Pancreatic Surgery

6

Abstract

Pancreatic surgery is an extremely challenging field, partly owing to the retroperitoneal location of the pancreas, the wide range and influence of operation, numerous postoperative complications and so on. The application of laparoscopic surgery for the treatments of pancreatic diseases is only recently gaining widespread popularity. These included diagnostic explorative laparoscopy for cancer staging (Kim et al., Curr Probl Surg 44(4):228–269, 2007; Ahmed et al., J Laparoendosc Adv Surg Tech A 16:458–463, 2006) pancreatic drainage (Hauters et al., Surg Endosc 18:1645–1648, 2004), enucleation (Toniato et al., World J Surg 30:1916–1919, 2006), distal pancreatectomy (Melotti et al., Ann Surg 246:77–82, 2007; Uranues et al., Am J Surg 192:257–261, 2006), and even pancreaticoduodenectomy (Palanivelu et al., J Am Coll Surg 205:222–230, 2007). Among these different laparoscopic procedures, laparoscopic distal pancreatectomy (LDP) is the most widely used, possibly because of its acceptable technical feasibility without the necessity for anastomoses (Park et al., Am J Surg 177:158–163, 1999).

Distal pancreatectomy has been performed since early twentieth century (Finney, Ann Surg 51:818–829, 1910). In 1994, the laparoscopic distal pancreatectomy (LDP) was first reported to be feasible and safe in a porcine model (Soper et al., Surg Endosc 8:57–60, 1994). Then, the LDP was quickly attempted to perform in humans (Cuschieri et al., Ann Surg 223:280–285, 1996; Gagner et al., Surgery 120:1051–1054, 1996; Sussman et al., Aust N Z J Surg 66(6):414–416, 1996). With better improvement of technologies, like ultrasonography, staplers, and other instrumentations, the multiple incision laparoscopic distal pancreatectomy (LDP) rapidly gained popularity, and is becoming a more widely used approach. Multiple prospective studies have shown the feasibility and safety of LDP in single-center and multicenter settings (Kooby et al., Ann Surg 248:438–446, 2008; Røsok et al., Br J Surg 97:902–909, 2010; Kneuertz et al., J Am Coll Surg 215:167–176, 2012). Now, the application of laparoscopic surgery for the distal pancreatectomy seems to become a trend in surgical technique, and might be considered as the first approach for distal pancreatectomy in the near future (Jin et al., HPB (Oxford) 14:711–724, 2012).

For a more cosmetic result and further minimizing the surgical trauma, a new minimally invasive technique called "single-incision laparoscopic surgery" (SILS) has been rapidly developed recently, and until now this approach has been performed in a variety of organs. SILS performed on the pancreatic lesions has been reported only recently, and only five cases were reported in the literature (Barbaros et al., JSLS 14:566–570, 2010; Kuroki et al., Hepatogastroenterology 58(107–108):1022–1024, 2011; Chang et al., Minim Invasive Surg 2012:197429, 2012; Misawa et al., Asian J Endosc Surg 5:195–199, 2012). However, these data might still be able to suggest that the transumbilical single-incision laparoscopic distal pancreatectomy (TUSI-LDP) is feasible, as in these reports even for the patients that had previously undergone a nephrectomy which caused dense fibrosis in the retroperitoneal region (Barbaros et al., JSLS 14:566–570, 2010), or that had two previous laparoscopic

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procedures for pelvic inflammatory disease and excision of ovarian cyst (Chang et al., Minim Invasive Surg 2012:197429, 2012), a SILS pancreatectomy could also be smoothly performed, and the TUSI-LDP together with splenectomy or spleen and spleen vessels preserving distal pancreatectomy were all performed successfully (Barbaros et al., JSLS 14:566–570, 2010; Kuroki et al., Hepatogastroenterology 58(107–108):1022–1024, 2011; Chang et al., Minim Invasive Surg 2012:197429, 2012; Misawa et al., Asian J Endosc Surg 5:195–199, 2012).

Keywords

Distal pancreatectomy • Splenic vessels • Splenectomy • Pancreatic pseudocyst • Cystojejunal anastomosis

6.1 Laparoscopic Distal Pancreatectomy

6.1.1 Indications and Case Selection

1. Patients with chronic pancreatitis and benign tumors (including cystic tumors and solid tumors) in the tail or body of the pancreas.
2. Patients with pancreatic ductal strictures and a pseudocyst in the tail or body of the pancreas.

6.1.2 Contraindications

1. Patients with malignant tumors or adenocarcinoma of the pancreas were relative contraindications, since no data are currently available regarding long-term outcomes for single incision laparoscopic resection of pancreatic adenocarcinoma or malignant tumors.
2. Patients with relatively operative contraindications should also be ruled out.

6.1.3 Major Instruments or Energy Sources

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

6.1.4 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. 6.1.

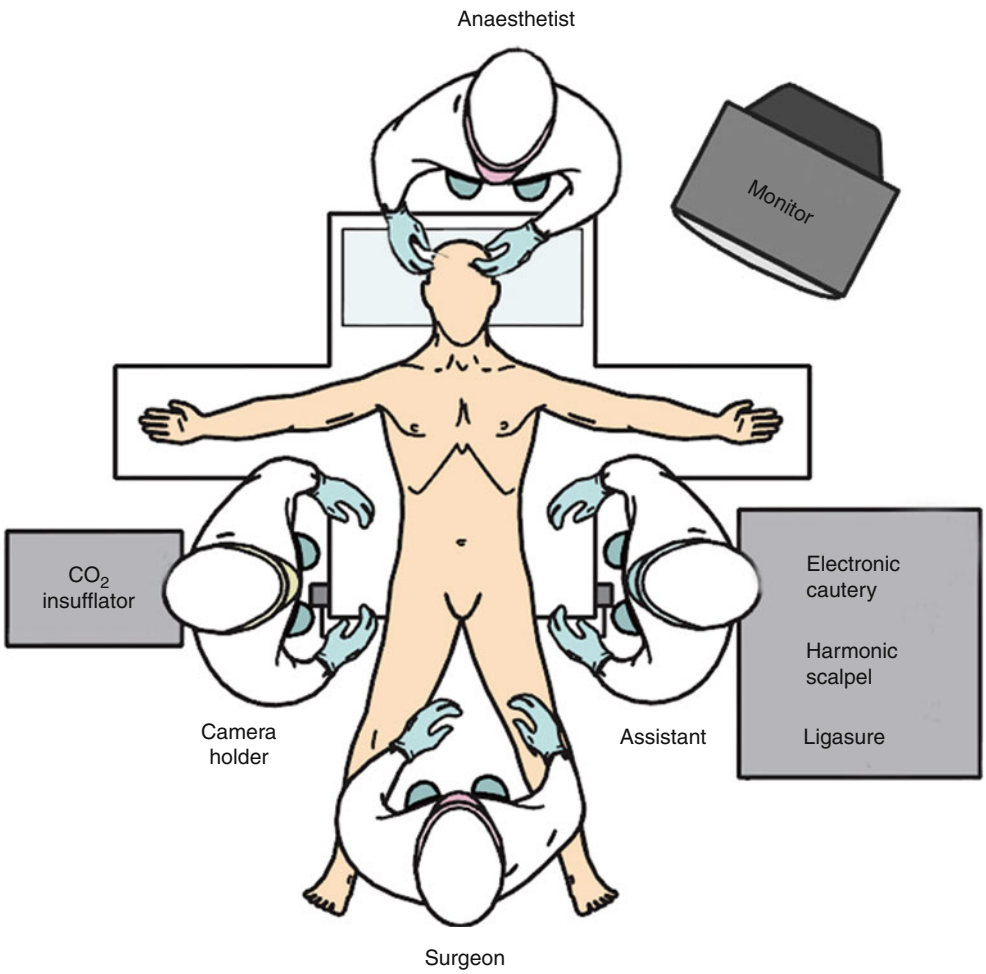


Fig. 6.1

6.1.5 Key Steps

1. Exploration of the abdominal cavity.
2. Exposure of pancreas.
3. Dissection of the pancreas.
4. Transection of pancreas.
5. Retrieval of the specimen and observation of the spleen.
6. Irrigation and drainage.

6.1.6 Surgical Techniques

1. Exploration of the abdominal cavity.
   A general exploration of the abdominal cavity was performed to rule out the possibility of an extrapancreatic lesion.
2. Exposure of pancreas.
   The patient was placed in a reverse Trendelenburg position. The operation began with the division of the gastrocolic ligament to expose the body and tail of pancreas and confirm the location and range of the lesion (Fig. 6.2a–e).

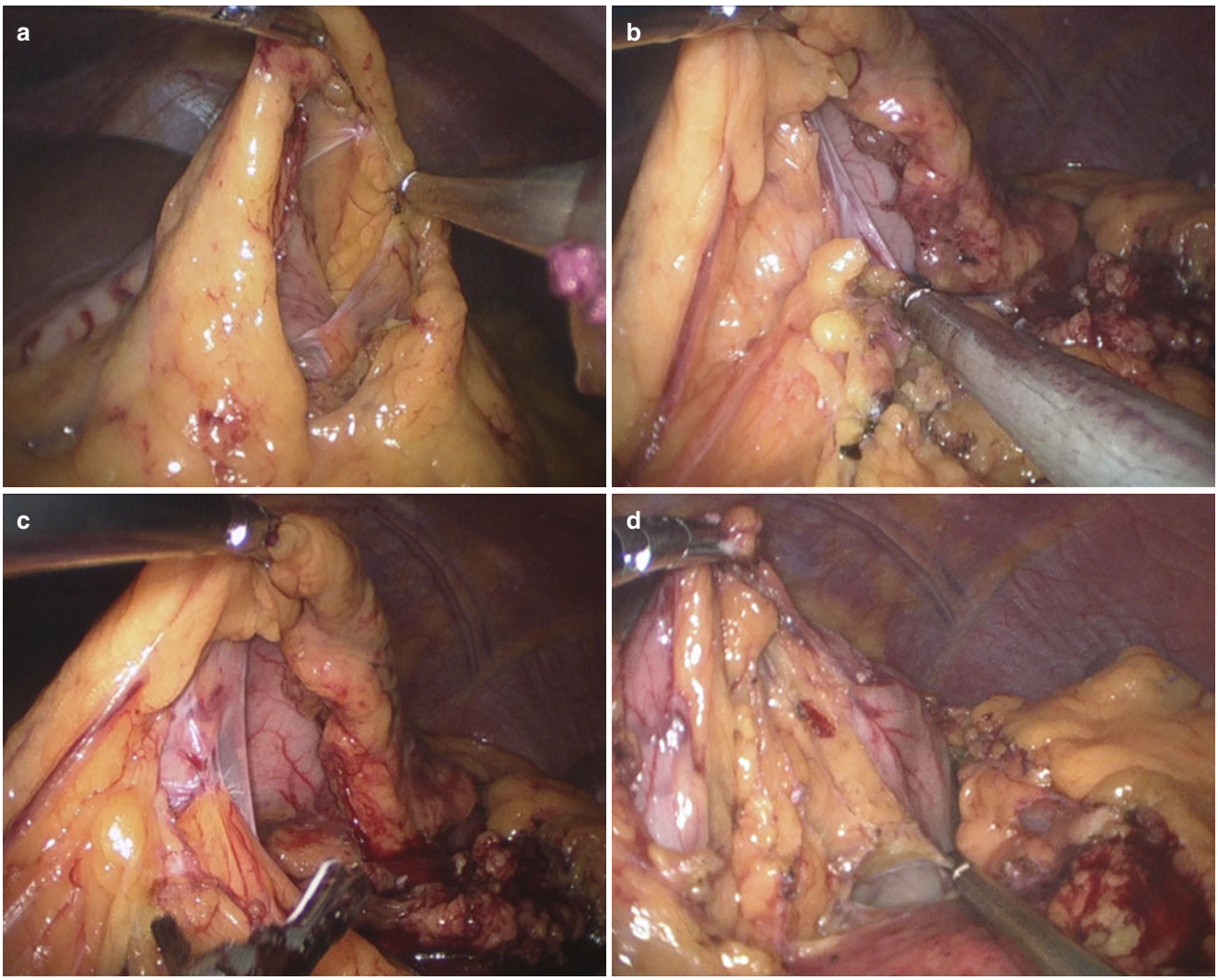
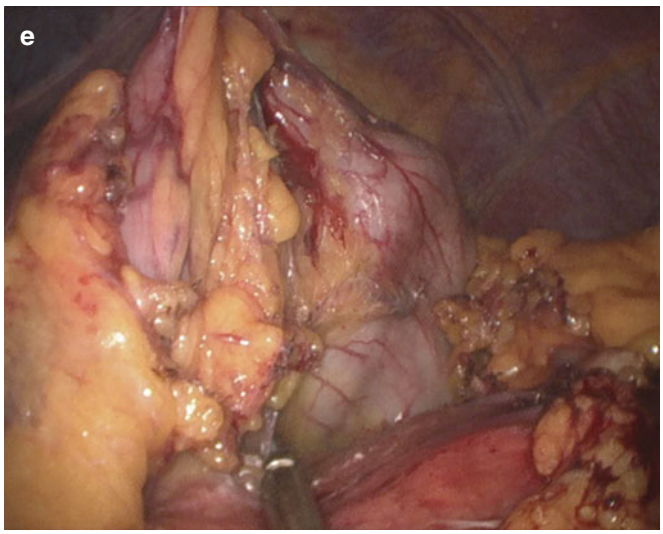


Fig. 6.2



3. Dissection of the pancreas.
   The serous membrane was dissected along the lower edge of pancreas on the right of the lesion, to expose the lower edge of the pancreas (Fig. 6.3a–d).

