

Abstract

Splenectomy is a very common surgical procedure. Indications for splenectomy vary, therefore the operative steps, difficulty and post-operative results differ. With the development of laparoscopic surgical technique and improvement of surgical instruments, single-incision laparoscopic splenectomy has been used in clinic. Barbaros U et al. reported the index case of laparoendoscopic single-site splenectomy in 2009 (Barbaros and Dinççağ, *Gastrointest Surg* 13:1520–1523, 2009). Thereafter, this procedure has been adapted in clinical practice by some institutions (Vatansev and Ece, *Surg Laparosc Endosc Percutan Tech* 19:e225–e227, 2009; Malladi et al., *JLS* 13:601–604, 2009; Lagrand and Kehdy, *Am Surg* 76:E158–E159, 2010; Barbaros et al., *Surg Laparosc Endosc Percutan Tech* 20:306–311, 2010; Colon et al., *JLS* 15:384–386, 2011; Bell et al., *J Pediatr Surg* 47:898–903, 2012; Dapri et al., *Surg Endosc* 25:3419–3422, 2011). We have reported the first case of laparoendoscopic single-site splenectomy in the treatment of traumatic rupture of the spleen in 2011 (Fan et al., *Surg Innov* 18:185–188, 2011) and hypersplenism secondary to portal hypertension in 2012 (Jing et al., *Surg Innov*, 2012).

We believe, in early series of highly selected patients, laparoendoscopic single-site splenectomy appears to be feasible and safe when performed by experienced laparoscopic surgeons. Despite technical difficulties, there may be potential benefits associated with single-incision over multiple-incision laparoscopic splenectomy but it is yet to be proven objectively.

Keywords

Splenectomy • Gastrocolic ligament • Splenogastric ligament • Splenocolic ligament • Splenorenal ligament • Phrenosplenic ligament • Spleen pedicle • Pericardial devascularization • Gastric coronary vein

7.1 Laparoscopic Splenectomy

7.1.1 Indications and Case Selection

1. Patients with haematological systemic disorder, including idiopathic thrombocytopenia purpura (ITP), thalassemia, hereditary spherocytosis, hairy cell leukemia, myelofibrosis, or hereditary elliptocytosis, etc.
2. Patients with benign occupying lesion, including splenic haematoma, splenic multilocular cysts, etc.
3. Patients undergoing splenic trauma with stable blood pressure.

7.1.2 Contraindications

1. Absolute contraindications:
 - (a) severe cardiorespiratory dysfunction.
 - (b) inability to tolerate general anesthesia or pneumoperitoneum.
 - (c) severe refractory coagulopathy.

2. Relative contraindications:

- (a) morbid obesity.
- (b) pregnancy.
- (c) patients with “frozen upper abdomen” due to previous surgery or peritonitis.
- (d) patients with megalosplenism (>30 cm in diameter).
- (e) arteriosteogenesis.

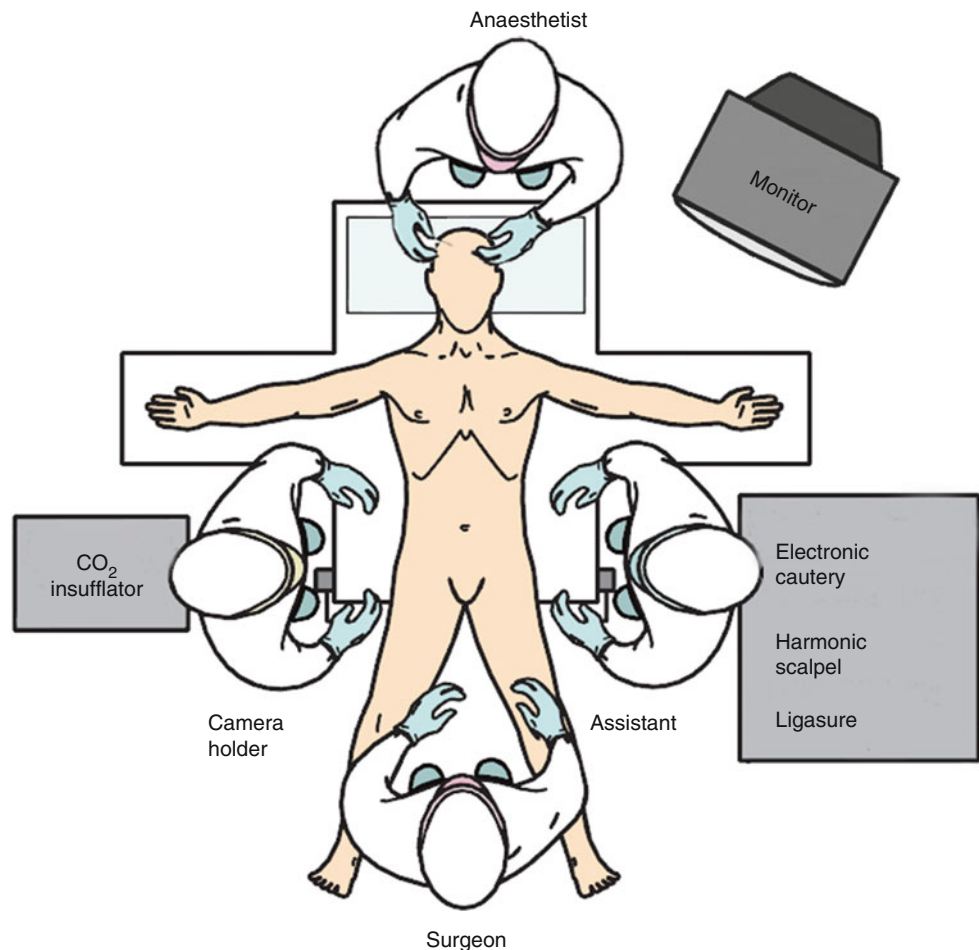
7.1.3 Major Instruments or Energy Sources

1. Laparoscopy System.
2. Holding forceps.
3. Harmonic scalpel.
4. Endoscopic Linear Stapler.

7.1.4 Team Setup, Anesthesia and Position

Under general anesthesia, the patient was placed in supine position with the legs apart. The position of surgeon, assistants and nurses is shown in Fig. 7.1.

Fig. 7.1



7.1.5 Key Steps

1. Dissection of gastrocolic ligament.
2. Dissection of splenogastric ligament.
3. Dissection of splenocolic ligament.
4. Dissection of splenorenal ligament.
5. Dissection of phrenosplenic ligament.
6. Dissection of splenic hilum and tail of pancreas.
7. Transection of spleen pedicle.
8. Retrieval of spleen.
9. Irrigation and drainage.

7.1.6 Surgical Techniques

1. Dissection of gastrocolic ligament.
The patient was placed in reverse Trendelenburg position with a little tilt to the right in order to expose the spleen. The gastrocolic ligament was dissected with harmonic scalpel to expose the pancreas (Fig. 7.2a–d).

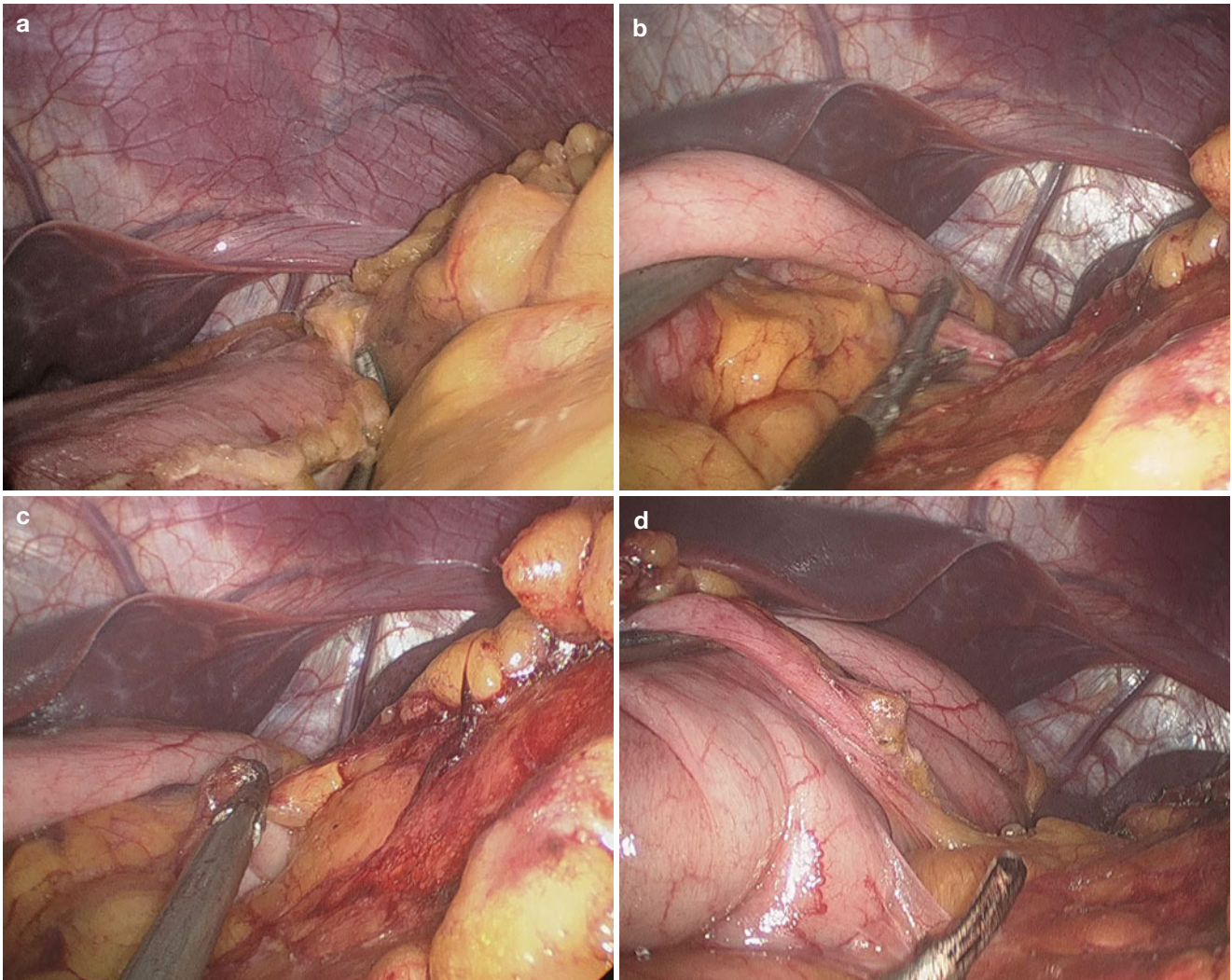


Fig. 7.2

2. Dissection of splenogastric ligament.

The splenogastric ligament and short gastric vessels were divided with harmonic scalpel (Fig. 7.3a, b).

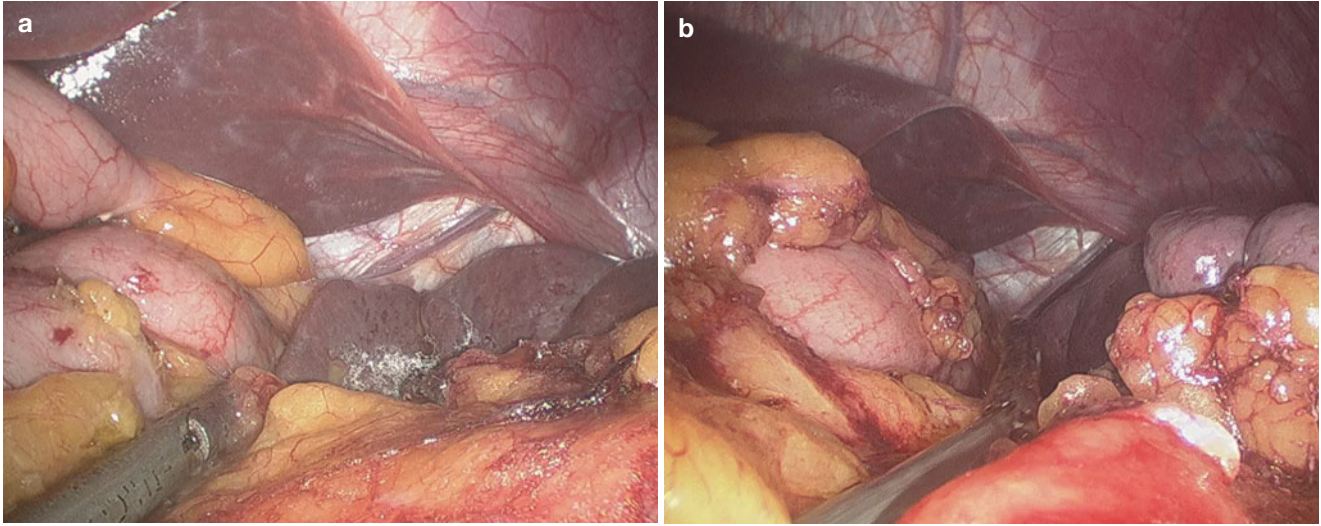


Fig. 7.3

3. Dissection of splenocolic ligament.

The splenocolic ligament was divided and attention was paid not to injure the transverse colon (Fig. 7.4a–d).

