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Case Report

Application of a Z-Shaped Umbilical Incision and a Saline-Cooled Radiofrequency Device to Single-Incision Laparoscopic Surgery for a Huge Liver Cyst: Report of a Case

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When compared with other diseases, few authors have reported on single-incision laparoscopic surgery (SILS) for liver cysts. We herein describe our experience with SILS for a huge liver cyst with the application of an umbilical Z-shaped incision using a gel port and a high-density monopolar saline-cooled radiofrequency device with a successful outcome. An 80-old-year woman was diagnosed with a huge liver cyst with abdominal pain. She underwent percutaneous drainage of the liver cyst and injection of both absolute ethanol and an antimicrobial agent into the liver cyst at the previous hospital. Because of re-expansion of the liver cyst and symptom recurrence, we performed SILS for the liver cyst. An umbilical Z-shaped incision was made for gel port placement. After aspiration of the cystic fluid and dissection of the thin cystic wall by laparoscopic coagulating shears, the thick cystic wall was divided using an endoscopic linear stapler to avoid bleeding and bile leakage. After wide fenestration, a high-density monopolar saline-cooled radiofrequency device was applied for the ablation of the remnant membrane of the cystic wall. All maneuvers could be performed only through the gel port. The patient was discharged 4 days after surgery and was satisfied with the cosmetic results. This case shows that the application of an umbilical Z-shaped incision using a gel port and a high-density monopolar saline-cooled radiofrequency device is useful for the accomplishment of SILS for a huge liver cyst.

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Since the laparoscopic procedure was introduced for the fenestration of a simple liver cyst in 1991,[1] laparoscopic surgery for symptomatic nonparasitic liver cysts has been recognized as a widely acceptable procedure to relieve symptoms.[2–5] In contrast, there are still few reports on single-incision laparoscopic surgery (SILS) for liver cysts.[6–10]

Ablation of the remnant membrane of the cystic wall is recognized as an important procedure for the prevention of recurrence.[2–5] In general, an argon beam coagulator is useful for such ablation, however, in laparoscopic surgery, intraoperative pulmonary embolism due to argon gas has been reported.[11,12]

We herein describe our experience with SILS for a huge liver cyst with the application of an umbilical Z-shaped incision using a gel port and a high-density monopolar saline-cooled radiofrequency device with a successful outcome.

Patient and Methods

An 80-year-old woman with a previous history of chronic hepatitis C infection after a cesarean section was diagnosed as having a huge liver cyst with abdominal pain. At the previous hospital, she underwent percutaneous drainage of the liver cyst and injection of both absolute ethanol and an antimicrobial agent into the liver cyst. Cytologic findings of the fluid in the liver cyst indicated no malignant cells. Approximately 1 month after treatment, the live cyst re-expanded and her complaints re-emerged; therefore, she was referred to our hospital for further investigation and treatment. Computed tomography with contrast enhancement showed a huge liver cyst, measuring 140 mm in diameter, in the right lobe of the liver without any tumors in the liver cyst (Fig. 1A and 1B) and a small stone in the gallbladder. Drip infusion cholangiographic computed tomography revealed that the Glissonean pedicles of the right anterior and posterior sectors ran around the cystic wall but did not connect to the liver cyst (Fig. 1C and 1D). We planned SILS for the liver cyst.

The surgical procedures were as follows. The patient was placed in the reverse Trendelenburg position with her legs open wide, and the operating surgeon and the assistant surgeon standing at the patient's leg and at the patient's left side, respectively. A Z-shaped skin incision was made at the umbilical region, and a gel port (GelPOINT Advanced Access Platforms, Applied Medical Resources Corp., Rancho Santa Margarita, CA) was placed through the umbilical incision (Fig. 2A). All instruments were inserted only through the gel port. After suction of the fluid in the liver cyst using a laparoscopic aspirator, the thin cystic wall was carefully dissected using laparoscopic coagulating shears (Fig. 2B). To avoid bleeding and bile leakage from the edge of the cystic wall after fenestration, the thick cystic wall was divided using an endoscopic linear stapler (Fig. 2C). After wide fenestration, we utilized a high-density monopolar saline-cooled radiofrequency device (TissueLink, Medtronic, Inc., Minneapolis, MN) for ablation of the remnant membrane of the cystic wall (Fig. 2D). After cholecystectomy and irrigation of the abdominal cavity, the specimens were removed through the umbilical incision. The umbilical incision was carefully closed without any drainage tubes. The amount of the fluid in the liver cyst, operative time, and intraoperative blood loss were 959 mL, 169 min, and 51 mL, respectively.