Fig. 6.2 (continued)

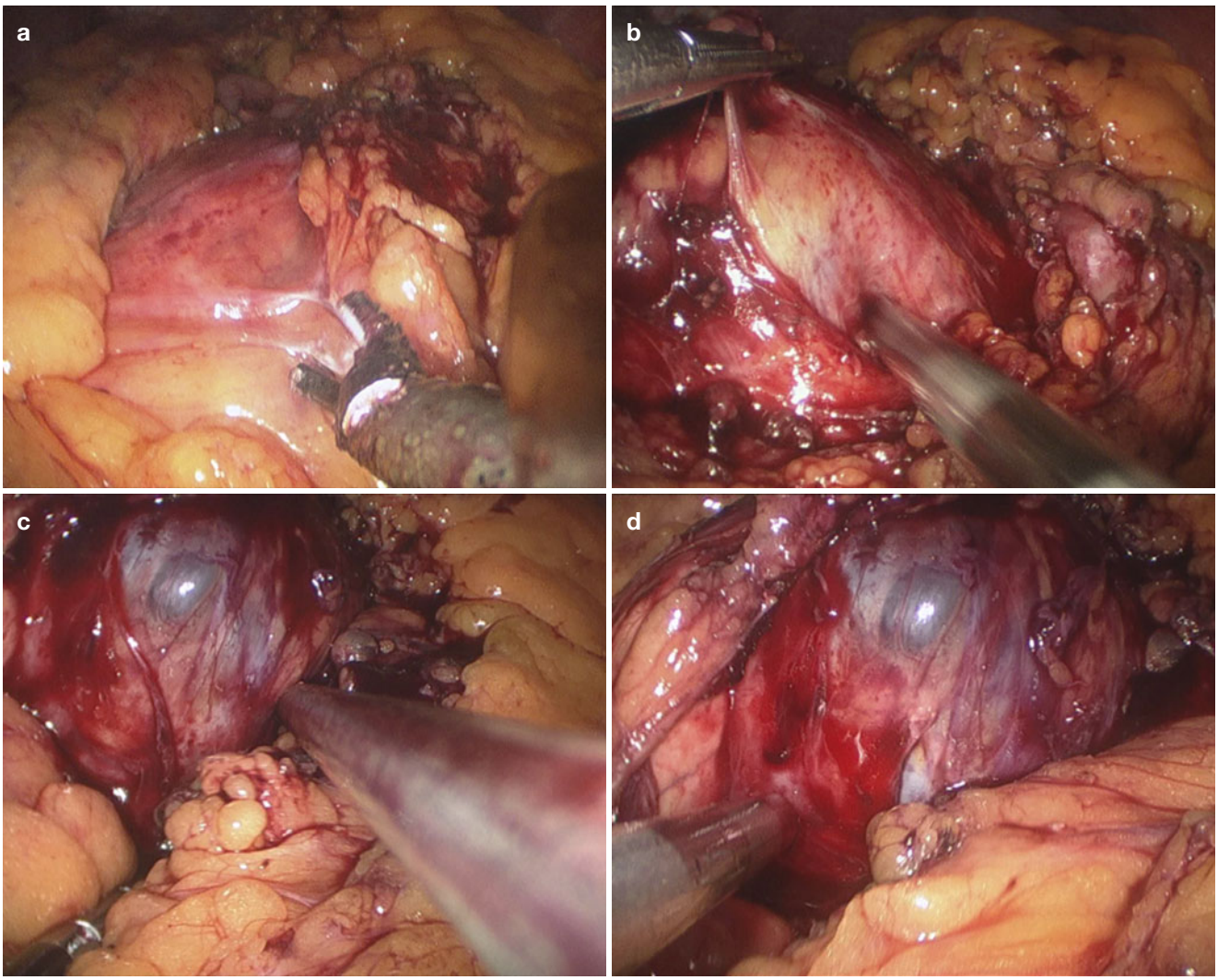


Fig. 6.3

Tunneling under the pancreatic neck was performed. Further dissection of the superior margin of the pancreas was done to facilitate tunneling beneath the pancreatic neck. Try not to injury the splenic vessels (Fig. 6.4a, b).

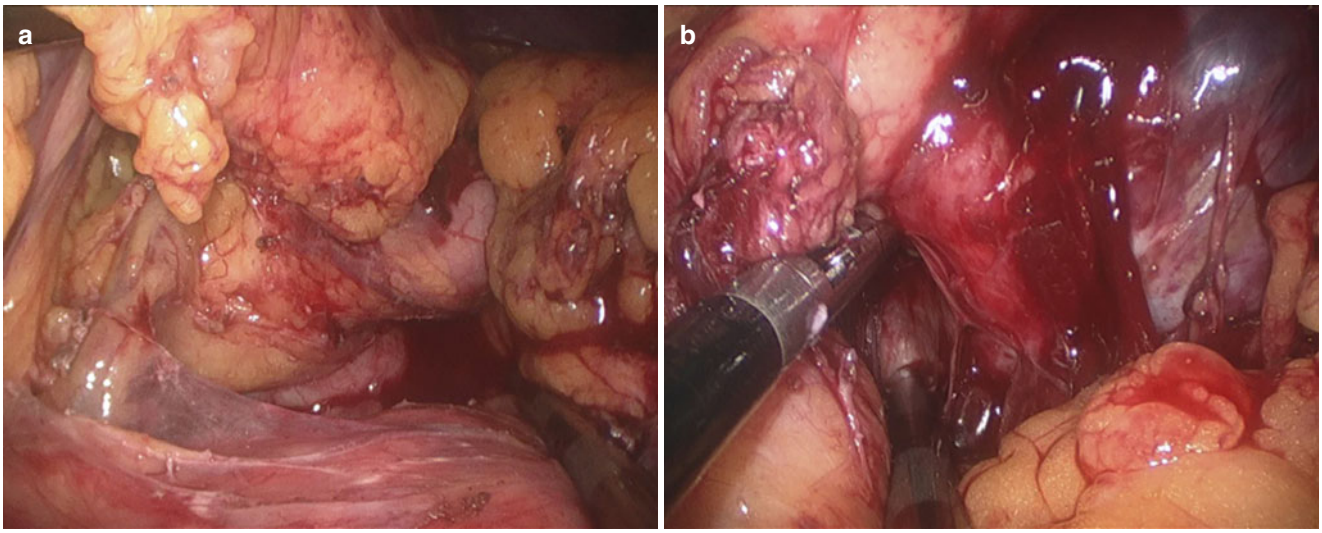


Fig. 6.4

4. Transection of distal pancreas.
   Transection of the pancreas along the neck was created using the endoscopic linear stapler. The splenic vessels were preserved carefully during the transection. Further dissection of the pancreas off the splenic vessels was carried on until the tail was reached. At the superior margin of the pancreas, care was taken to preserve the splenic vessels. The dissection was continued until the whole body and tail of the pancreas were dissected (Fig. 6.5a–h).

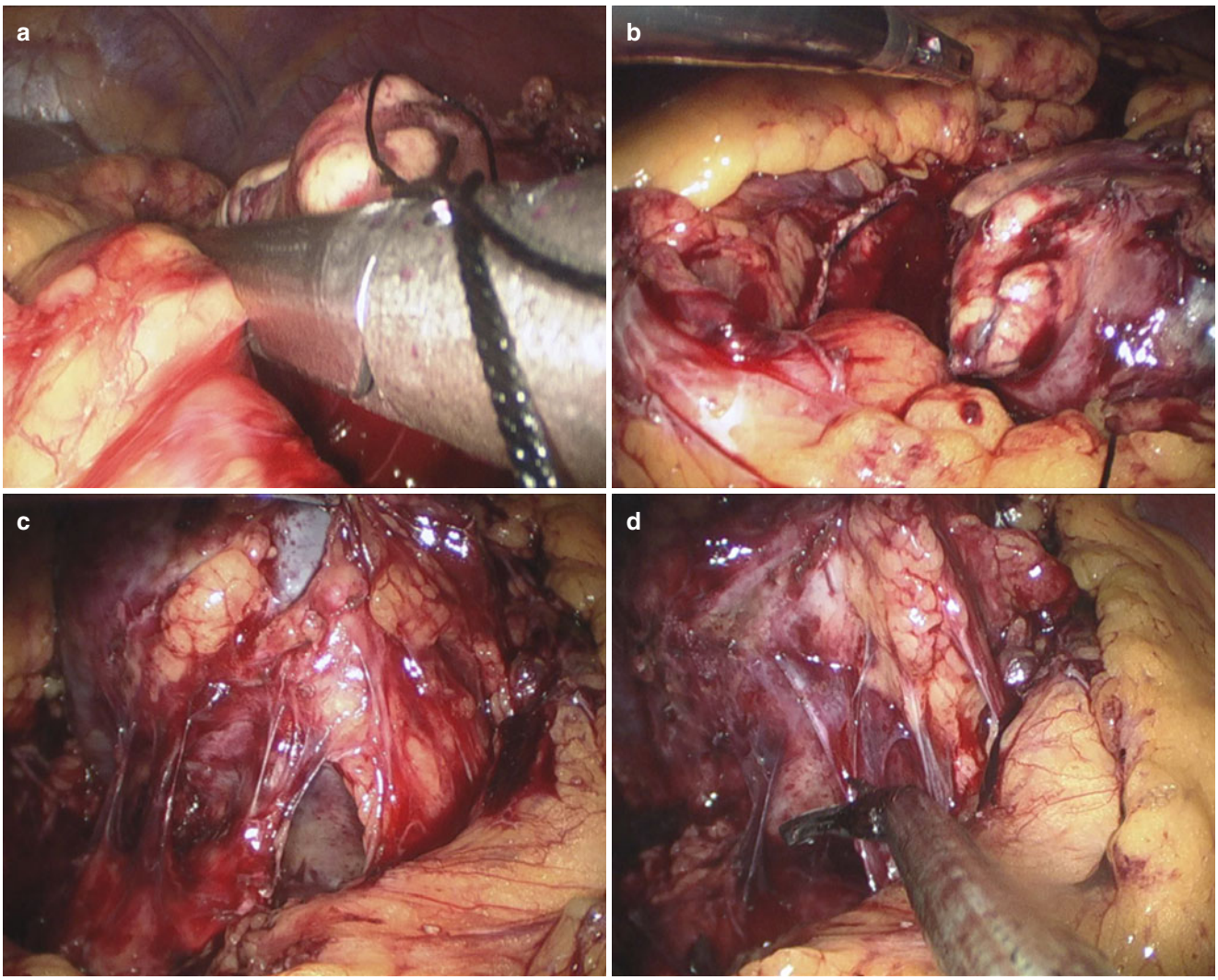


Fig. 6.5

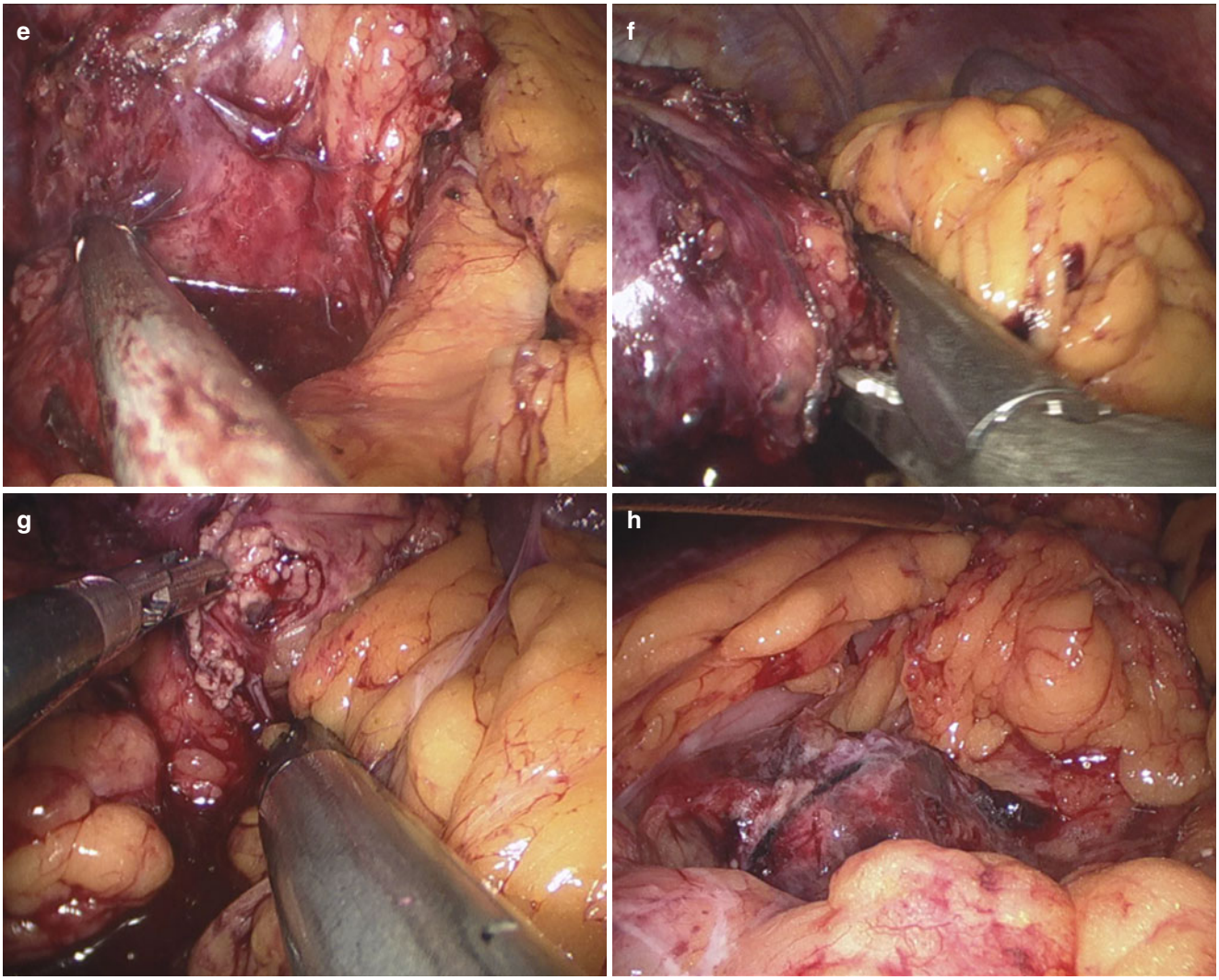


Fig. 6.5 (continued)

5. Retrieval of the specimen and observation of the spleen.
   The specimen was delivered out of the abdomen using a plastic bag. The viability of the spleen was assessed. No signs of infarct were detected (Fig. 6.6a, b).
6. Irrigation and drainage.
   After final inspection for the site of bleeding, aided by saline irrigation, the stump of the pancreas was reinforced with glue. The drainage tube was placed at the transected part of the pancreas.

6.1.7 Tips and Tricks

1. Several prolene straight needles stay sutures may be placed superficially to the posterior gastric wall and slinged to the anterior abdominal wall to expose the pancreas.
2. Intraoperative laparoscopic ultrasound may be used to confirm the lesion and exclude the presence of other lesions.
3. After the lesion has been identified and assessed to be operable, the inferior edge of the pancreatic capsule should be incised firstly. Then a tunnel should be created beneath the pancreatic neck from caudal to cephalad direction and freeing the pancreatic parenchyma from the splenic vessels for preserving the splenic vessels procedure.
4. A careful dissection of distal pancreas from medial to lateral approach should be carried out with preservation of the main splenic artery and veins.

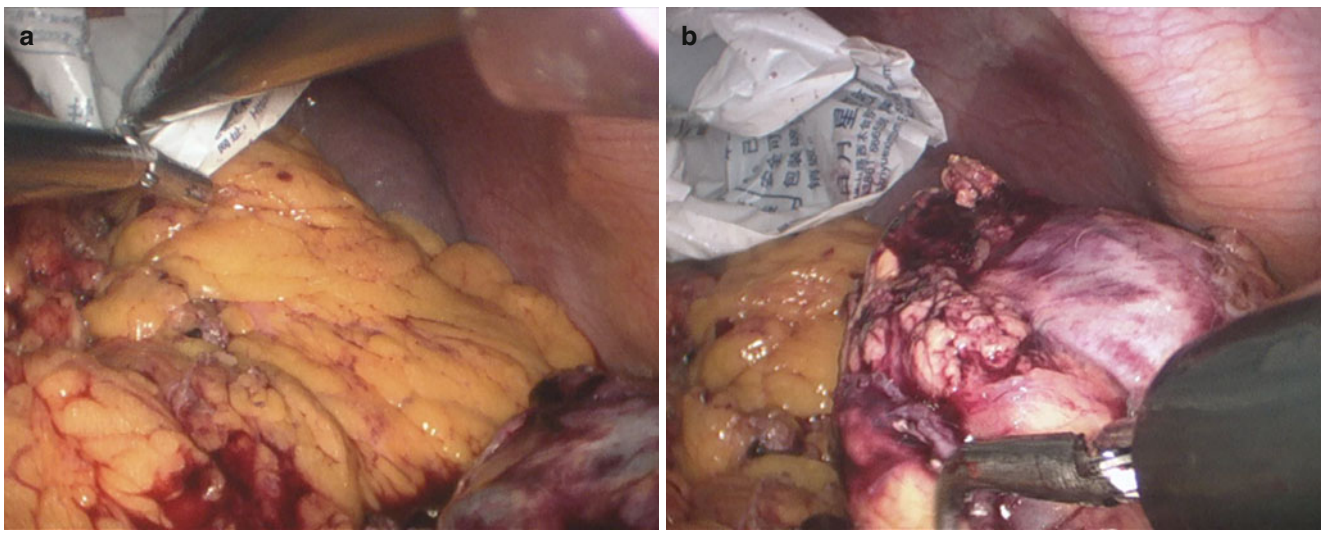


Fig. 6.6

6.2 Laparoscopic Distal Pancreatectomy Plus Splenectomy

6.2.1 Indications and Case Selection

Indications are similar with laparoscopic distal pancreatectomy, except the cases in which appropriate vascular inflow and outflow through splenic and /or short gastric vessels could not be preserved or was mandated by oncologic principles.