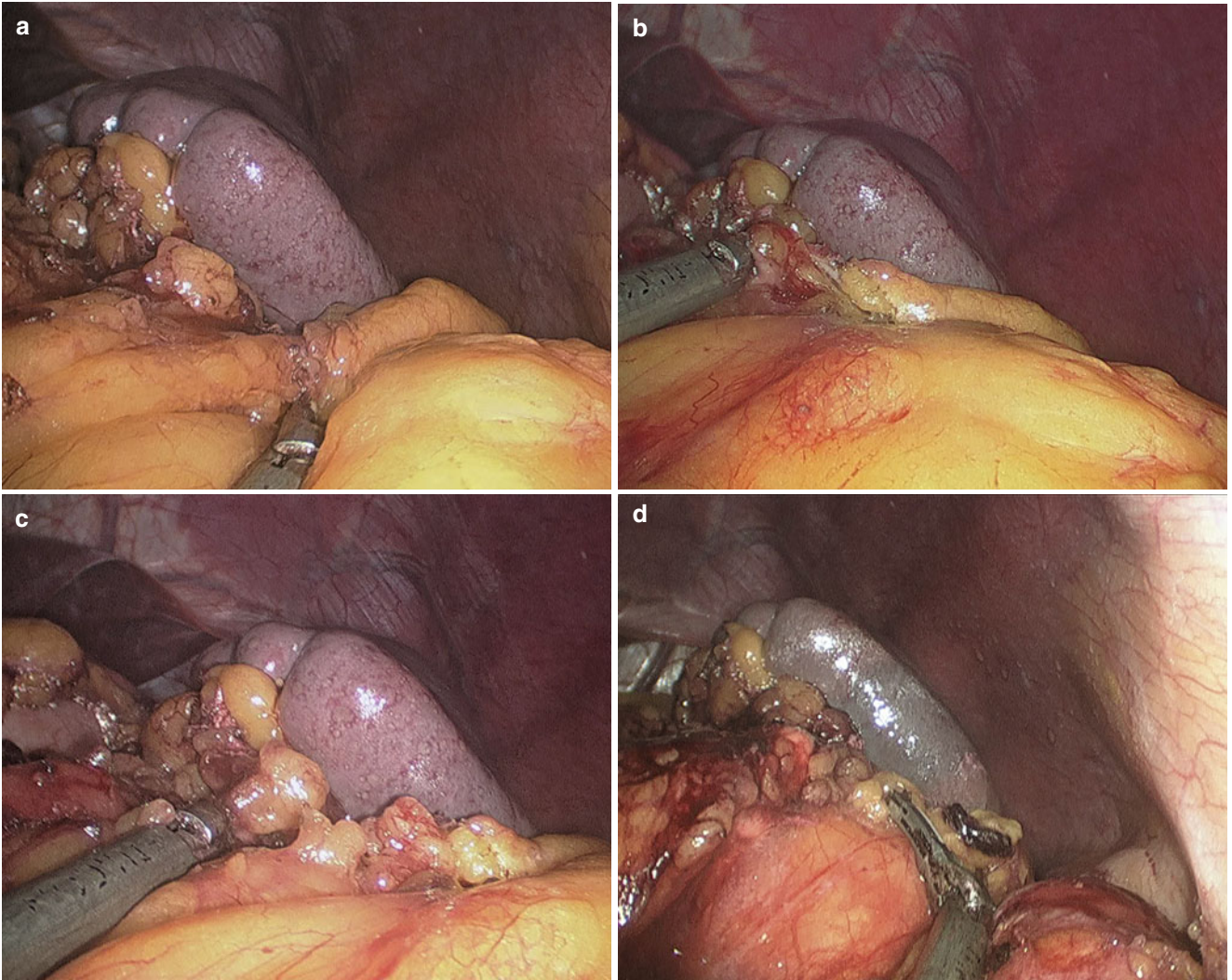


Fig. 7.4

4. Dissection of splenorenal ligament.

The splenocolic ligament was divided and the splenorenal ligament was exposed by lifting the lower pole of the spleen (Fig. 7.5a, b).

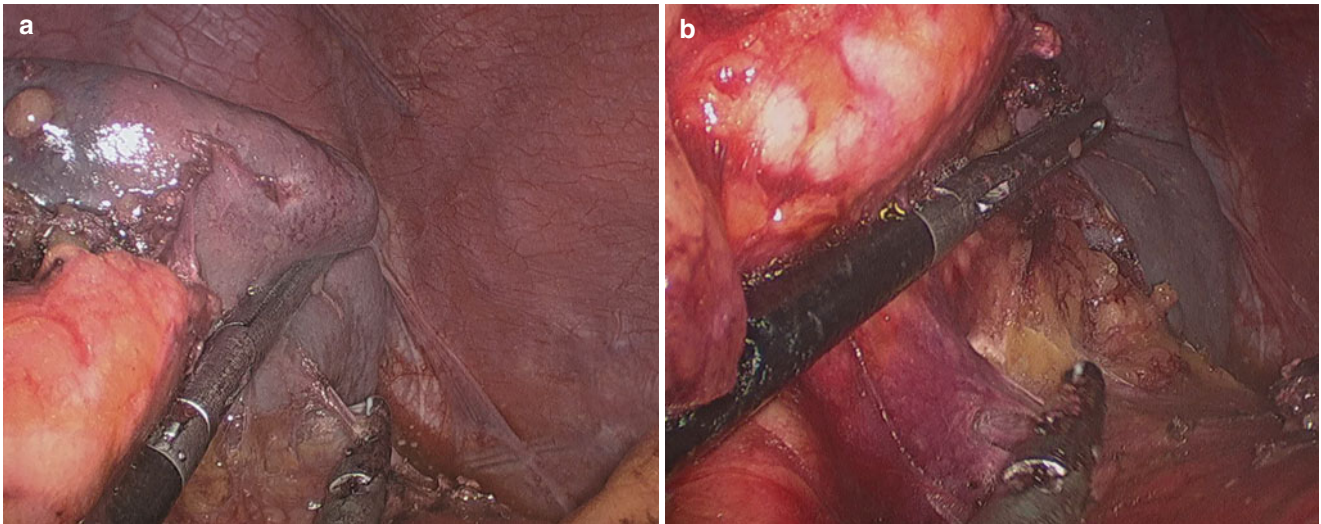


Fig. 7.5

5. Dissection of phrenosplenic ligament.

The division was continued upwardly to the phrenosplenic ligament (Fig. 7.6a-d).

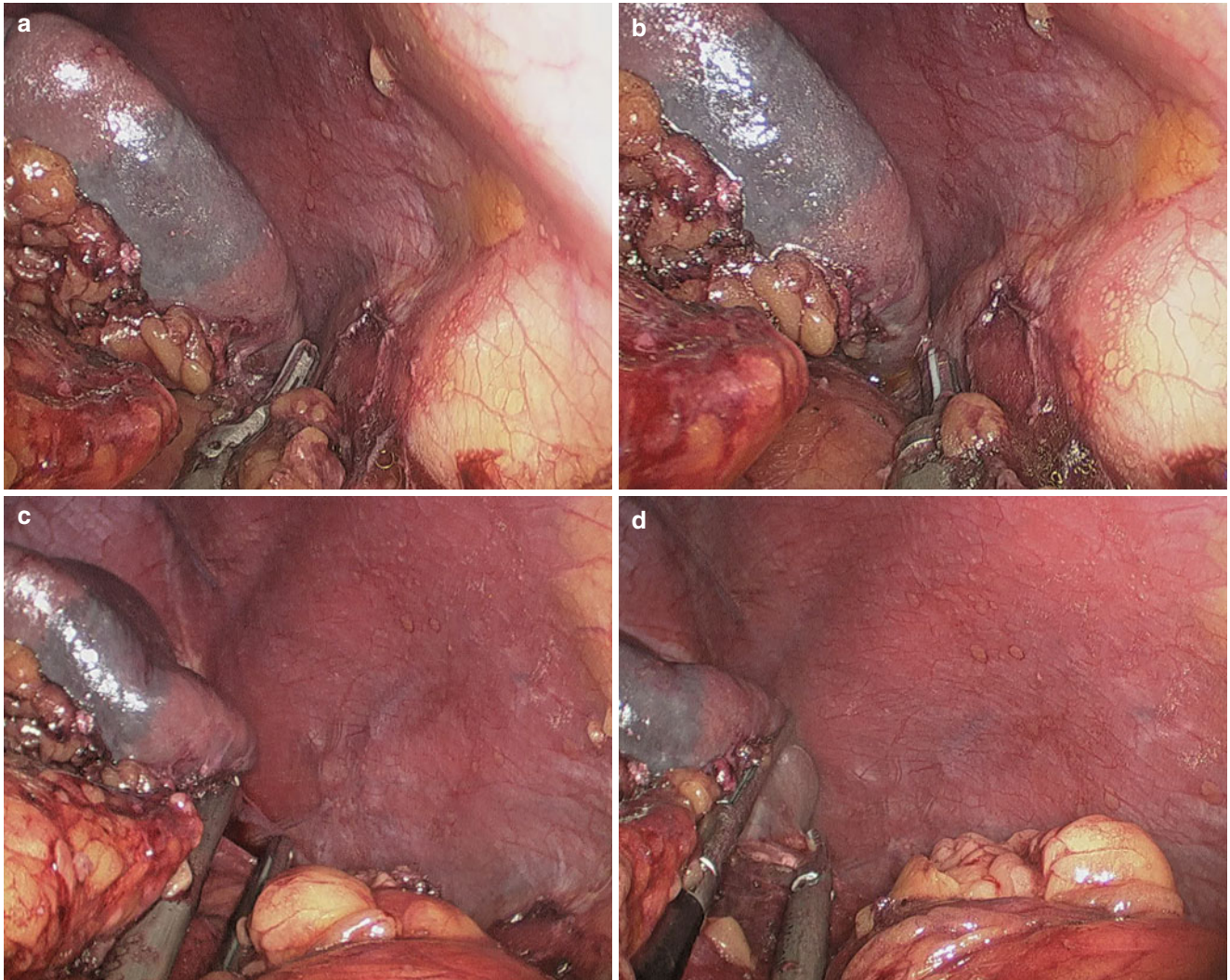


Fig. 7.6

6. Dissection of splenic hilum and tail of pancreas.

The pancreatic tail was exposed by dissecting the peritoneum on the splenic hilum with harmonic scalpel (Fig. 7.7a–d).