Macroscopic analysis of the resected cystic wall and the gallbladder showed no tumors. The gallbladder included 1 mixed stone. The histologic findings of the resected cystic wall and the gallbladder revealed no malignant disease. Her postoperative course was uneventful and she was discharged from our hospital 4 days after surgery. She was quite satisfied with the cosmetic result 1 month after surgery (Fig. 3A) and had no signs of recurrence of the liver cyst by follow-up computed tomography 1 year after surgery (Fig. 3B).

Discussion

Although laparoscopic fenestration has become a standard approach for the treatment of liver cysts,[1–5] there are still few reports regarding SILS for liver cysts,[6–10] when compared with other diseases, i.e., cholecystectomy,[13] appendectomy,[14] splenectomy,[15] and pancreatic resection.[16] To avoid the recurrence of a liver cyst after surgery, wide fenestration and ablation of the remnant membrane of the cystic wall are recognized as essential and important techniques.[2–5] To perform wide fenestration, dis-

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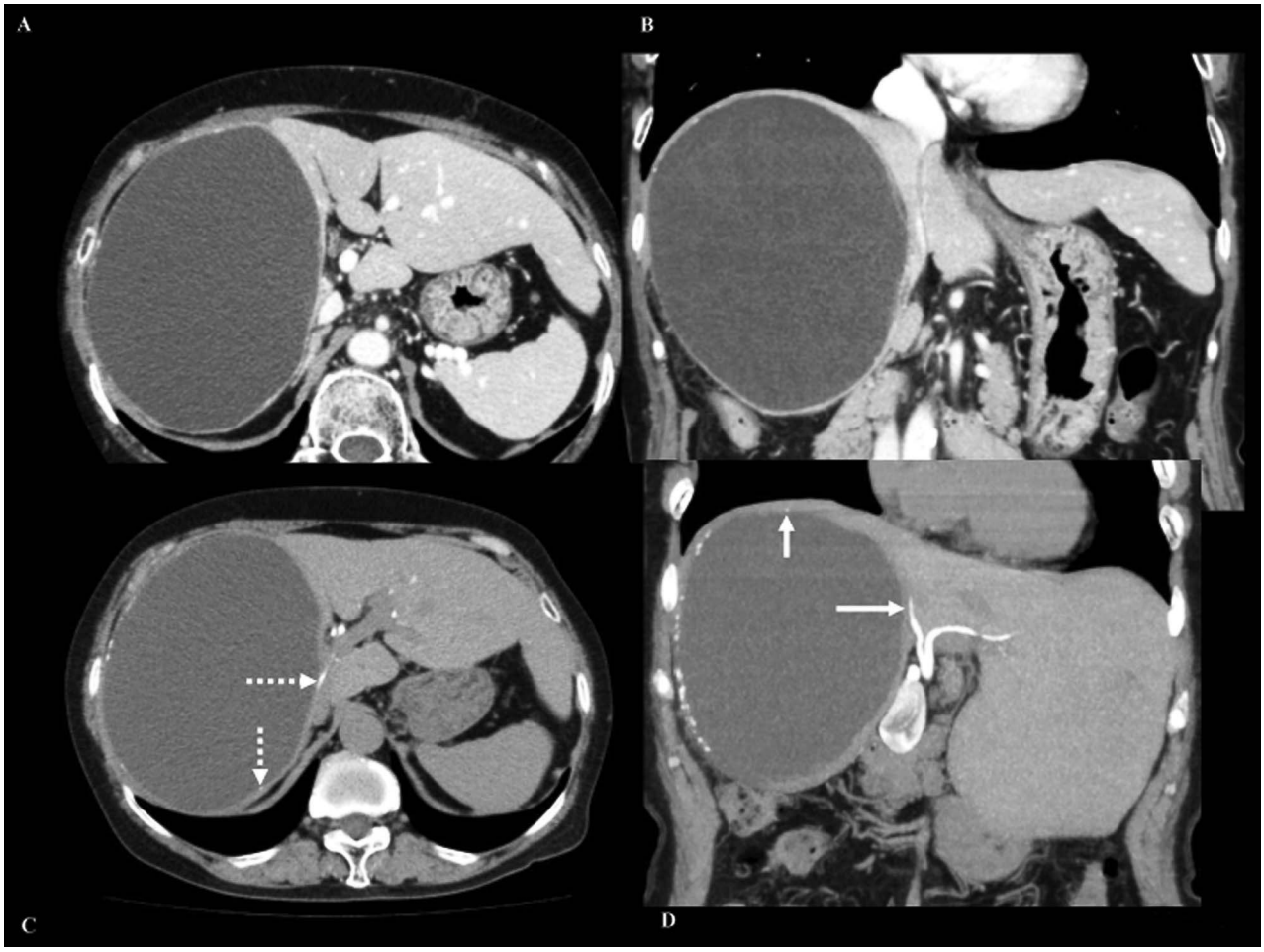

