



Postoperative complications of radical dissection for gastric cancer

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Received: 10 October 2016; Accepted: 12 January 2017; Published: 15 April 2017.

doi: 10.21037/ales.2017.02.09

View this article at: <http://dx.doi.org/10.21037/ales.2017.02.09>

Complications of radical gastric resection including complications of stomach resection and lymph node resection related complications. Since the surgical technology and surgical instruments have been improved, the rate of common surgical complications such as anastomotic bleeding, duodenal stump caryoclasia, anastomotic rupture or fistula, postoperative obstruction decreased. Meanwhile the clinical general surgeons are more familiar with the diagnosis and treatment so they pay more attention and are more skillful to handle. Relatively some of the rare complications after radical dissection are more likely to be ignored by clinicians causing misdiagnosis and more difficult to deal with. Therefore it is of great importance to understand rare complications of gastric radical surgery.

Postoperative delayed massive hemorrhage

Early postoperative bleeding of gastric radical resection mainly includes anastomotic bleeding, hemorrhage of abdominal cavity which often occurs within 48 hours after surgery, both may be associated with operating defects during the operation. Most of the early postoperative hemorrhage can be controlled by endoscopy and other conservative treatment. Even for a few arterial bleeding in the abdominal cavity the mentioned treatments are invalid, the exploration surgery has fine prognosis. Gastric postoperative delayed hemorrhage is different from early postoperative intraperitoneal or anastomotic bleeding. The former is a kind of fatal haemorrhage due to the rupture of celiac artery or its branches that often occurs more than 1 week after surgery. The bleeding is always dreadful, accompanied by severe abdominal pain and

instable blood circulation. Almost all of the bleedings are arterial, basically all fatal, and the rebleeding afterwards is inescapable.

Our experiences think that pancreatic leakage and abdominal infection are major causes of gastric postoperative delayed hemorrhage, because the intestinal and pancreatic corrosions damage the vascular system of the operation area. Pseudoaneurysm is another important reason for the delayed bleeding. Vascular adventitia can be damaged when performing the VLND. Then the high blood pressure or persistent infection or splenic artery's long-term immersion by the corrosive liquid, pseudoaneurysm can be formed. And the infection of operation area is the major cause of aneurysm rupture and hemorrhage. Common hepatic artery and splenic artery are two vessels most likely to bleed postoperatively. It might be associated with their location and the intestinal and pancreatic corrosions.

Endovascular interventional therapy is a safe, simple, reliable and optimal therapy for delayed hemorrhage of celiac arteries. For the patients with arterial aneurysm, it is the prior method. Theoretically, bleeding faster than 0.5 mL/min can be displayed with arteriography, but there are still 25% angiographies find no hemorrhage. Because sometimes blood clot jams the developer, or the bleeding itself is interrupted, or clotting factors cause vasospasm and then stop the bleeding temporarily. Angiography can increase the positive rate for suspected bleeding when there are active bleedings. For those bleedings that cannot be detected by selective angiography, super selective angiography can clearly find out the cause and bleeding location. If there is no angiographic finding of hemorrhage, it could be difficult to find the bleeding during the operation because of the low blood pressure caused by

bleeding and anesthesia. On the one hand, the embolism can create surgical opportunity and on the other hand it can help find bleeding site and help target and vessels, avoiding unnecessary emergency operation. If surgical treatment is applied, due to the long surgical time, the infection, tissue adhesion, exudation and edema make the bleeding vessels inaccessible. Furthermore, peri-pancreatic inflammation, infected, brittle tissue and vessels often lead to unsuccessful suture. Stanching using the forceps blindly can often damage the celiac trunk or hepatic artery and lead to diffuse abdominal infection. So, the timing of surgical exploration should be carefully decided and reoperation brings high morbidity and mortality.

After the interventional embolization of the main branches of the celiac trunk, the hepatic function could be changed and serious biliary complications such as cholangitis, liver abscess, and liver failure would occur. The safety of liver function can not be guaranteed. Before the embolization, the angiography of superior mesenteric artery should be performed in order to ensure whether pancreaticoduodenal artery has mutation. Our experiences suggest that because of the anastomosis, the hepatic function can fluctuate in a short period after the embolization of common hepatic artery or celiac trunk and then recover in a period, but after a period of time will return to normal. Using the vascular stent graft on the one hand will increase the success rate of interventional treatment, on the other hand, it will greatly reduce the damage of liver function caused by celiac trunk embolism.

Postoperative delayed bleeding has a high mortality rate. Although radical dissection of advanced gastric cancer does not lead to postoperative delayed bleeding, it is crucial to prevent the occurrence of complications. For patients with fistula or significantly increased amylase in the drainage fluid, unblocked drainage should be ensured. Timely ultrasonic puncture is a critical factor to ensure the non-bleeding. Interventional embolization can be used as the preferred method to treat delayed bleeding of gastric surgery. Fix the bleeding cause after stopping the bleeding. If CT or ultrasound finds of abdominal effusion or infection, puncture and drainage can be performed to reduce the possibility of repeated hemorrhage. For those who have long-term fever or high WBC after gastric cancer surgery, we should guard against the abdominal infection by early diagnosis and treatment, including ultrasonic examination, complete drainage and antibiotics, prevent the intra-abdominal hemorrhage caused by abdominal infection.

