



Experience in managing splenic hilar vascular injury during laparoscopic total gastrectomy

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ABSTRACT

Splenic hilar vascular injury may occur during laparoscopic radical total gastrectomy for splenic hilar lymph node dissection and often causes massive hemorrhage, requiring conversion to laparotomy and splenectomy. Surgeons treating splenic hilar vascular injuries need a way to stop bleeding promptly and accurately. Herein, we report a case of splenic hilar vascular injury during laparoscopic total gastrectomy in which we successfully managed to stop the bleeding and preserve the spleen.

1. Introduction

Iatrogenic spleen injury often occurs during surgery, especially total gastrectomy with hilar lymph node dissection. Of these injuries, splenic hilar vascular injury is the most dangerous, often resulting in massive bleeding and splenectomy. There are few reports on the management of splenic hilar vascular injury. Recently, we encountered a case of splenic hilar vascular injury during laparoscopic total gastrectomy, and the injury involved multiple vessels. We successfully established hemostasis under laparoscopy. The spleen was preserved, and the patient recovered well after the operation. Herein, we share our experience and some surgical videos.

2. Case report

The patient, a 65-year-old male, was diagnosed with gastric cancer. The tumor was located in the lesser curvature of the gastric body, and the clinical stage was cT2N1M0. Laparoscopic radical total gastrectomy was performed as recommended by the multidisciplinary team (MDT) and according to the patient's wishes. During the operation, the junior surgeon encountered massive bleeding while handling the root of the left gastroepiploic vessels. The senior physician handled it promptly and successfully controlled the bleeding. The specific process was as follows: In the first step, the bleeding was controlled with gauze compression (Fig. 1). In the second step, lymph node dissection was completed, the stomach and omentum were moved to the right upper quadrant, and the splenic hilum area was fully exposed. In the third step, the splenic artery was divided, and a tourniquet was applied to reduce blood flow to the spleen (Fig. 2). In the fourth step, the gauze was removed, and bleeding from multiple blood vessels was found. The major site of bleeding was the root of the left gastroepiploic artery and vein, which was accurately clamped with a vascular clamp and then closed with a hem-o-lok (Fig. 3). The other bleeding vessel was considered a branch of the splenic vein, and bipolar electrocoagulation was used to stop the bleeding (Fig. 4). We removed the tourniquet from the splenic artery after confirming that there was no further bleeding. The stomach and omentum were removed, and esophagojejunostomy and jejunojunctionostomy were completed.

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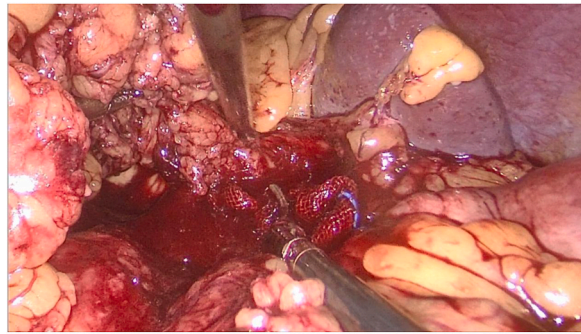


Fig. 1. Gauze compression to stop bleeding.

During the final flushing of the surgical field, bleeding occurred at the original site again, and bipolar electrocoagulation was not effective. We used FIBRILLAR™ compression to stop the bleeding (Fig. 5) and then used 4–0 PROLENE™ to suture the stumps of the splenogastric ligament and the capsule of the pancreas to close the bleeding area (Fig. 6). Exploration revealed partial ischemia in the lower pole of the spleen, covering approximately 20% of the area. The entire operation lasted 280 min, and it took 37 min to stop the bleeding. The blood loss during the operation was approximately 800 mL, and 4 U of concentrated red blood cells were transfused. (supplementary video for surgical procedure).

The patient recovered well and was discharged ten days after the operation. Color Doppler ultrasound showed normal splenic blood flow and no infarction one month after the operation. The patient was free of disease at the one-year follow-up.