Fig. 1 Preoperative computed tomography. Computed tomography with contrast enhancement (A, axial view; B, coronal view) showed a huge liver cyst but no tumors in the liver cyst. Drip infusion cholangiographic computed tomography (C, axial view; D, coronal view) revealed that the Glissonean pedicles of the right anterior (solid arrow) and posterior (broken arrow) sectors ran around the cystic wall but did not connect to the liver cyst.

section of the thick part of the cystic wall is required but includes the potential risk of bile leakage after surgery. As a countermeasure against this complication, the application of a laparoscopic running suture of the thick margin of the cystic wall is widely accepted[2]; however, this suturing procedure is technically demanding in SILS. Compared to the suturing technique, the utilization of an endoscopic linear stapler to divide the thick part of the cystic wall is a safe and easy approach, but this technique requires a 12-mm port. To ensure the restriction of moving instruments, the usage of a 12-mm port is not favored in the SILS procedure. The application of a Z-shaped incision in the umbilical region can obtain a wide orifice in the abdominal cavity and allow the use of a gel port; therefore, the usage of a laparoscopic instrument requiring a 12-mm port can be facilitated, unlike in other SILS procedures. A previous report described that a zigzag incision in the umbilical region had clinical values resembling our procedures but required collaboration with plastic surgeon for keeping aesthetics after surgery.[17] Meanwhile, a Z-shaped incision is simple procedure without requiring any collaboration with a plastic surgeon.

As mentioned above, ablation of the remnant membrane of the cystic wall is also recognized as an important procedure for the prevention of recurrence.[2–5] In general, an argon beam coagulator is useful for ablation and the control of hemorrhage; however, in laparoscopic surgery, intraoperative pulmonary embolism due to argon gas has