6.2.2 Contraindications

It's identical to Sect. 6.1.2.

6.2.3 Major Instruments or Energy Sources

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

6.2.4 Team Setup, Anesthesia and Position

It is the same as Sect. 6.1.4.

6.2.5 Key Steps

1. Exploration of the abdominal cavity.
2. Exposure of pancreas.
3. Dissection of the pancreas.
4. Dissection of distal pancreas and spleen.
5. Transection of the pancreas.
6. Retrieval of the specimen.
7. Irrigation and drainage.

6.2.6 Surgical Techniques

1. Exploration of the abdominal cavity.
   A general exploration of the abdominal cavity was performed to rule out the possibility of an extrapancreatic lesion.
2. Exposure of pancreas.
   The patient was placed in a reverse Trendelenburg position. The operation began with the division of the gastrocolic ligament and the lower part of gastrosplenic ligament, to expose the pancreas (Fig. 6.7a–l).

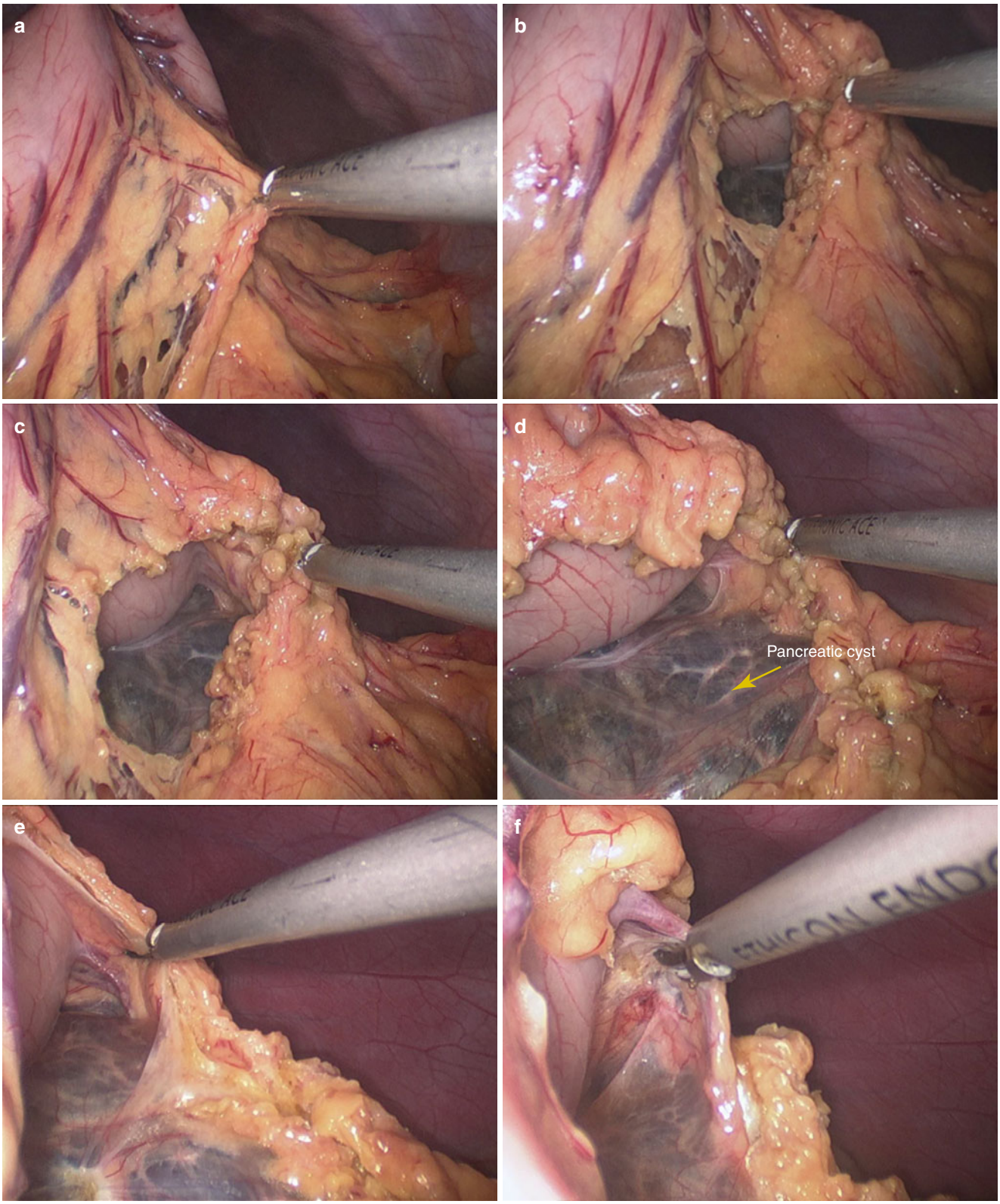


Fig. 6.7

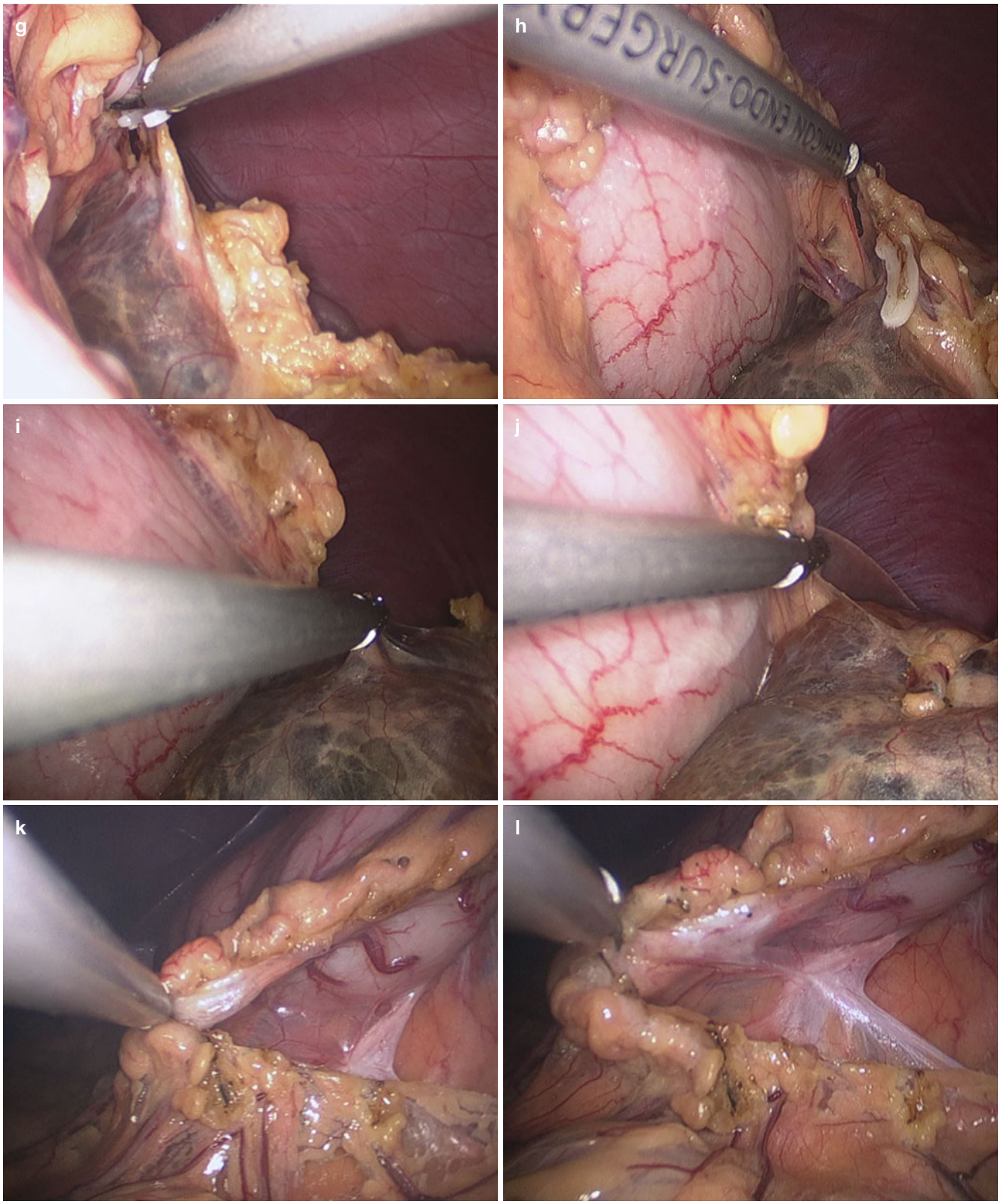


Fig. 6.7 (continued)

Continuous dissection of the adhesion between the superior margin of the pancreas and the posterior wall of the stomach was performed. The splenic vessels were exposed at the superior margin of the pancreas. In case of close relationship between the lesion and splenic vessels, combined splenectomy was scheduled (Fig. 6.8a–j).

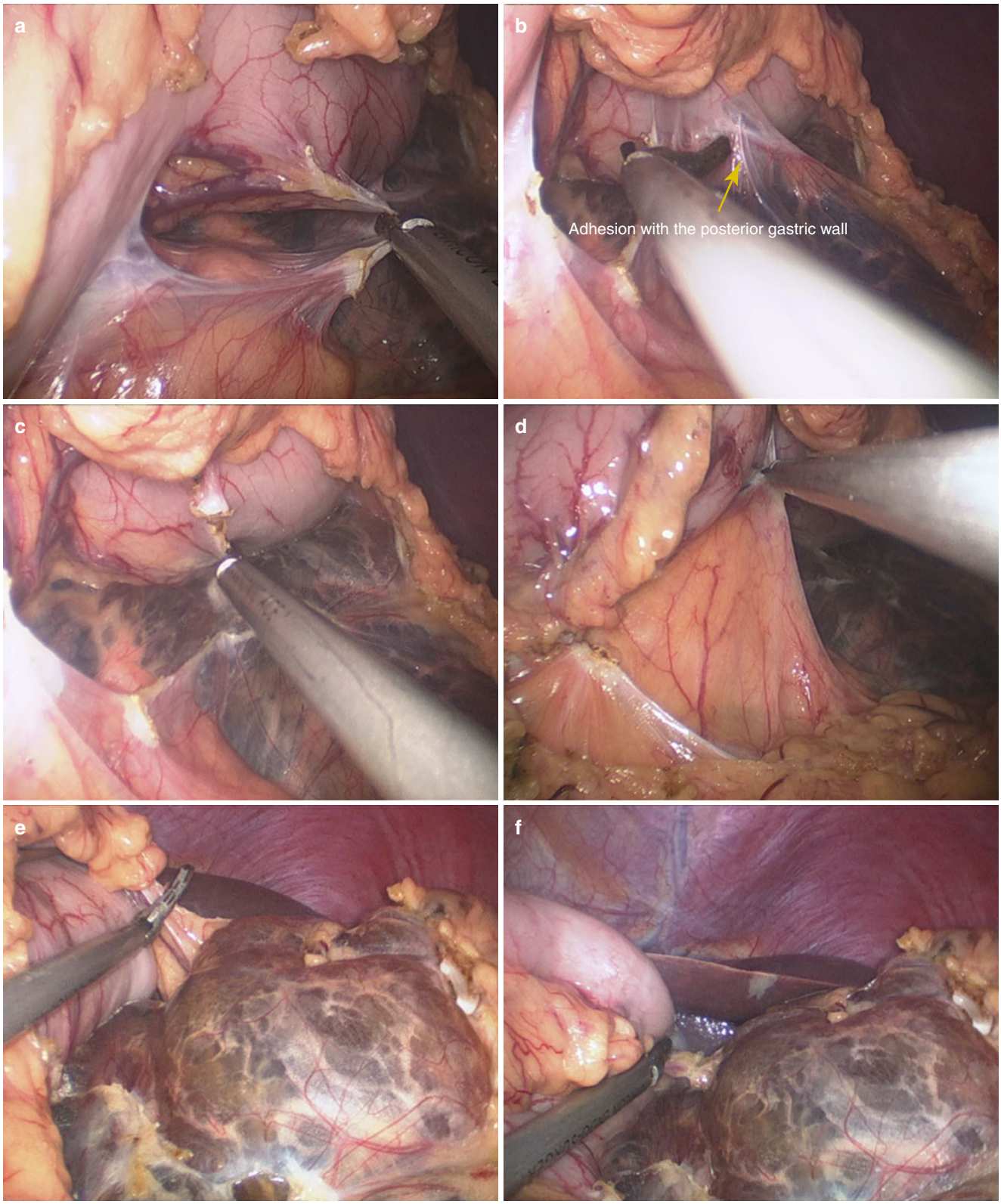


Fig. 6.8

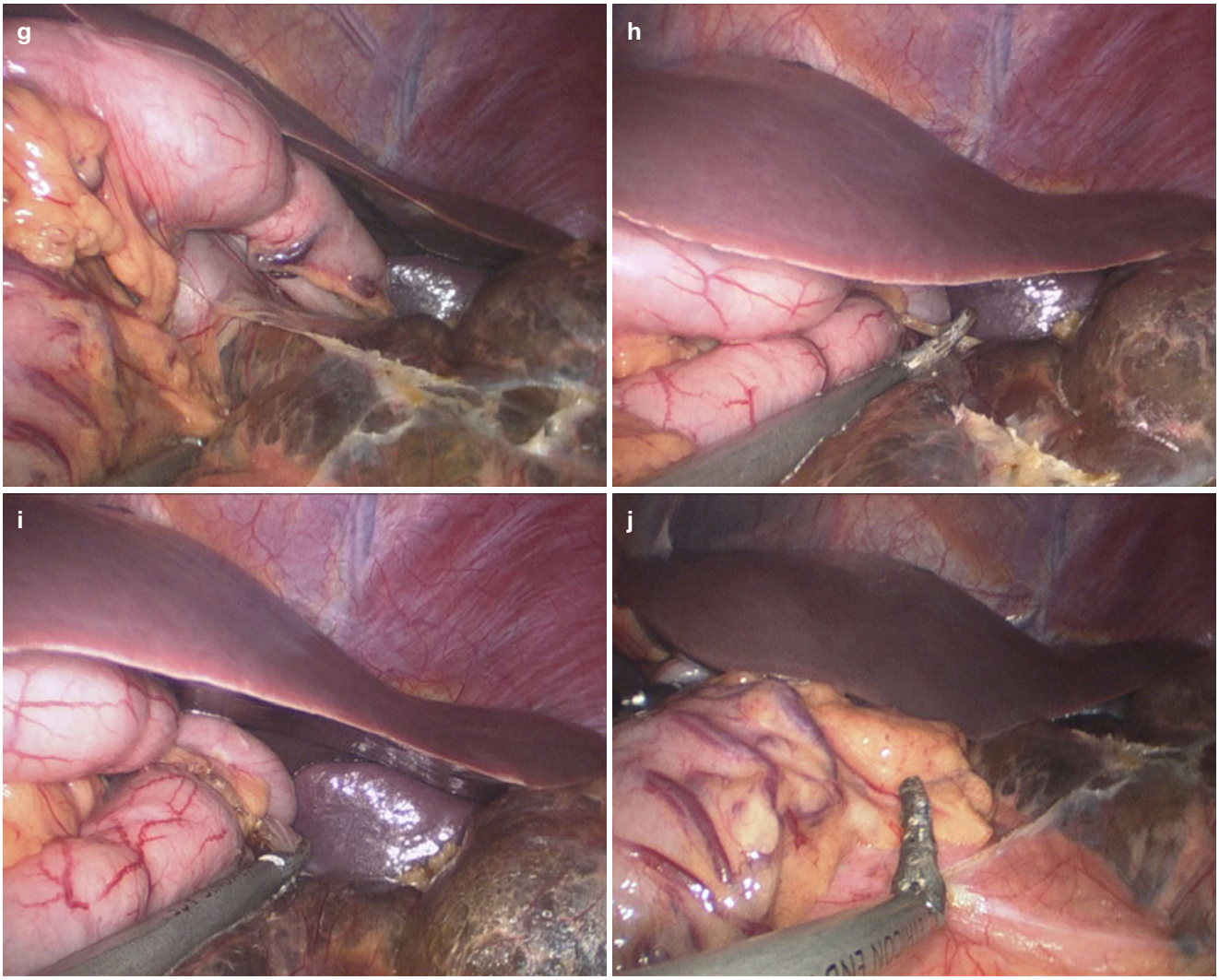


Fig. 6.8 (continued)

Mobilization of the superior margin of the pancreas was performed. Attention should be paid not to tear the splenic vessels (Fig. 6.9a–f).

