic status of the patient. As reported in the literature, interventional radiology has to be performed for stable patients. On the other hand, a salvage surgery is needed for patients with hemodynamic instability. We recommend, after the surgical procedure, to secure the vascular repair with a secondary stenting by interventional radiology. This technique could reduce the risk of potential fatal rebleeding.

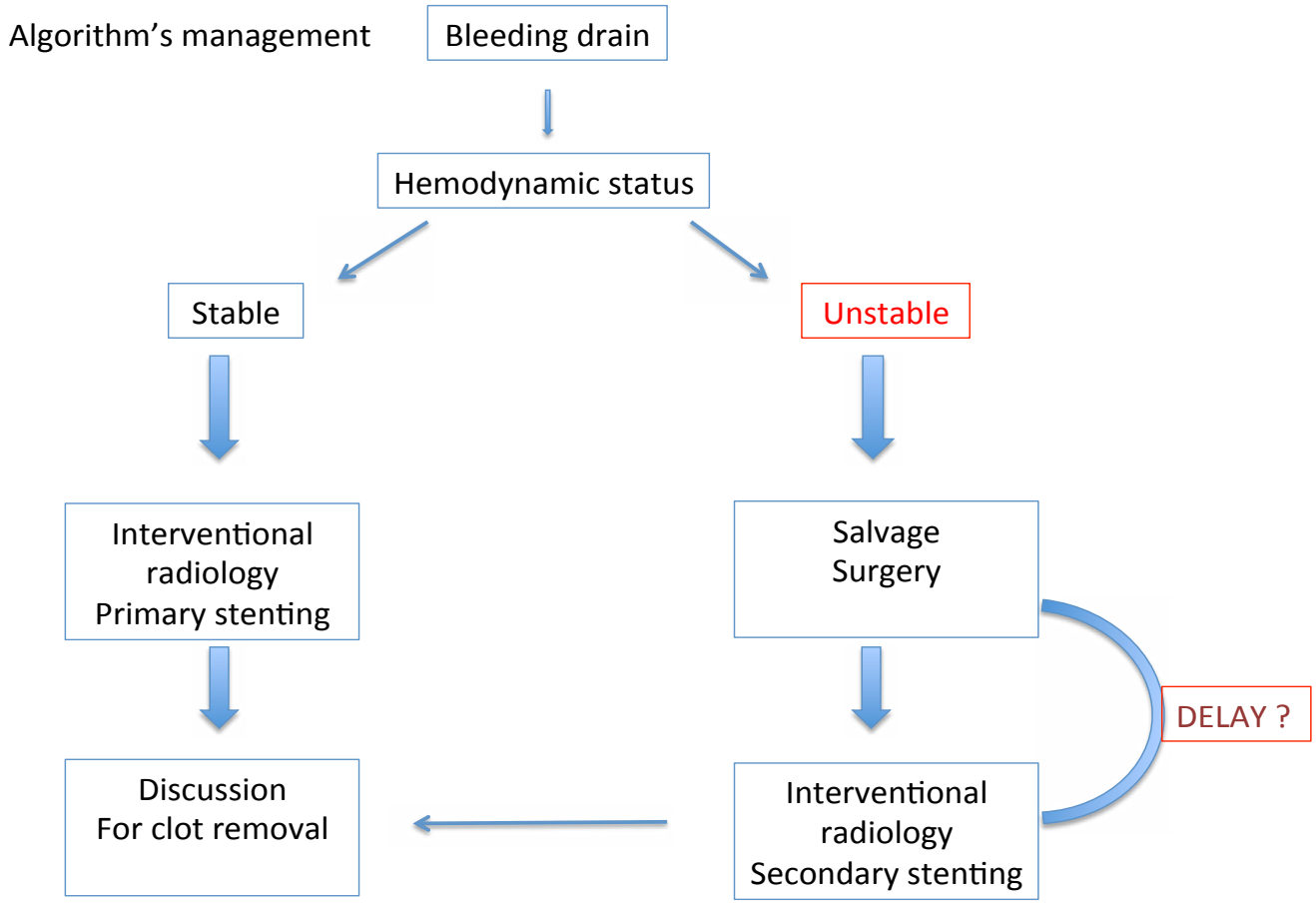

Figure 3. Algorithm's management.

