

## Laparoscopic liver resection: Toward a truly minimally invasive approach

Satoshi Ogiso, Etsuro Hatano, Takeo Nomi, Shinji Uemoto

Satoshi Ogiso, Etsuro Hatano, Shinji Uemoto, Division of Hepato-Biliary-Pancreatic Surgery and Transplantation, Department of Surgery, Graduate School of Medicine, Kyoto University, Kyoto 606-8507, Japan

Takeo Nomi, Department of Surgery, Nara Medical University, Nara 634-8522, Japan

**Author contributions:** Ogiso S, Nomi T, Hatano E and Uemoto S designed research; Ogiso S, Nomi T and Hatano E drafted the article; Ogiso S, Nomi T and Hatano E analyzed data; Nomi T, Hatano E and Uemoto S made critical revision; Ogiso S, Nomi T, Hatano E and Uemoto S gave final approval to the article.

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**Correspondence to:** Satoshi Ogiso, MD, Division of Hepato-Biliary-Pancreatic Surgery and Transplantation, Department of Surgery, Graduate School of Medicine, Kyoto University, 54 Shogo-in Kawahara-cho, Sakyo-ku, Kyoto 606-8507, Japan. [oggy\\_so@ybb.ne.jp](mailto:oggy_so@ybb.ne.jp)

Telephone: +81-75-7513242

Fax: +81-75-7514263

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### Abstract

In the surgical treatment of hepatocellular carcinoma and colorectal liver metastasis, it is important to preserve sufficient liver volume after resection in order to avoid post-hepatectomy liver sufficiency and to increase the feasibility of repeated hepatectomy

in case of intrahepatic recurrence. Parenchyma-sparing approach, which minimizes the extent of resection while obtaining sufficient surgical margins, has been developed in open hepatectomy. Although this approach can possibly have positive impacts on morbidity and mortality, it is not popular in laparoscopic approach because parenchyma-sparing resection is technically demanding especially by laparoscopy due to its intricate curved transection planes. "Small incision, big resection" is the words to caution laparoscopic surgeons against an easygoing trend to seek for a superficial minimal-invasiveness rather than substantial patient-benefits. Minimal parenchyma excision is often more important than minimal incision. Recently, several reports have shown that technical evolution and accumulation of experience allow surgeons to overcome the hurdle in laparoscopic parenchyma-sparing resection of difficult-to-access liver lesions in posterosuperior segments, paracaval portion, and central liver. Laparoscopic surgeons should now seek for the possibility of laparoscopic parenchyma-sparing hepatectomy as open approach can, which we believe is beneficial for patients rather than just a small incision and lead laparoscopic hepatectomy toward a truly minimally-invasive approach.

**Key words:** Laparoscopy; Liver resection; Hepatectomy; Minimally-invasive; Parenchyma-sparing; Laparoscopic surgery; Hepatocellular carcinoma; Liver metastasis; Liver lesion; Colorectal carcinoma

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**Core tip:** In the surgical treatment of hepatocellular carcinoma and colorectal liver metastasis, it is important to preserve sufficient liver volume after resection in order to avoid post-hepatectomy liver sufficiency and to increase the feasibility of repeated hepatectomy in case of intrahepatic recurrence. Parenchyma-sparing hepatectomy has been developed for the best remnant liver function as well as sufficient surgical margins and

may have positive impacts on morbidity and mortality. Surgeons should overcome the technical difficulty and seek for the possibility of laparoscopic parenchyma-sparing hepatectomy, which will lead laparoscopic hepatectomy toward a truly minimally-invasive and beneficial approach.

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## TOWARD A TRULY MINIMALLY- INVASIVE LIVER RESECTION

I remember the words, "small incision, big resection", in the keynote lecture by Professor Henri Bismuth at the European Association for Endoscopic Surgery meeting in 2011, which cautioned laparoscopic surgeons against an easygoing trend to seek for a superficial minimal-invasiveness of hepatectomy rather than substantial patient-benefits.

