Editorial

From venture to evidence in laparoscopic liver resection

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Laparoscopic procedures have rapidly spread to almost parts of surgery, resulting in the rapid recovery of patients and remaining the cosmetic small wound. With the development of laparoscopic instruments and surgical skills, the extent and complexity of laparoscopic surgery have increased recently.

Since the first laparoscopic wedge resection for the liver benign lesion was reported by Reich *et al.* in 1991 (1), its indication has been expanded to the liver malignant tumor with liver cirrhosis. LLR showed the low incidence of postoperative hepatic failure and ascites because of the reduced invasiveness of laparoscopy with the rapid recovery of patients and shorter hospital stay, less postoperative pain and early return to social activity with a low rate of operative complications (2-4).

Improved laparoscopic surgical techniques, detailed visualization of the resected liver parenchyma using a high-resolution flexible laparoscope and a laparoscopic cavitron ultrasonic surgical aspirator have allowed laparoscopic surgery to be a standard procedure in left lateral sectionectomy and minor liver resection. The extent of resection has also grown over time. Major liver resection, such as right or left hemihepatectomy and laparoscopic living donor hepatectomy has been performed in some centers nowadays (2).

However, the advancements of laparoscopic procedures in hepatectomy have spread slowly given the inherent risks for massive bleeding, the technical difficulty associated with the complexity of liver anatomy and a lack of concrete evidence in most of the countries.

A first International Consensus Conference on laparoscopic liver resection (LLR) was convened in Louisville, Kentucky, in 2008. Since then, the number of LLR reported has increased steadily worldwide and the greatest diffusion of LLR occurred in East Asia, North America, and Europe (5-7). The experts discussed achievements and recommendations for this approach. This consensus statement defined the current international position on laparoscopic liver surgery as "a safe and effective approach" for the management of surgical liver disease in the hands of trained surgeons with experience in hepatobiliary and laparoscopic surgery (6).

In the 2nd international Consensus Conference on LLR held in Morioka, in 2014, the experts concluded that patients who underwent major hepatectomy showed shorter hospital stay and less morbidity but, there is still risk associated with novelty, not bet become standard practice (8).

Recent reports have described the feasibility, safety, and adequacy of LLR, almost of them are systematic reviews or meta-analyses based on observational data (9). In fact, ethical problems will be followed to perform the randomized controlled study of laparoscopic hepatectomy as well as difficulty in recruiting patients. To overcome these practical issues, studies using propensity score matching have been reported (5,10-14).

Cheung *et al.* reported the long-term outcomes comparing pure laparoscopic hepatectomy and open hepatectomy for hepatocellular carcinoma in 110 patients with liver cirrhosis in the *Annals of Surgery*. The authors showed that the 1, 3, and 5-year overall survival rates were 98.9%, 89.8%, and 83.7%, respectively, in the laparoscopic group, and 94%, 79.3%, and 67.4%, respectively, in the

open group (P=0.033). The 1, 3, and 5-year disease-free survival rates were 87.7%, 65.8%, and 52.2%, respectively, in the laparoscopic group, and 75.2%, 56.3%, and 47.9%, respectively, in the open group (P=0.141). They concluded that pure laparoscopic hepatectomy for hepatocellular carcinoma can be carried out safely with favorable short-term and long-term outcomes even in cirrhotic patients (13).

The beauty of this result encourages the surgeons to perform laparoscopic hepatectomy, which will be beneficial for patients with liver cirrhosis.

However, major hepatectomy occupied for only 10%, minor hepatectomy was for 90% in this study. Laparoscopic minor hepatectomy for a patient with a small single lesion can show the good outcome, which lesion is compatible with stage I or II in 7th AJCC like this study. Additionally, the location of tumors and surgical extent is closely related with operation time and estimated blood loss, those factors or difficulty positions were not included in propensity score matching. Even though the well-designed study, left lateral sectionectomy was included in 30% of the laparoscopic group compared to 7.6% of the open group. Imbalance of surgical type might affect the outcomes.

Though the various locations might have decreased the total number of patients in matching groups, each location could be replaced with locational groups like the same section or favorable versus unfavorable location (anterolateral versus posterosuperior location). The other propensity score matching studies used this method to overcome the small number of enrolled patients.

Laparoscopic hepatectomy is generally known to make an enough surgical margin, but a report about local recurrence at the resection margin is rare. When performing laparoscopic hepatectomy in a patient with cirrhosis, making a secure surgical margin is difficult because of an invisible main mass surrounding cirrhotic nodules even in a real-time ultrasonography examination in the non-anatomical hepatectomy. In this study, about 50% patients experienced recurrence, information about local recurrence, which related to resection margin, might have given readers a clue to decided surgical option. Various surgical type and extent with a small number of the cases make difficult to establish a powerful evidence in LLR for patients with liver cirrhosis.

Despite these limitations, this report reinforced the safety and feasibility of LLR with a less biased study design. Several studies comparing laparoscopic hepatectomy with open hepatectomy in patients with liver cirrhosis, showed the comparative surgical and oncological outcomes. Most of the hepatectomy was minor liver resection with insufficient evidence in those studies. Moreover, those enrolled surgical cases were those before overcoming a learning curve for LLR. On the other hand, Cheung *et al.* showed the long-term follow-up of patients' results with a prospective collected data from the beginner to the expert in LLR. As it is difficult to spread laparoscopic hepatectomy universally without good evidence in surgical procedures, this paper will be a guide based on the data, not on the venture.

In summary, some pioneers performed a lot of laparoscopic major and complicated hepatectomy. A few experts are trying to set up the laparoscopic living donor right hepatectomy in the world. In clinical practice, LLR and laparoscopic major hepatectomy are performed more than expected and reported. However, those are in the venture stage. Even several difficulties to proceed randomized studies about LLR, laparoscopic hepatectomy should be based on the concrete evidence using well-designed studies. Furthermore, to make an evidence-based procedure over venture based on a small number of surgical cases, multi-centers prospective data collection is necessary.

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