3. Discussion

Spleen injury is likely to occur during laparoscopic radical gastrectomy, especially total gastrectomy. The incidence of splenectomy due to spleen injury in radical total gastrectomy has been reported to be as high as 2.7% [1]. The spleen is an important immune organ and plays an important roles in preventing infection, providing tumor immunity, and other functions. When the spleen is injured during surgery, most surgeons consider preservation of the spleen a priority [2].

Splenic vessel injury is one of the most severe complications in laparoscopic radical gastrectomy for gastric cancer. Its management consists of two steps: controlling the bleeding and stopping the bleeding. Sudden hemorrhaging can cause the surgeon to feel overwhelmed. Thus, it is important to remain calm in such situations. If the bleeding site is clearly visible, hemostasis can be accurately established with a vascular clamp. Importantly, blind clamping should be avoided. Upon reviewing the video, we found that the bleeding initially involved only the left gastroepiploic vessels, but because of panic and blind clamping, the adjacent branch of the splenic vein was injured and hemorrhaged, which increased the difficulty of treatment. Gauze compression may be the most effective method for achieving hemostasis in cases in which multiple blood vessels are bleeding and the operative field is unclear. If the bleeding is fast and cannot be controlled in time, the patient's circulation may become unstable, and the surgery needs to be converted to laparotomy without delay. In this case, the hemorrhage was successfully controlled with the compression method in 7 minutes. It is important that the surgeon does not rush to find the site of bleeding after controlling the bleeding, and the following adequate preparations should be made first: First, the surgeon needs to communicate with the anesthesiologist to properly control the patient's blood pressure and promptly perform a blood transfusion if necessary to maintain circulatory stability. Second, the surgeon needs to communicate with the nurses to prepare any equipment that may be used. Finally, the surgeon also needs to communicate with the assistants on how to fully expose the operative field and aspirate the accumulated blood in a timely fashion to clearly reveal the bleeding site. In this case, the omentum and stomach wall around the bleeding area were compressed together, and the operation field was narrow, which was very unfavorable. Thus, we decided to complete the other surgical steps first. After that, the stomach and

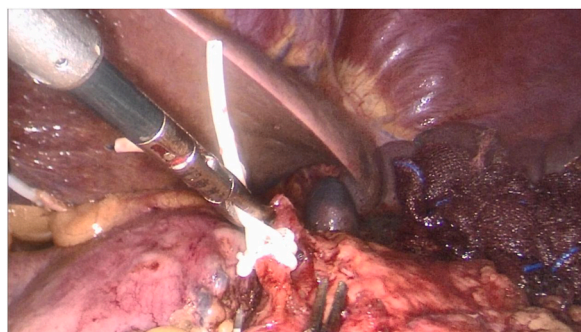


Fig. 2. Temporary occlusion of the splenic artery.

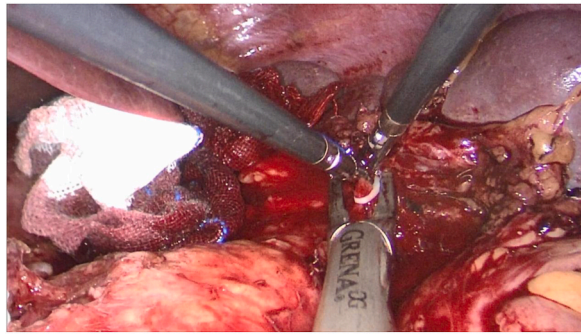


Fig. 3. Hemo-lock ligation of major bleeding vessels.

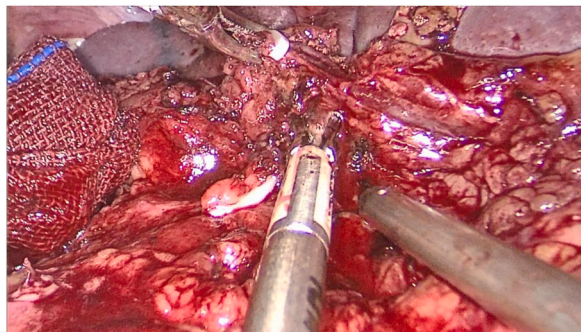


Fig. 4. Electrocoagulation to stop venous bleeding.