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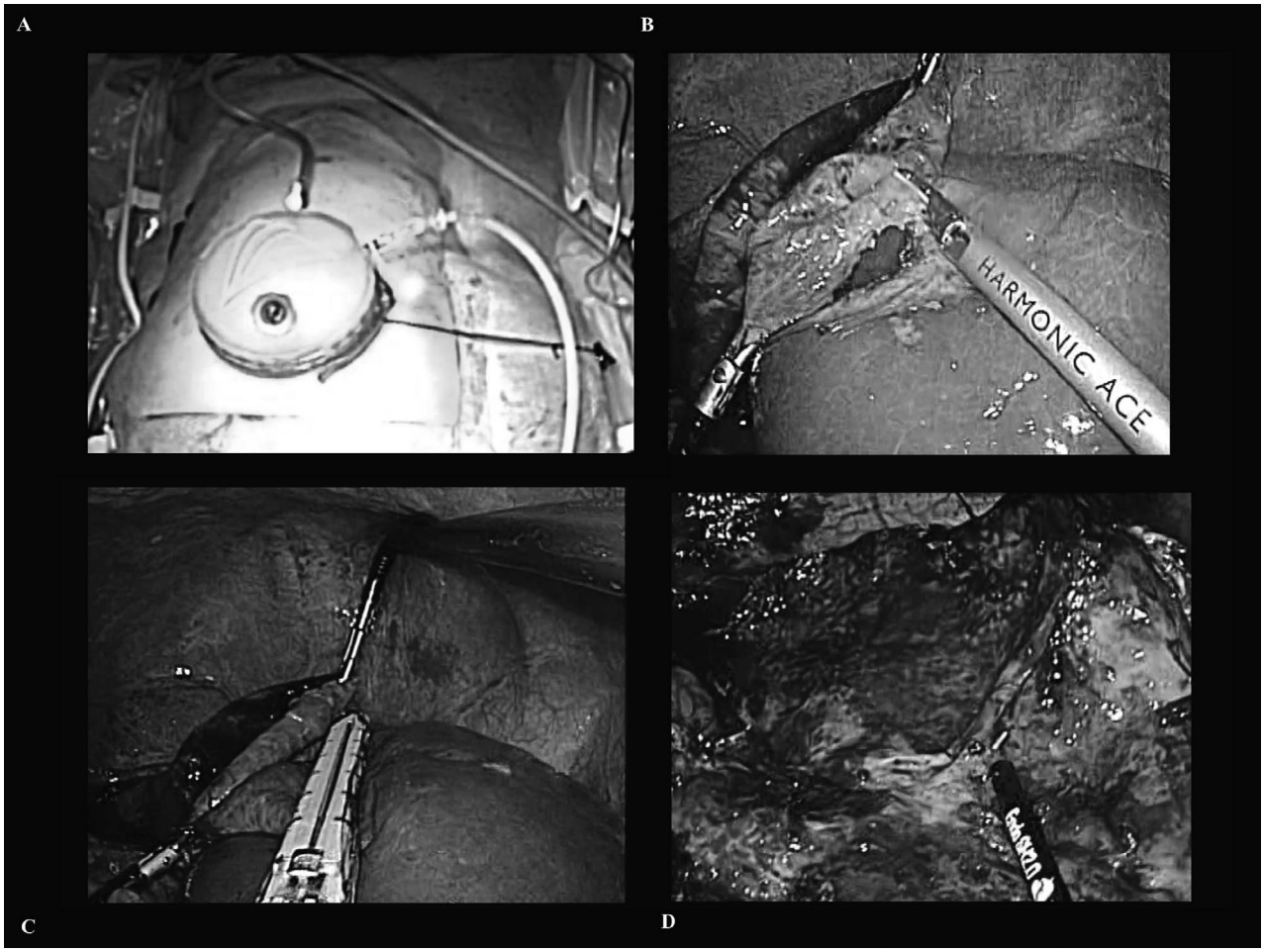

Fig. 2 Intraoperative findings. (A) A gel port was placed through the Z-shaped umbilical incision. (B) The thin part of the cystic wall was dissected by laparoscopic coagulating shears. (C) The thick part of the cystic wall was divided using an endoscopic linear stapler. (D) The remnant membrane of the cystic wall was ablated by a high-density monopolar saline-cooled radiofrequency device.

been reported.[11,12] To prevent this fatal complication, the utilization of a high-density monopolar saline-cooled radiofrequency device is widely accepted for precoagulation and control of hemorrhage in laparoscopic surgery.[18,19] In the present case, a high-density monopolar saline-cooled radiofrequency device was utilized to ablate the remnant membrane of the cystic wall, and we obtained a satisfactory outcome. These results indicate that the application of this device to ablate the remnant membrane of the cystic wall can be recognized as a safe and suitable procedure.

It is commonly believed that a surgical approach should be used only when symptoms associated with a liver cyst arise and gain clinical significance.[2–5] Whether an open or laparoscopic procedure, the surgical outcomes of a "single" liver cyst less frequently involve either the recurrence of symptoms or re-expansion of the cyst than do those of "multiple" liver cysts.[2–5] Additionally, SILS is deemed unable to obtain better surgical outcomes for "multiple" liver cysts when compared with other surgical approaches. Currently, SILS should be applied only in the treatment of a "single" liver cyst.

In conclusion, the application of a Z-shaped incision in the umbilical region using a gel port extends the indication criteria of SILS to patients with a huge liver cyst. In the laparoscopic ablation of the remnant membrane of the cystic wall, a high-density monopolar saline-cooled radiofrequency device can represent an alternative to an argon beam coagulator.