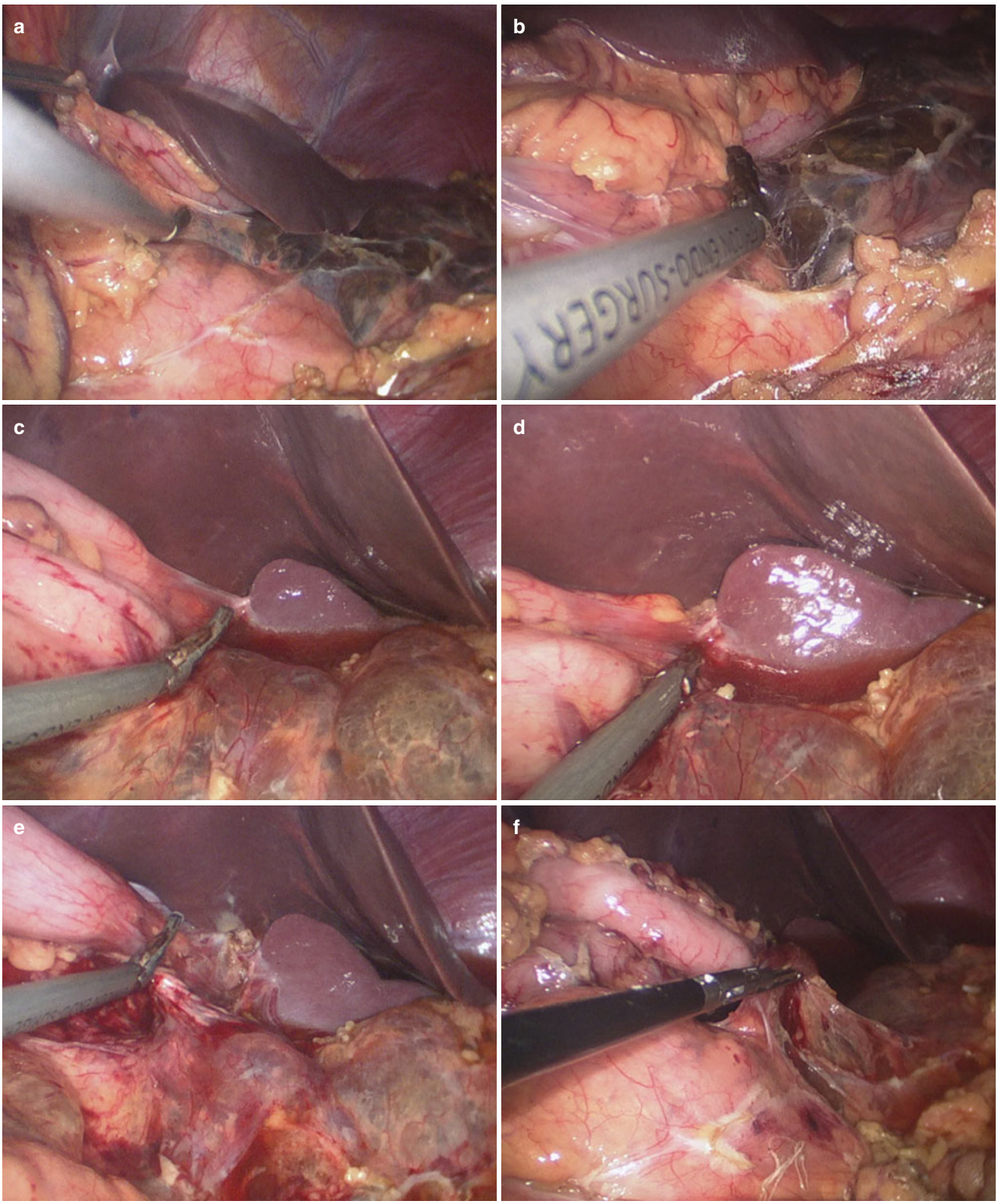


Fig. 6.9

3. Dissection of the pancreas.
   The transverse mesocolon was retracted downwards to fully expose the lower margin of the pancreas (Fig. 6.10a–g).

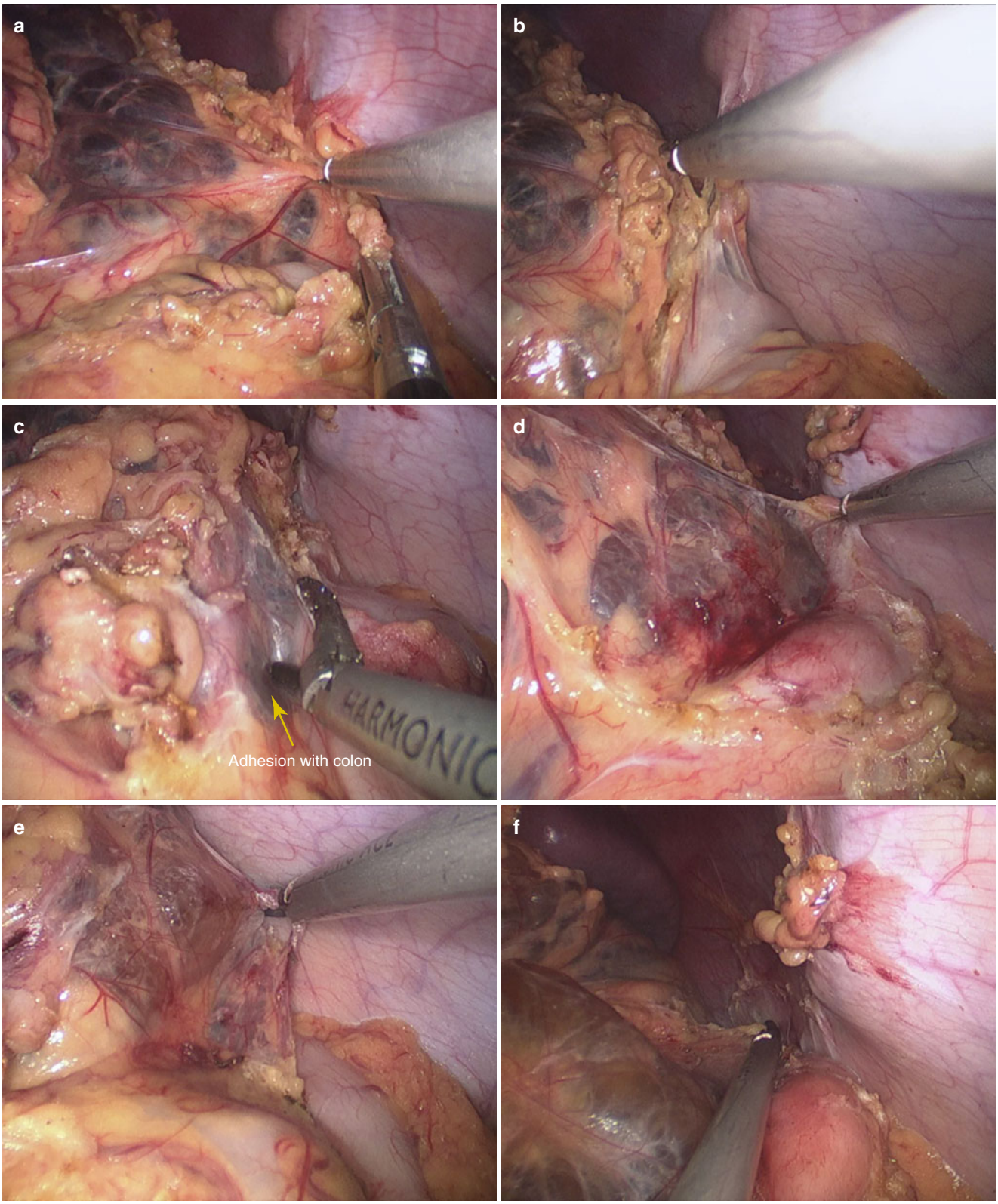


Fig. 6.10

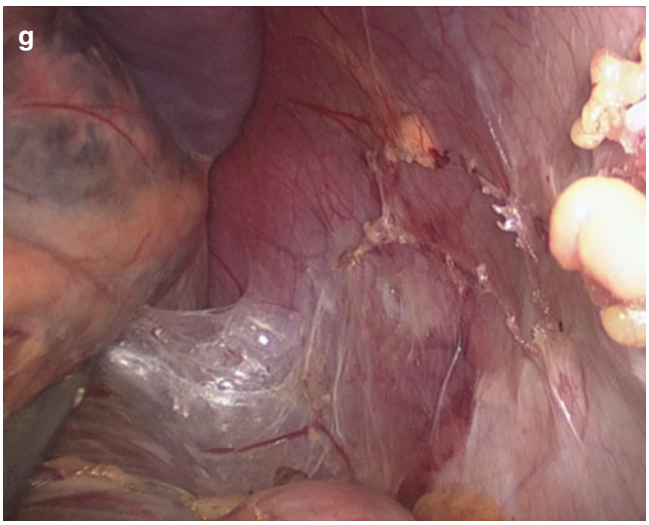


Fig. 6.10 (continued)

The loose connective tissues behind the pancreas was mobilized by using the harmonic scalpel to expand the posterior pancreatic space (Fig. 6.11a–h).