Postoperative infection of peritoneal effusion

Because of the vascularizing dissection during standard radical gastric surgery, the surgical wound is massive, leading to the infiltration or lymph leakage, so there would be an amount of abdominal drainage. The liquid is clean and the amount gradually reduces.

If the drainage tube is not expedited or the abdominal effusion is plentiful and limited, the peritoneal effusion infection may appear. The clinical manifestation could be continuous or repeating fever after surgery or the up-and-down WBC level. Patients may have abdominal pain, abdominal distension, and slow borborygmus recovery and sometimes the borborygmus could be weak or disappear. After excluding complications that probably cause the fever such as anastomotic leakage, infections of deep venous catheter, respiratory tract, and urinary tract, infection of peritoneal effusion should be considered if accompanied with poor drainage or changed characteristics of the drainage. Abdominal ultrasonography can tell the amount and location of the effusion. A small amount of fluid can be controlled by antibiotics. Ultrasound-guiding puncture or catheter drainage is feasible if the amount is massive. Do the bacterial culture and drug sensitivity test in order to select the sensitive antibiotics for the infection.

Postoperative pancreatitis

The standard radical operation of gastric carcinoma needs to strip off the pancreatic capsule and vascularize the superior gastroduodenal artery, the common hepatic artery and the celiac trunk. Superior border of pancreatic lymph tissue also needs to be stripped. Stripping pancreatic capsule injuring the pancreatic tissue, or the blood supply of the pancreas influenced by vascularizing and the vessel ligation, could cause pancreatitis. In the standard gastric radical surgery, the patient's pancreatic amylase in serum and drainage liquid will increase 3 days after surgery. But they will gradually decrease back to normal level after that. Patient's pancreatitis is usually mild and there are very few cases of severe necrotizing pancreatitis. Moreover, use of somatostatin and trypsin inhibitor postoperatively controls the further development of pancreatitis which can be covered by untypical clinical manifestation such as postoperative incision pain, surgical fever. When pancreas is damaged after the operation, we should observe the situation of amylase in the drainage liquid and get ready to perform ultrasound-guiding puncture.

Postoperative chylous ascites

Chylocyst usually locates between the right angle of diaphragm and the aorta, at the level of first and second lumbar vertebra. Lumbar trunk and chylocyst could be accidentally injured during the dissection of No. 16, 14 and 8p lymph nodes or cardiac tissue. We recommend that all soft tissue or cord-like tissues should be ligatured while resecting them.

As far as we know that the postoperative chylous ascites occurs within 2–3 days after operation and it shows increasing abdominal drainage liquid, which could be 500–1,000 mL or more than 1,500 mL but generally no more than 2,000 mL. Chyle test is positive. Such patients generally have no obvious discomfort but early removal of drainage tube may cause abdominal distension. Different from chylothorax, chyloperitoneum is usually not fatal. Major treatment is conservative. Keep the drainage unobstructed. Give sufficient liquid supply including the colloid supply and electrolyte balance according to the amount of drainage liquid. Generally within a week, the liquid would gradually reduce.

Postoperative cholecystitis and cholecystic gangrene

Cholecystitis and cholecystic gangrene are special complications caused by dissection of No. 12 lymph nodes, and vascularization of hepatoduodenal ligament. Almost all gallbladder arteries stem from the branch of common hepatic arteries and arrive to the gallbladder through the gallbladder triangle. If cystic artery is injured during the No. 12 lymph node dissection, cholecystic gangrene usually occurs. Other causes include vagotomy, postoperative fasting induced gallbladder emptying disorder, cholestasis and gallbladder pressure rise. In general, the postoperative cholecystic gangrene occurs within 3–5 days after operation accompanied by symptoms of peritonitis. Patients show persistent fever or postoperative hypothermia and fever, right upper abdominal pain, intense abdominal muscle, tenderness and rebound tenderness, followed by increased heart rate, WBC rise and so on. Clinically, those manifestations are sometimes very similar to the duodenal stump fistula. Once we suspect the cholecystic gangrene, emergency abdominal ultrasound examination must be performed to find out the situation of the gallbladder, and the specific location and the amount of right upper abdominal effusion. Emergency laparoscopic cholecystectomy could be performed.

Ultrasound-guiding puncture or catheter drainage is also applicable. Other treatments include using broad-spectrum antibiotic to control the infection.

Postoperative cholecystitis and cholestasis: due to extensively vascularizing the 12 groups of lymph nodes, blood supply and nerve innervation of the gallbladder are damaged more or less, causing gallbladder emptying disorder. In a period of time after surgery, the patients may show cholecystitis signs like right upper abdominal pain and intense abdominal muscle. Ultrasound examination may reveal the signs of enlarged gallbladder and cholestasis. Cholecystectomy is needed when it is severe.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Annals of Laparoscopic and Endoscopic Surgery*. The article did not undergo external peer review.

Conflicts of Interest: The author has completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ales.2017.02.09>). The author has no conflicts of interest to declare.

Ethical Statement: The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/ales.2017.02.09

Cite this article as: Song W. Postoperative complications of radical dissection for gastric cancer. *Ann Laparosc Endosc Surg* 2017;2:64.