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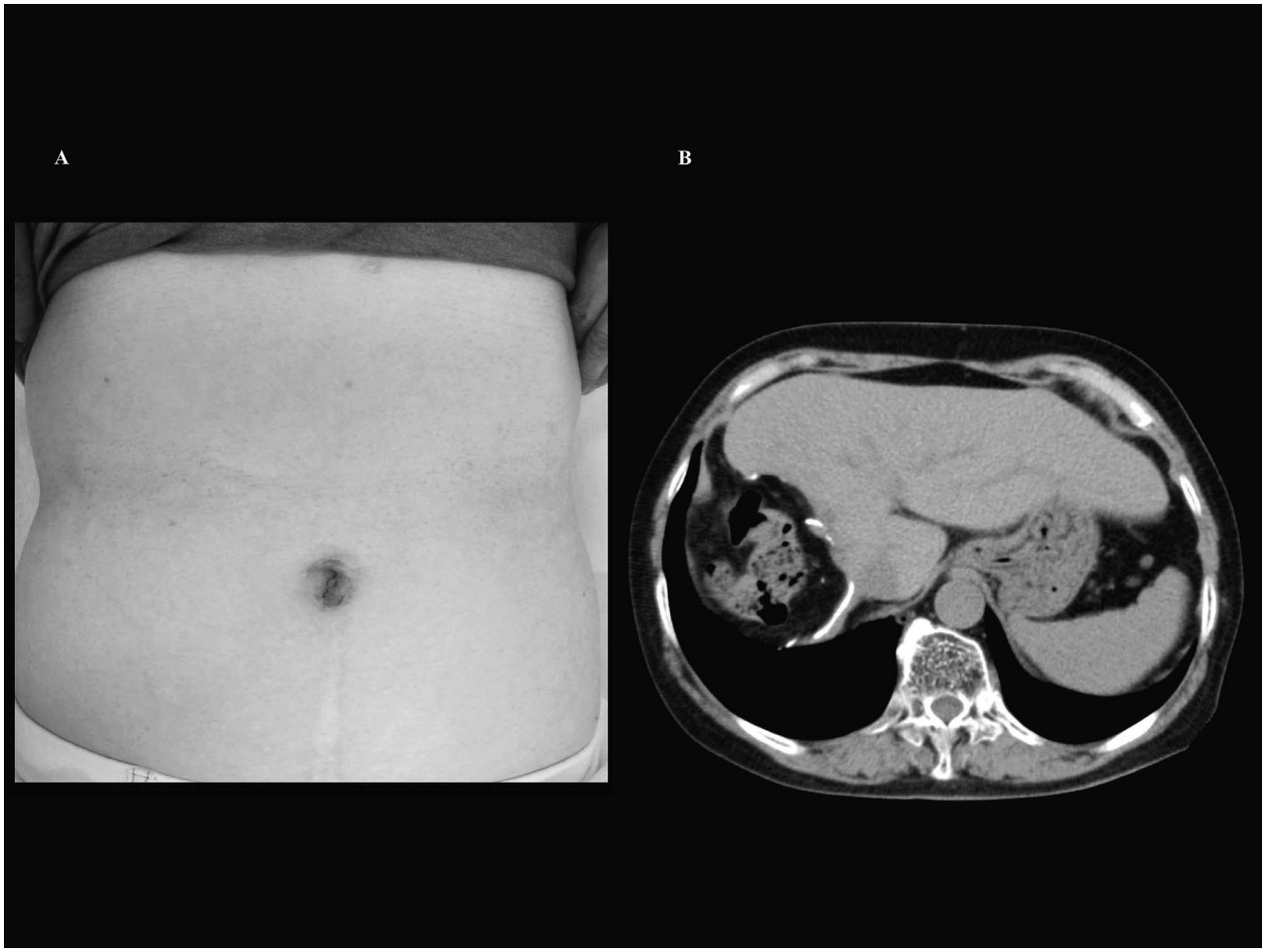

Fig. 3 Postoperative findings. (A) The Z-shaped umbilical incision was virtually scarless 1 month after surgery. (B) Computed tomography did not show any signs of recurrence of the liver cyst 1 year after surgery.