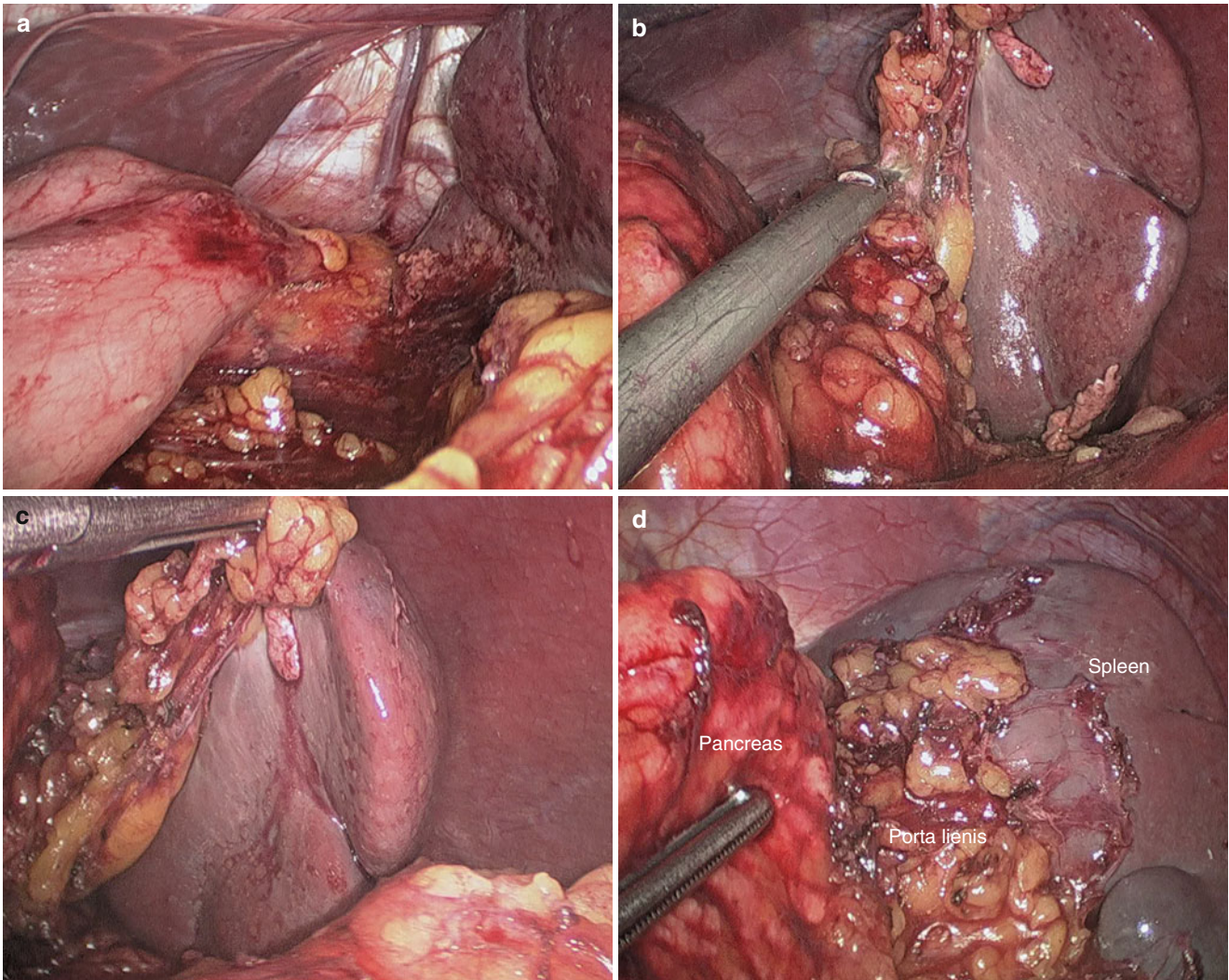


Fig. 7.7

7. Transection of spleen pedicle.

The splenic pedicle was dissected and divided by a 60-mm endoscopic stapler inserted through the 12-mm trocar. The entire spleen was completely resected (Fig. 7.8a–f).

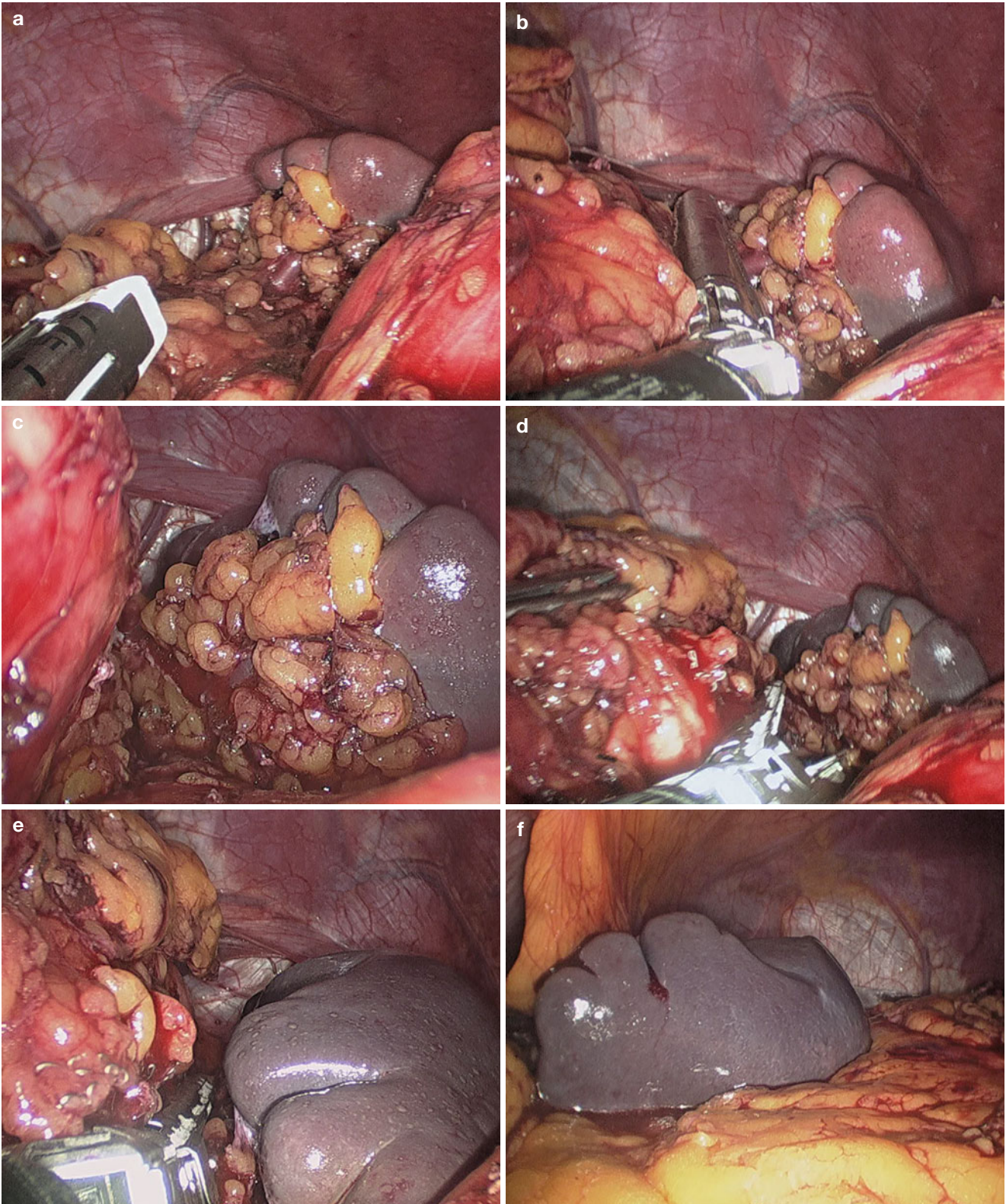


Fig. 7.8

8. Retrieval of spleen.

The freely mobile spleen was put into a specimen bag placed through the 12 mm Trocar. Then the lura of the

bag was dragged out of the abdominal cavity through the umbilical incision; the specimen was taken out in pieces by oval forceps (Fig. 7.9a-d).



Fig. 7.9

9. Irrigation and drainage.

The abdominal cavity was suctioned and a closed suction drain was placed into the splenic fossa through the incision at umbilicus (Fig. 7.10a–d).

7.1.7 Tips and Tricks

1. Difficulty with retraction can be solved with external traction suture placement. For example, the stomach may be retracted with a 2-0 polydioxanone traction suture placed

percutaneously through the anterior gastric wall to facilitate exposure of the short gastric vessels.

2. Once the splenic hilum was exposed, one of the 5-mm ports was upsized to 12 mm to admit a reticulating vascular endostapler (Ethicon Endosurgery, Cincinnati, OH).
3. The hilar vessels were divided, taking care to avoid the tail of pancreas.
4. The spleen was placed within an endobag then morcelated within the bag using a finger fracture technique and subsequently removed in a piecemeal fashion.

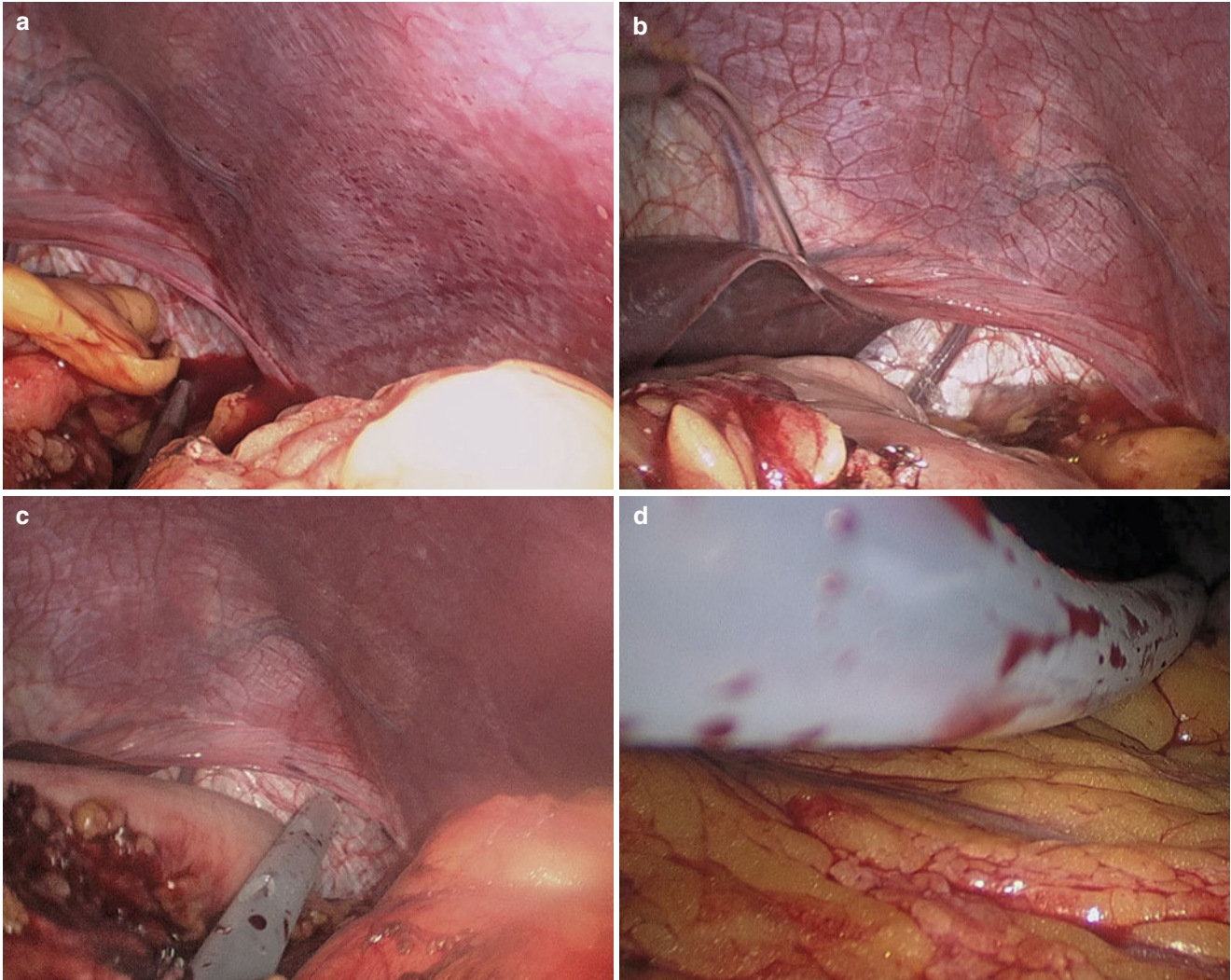


Fig. 7.10

7.2 Laparoscopic Splenectomy Plus Pericardial Devascularization

ascites, or severe damage of liver function (Child C) have a high death rate.

