



Use of laparoscopic hepatectomy by recognizing disadvantages and difficulty level of operative procedure

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Comment on: Deng ZC, Jiang WZ, Tang XD, *et al.* Laparoscopic hepatectomy versus open hepatectomy for hepatocellular carcinoma in 157 patients: A case controlled study with propensity score matching at two Chinese centres. *Int J Surg* 2018;56:203-7.

Received: 27 August 2018; Accepted: 10 September 2018; Published: 11 September 2018.

doi: 10.21037/ls.2018.09.01

View this article at: <http://dx.doi.org/10.21037/ls.2018.09.01>

In a recent issue of *International Journal of Surgery*, Deng *et al.* published the results of laparoscopic hepatectomy (LH) compared with open hepatectomy (OH) for patients with hepatocellular carcinoma (1). The authors analyzed 157 patients undergoing LH and 157 patients undergoing OH using propensity score matching. The operation time was significantly shorter and the amount of estimated blood loss was significantly less in the LH group than in the OH group. The LH group was associated with a smaller rate of postoperative morbidity than the OH group. However, it should be noted that the type of resection was different between the groups. The proportions of right hepatectomy, extended left hepatectomy, and right anterior sectionectomy were higher in the OH group than in the LH group. In contrast, left lateral sectionectomy and left hepatectomy were more frequently performed in the LH group than in the OH group. This difference between the two groups may have influenced the surgical and postoperative outcomes. Long-term outcomes were assessed on the basis of long median follow-up period, demonstrating the comparative overall and disease-free survivals between the groups.

Adhering to the authors' findings, it is important to use the laparoscopic approach depending on the difficulty of the operative procedure and the technical expertise of surgeons/teams. We have recently reported a new classification of LH on the basis of the operation time, amount of blood loss, and conversion rate (2). This classification stratifies the difficulty of 11 different LH procedures into the following three grades: grade I (low level), grade II (intermediate level), and grade III (high level) (*Table 1*). The operation time, amount

of blood loss, and conversion rate of grades I, II, and III in terms of median [range] were as follows: operation time, 135 [25–480] *vs.* 200 [40–420] *vs.* 250 [90–600] min, $P < 0.001$; blood loss, 10 [0–1,000] *vs.* 100 [0–1,500] *vs.* 250 [0–4,500] mL, $P < 0.001$; and conversion rate, 0.5% *vs.* 2.7% *vs.* 8.6%, $P < 0.001$. In this three-level classification, grade I procedures should not be regarded as being “easy”, but are less complicated than the other LHs because the surgical outcomes were found to be better than those observed in grade II and III procedures. Thus, grade I procedures can be suitable for liver surgeons at the beginning level of LH. This classification is expected to serve as a guide to determine whether the laparoscopic approach can be used depending on the surgeons' technical expertise. Although the classification was based on intraoperative outcomes, the results of the classification showed that morbidity rates were associated with a significant stepwise increase in grades from I to III: morbidity rate, 8.4% *vs.* 17.3% *vs.* 45.7%, $P < 0.001$, and major complication rate (the Clavien-Dindo classification grade \geq III), 1.1% *vs.* 4.0% *vs.* 20.4%, $P < 0.001$. The major complication and mortality rates were as low as 0% for grade I and II procedures, implying that grade I/II LHs are least likely to be associated with severe postoperative complications and are less complicated operations than grade III LHs. Grade III procedures should be performed only by experts because of high major complication rates. This classification can be useful for indicating the appropriate LH depending on surgeons' expertise and ensuring the safety of patients undergoing LH.

Table 1 New three level classification for laparoscopic liver resection

Grade	Three difficulty levels
Grade I	Low level
	❖ Wedge resection (AL segment [†])
	❖ Wedge resection (PS segment [§])
Grade II	Intermediate level
	❖ Segmentectomy (AL segment [†])
	❖ Left hepatectomy
Grade III	High level
	❖ Segmentectomy (PS segment [§])
	❖ Right hepatectomy
	❖ Extended right hepatectomy
	❖ Right posterior sectionectomy
	❖ Central hepatectomy
❖ Extended left hepatectomy	

Left hepatectomy (resection of segments 2, 3, and 4); right posterior sectionectomy (resection of segments 6 and 7); right hepatectomy (resection of segments 5, 6, 7, and 8); extended right hepatectomy (resection of segments 4, 5, 6, 7, and 8); central hepatectomy (resection of segments 5 and 8, or segments 4, 5, and 8); extended left hepatectomy (resection of segments 1, 2, 3, 4, 5, and 8). [†], Couinaud's segments 2, 3, 4b, 5, and 6; [§], Couinaud's segments 1, 4a, 7, and 8. AL, anterolateral; PS, posterolateral.