Acknowledgments

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References

1. Z'graggen K, Metzger A, Klaiber C. Symptomatic simple cysts of the liver: treatment by laparoscopic surgery. *Surg Endosc* 1991;**5**(4):224–225
2. Krahenbuhl L, Baer HU, Renzulli P, Z'graggen K, Frei E, Buchler MW. Laparoscopic management of nonparasitic symptom-producing solitary hepatic cysts. *J Am Coll Surg* 1996;**183**(5):493–498
3. Mazza OM, Fernandez DL, Pekilj J, Pfaffen G, Claria RS, Molmenti EP *et al*. Management of nonparasitic hepatic cysts. *J Am Coll Surg* 2009;**209**(6):733–739
4. Treckmann JW, Paul A, Sgourakis G, Heuer M, Wandelt M, Sotiropoulos GC. Surgical treatment of nonparasitic cysts of the liver: open versus laparoscopic treatment. *Am J Surg* 2010; **199**(6):776–781
5. Loehe F, Globke B, Marnoto R, Bruns CJ, Graeb C, Winter H *et al*. Long-term results after surgical treatment of nonparasitic hepatic cysts. *Am J Surg* 2010;**200**(1):23–31
6. Mantke R, Wicht S. Single-port liver cyst fenestration combined with single-port laparoscopic cholecystectomy using completely reusable instruments. *Surg Laparosc Endosc Percutan Tech* 2010;**20**(1):e28–e30
7. Sasaki K, Watanabe G, Matsuda M, Hashimoto M, Harano T. Original method of transumbilical single-incision laparoscopic deroofing for liver cyst. *J Hepatobiliary Pancreat Sci* 2010;**17**(5): 733–734
8. Kashiwagi H, Kumagai K, Nozue M. Single incision laparoscopic surgery for a life-threatening, cyst of liver. *Tokai J Exp Clin Med* 2011;**36**(1):13–16

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9. Gocho T, Misawa T, Suzuki F, Ito R, Shiba H, Futagawa Y *et al*. Single-incision laparoscopic surgery for giant hepatic cyst. *Asian J Endosc Surg* 2013;**6**(3):237–240
10. Chinnusamy P, Ahluwalia JS, Palanisamy S, Seshiyer RP. Single incision multi-trocar hepatic cyst excision with partial splenectomy. *J Minim Access Surg* 2013;**9**(2):91–94
11. Kono M, Yahagi N, Kitahara M, Fujiwara Y, Sha M, Ohmura A. Cardiac arrest associated with use of an argon beam coagulator during laparoscopic cholecystectomy. *Br J Anesth* 2001;**87**(4):644–646
12. Ikegami T, Shimada M, Imura S, Nakamura T, Kawahito S, Morie Y *et al*. Argon gas embolism in the application of laparoscopic microwave coagulation therapy. *J Hepatobiliary Pancreat Surg* 2009;**16**(3):394–398
13. Gangl O, Hofer W, Tomaselli F, Sautner T, Függer R. Single incision laparoscopic cholecystectomy (SILC) versus laparoscopic cholecystectomy (LC)-a matched pair analysis. *Langenbecks Arch Surg* 2011;**396**(6):819–824
14. Markar SR, Karthikesalingam A, Di Franco F, Harris AM. Systematic review and meta-analysis of single-incision versus conventional multiport appendectomy. *Br J Surg* 2013;**100**(13): 1709–1718
15. Fan Y, Wu SD, Kong J, Su Y, Tian Y, Yu H. Feasibility and safety of single-incision laparoscopic splenectomy: a systematic review. *J Surg Res* 2014;**186**(1):354–362
16. Misawa T, Ito R, Futagawa Y, Fujiwara Y, Kitamura H, Tsutsui N *et al*. Single-incision laparoscopic distal pancreatectomy with or without splenic preservation: how we do it. *Asian J Endosc Surg* 2012;**5**(4):195–199
17. Hachisuka T, Kinoshita T, Yamakawa T, Kurata H, Tsutsuyama M, Umeda S *et al*. Transumbilical laparoscopic surgery using GelPort through an umbilical zigzag skin incison. *Asian J Endosc Surg* 2012;**5**(1):50–52
18. Herrell SD, Levin BM. Laparoscopic partial nephrectomy: use of the TissueLink hemostatic dissection device. *J Endourol* 2005;**19**(4):446–469
19. Nissen NN, Grewal N, Lee J, Nawabi A, Korman J. Completely laparoscopic nonanatomic hepatic resection using saline-cooled cautery and hydrodissection. *Am Surg* 2007; **73**(10):987–990

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