7.2.1 Indications and Case Selection

1. Patients suffer from hepatic cirrhosis complicated with portal hypertension, who have the history of upper gastrointestinal hemorrhage, and the hepatic function should be corrected to Child A or B.
2. Patients suffer from enlargement of spleen and hypersplenism with varicose veins in the middle or inferior segment of esophagus, who have the history of hematemesis or the possibility of uncontrolled hemorrhage due to phlebotomosis in the inferior segment of esophagus.
3. Patients with above indications suffering from non-severe ascites or icterus, or above symptoms worsened after medical treatment.

7.2.2 Contraindications

1. Absolute contraindications:
 - (a) severe cardiorespiratory dysfunction.
 - (b) inability to tolerate general anesthesia or pneumoperitoneum.
 - (c) severe refractory coagulopathy.
2. Relative contraindications:
 - (a) morbid obesity.
 - (b) pregnancy.
 - (c) patients with “frozen upper abdomen” due to previous surgery or peritonitis.

Laparoscopic splenectomy with pericardial devascularization performed for patients with icterus, large amount of

7.2.3 Major Instruments or Energy Sources

1. Laparoscopy System.
2. Holding forceps.
3. Harmonic scalpel.
4. Endoscopic Linear Stapler.

7.2.4 Team Setup, Anesthesia and Position

It is the same as Sect. 7.1.4.

7.2.5 Key Steps

1. Dissection of gastrocolic ligament.
2. Dissection of varices around the spleen pedicle.
3. Dissection of splenorenal ligament.
4. Dissection of phrenosplenic ligament.
5. Dissection of splenogastric ligament.
6. Dissection of splenic hilum and tail of pancreas.
7. Transection of spleen pedicle.
8. Transection of posterior vein of stomach.
9. Dissection of esophagus and transection of varices around the esophagus.
10. Transection of gastric coronary vein.
11. Retrieval of spleen.
12. Irrigation and drainage.

7.2.6 Surgical Techniques

1. Dissection of gastrocolic ligament.

The patient was placed in reverse Trendlenburg position to expose the spleen. The splenocolic ligament was dissected with harmonic scalpel or Ligasure (Fig. 7.11a–d).

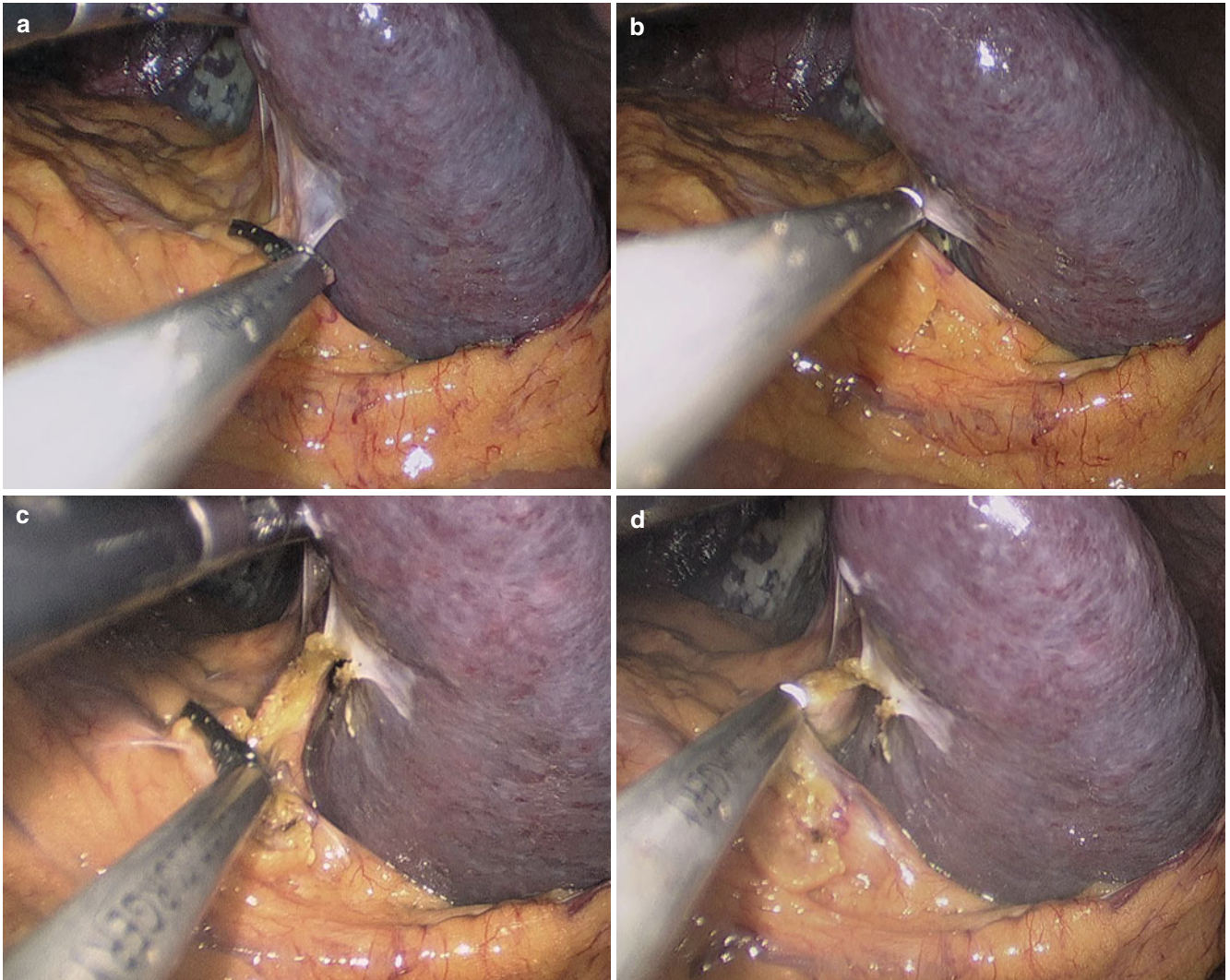


Fig. 7.11

2. Dissection of varices around the spleen pedicle.
Peritoneum on the splenic hilum was divided with harmonic scalpel and secondary splenic pedicle exposed.

Small vessels were coagulated with Ligasure and larger ones divided between clips (Fig. 7.12a-p).