Laparoscopic hepatectomy has become popular<sup>[1-4]</sup> and is the standard of care<sup>[3]</sup> to treat lesions in the left lateral section<sup>[5]</sup> or peripheral anteroinferior segments<sup>[6,7]</sup> with better short-term outcomes compared to open hepatectomy, including less blood loss, less pain, and earlier recovery<sup>[8,9]</sup>. In addition, increasing number of laparoscopic major hepatectomy is actively performed in specialized centers all over the world<sup>[2,10]</sup>, based on the recognition that such benefits may confirm the superiority of laparoscopic hepatectomy as a minimally-invasive surgical treatment compared to open hepatectomy. However, now is the time to reconsider if laparoscopy is truly minimally-invasive and advantageous for patients. Hepatectomy is different from other visceral surgery with regard to the importance of postoperative remnant organ function. Post-hepatectomy liver sufficiency is a life-threatening complication, mainly observed in hepatocellular carcinoma (HCC) patients with cirrhosis or colorectal metastases (CLM) patients after prolonged chemotherapy. Even after successful hepatectomy, both HCC and CLM patients may develop intrahepatic recurrence and then the possibility of repeated hepatectomy depends on the liver functional reserve. As Professor Bismuth cautioned, "big resection with small incision" should not be beneficial for patients compared to "small resection with big incision".

In seeking for both sufficient surgical margins and the best remnant liver function, parenchyma-sparing hepatectomy, including mono-segmentectomy<sup>[11]</sup> and combination of minor resections<sup>[12]</sup>, has been developed in open hepatectomy. On the other hand, parenchyma-sparing approach is not popular in

laparoscopic hepatectomy. This is because laparoscopy has a significant limitation of forceps manipulation so that making intricate curved transection planes for parenchyma-sparing hepatectomy is much more demanding in laparoscopic approach than in open approach. In our opinion, major hepatectomy with a single and straight transection plane, such as right and left hepatectomy, is easier and more suitable for laparoscopy, compared to anatomical or non-anatomical minor resection. For this reason, large resection, which excises non-tumorous parenchyma more than required to obtain sufficient surgical margins, is often performed by laparoscopy for small-to-intermediate-sized lesions in difficult-to-access areas. Recently, several reports have shown that technical evolution and accumulation of experience allow surgeons to overcome the hurdle in laparoscopic parenchyma-sparing resection of difficult-to-access liver lesions<sup>[13]</sup> in posterosuperior segments<sup>[14,15]</sup>, paracaval portion<sup>[16]</sup>, and central liver<sup>[17]</sup>. We believe laparoscopic surgeons should now reconsider the importance of parenchyma-sparing hepatectomy and try to minimize the extent of resection by laparoscopy as open approach can. "Small incision, minimum resection required for oncologic principles" should lead laparoscopic hepatectomy toward a truly minimally-invasive and beneficial approach.

## REFERENCES

- 1 **Buell JF**, Cherqui D, Geller DA, O'Rourke N, Iannitti D, Dagher I, Koffron AJ, Thomas M, Gayet B, Han HS, Wakabayashi G, Belli G, Kaneko H, Ker CG, Scatton O, Laurent A, Abdalla EK, Chaudhury P, Dutson E, Gamblin C, D'Angelica M, Nagorney D, Testa G, Labow D, Manas D, Poon RT, Nelson H, Martin R, Clary B, Pinson WC, Martinie J, Vauthey JN, Goldstein R, Roayaie S, Barlet D, Espot J, Abecassis M, Rees M, Fong Y, McMasters KM, Broelsch C, Busuttil R, Belghiti J, Strasberg S, Chari RS. The international position on laparoscopic liver surgery: The Louisville Statement, 2008. *Ann Surg* 2009; **250**: 825-830 [PMID: 19916210 DOI: 10.1097/SLA.0b013e3181b3b2d8]
- 2 **Dagher I**, Gayet B, Tzanis D, Tranchart H, Fuks D, Soubrane O, Han HS, Kim KH, Cherqui D, O'Rourke N, Troisi RL, Aldrighetti L, Bjorn E, Abu Hilal M, Belli G, Kaneko H, Jarnagin WR, Lin C, Pekolj J, Buell JF, Wakabayashi G. International experience for laparoscopic major liver resection. *J Hepatobiliary Pancreat Sci* 2014; **21**: 732-736 [PMID: 25098667 DOI: 10.1002/jhbp.140]
- 3 **Hibi T**, Cherqui D, Geller DA, Itano O, Kitagawa Y, Wakabayashi G. International Survey on Technical Aspects of Laparoscopic Liver Resection: a web-based study on the global diffusion of laparoscopic liver surgery prior to the 2nd International Consensus Conference on Laparoscopic Liver Resection in Iwate, Japan. *J Hepatobiliary Pancreat Sci* 2014; **21**: 737-744 [PMID: 25088825 DOI: 10.1002/jhbp.141]
- 4 **Nguyen KT**, Gamblin TC, Geller DA. World review of laparoscopic liver resection-2,804 patients. *Ann Surg* 2009; **250**: 831-841 [PMID: 19801936 DOI: 10.1097/SLA.0b013e3181b0c4df]
- 5 **Chang S**, Laurent A, Tayar C, Karoui M, Cherqui D. Laparoscopy as a routine approach for left lateral sectionectomy. *Br J Surg* 2007; **94**: 58-63 [PMID: 17054316 DOI: 10.1002/bjs.5562]
- 6 **Cho JY**, Han HS, Yoon YS, Shin SH. Experiences of laparoscopic liver resection including lesions in the posterosuperior segments of the liver. *Surg Endosc* 2008; **22**: 2344-2349 [PMID: 18528623 DOI: 10.1007/s00464-008-9966-0]