CONCLUSION

Sometimes POH require prompt reintervention. However, ligature in adverse local condition could explain that re-bleeding is not rare notably if the pancreatic anastomosis/remnant is preserved. IR following POH was a safe procedure and might decrease re-bleeding rate after reintervention. However, this attitude had to be discussed case by case to not induce IR-direct related morbidity.

We needed more patients undergoing this original sequence to determine if it's strongly impact re-bleeding rate.

Conflict of Interest

Authors declare no conflict of interests for this article.

References

1. Puppala S, Patel J, McPherson S, Nicholson A, Kessel D. Hemorrhagic complications after Whipple surgery: imaging and radiologic intervention. AJR Am J Roentgenol 2011; 196:192–197. [PMID: 21178067]

2. Grobmyer SR, Kooby DA, Hochwald SN, Blumgart LH. Blumgart anastomosis for pancreaticojejunostomy minimizes severe complications after pancreatic head resection. Br J Surg 2009; 96:741–750. [PMID: 20013921]

3. Beyer L1, Bonmardion R, Marciano S, Hartung O, Ramis O, Chabert L, Léone M, et al. Results of non-operative therapy for delayed hemorrhage after pancreaticoduodenectomy. J Gastrointest Surg 2009; 13:922–928. [PMID: 19224299]

4. de Castro SM, Kuhlmann KF, Busch OR, van Delden OM, Laméris JS, van Gulik TM, Obertop H, et al. Delayed massive hemorrhage after pancreatic and biliary surgery: embolization or surgery? Ann Surg 2005; 241:85–91. [PMID: 15621995]

5. Blanc T, Cortes A, Goere D, Sibert A, Pessaux P, Belghiti J, Sauvanet A, et al. Hemorrhage after pancreaticoduodenectomy: when is surgery still indicated? Am J Surg 2007; 194:3–9. [PMID: 17560900]

6. Wente MN, Veit JA, Bassi C, Dervenis C, Fingerhut A, Gouma DJ, Izbicki JR, et al. Postpancreatectomy hemorrhage (PPH): an International Study Group of Pancreatic Surgery (ISGPS) definition. Surgery 2007; 142:20–25. [PMID: 17629996]

7. Choi SH, Moon HJ, Heo JS, Joh JW, Kim YI. Delayed hemorrhage after pancreaticoduodenectomy. J Am Coll Surg 2004; 199:186–191. [PMID: 15275871]

8. Farley DR, Schwall G, Trede M. Completion pancreatectomy for surgical complications after pancreaticoduodenectomy. Br J Surg 1996; 83:176–179. [PMID: 8689156]

9. Sato N, Yamaguchi K, Shimizu S, Morisaki T, Yokohata K, Chijiiwa K, Tanaka M. Coil embolization of bleeding visceral pseudoaneurysms following pancreatectomy: the importance of early angiography. Arch Surg 1998; 133:1099–1102. [PMID: 9790208]

10. Jilesen AP, Tol JA, Busch OR, van Delden OM, van Gulik TM, Nieveen van Dijkum EJ, Gouma DJ. Emergency management in patients with late hemorrhage after pancreatoduodenectomy for a periampullary tumor. World J Surg 2014; 38:2438–2447. [PMID: 24791669]

11. Tol JA, Busch OR, van Delden OM, van Lienden KP, van Gulik TM, Gouma DJ. Shifting role of operative and nonoperative interventions in managing complications after pancreatoduodenectomy: what is the preferred intervention? Surgery 2014; 156:622–631. [PMID: 25017138]

12. Mañas-Gómez MJ, Rodríguez-Revuelto R, Balsells-Valls J, Olsina-Kissler JJ, Caralt-Barba M, Pérez-Lafuente M, Charco-Torra R. Post-pancreaticoduodenectomy hemorrhage. Incidence, diagnosis, and treatment. World J Surg 2011; 35:2543–2548. [PMID: 21882027]

13. Rajarathinam G, Kannan DG, Vimalraj V, Amudhan A, Rajendran S, Jyotibasu D, Balachandar TG,et al. Post pancreaticoduodenectomy haemorrhage: outcome prediction based on new ISGPS Clinical severity grading. HPB 2008; 10:363–370. [PMID: 18982153]