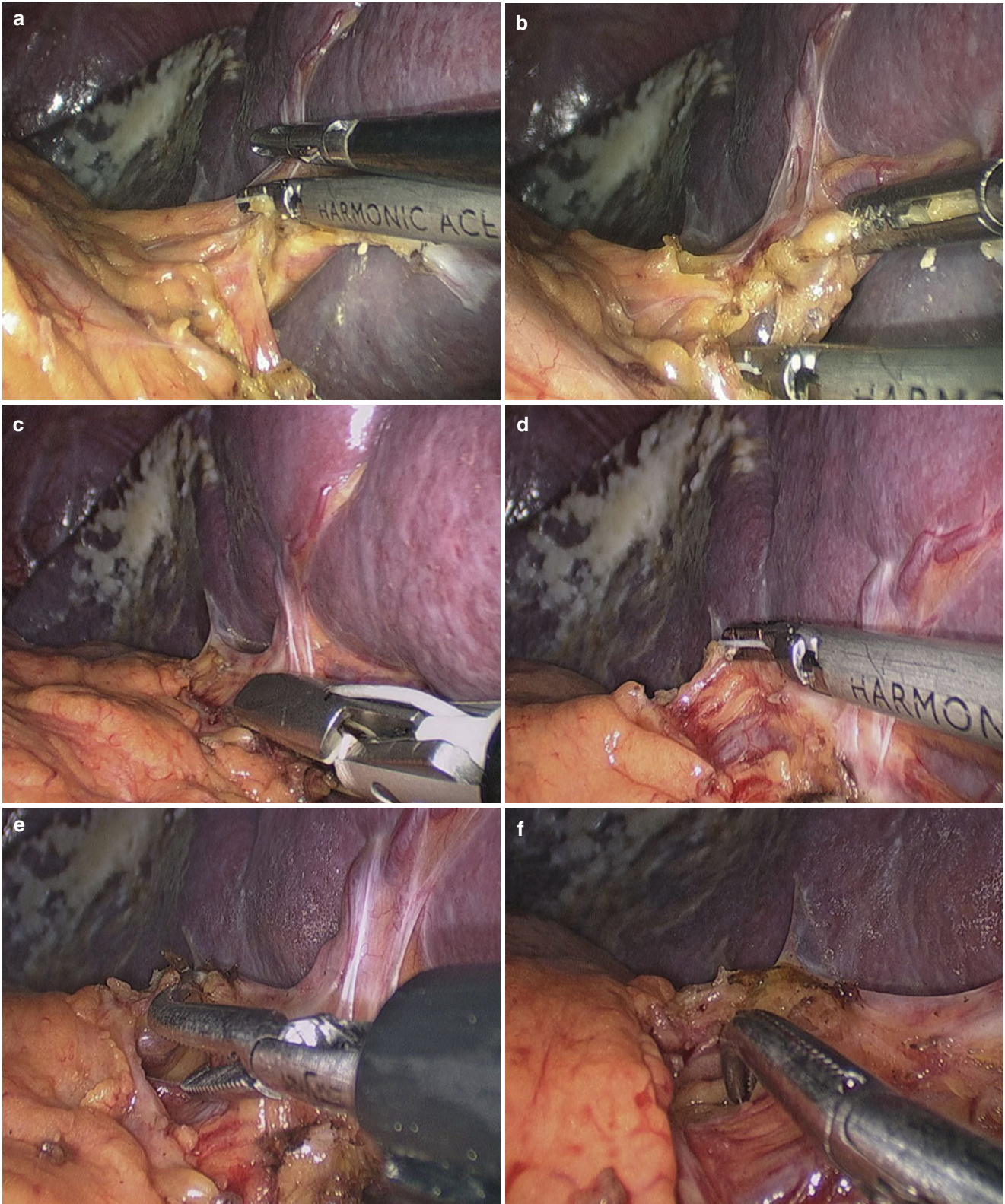


Fig. 7.12

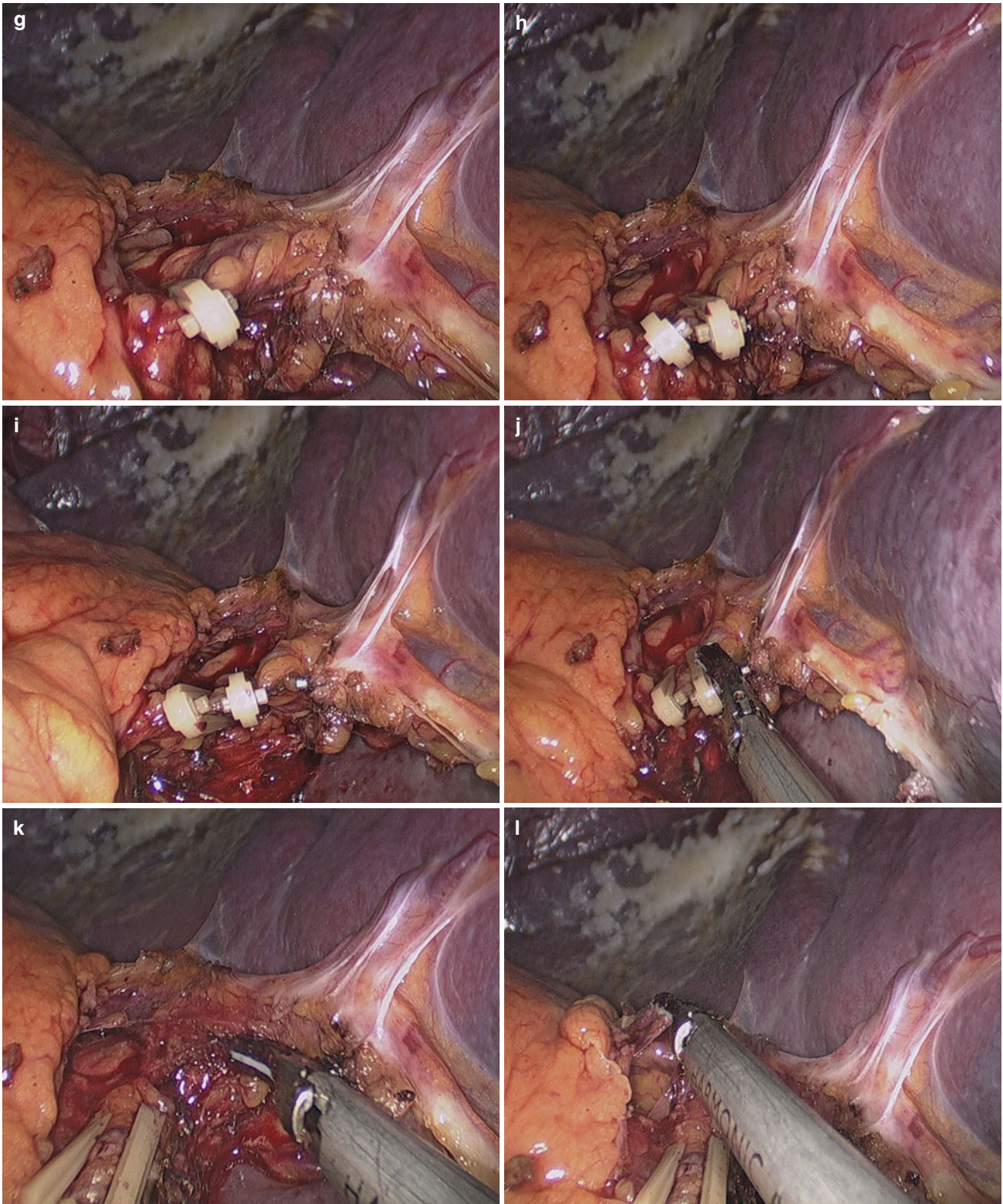


Fig. 7.12 (continued)

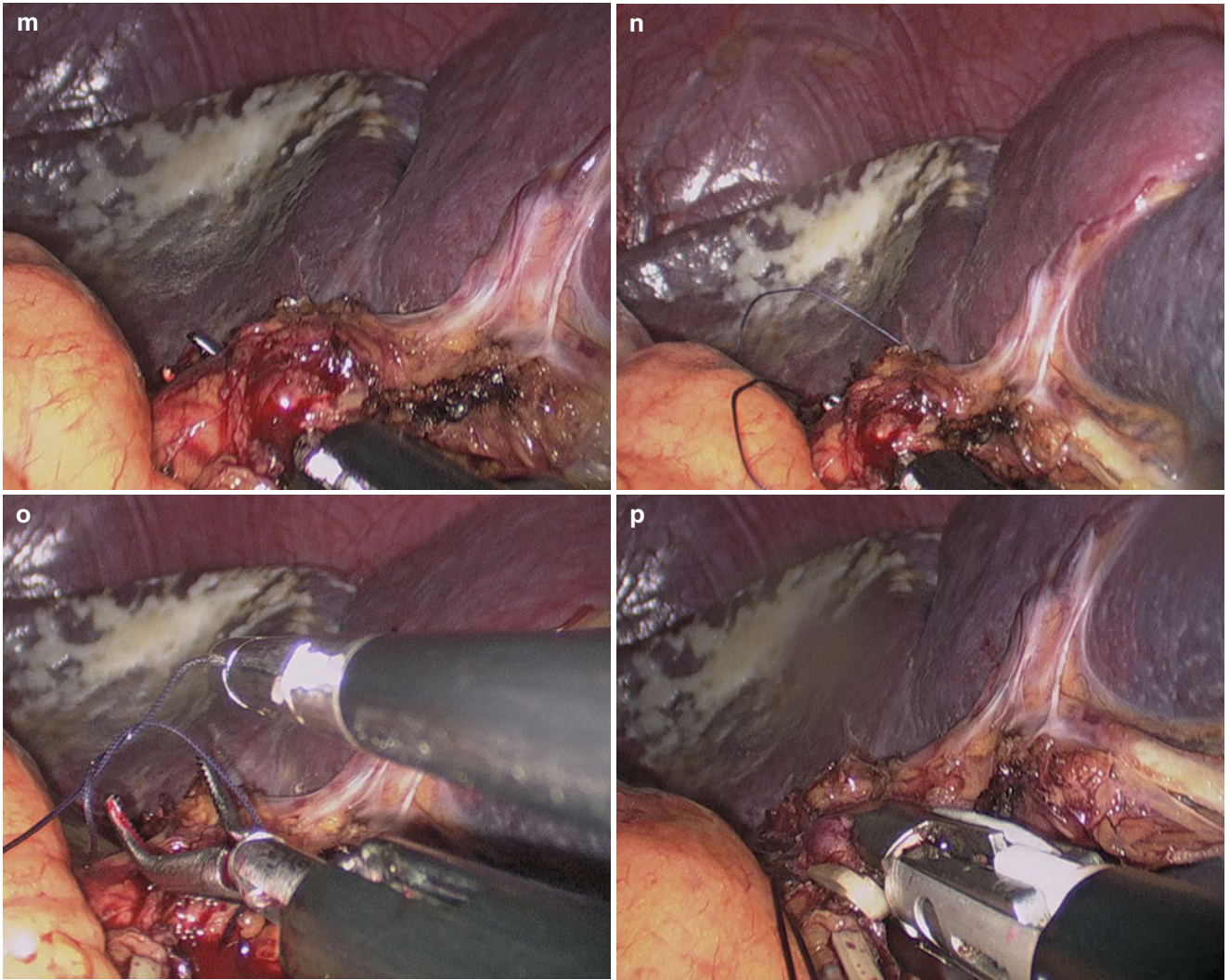


Fig. 7.12 (continued)

3. Dissection of splenorenal ligament.

The division was further continued towards the splenorenal ligament. The exposure was assisted by lifting the spleen or by postural adjustment of the patient (Fig. 7.13a, b).

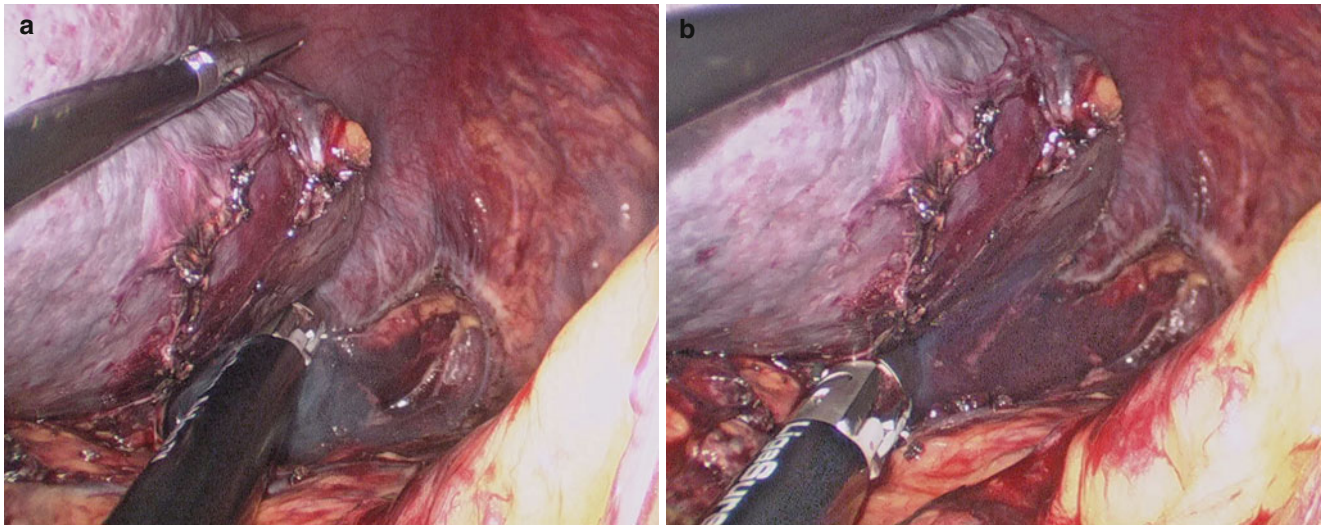


Fig. 7.13

4. Dissection of phrenosplenic ligament.

The division was continued upwardly towards the phrenosplenic ligament (Fig. 7.14a–d).

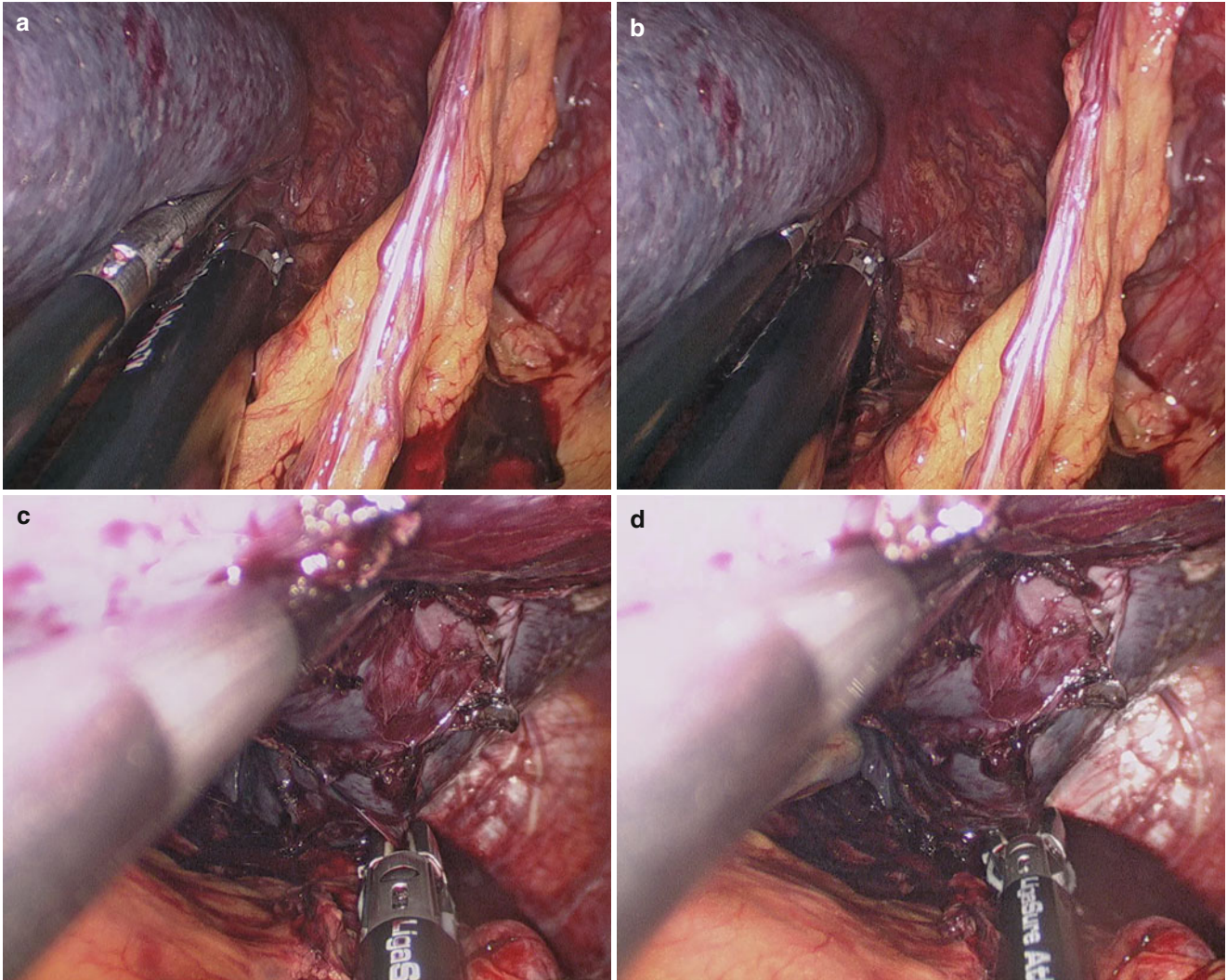


Fig. 7.14

5. Dissection of splenogastric ligament.

The greater curvature of stomach was lifted and spleno-gastric ligament exposed. The splenogastric ligament and short gastric vessels were divided with harmonic scalpel or Ligasure (Fig. 7.15a–c).