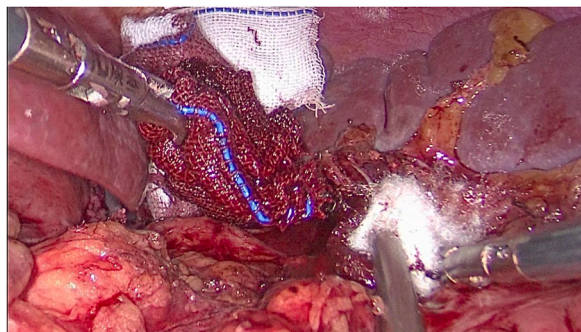


Fig. 5. Compression with Fibrillar™

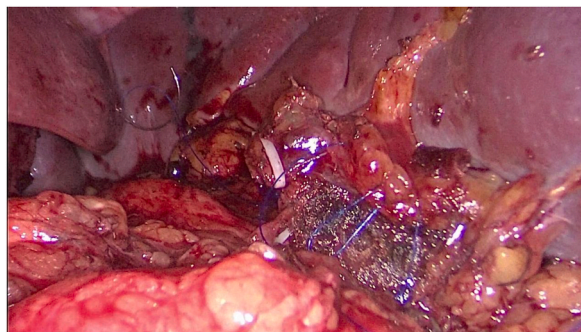


Fig. 6. Wound closure with suturing to completely stop the bleeding.

omentum were moved to the right upper quadrant. The splenic hilum region was then fully exposed to provide a better operating space. The blood flow in the splenic artery was blocked to reduce the amount of bleeding and facilitate hemostasis.

The second step was accurate hemostasis. Different strategies can be implemented depending on the injured vessels. For bleeding at the end of a blood vessel, the bleeding point should be located and a hem-o-lok used to stop the bleeding. For bleeding due to a lateral wall rupture, the bleeding site can be clamped with an atraumatic vascular clamp and then assessed. If bleeding occurs in the trunk, which needs to be preserved, serrefine should be applied on either side of the injury site to block blood flow, and meticulous suturing should be performed to keep the vessels open. If bleeding occurs in a branch vessel, the vessel can be clipped with a hem-o-lock or sutured to achieve hemostasis. The splenic artery may have as high as sixth-order branches before entering the splenic parenchyma [3]. Therefore, the splenic infarct size caused by branch vessel occlusion usually does not exceed 50%.

For venous injury and hemorrhage in the splenic hilar region, it is very difficult to place sutures directly to achieve hemostasis because the vein wall is thin and easily damaged. Thus, compression or bipolar electrocoagulation can be highly effective in such cases. However, the long-term effect of this method is uncertain, and increased abdominal pressure or eschar sloughing may cause new bleeding, which may be massive. This case showed that suturing the tissue around the bleeding site to create continuous compression was an effective way to prevent rebleeding.

After establishing hemostasis, it is very important to check for spleen ischemia and evaluate the affected area. If the ischemic area is less than 50% of the spleen, it usually does not cause serious complications [4]. In our case, the lower pole of the spleen was partially ischemic, and the area was approximately 20%. The patient had no postoperative symptoms or complications related to splenic infarction. Color Doppler ultrasound showed no splenic infarction or ischemia one month after the operation.

Splenic vascular injury rarely occurs in laparoscopic radical gastrectomy, but it is a challenging problem that surgeons encounter. Splenic hilar vascular injury, especially multivessel injury, often leads to a large amount of bleeding and is difficult to handle. Our experience shows that various management methods for different types of vascular injury can successfully stop bleeding and preserve the spleen under laparoscopy. However, if hemostasis becomes difficult to establish or the bleeding becomes life-threatening, laparotomy and splenectomy should be performed promptly.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e18194>.

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