The advantages of using the laparoscopic approach include a magnified view (3,4) and hemostatic effect caused by pneumoperitoneum (5). The authors showed that LH group was associated with lower amount of estimated blood loss than the OH group. Conversely, the disadvantages of LH are the lacks of a complete hepatic view and tactile feedback, which may mislead surgeons toward near misses or fatal intraoperative complications (6). The lack of a complete hepatic view may hinder surgeons from noticing bleeding that occurs outside the surgical field and identifying the right or left hepatic vessels. The lack of tactile feedback may hinder surgeons from identifying tumors and securing the surgical margin because surgeons generally use their hands and fingers to feel tumor elasticity and to hold the liver during OH. Such manual palpation and tactile feedback are helpful in identifying tumors that

are not exposed on the liver surface and in tailoring the transection line. To compensate for these disadvantages, previous reports have demonstrated the usefulness of new intraoperative modalities, including contrast-enhanced ultrasonography (7), real-time tissue elastography (8,9), and fluorescence imaging (10-14). Contrast-enhanced ultrasonography and real-time tissue elastography enhances visualization of iso-echoic lesions in B-mode images (7,8). Fluorescence imaging using indocyanine green as a fluorophore has been employed in hepatobiliary surgeries (15-18). As intraoperative laparoscopic ultrasonography is inflexible compared with open devices, indocyanine green-fluorescence imaging is helpful in visualizing liver lesions as fluorescence on the liver surface (10,12). Fluorescence imaging also helps in visualizing the bifurcation of the bile ducts, differentiating the portal vein from the bile duct, and identifying the tiny bile duct during hepatic parenchymal transection (11).

Finally, the type of LH procedure to be used should not be decided merely on the basis of technical simplicity. LH has been increasingly used in clinical practice, and surgeons may select technically simpler left lateral sectionectomy instead of parenchyma-sparing liver resection including anatomic resection of segment II or segment III. In fact, the first and second International Consensus Conferences on Laparoscopic Liver Resection recommended that laparoscopic left lateral sectionectomy is associated with lower level of complexity and should be considered as a standard procedure (19,20). Similar to the results of authors' study, the survey results from the Consensus Conference showed that the rate of laparoscopic approach was higher for left lateral sectionectomy than for other liver resection procedures (21). Compared with left lateral sectionectomy, anatomic resection of segment II/III was reportedly associated with better postoperative liver volume recovery than was left lateral sectionectomy (22). The long-term outcomes after anatomic resection of segment II/III were comparable to those after left lateral sectionectomy. As such, the parenchyma-sparing strategy can be useful for resection of hepatocellular carcinoma located at left lateral section and can facilitate repeated liver resection (23).

In conclusion, we congratulate Deng *et al.* for comparing the outcomes of LH and OH using propensity score matching and showing better short-term outcomes and comparable long-term outcomes in carefully selected patients. LH is increasingly used in clinical practice because of its advantages: magnified view and hemostatic effect caused by pneumoperitoneum (20). However,

we must consider the disadvantages of LH, lack of a complete hepatic view and tactile feedback, and then use a laparoscopic approach considering the difficulty of the LH procedure and the surgeons' technical expertise. As the authors' mentioned in their study, the laparoscopic approach should be carefully selected to ensure the safety of patients undergoing LH.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Laparoscopic Surgery*. The article did not undergo external peer review.

Conflicts of Interest: The author has completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ls.2018.09.01>). The author has no conflicts of interest to declare.

Ethical Statement: The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/ls.2018.09.01

Cite this article as: Kawaguchi Y. Use of laparoscopic hepatectomy by recognizing disadvantages and difficulty level of operative procedure. *Laparosc Surg* 2018;2:42.