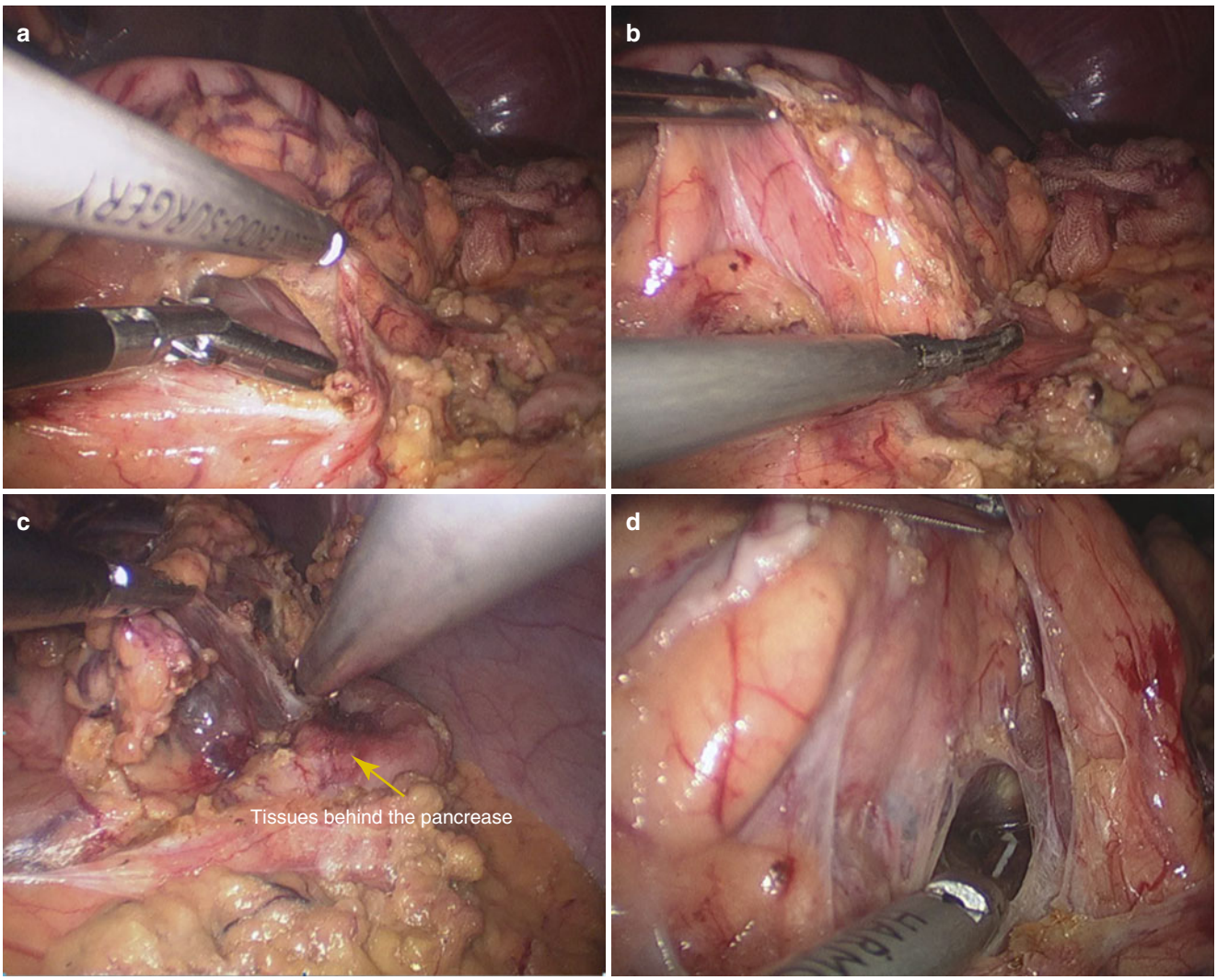


Fig. 6.11

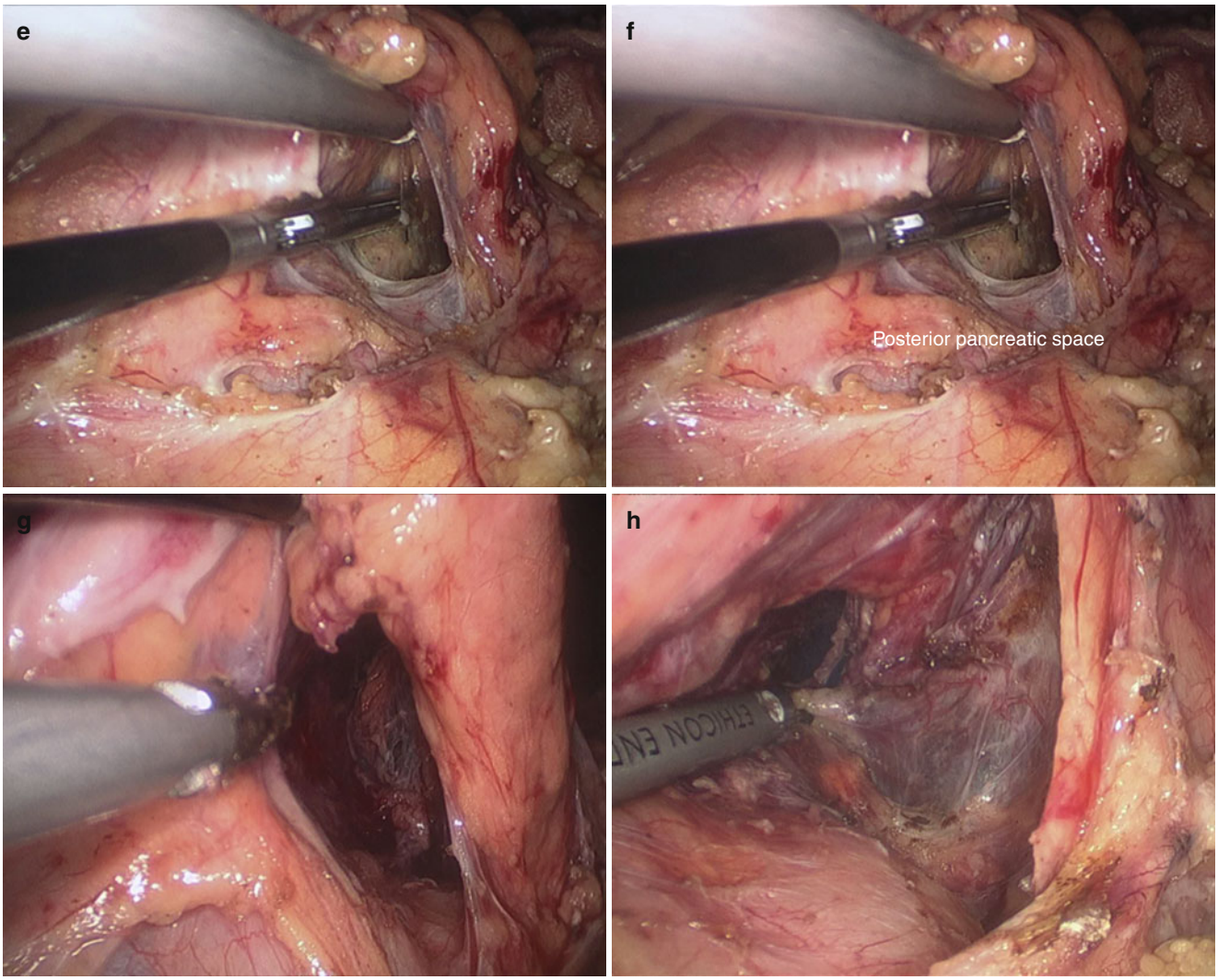


Fig. 6.11 (continued)

4. Dissection of distal pancreas and spleen.
   The division of the splenic artery was performed first so as to reduce the vascular supply at the level of the spleen, hence reducing its volume. The origin of the splenic vein was identified, and then ligated and dissected. After the superior part of gastrosplenic ligament, splenophrenic ligament and splenorenal ligament was respectively dissected, the spleen was freed (Fig. 6.12a–j).

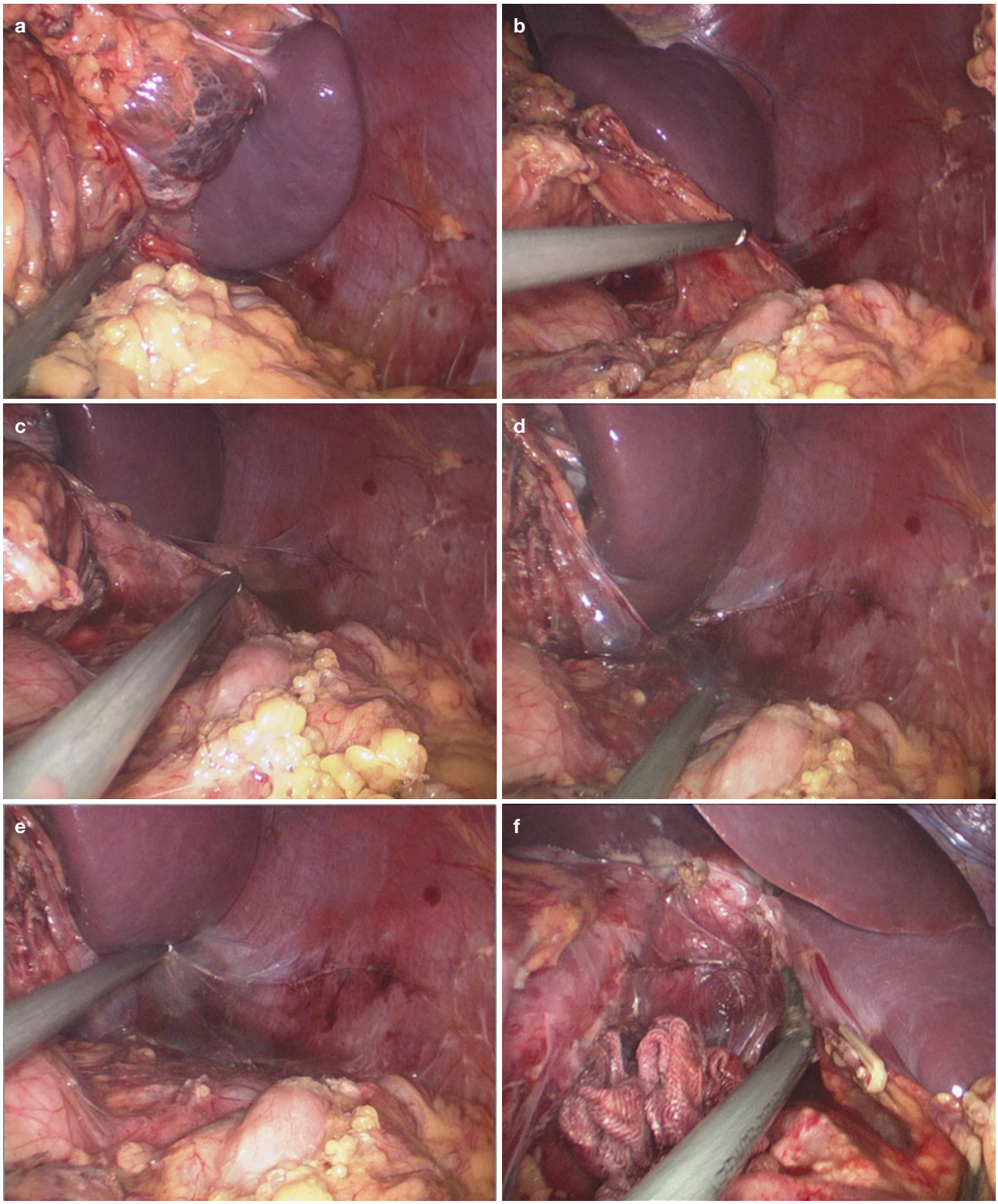


Fig. 6.12

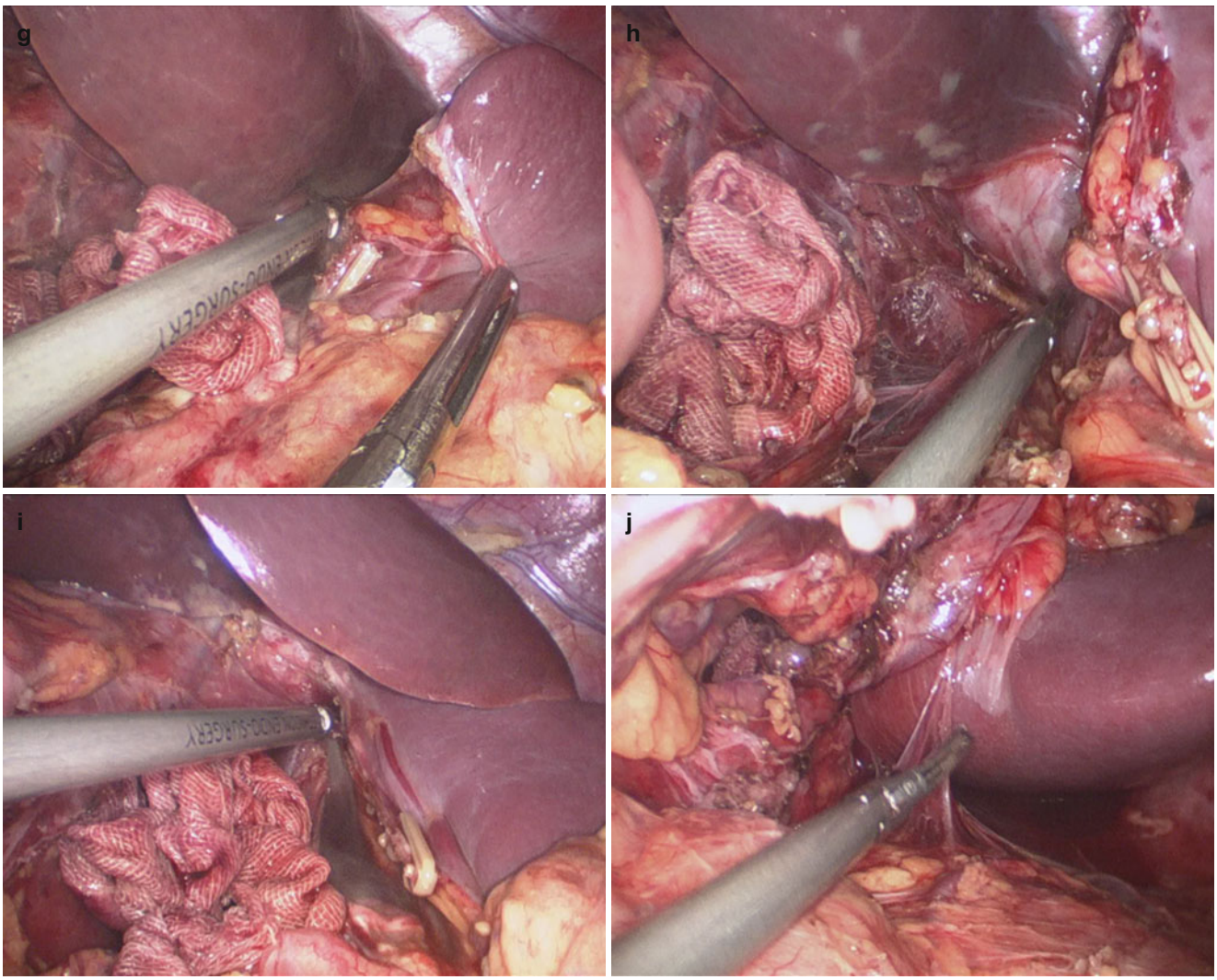


Fig. 6.12 (continued)

5. Transection of the pancreas.
   Transection of the pancreas along the neck was created using the endoscopic linear stapler. The splenic vessels were transected simultaneously during the transection (Fig. 6.13a–h).

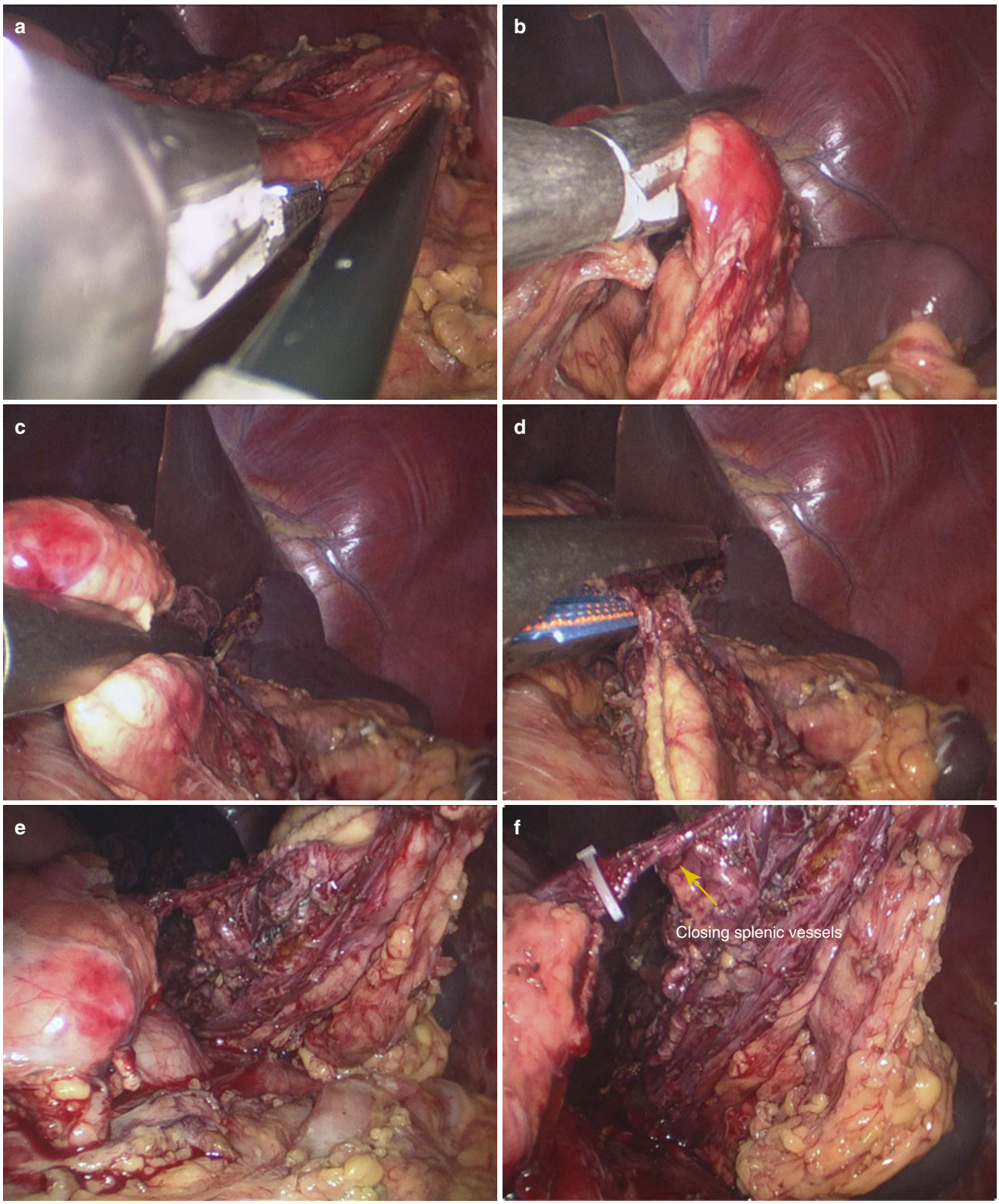


Fig. 6.13

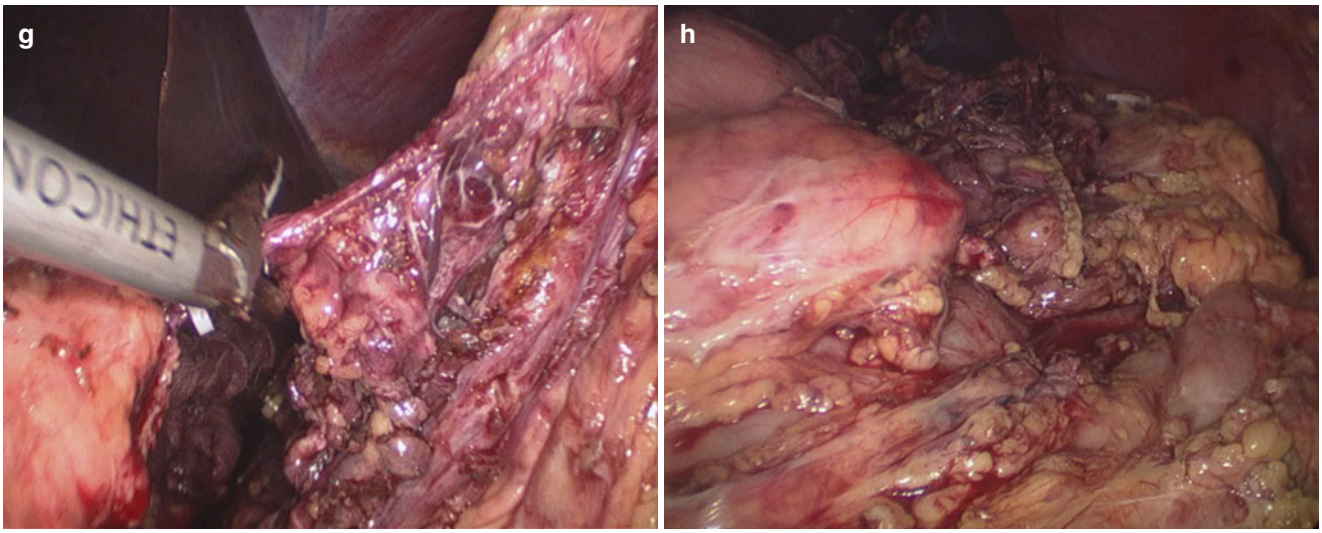


Fig. 6.13 (continued)

6. Retrieval of the specimen.
   Once the distal pancreas was dissected in the way as formerly described, the specimen was removed in a plastic bag through the umbilical incision. A careful hemostatic control was performed at the level of the stump of the splenic artery and of the splenic vein (Fig. 6.14a, b).