14. Büchler MW, Wagner M, Schmied BM, Uhl W, Friess H, Z'graggen K. Changes in morbidity after pancreatic resection: toward the end of completion pancreatectomy. Arch Surg 2003; 138:1310–1314; discussion 1315. [PMID: 14662530]

15. Yoshida T, Matsumoto T, Morii Y, Aramaki M, Bandoh T, Kawano K, Kitano S. Delayed massive intraperitoneal hemorrhage after pancreatoduodenectomy. Int Surg 1998; 83:131–135. [PMID: 9851330]

16. Ding X, Zhu J, Zhu M, Li C, Jian W, Jiang J, Wang Z, et al. Therapeutic management of hemorrhage from visceral artery pseudoaneurysms after pancreatic surgery. J Gastrointest Surg 2011; 15:1417–1425. [PMID: 21584822]

17. Boufi M, Hashemi AA, Azghari A, Hartung O, Ramis O, Moutardier V, Alimi YS. Endovascular management of severe bleeding after major abdominal surgery. Ann Vasc Surg 2013; 27:1098–1104. [PMID: 23790760]

18. Wang MQ, Liu FY, Duan F, Wang ZJ, Song P, Fan QS. Stent-grafts placement for treatment of massive hemorrhage from ruptured hepatic artery after pancreaticoduodenectomy. World J Gastroenterol WJG 2010; 16:3716–3722. [PMID: 20677346]

19. Pottier E, Ronot M, Gaujoux S, Cesaretti M, Barbier L, Sauvanet A, Vilgrain V. Endovascular management of delayed post-pancreatectomy haemorrhage. Eur Radiol 2016; 26:3456–3465. [PMID: 26815369]

20. Paye F, Lupinacci RM, Kraemer A, Lescot T, Chafaï N, Tiret E, Balladur P. Surgical treatment of severe pancreatic fistula after pancreaticoduodenectomy by wirsungostomy and repeat pancreatico-jejunal anastomosis Am J Surg 2013; 206:194–201. [PMID: 23706258]

21. Ribero D, Amisano M, Zimmitti G, Giraldi F, Ferrero A, Capussotti L. External tube pancreatostomy reduces the risk of mortality associated with completion pancreatectomy for symptomatic fistulas complicating pancreaticoduodenectomy. J Gastrointest Surg 2013; 17:332–338. [PMID: 23207684]

22. Turrini O, Moutardier V, Guiramand J, Lelong B, Bories E, Sannini A, Magnin V, et al. Hemorrhage after duodenopancreatectomy: impact of neoadjuvant radiochemotherapy and experience with sentinel bleeding. World J Surg 2005; 29:212–216. [PMID: 15654661]

23. Camerlo A, Turrini O, Marciano S, Sarran A, Berdah S, Delpero JR, Moutardier V. Delayed arterial hemorrhage after pancreaticoduodenectomy: is conservation of hepatic arterial flow vital? Pancreas 2010; 39:260–262. [PMID: 20182313]

24. Yekebas EF, Wolfram L, Cataldegirmen G, Habermann CR, Bogoevski D, Koenig AM, Kaifi J, et al. Postpancreatectomy hemorrhage: diagnosis and treatment: an analysis in 1669 consecutive pancreatic resections. Ann Surg 2007; 246:269–280. [PMID: 17667506]

25. Fujii Y, Shimada H, Endo I, Yoshida K, Matsuo K, Takeda K, Ueda M, et al. Management of massive arterial hemorrhage after pancreatobiliary surgery: does embolotherapy contribute to successful outcome? J Gastrointest Surg 2007; 11:432–438. [PMID: 17436126]

26. Baker TA, Aaron JM, Borge M, Pierce K, Shoup M, Aranha GV. Role of interventional radiology in the management of complications after pancreaticoduodenectomy. Am J Surg 2008; 195:386–390; discussion 390. [PMID: 18308043]

27. Enomoto LM, Gusani NJ, Dillon PW, Hollenbeak CS. Impact of surgeon and hospital volume on mortality, length of stay, and cost of pancreaticoduodenectomy. J Gastrointest Surg 2014; 18:690–700. [PMID: 24297652]