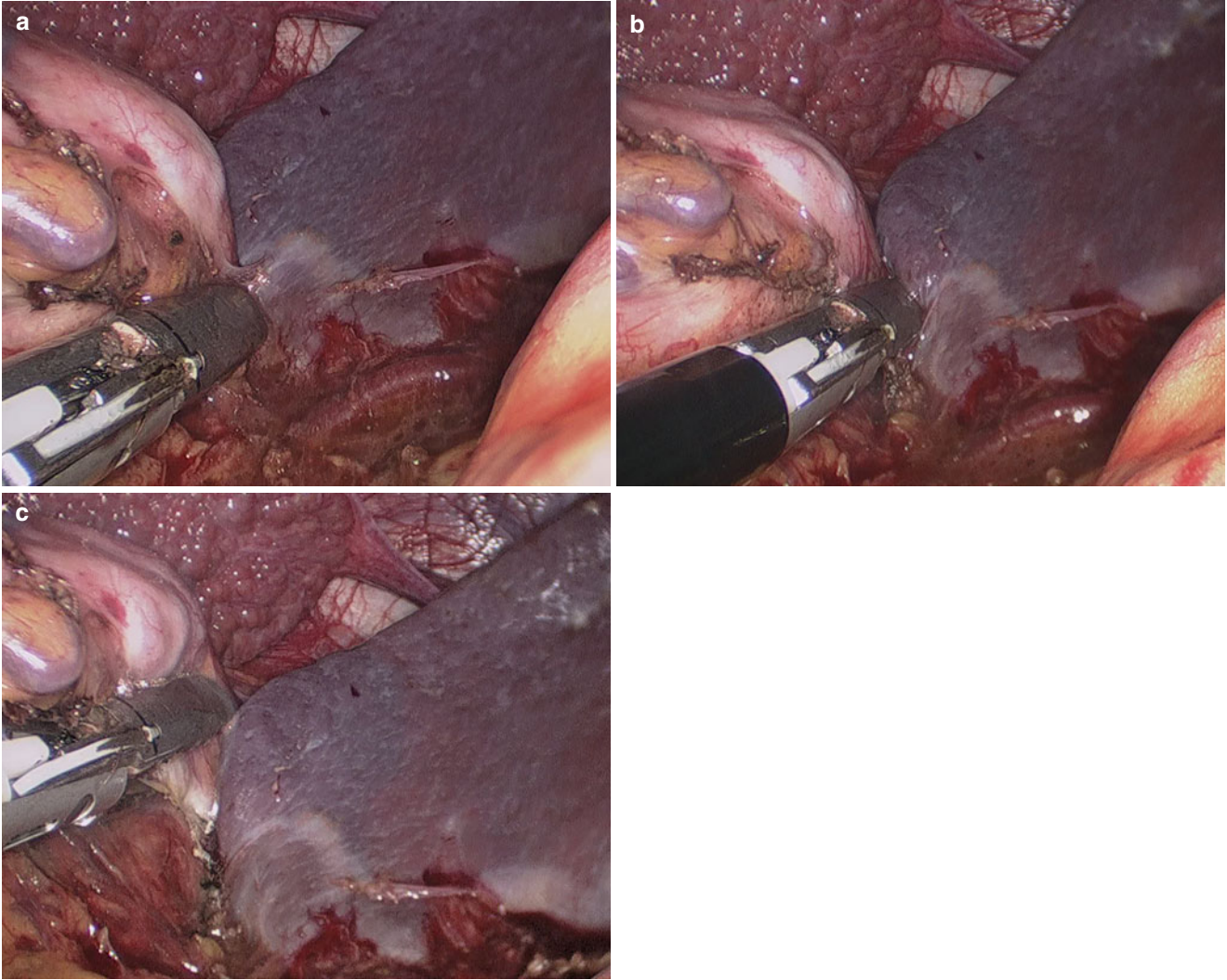


Fig. 7.15

6. Dissection of splenic hilum and tail of pancreas.

The pancreatic tail was exposed by dissecting the peritoneum on the splenic hilum with the arteries and veins

divided. The vessels were divided by harmonic scalpel with proximal ends double clipped (Fig. 7.16a, b).

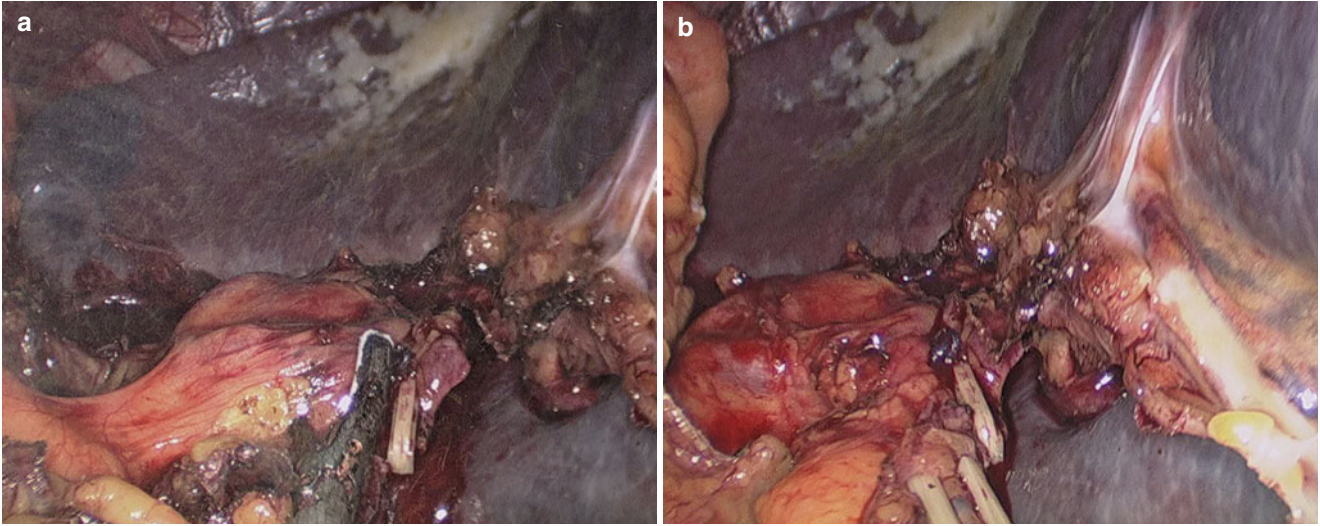


Fig. 7.16

7. Transection of spleen pedicle.

The pancreatic tail was separated from the splenic pedicle. The splenic pedicle was dissected and divided by a 60-mm endoscopic stapler inserted through the 12-mm trocar (Fig. 7.17a–d).

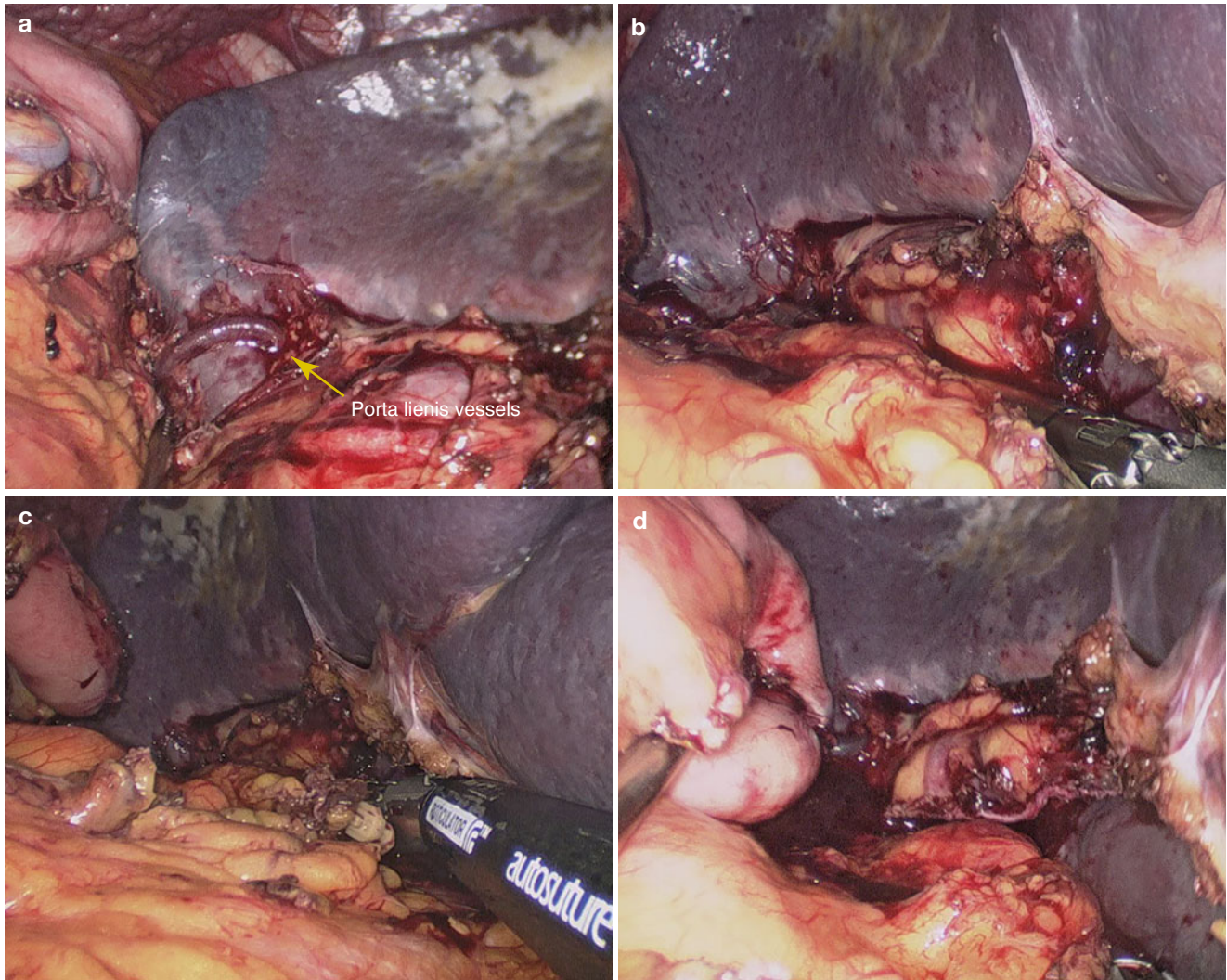


Fig. 7.17

8. Transection of posterior vein of stomach.

The greater curvature was lifted upwardly and vena gastrica posterior was divided by Ligasure (Fig. 7.18a-d).