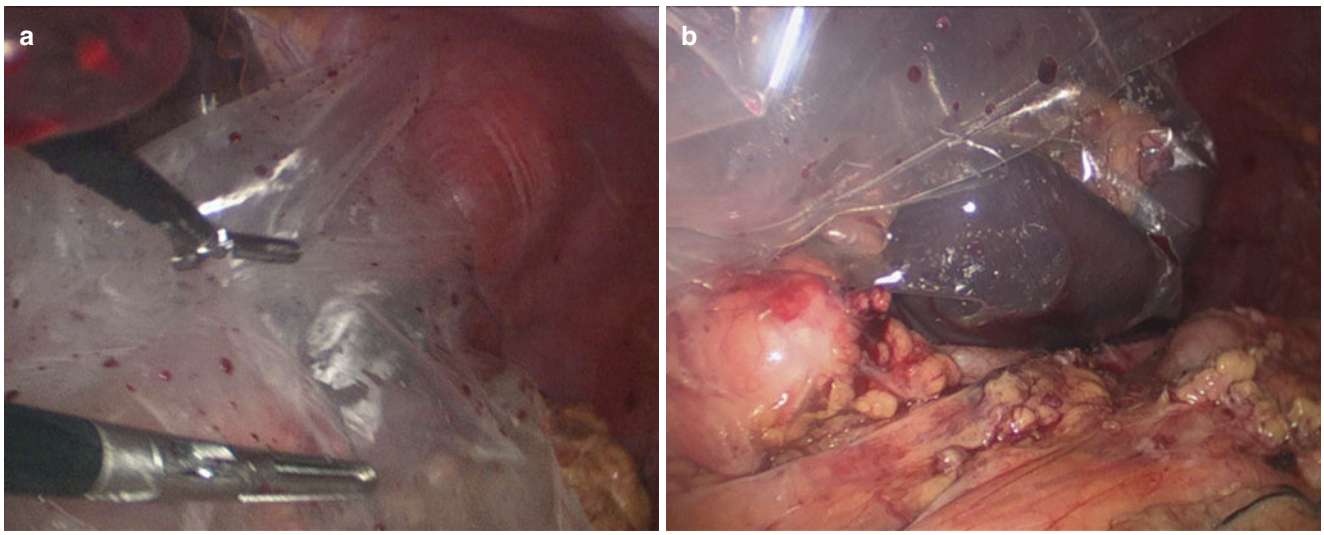


Fig. 6.14

7. Irrigation and drainage.
   After final inspection for the site of bleeding, aided by saline irrigation, the stump of the pancreas was reinforced with glue. The drainage tube was placed at the level of the splenic bed (Fig. 6.15a–d).

6.2.7 Tips and Tricks

1. Several prolene straight needles stay sutures may be placed superficially to the posterior gastric wall and slinged to the anterior abdominal wall to expose the pancreas.
2. Intraoperative laparoscopic ultrasound may be used to confirm the lesion and that no other lesion was present.

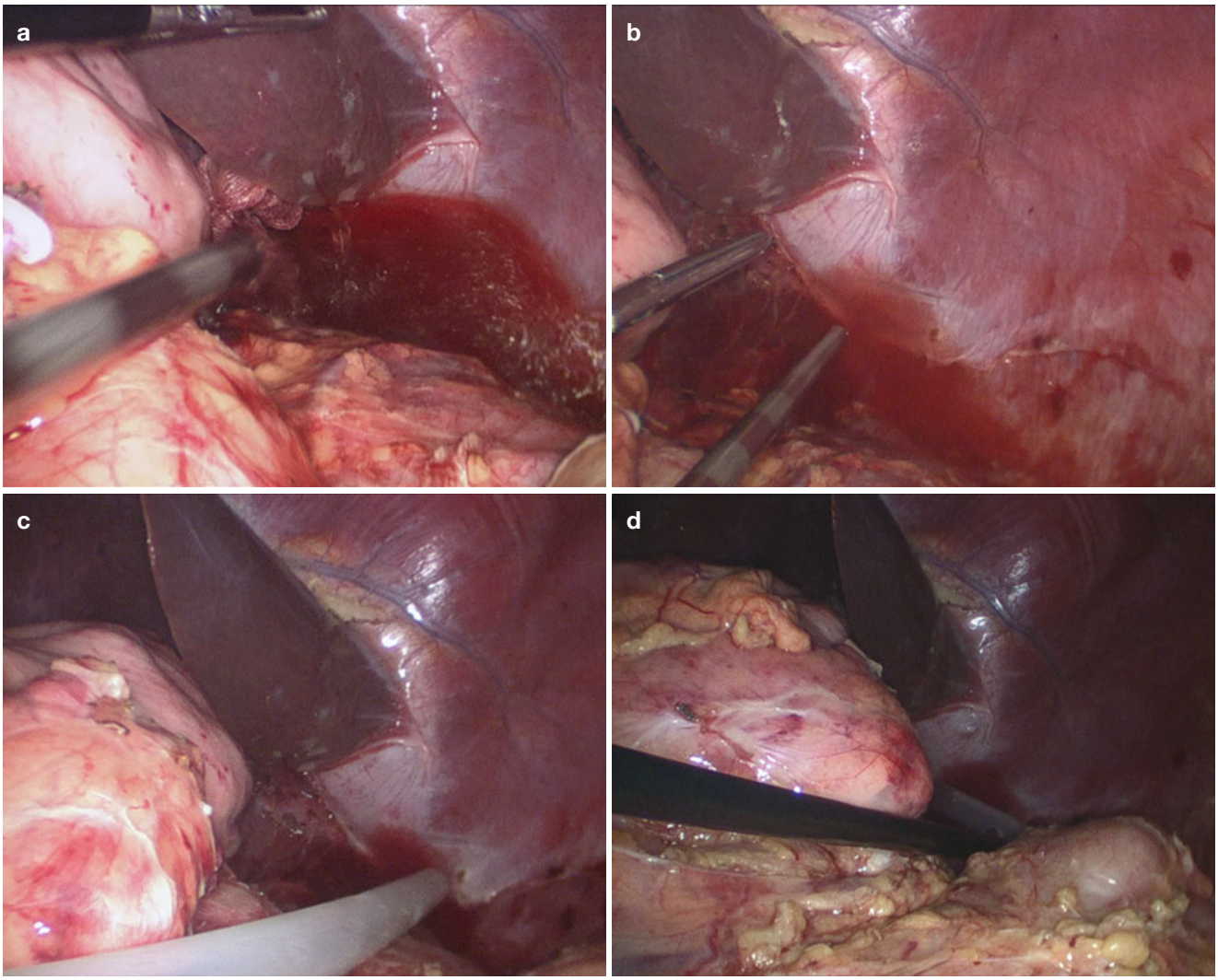


Fig. 6.15

6.3 Laparoscopic Surgery for Pancreatic Pseudocyst

6.3.1 Indications and Case Selection

1. Symptomatic pseudocyst greater than 6 cm in size that have been present for more than 6 weeks.
2. Pseudocyst with complications such as infection, hemorrhage, rupture, obstruction.
3. Suspicion of carcinoma requires biopsy and inspection of the pseudocyst wall.
4. Consideration for an easier reoperation when attempting more extensive debridement or subtotal pancreatic resection due to its minimally invasion to other intra-abdominal tissue.

6.3.2 Contraindications

1. Communication of the pseudocyst with the main pancreatic duct is not a contraindication to laparoscopic drainage, except in patients with multiple pancreatic duct strictures.
2. Patients with relatively operative contraindications should also be ruled out.

6.3.3 Major Instruments or Energy Sources

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

6.3.4 Team Setup, Anesthesia and Position

It is the same as Sect. 6.1.4.

6.3.5 Key Steps

1. Exploration of the abdominal cavity.
2. Exposure of pancreatic pseudocyst.
3. Dissection of loop of jejunum .
4. Cystojejunal anastomosis.
5. Anastomosis of jejunum and jejunum extracorporeally.
6. Irrigation and drainage.

6.3.6 Surgical Techniques

1. Exploration of the abdominal cavity.
   Pancreatic pseudocyst is usually secondary to acute pancreatitis that leads to abdominal adhesions. So a thorough abdominal exploration is needed to find out the size and the thickness of the cyst as well as its relationship with neighboring organs.
2. Exposure of the pancreatic pseudocyst.
   The patient was placed in reverse Trendlenburg position. The gastrocolic ligament was divided to expose pancreatic pseudocyst (Fig. 6.16a–d).

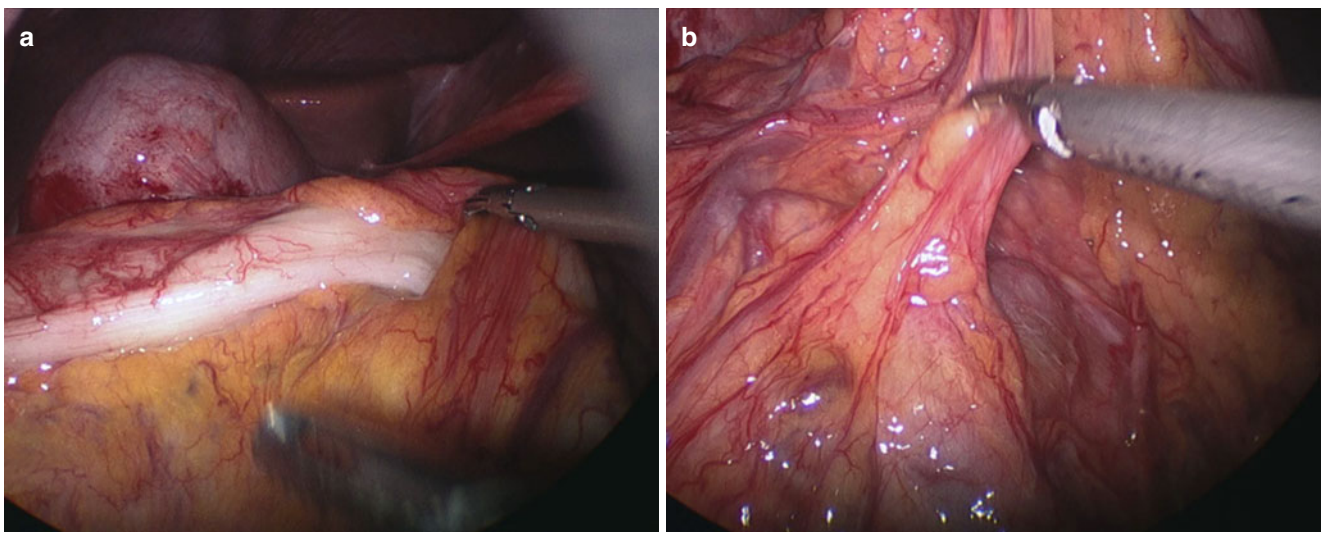


Fig. 6.16

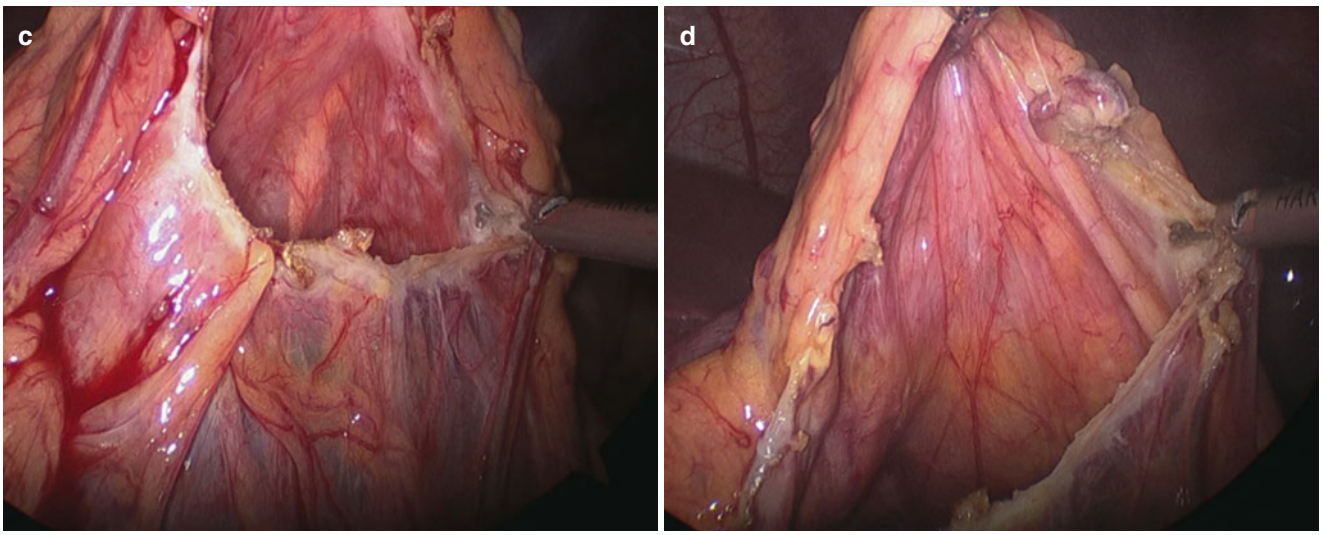


Fig. 6.16 (continued)

A puncture needle was used to extract the hydatid fluid. Once a cystojejunal anastomosis was decided, the cyst was opened with the hydatid fluid thoroughly drained out (Fig. 6.17a–e).

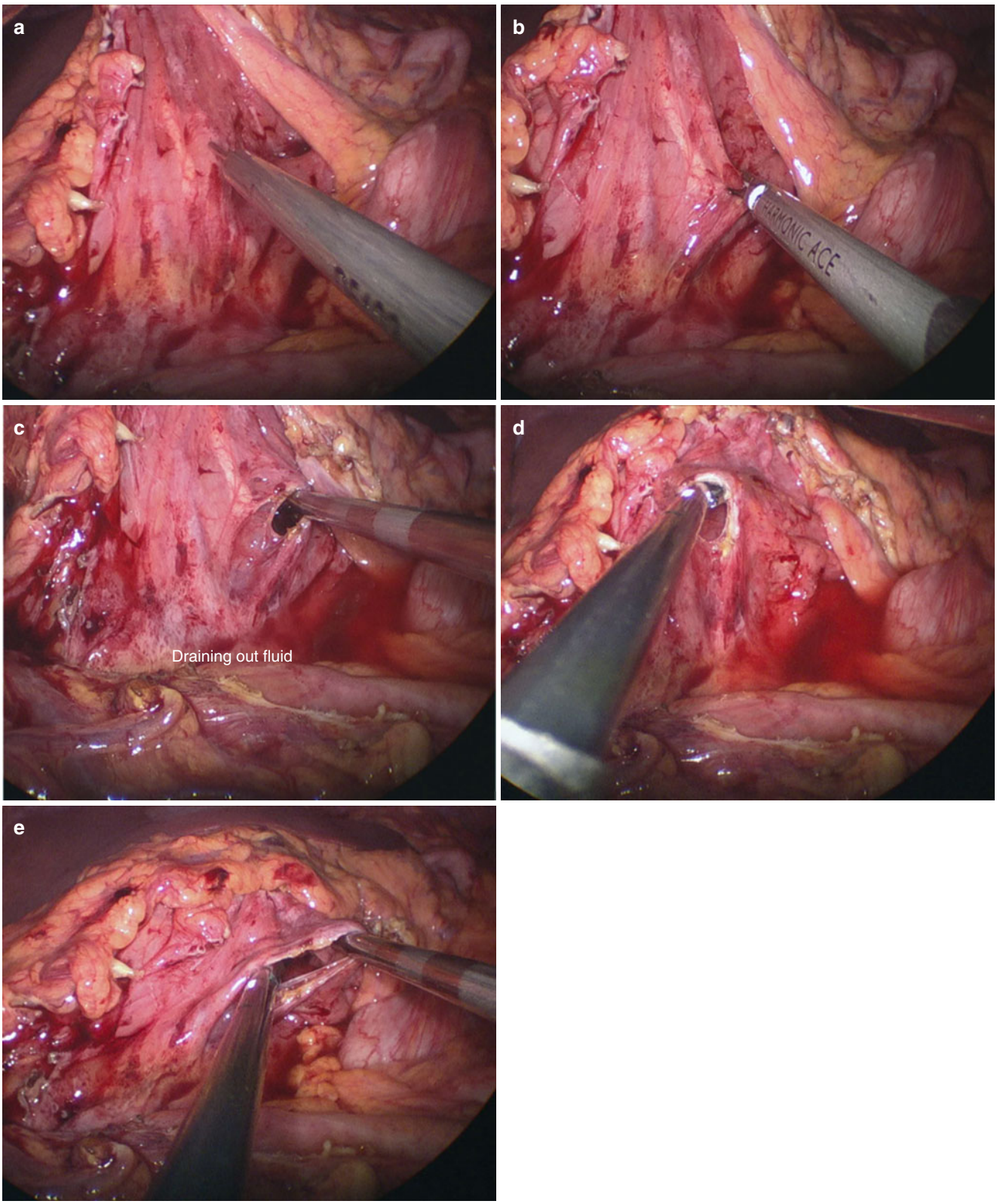


Fig. 6.17

3. Dissection of loop of jejunum.
   The proximal mesojejunum was dissociated. The proximal jejunum was disconnected by an endoscopic stapler with the distal stump lifted towards the cyst for anastomosis (Fig. 6.18a–h).

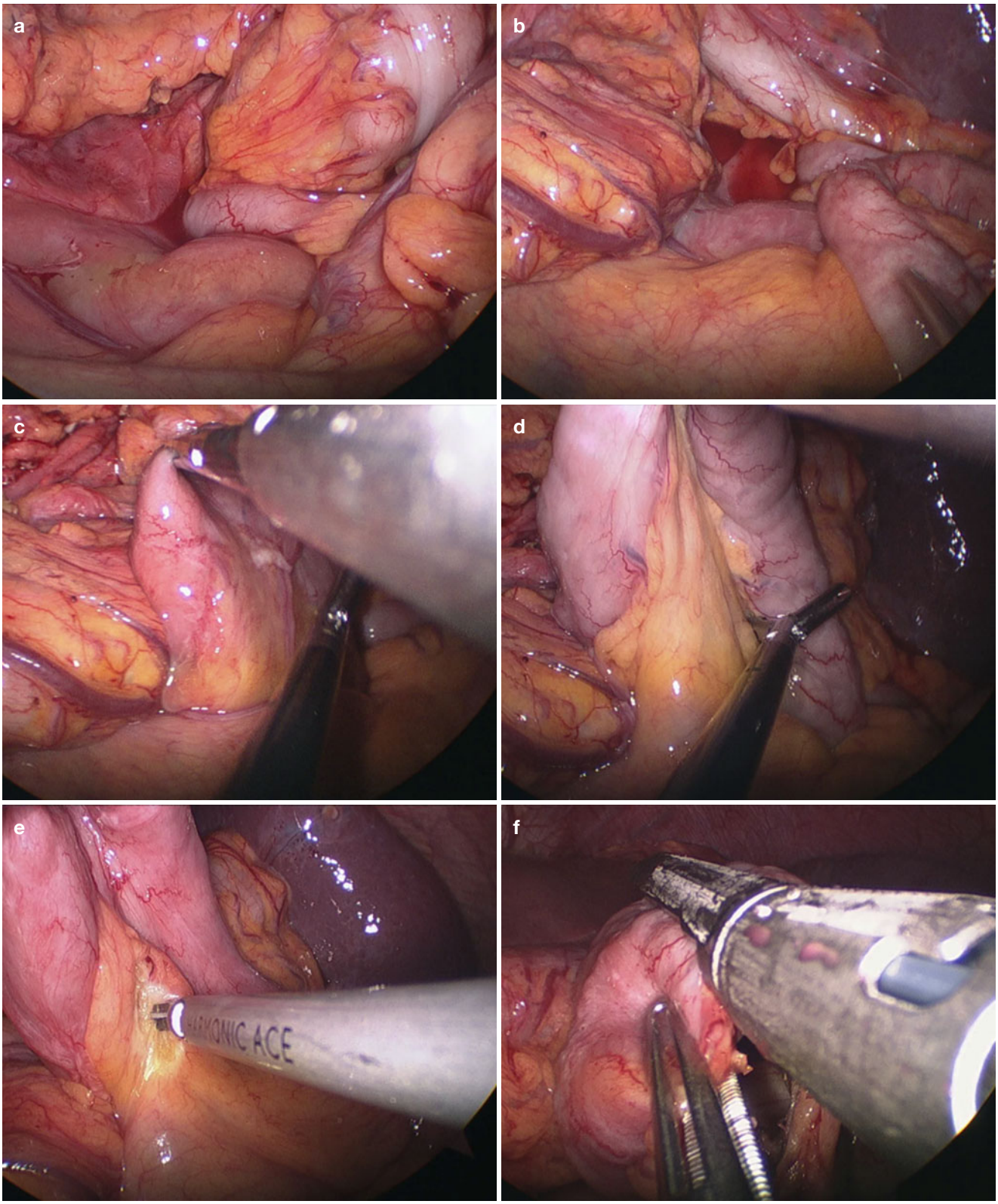


Fig. 6.18

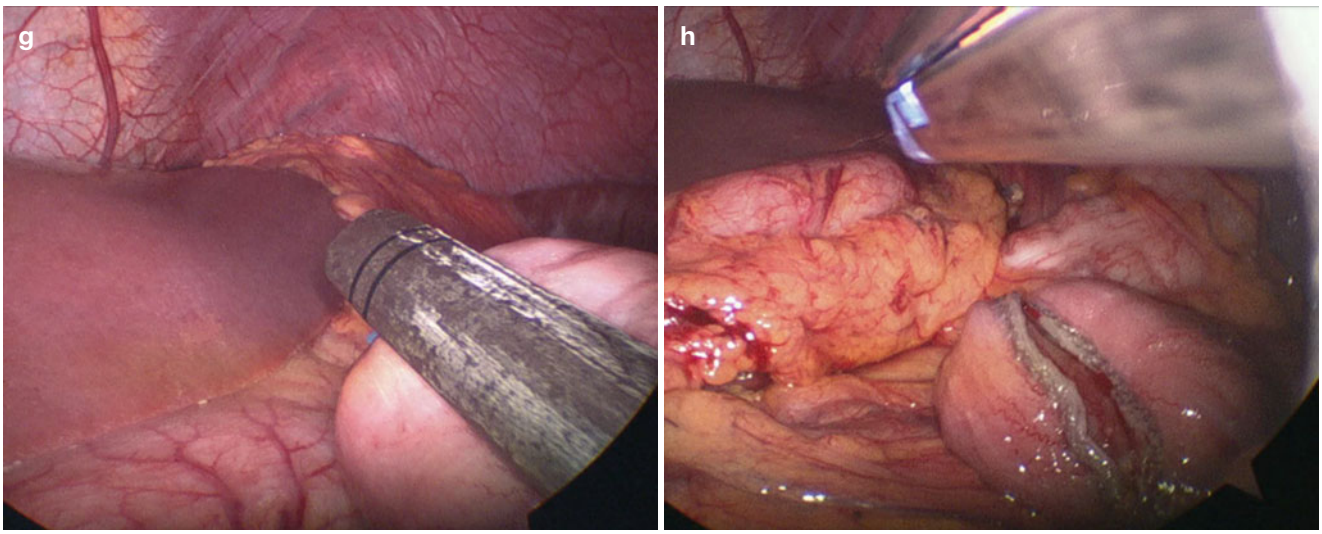


Fig. 6.18 (continued)

4. Cystojejunal anastomosis.
   The distal jejunum was lifted towards the cyst with the enteric cavity opened by harmonic scalpel. In a step-by-step manner, an endoscopic stapler was inserted in both the incisions on the cyst and jejunum. The wall of the cyst and the anti-mesenteric side of the jejunum were put together. Then the endoscopic stapler was closed and fired (Fig. 6.19a–h).

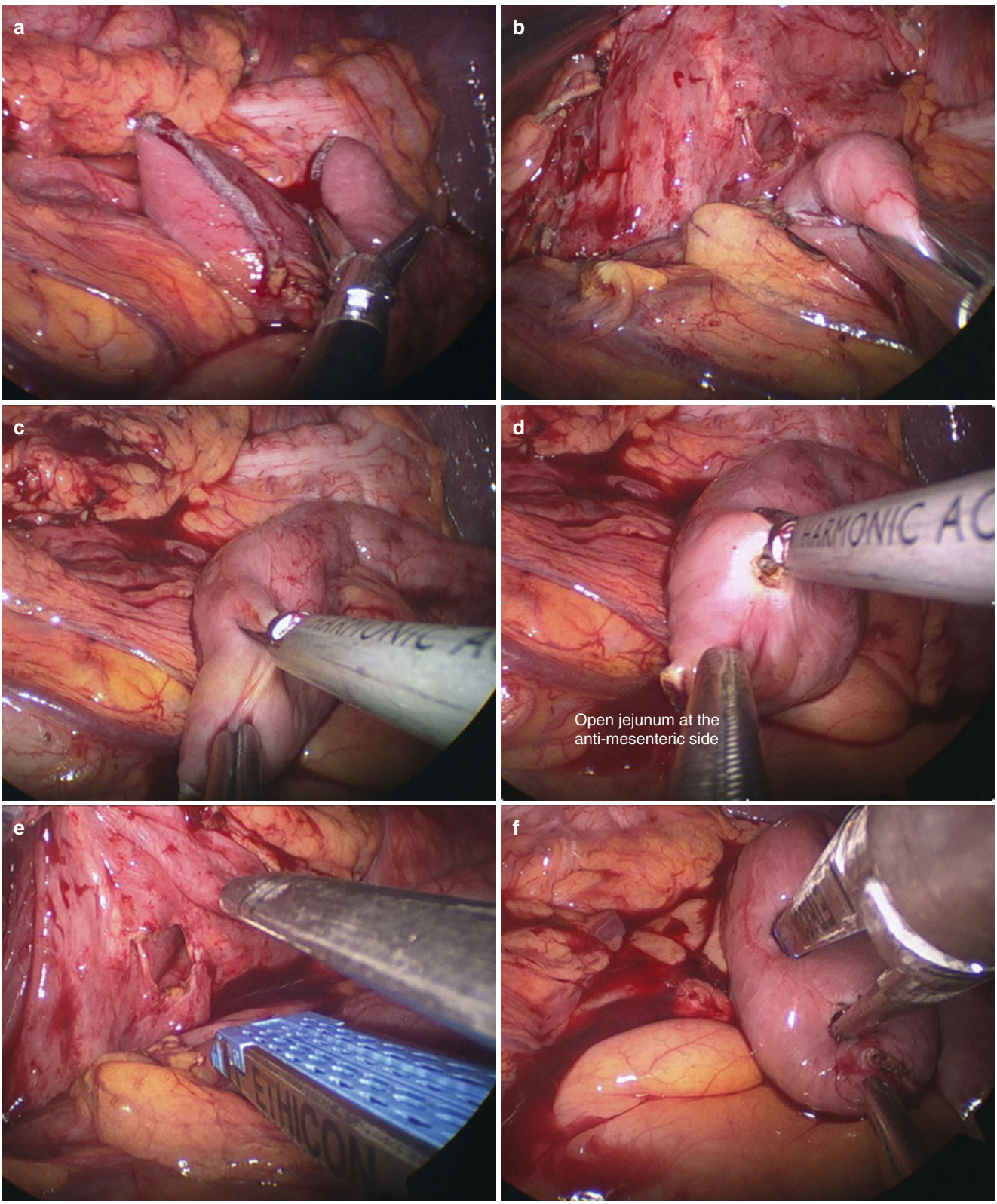


Fig. 6.19

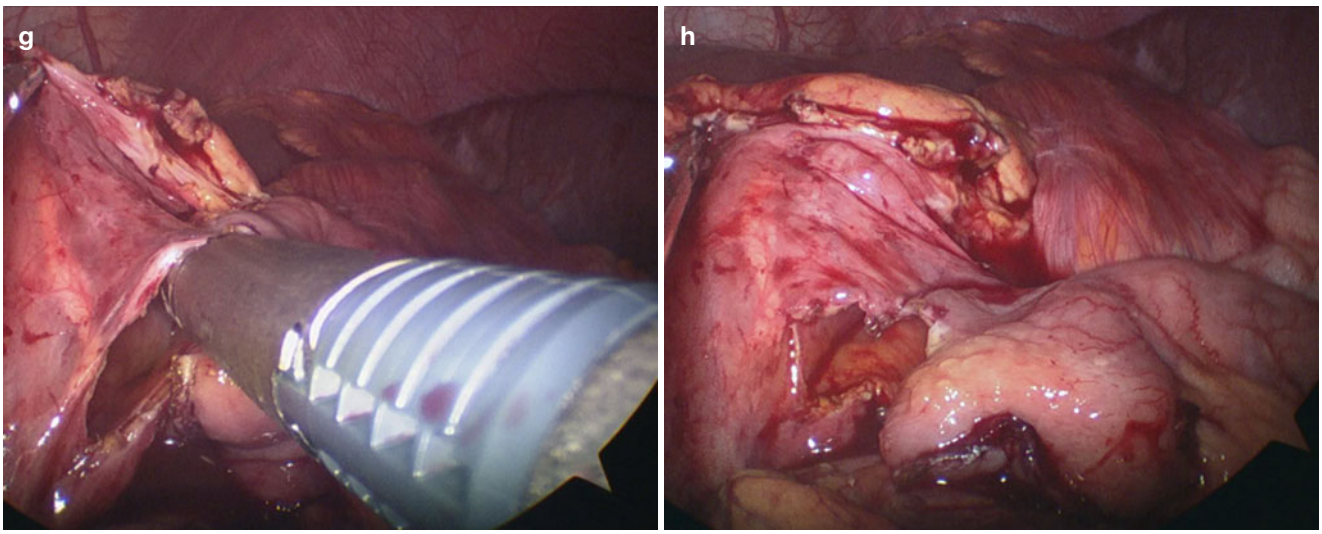


Fig. 6.19 (continued)

The common incisions were joined together and closed by running suture with 3/0 absorbable suture (Fig. 6.20a–e).