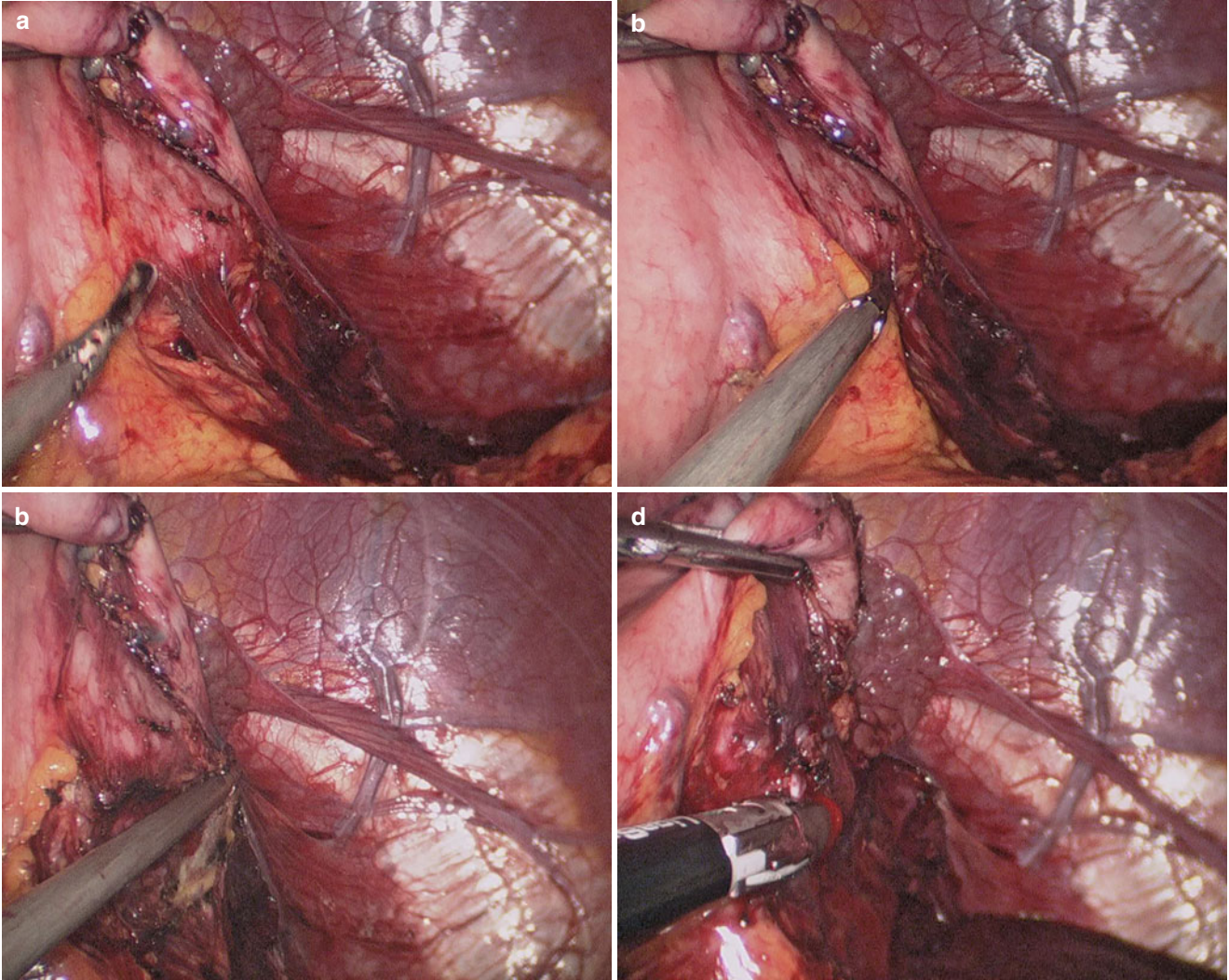


Fig. 7.18

9. Dissection of esophagus and transection of varices around the esophagus.

The serosa on the esophagus was opened. The esophagus was pulled downward. Vessels around the lower esophagus

were dissected superior to a point 6 cm away from the esophageal cardia junction. Small vessels were coagulated with Ligasure and larger ones divided between clips (Fig. 7.19a-j).

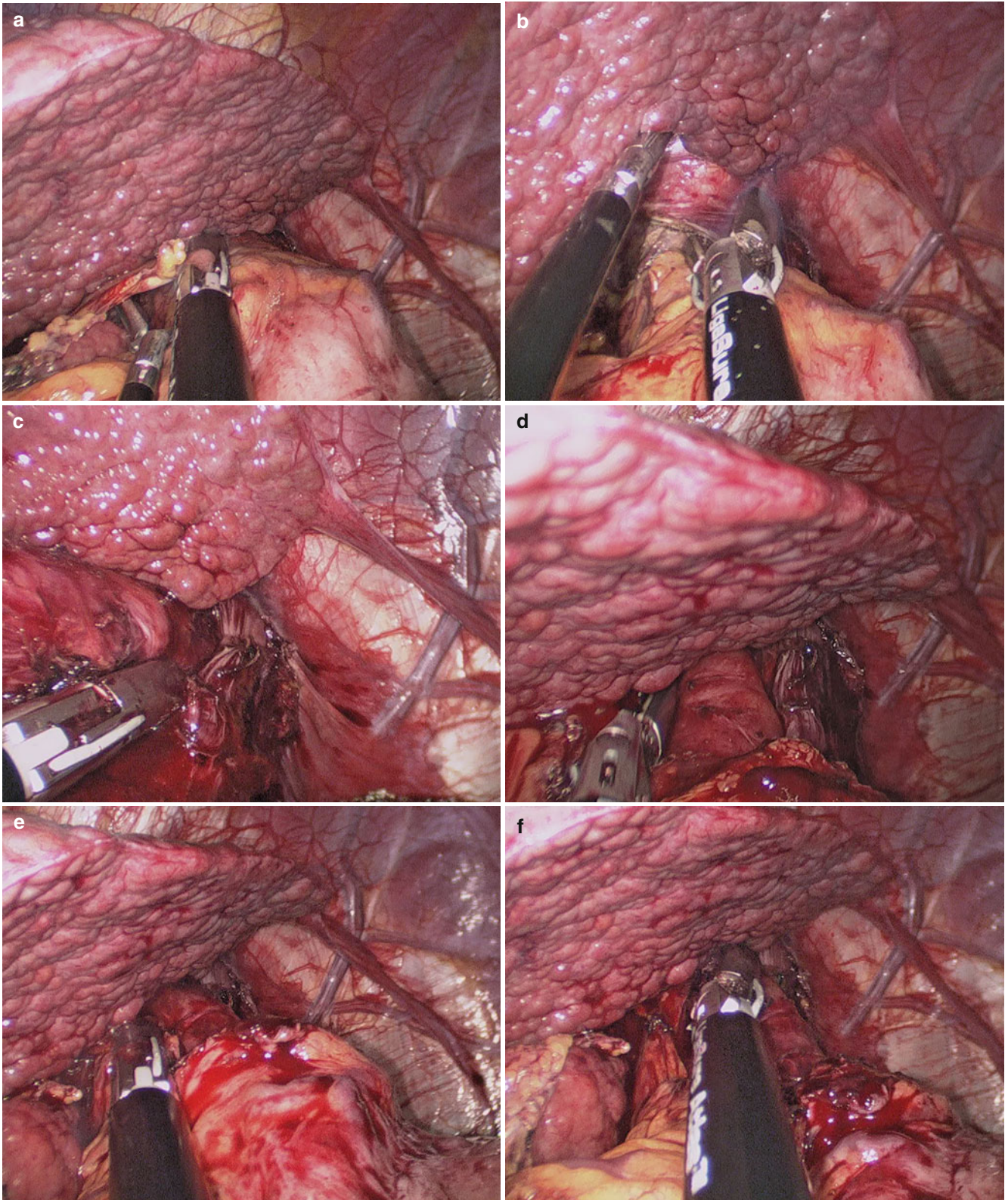


Fig. 7.19

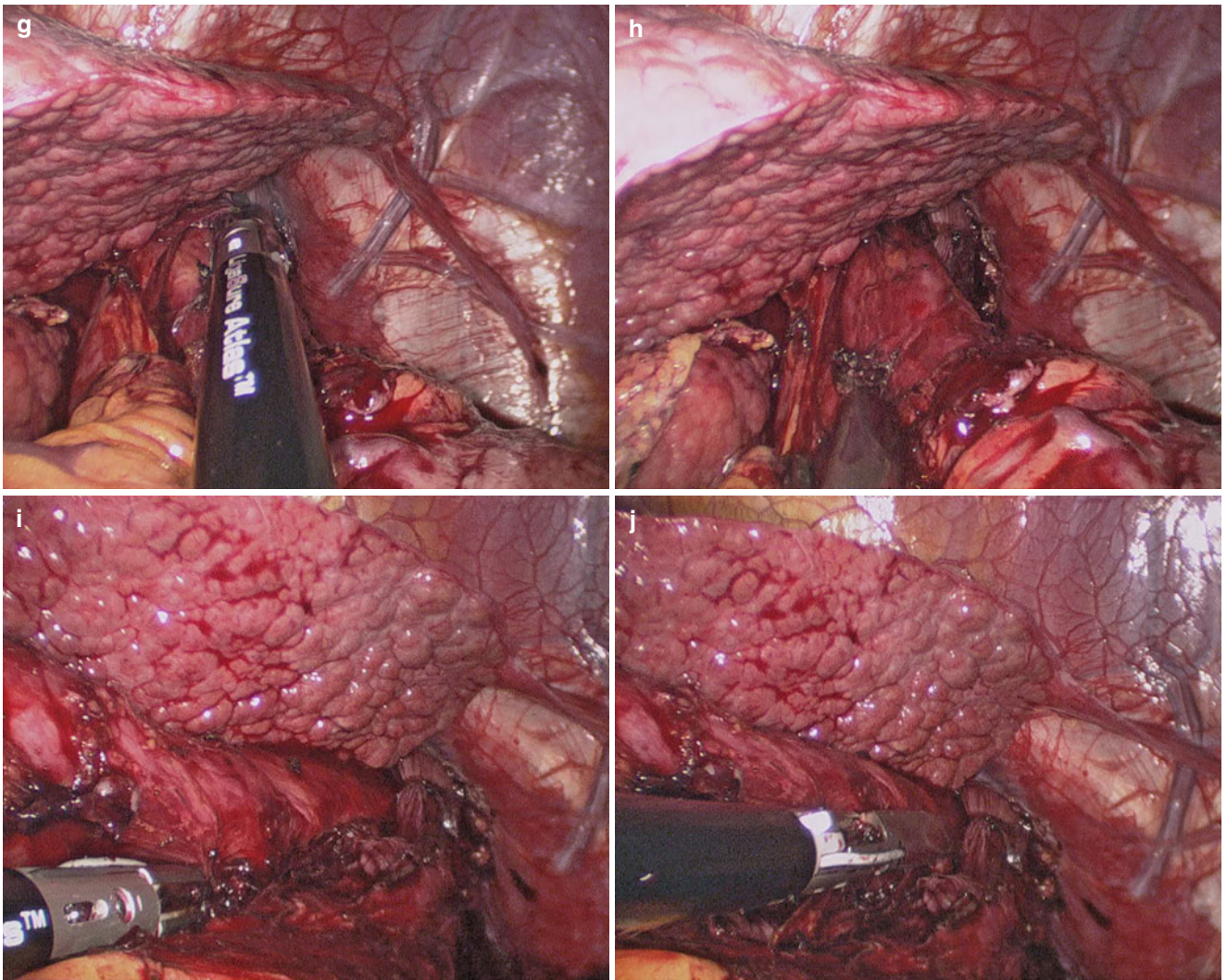


Fig. 7.19 (continued)

10. Transaction of gastric coronary vein.

The gastrohepatic ligament was opened and devascularization of the lesser curvature was performed by the same way. With the use of Ligasure, this procedure can

be performed without significant bleeding. A large draining vein left gastric vessel was ligated with an Endo-GIA stapler (Fig. 7.20a–f).