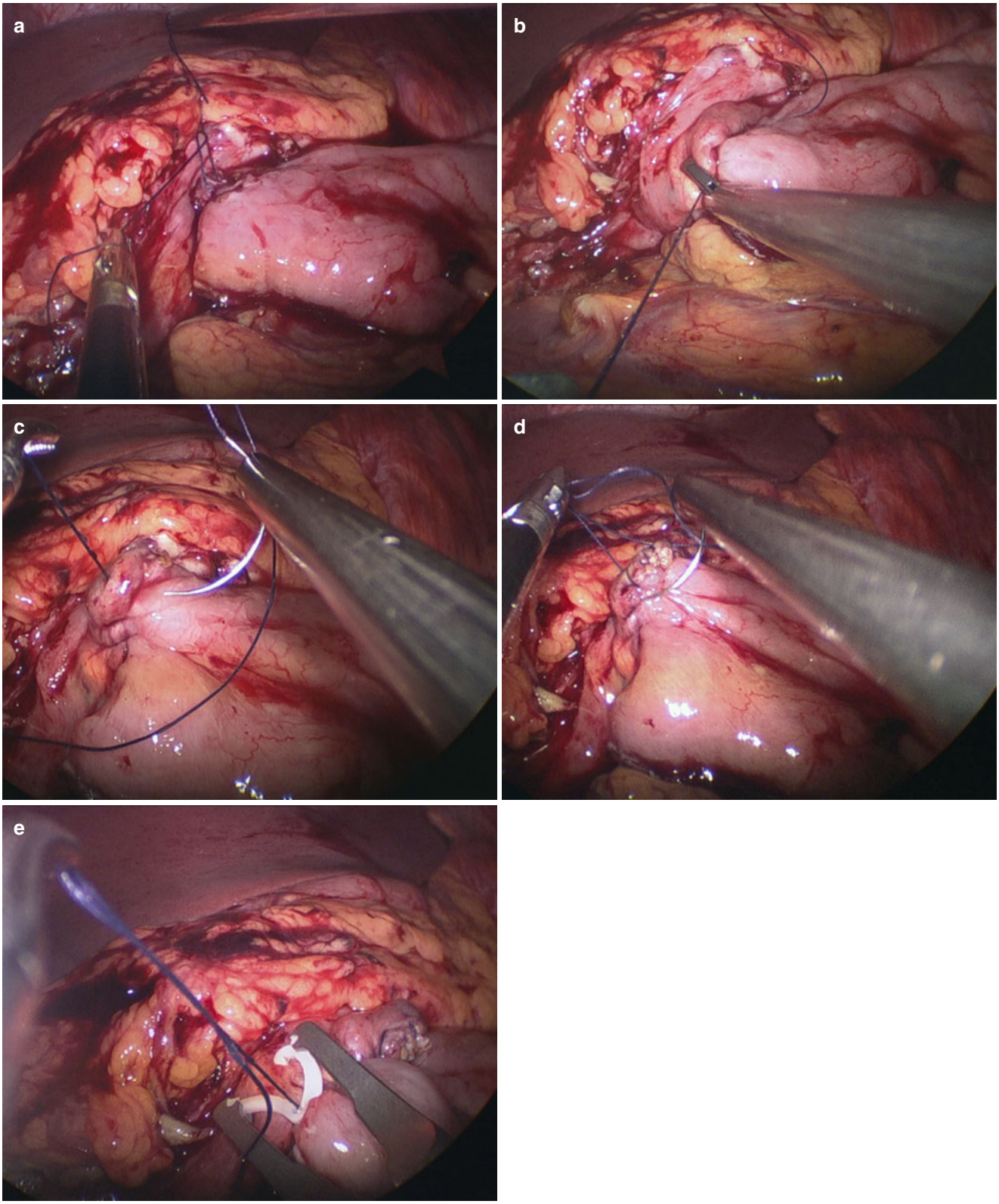


Fig. 6.20

5. Anastomosis of jejunum and jejunum extracorporeally. The proximal jejunum and intended anastomotic distal jejunum were marked by laparoscopic suture. Both were lifted out of the enlarged umbilical incision and then an extracorporeal intestinal anastomosis was performed. The intestine was then put back into the abdominal cavity and the peritoneum incision was closed (Fig. 6.21a–f).

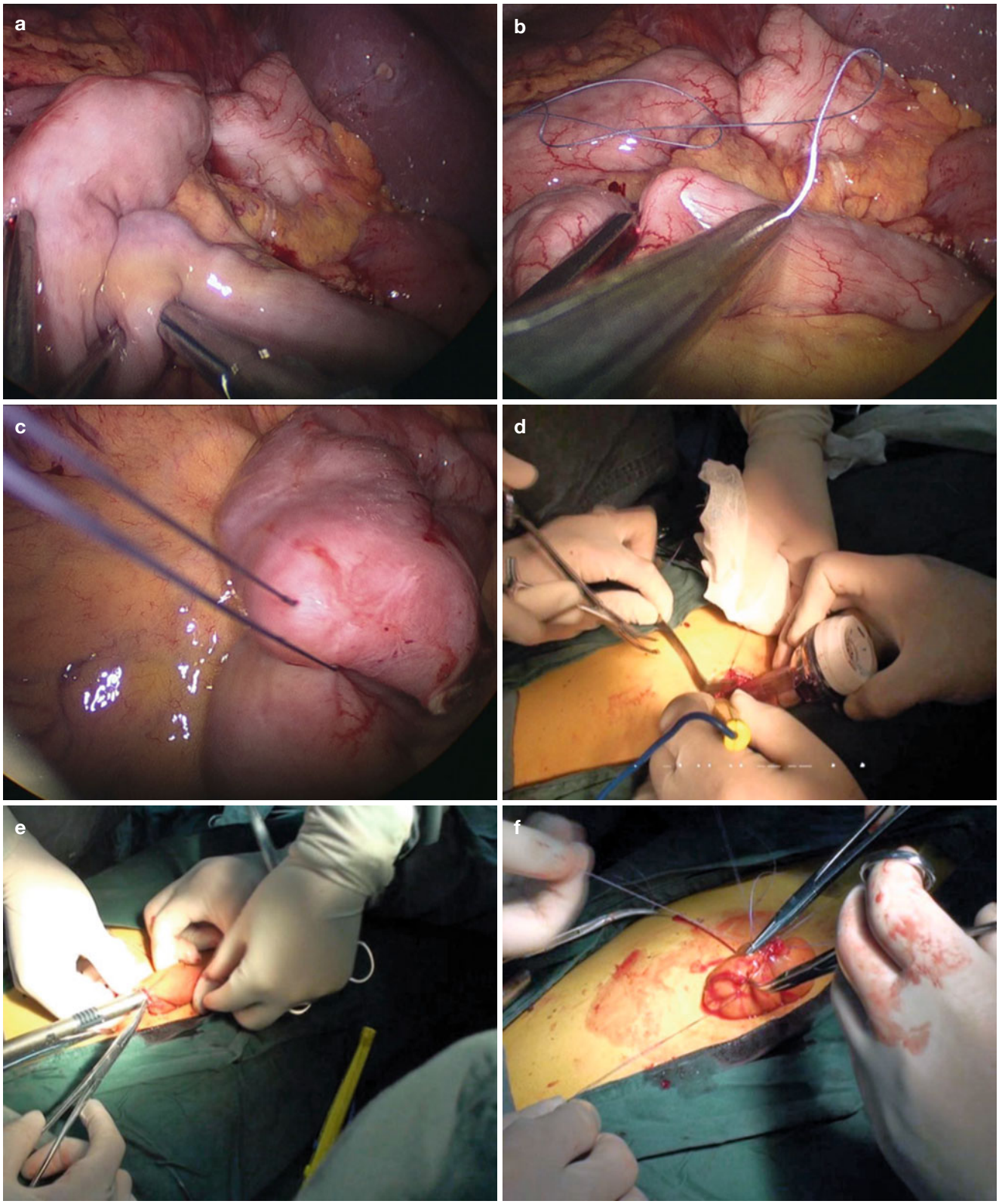


Fig. 6.21

6. Irrigation and drainage.
   The abdominal cavity was suctioned and a closed suction drain was placed beside the anastomotic stoma through the incision at umbilicus (Fig. 6.22a–d).

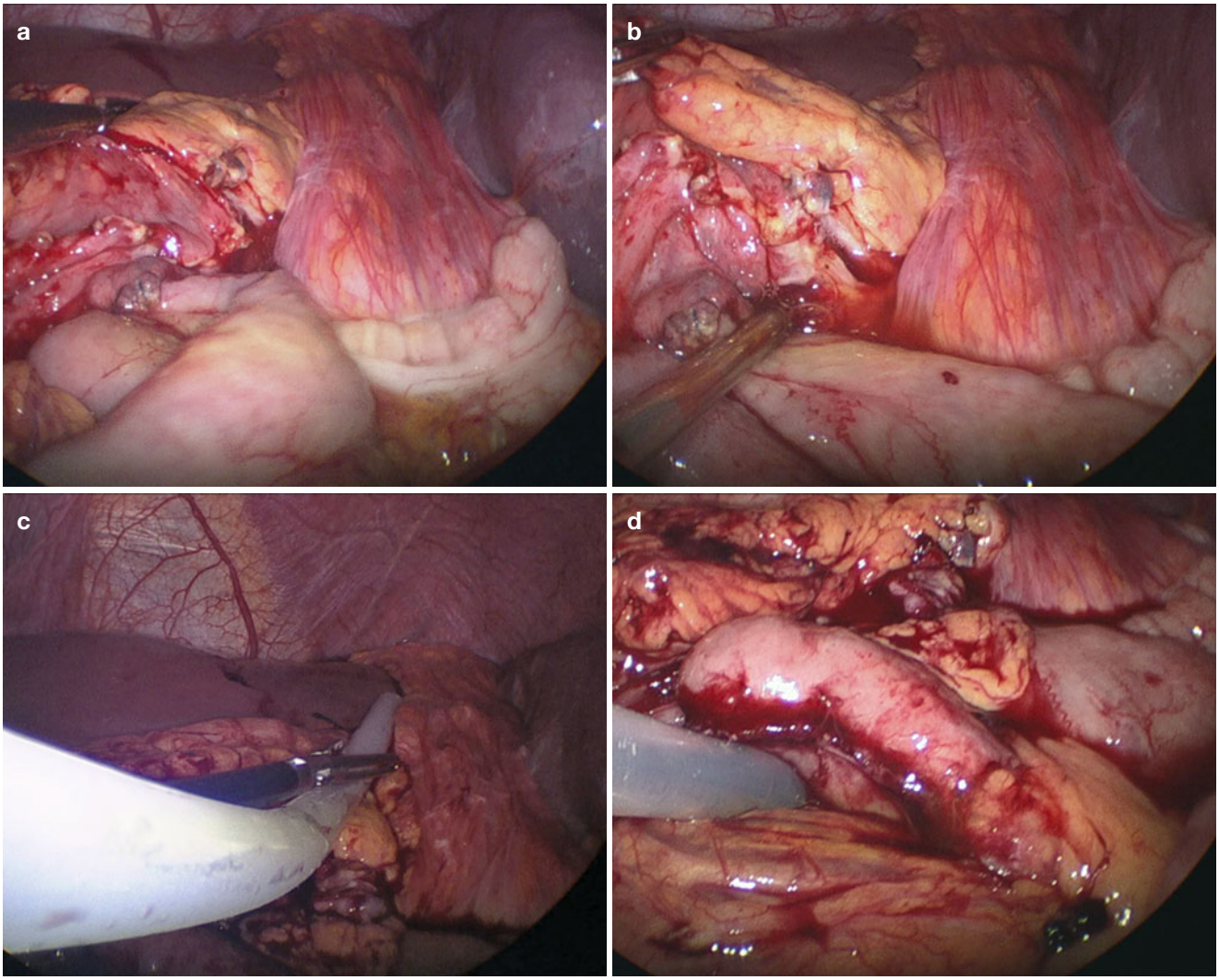


Fig. 6.22

6.4 Complications Analysis and Management

6.4.1 Haemorrhage

Intraoperative bleeding can be induced by the wrong treatment of peripancreatic vessels. Massive bleeding is commonly caused by the injury of splenic vessels during the dissection of the back of pancreas due to the lacking of essential assistant retraction in SILS. If the splenectomy is simultaneous, firstly, the splenic artery should be dissected and controlled to reduce the volume of spleen, which can decrease the haemorrhage in spleen dissection. The position of splenic artery is fixed, so it is not difficult to be handled. However, for spleen-preserving surgery, the key is the treatment of splenic vein. The texture of pancreas is crisp and has abundant blood supply, so the intraopertive hemostasis must be definite. The liner stapler is a nice choice for dissecting the splenic vessels and pancreas with excellent hemostatic effect of pancreatic stump.

In internal drainage of pancreatic cyst, anastomotic bleeding is common in the anastomosis of pancreatic cyst and intestinal wall. Therefore, after sealing, the anastomotic stoma should be examined carefully. Active bleeding can be stopped by absorbed suture.

6.4.2 Pancreatic Leakage

In SILS pancreatic procedure, stapler entering the abdomen via umbilical Trocar and being vertical to the direction of pancreas makes it suitable to dissect the pancreas. This is the advantage of SILS. But the vertical position to pancreas should be carefully kept to prevent the tearing of pancreas. And in internal drainage of pancreatic cyst, the residual incision of anastomosis must be closely sutured. Somatostation and a smooth drainage are necessary for pancreatic leakage.

6.4.3 Anastomotic Leakage

In SILS internal drainage of pancreatic cyst, if the formation of cyst is less than 6 weeks, the wall of pancreatic cyst is not mature. In addition, if the thickness of it is less than 0.5cm and inflammatory edema around pancreas is severe, the anastomotic leakage will be possible. The length of anastomotic stoma should be moderate and only a single bite should be enough.

6.4.4 Splenic Infarction

In SILS pancreatic spleen-preserving surgery, because of the limitation of surgical field vision and lacking of assistant help, the vessels of hilus lienis may be injured when dissecting the distal pancreas. In the procedure, the splenic vessels should be carefully dissected and protected to avoid blindly clamping the splenic vessels, which may induce ischemic splenic infarction.

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