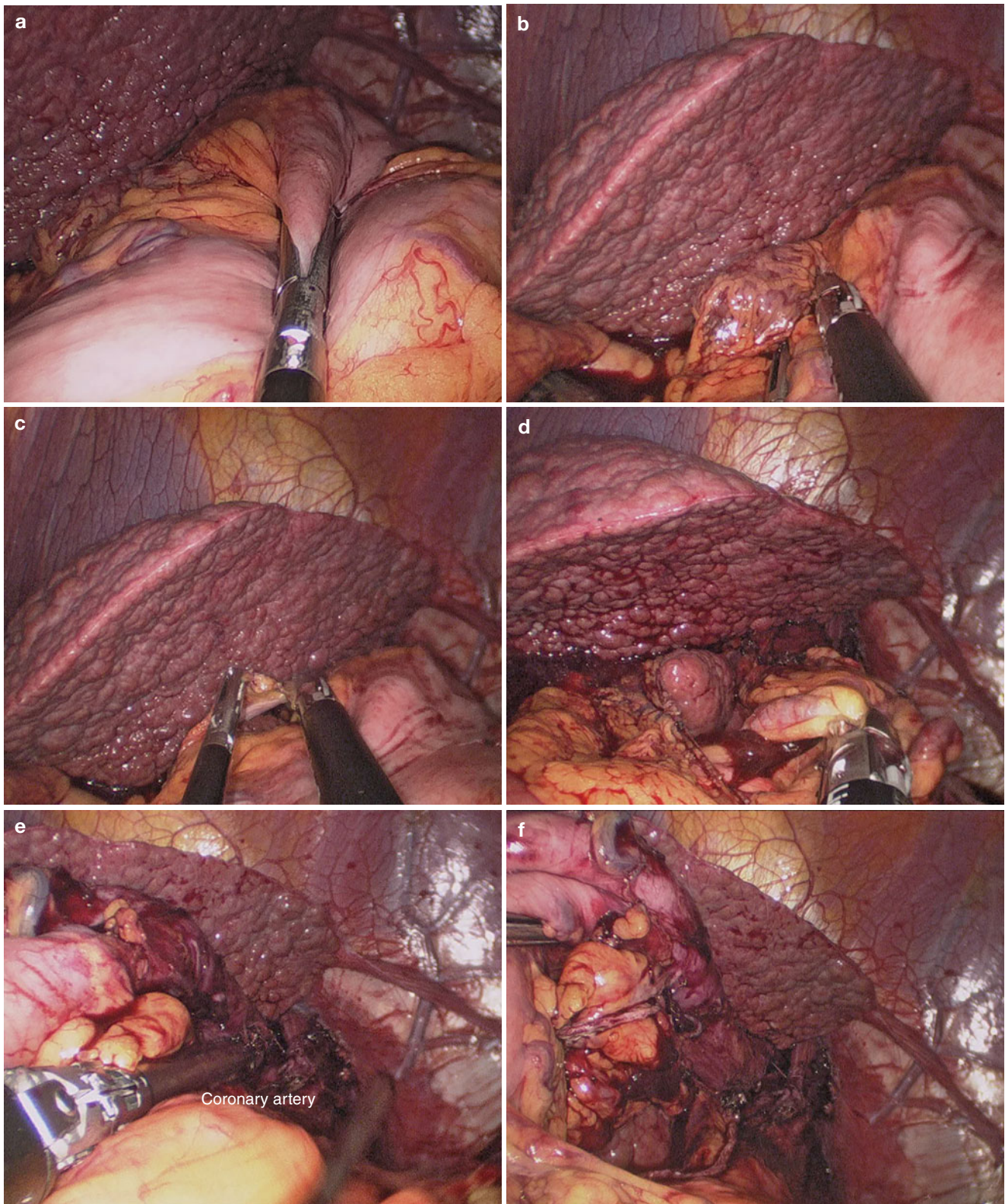


Fig. 7.20

11. Retrieval of spleen.

The freely mobile spleen was put into a specimen bag placed through the 12 mm Trocar. Then the lura of the

bag was dragged out of the abdominal cavity through the umbilical incision; the specimen was taken out in pieces by oval forceps (Fig. 7.21a, b).

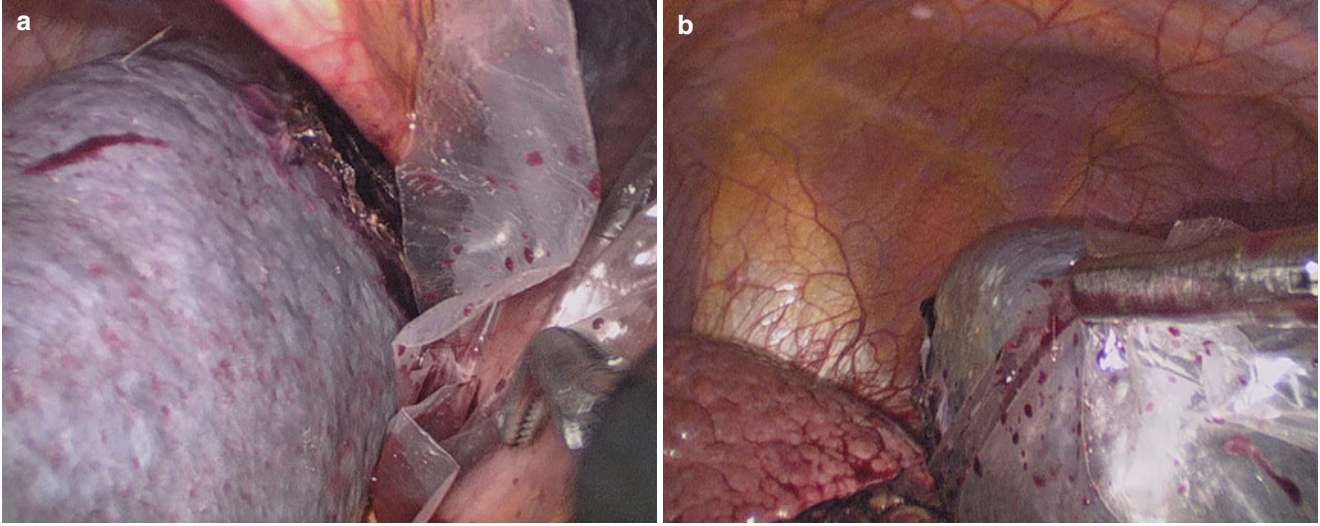


Fig. 7.21

12. Irrigation and drainage.

The abdominal cavity was suctioned and a closed suction drain was placed into the splenic fossa through the incision at umbilicus (Fig. 7.22a–c). Tissue glue was sprayed if there was minor errhysis.

7.2.7 Tips and Tricks

1. The laparoscopic splenectomy should be performed by a lateral approach with the left side of the patient elevated 30–45°.
2. The dissection of spleen should begin with division of the splenocolic and gastrocolic ligament with a 5-mm Harmonic scalpel or a Ligasure. Then, the spleen was elevated properly by the assistant hand, while the Ligasure held by the dominant hand was used to divide and dissect the splenorenal ligament. Then, the splenophrenic ligament attached to the upper pole of the spleen was freed with the Ligasure, leaving the spleen hanging only on its pedicle.
3. When an endoscopic stapler through the trocar was used to dissect the pedicle, the position should be reversed in order to stretch the pedicle.
4. Vessels around the lower esophagus should be dissected superior to a point 6 cm away from the esophageal cardia junction.
5. With the use of a Ligasure, this procedure can be performed without significant bleeding.

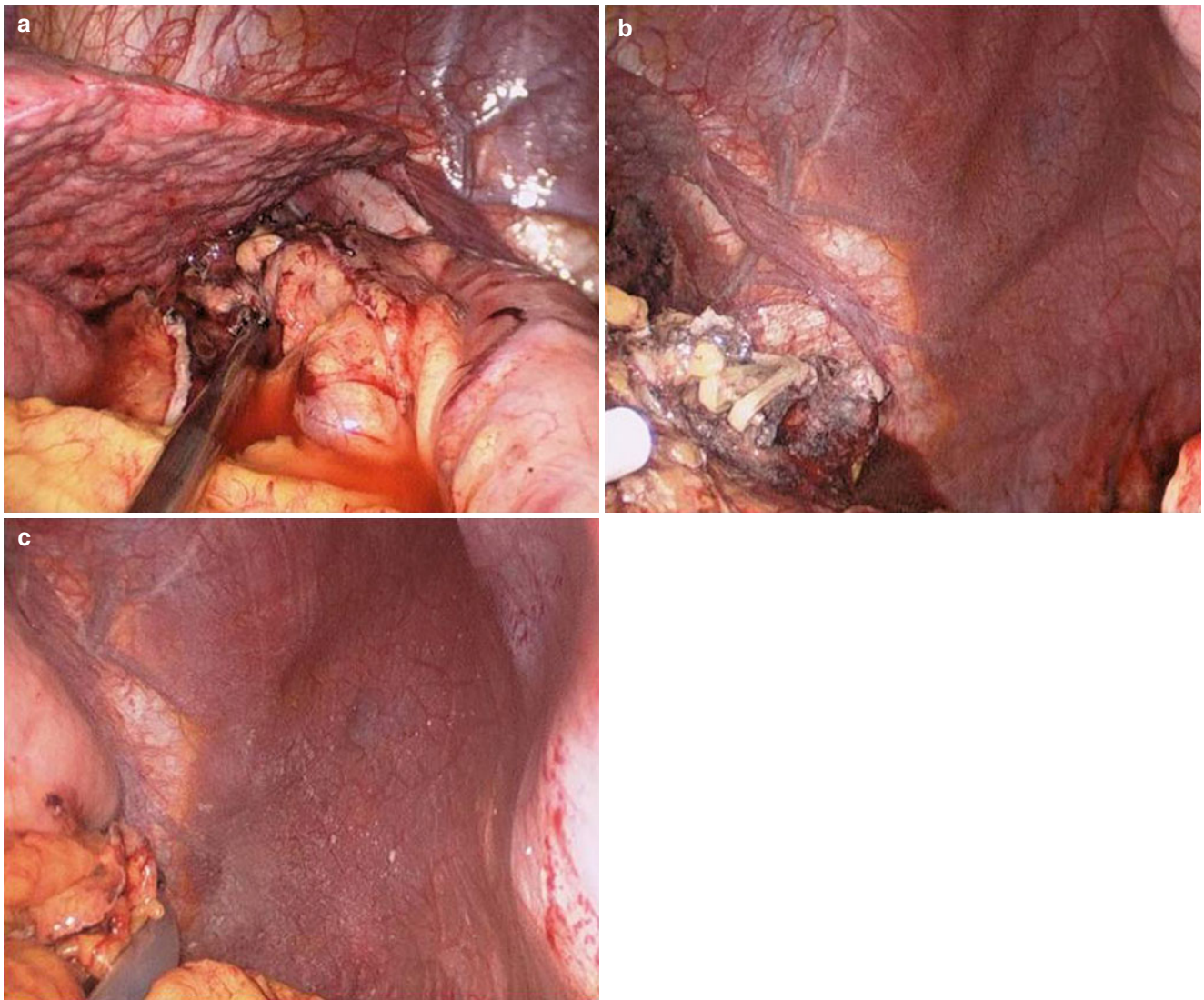


Fig. 7.22

7.3 Complications Analysis and Management

7.3.1 Haemorrhage

In SILS splenic surgery, triangle relationship is lack and the length of operational instruments is limited. When the superior part of spleen is dissected, the umbilical operational point is far from the surgical field. So the haemorrhage is common. Changing the body position and making it in anti-Trendelenburg position may assist the exposure of superior part of spleen. In SILS surgery, excessive retraction of spleen and tearing of splenic peripheral vessels may induce haemorrhage. So, violent retraction for exposure is forbidden in SILS splenic surgery. For larger spleen, changing body position may assist to expose the surgical field and splenic movement. And dissecting the splenic peripheral ligaments from the near to the distance may increase the activity of spleen and effectively prevent splenic haemorrhage. The key to preventing haemorrhage is correcting coagulation disorders preoperatively and definite hemostasis in the operation. If the bleeding is massive, it should be converted to conventional laparoscope or open surgery as soon as possible.

7.3.2 Esophageal Leak and Distal Pancreatic Injury

It is similar to the SILS Heller myotomy, the possibility of esophageal leak is existent. In addition to paying attention to dissecting area of pericardial vessels, which can prevent the formation of lower part esophageal necrosis and leak, the injury caused by energy devices should also be noticed. Persistent gastrointestinal decompression and smooth abdominal drainage can

prevent the leak. Reoperation should be considered if abdominal abscess is formed.

When the splenic hilum is dissected, the distal pancreas may be injured, forming pancreatic leakage. Due to the lack of necessary assistance, hurried clamping of the spleen pedicle in obscure vision may injure the distal pancreas when the splenic hilum is dissected.

References

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