- 7 **Cho JY**, Han HS, Yoon YS, Shin SH. Feasibility of laparoscopic liver resection for tumors located in the posterosuperior segments of the liver, with a special reference to overcoming current limitations on tumor location. *Surgery* 2008; **144**: 32-38 [PMID: 18571582 DOI: 10.1016/j.surg.2008.03.020]
- 8 **Yin Z**, Fan X, Ye H, Yin D, Wang J. Short- and long-term outcomes after laparoscopic and open hepatectomy for hepatocellular carcinoma: a global systematic review and meta-analysis. *Ann Surg Oncol* 2013; **20**: 1203-1215 [PMID: 23099728 DOI: 10.1245/s10434-012-2705-8]
- 9 **Schiffman SC**, Kim KH, Tsung A, Marsh JW, Geller DA. Laparoscopic versus open liver resection for metastatic colorectal cancer: A metaanalysis of 610 patients. *Surgery* 2015; **157**: 211-222 [PMID: 25282529 DOI: 10.1016/j.surg.2014.08.036]
- 10 **Nomi T**, Fuks D, Kawaguchi Y, Mal F, Nakajima Y, Gayet B. Laparoscopic major hepatectomy for colorectal liver metastases in elderly patients: a single-center, case-matched study. *Surg Endosc* 2014; Epub ahead of print [PMID: 25149638 DOI: 10.1007/s00464-014-3806-1]
- 11 **Makuuchi M**, Hashikura Y, Kawasaki S, Tan D, Kosuge T, Takayama T. Personal experience of right anterior segmentectomy (segments V and VIII) for hepatic malignancies. *Surgery* 1993; **114**: 52-58 [PMID: 8356527]
- 12 **Torzilli G**, Procopio F, Botea F, Marconi M, Del Fabbro D, Donadon M, Palmisano A, Spinelli A, Montorsi M. One-stage ultrasonographically guided hepatectomy for multiple bilobar colorectal metastases: a feasible and effective alternative to the 2-stage approach. *Surgery* 2009; **146**: 60-71 [PMID: 19541011 DOI: 10.1016/j.surg.2009.02.017]
- 13 **Ishizawa T**, Gumbs AA, Kokudo N, Gayet B. Laparoscopic segmentectomy of the liver: from segment I to VIII. *Ann Surg* 2012; **256**: 959-964 [PMID: 22968066 DOI: 10.1097/SLA.0b013-e31825ffed3]
- 14 **Gumbs AA**, Gayet B. Video: the lateral laparoscopic approach to lesions in the posterior segments. *J Gastrointest Surg* 2008; **12**: 1154 [PMID: 18193325 DOI: 10.1007/s11605-007-0455-x]
- 15 **Ogiso S**, Conrad C, Araki K, Nomi T, Anil Z, Gayet B. Laparoscopic Transabdominal with Transdiaphragmatic Access Improves Resection of Difficult Posterosuperior Liver Lesions. *Ann Surg* 2014; In press
- 16 **Yoon YS**, Han HS, Cho JY, Kim JH, Kwon Y. Laparoscopic liver resection for centrally located tumors close to the hilum, major hepatic veins, or inferior vena cava. *Surgery* 2013; **153**: 502-509 [PMID: 23257080 DOI: 10.1016/j.surg.2012.10.004]
- 17 **Conrad C**, Ogiso S, Inoue Y, Shivathirthan N, Gayet B. Laparoscopic parenchymal-sparing liver resection of lesions in the central segments: feasible, safe, and effective. *Surg Endosc* 2014; Epub ahead of print [PMID: 25391984 DOI: 10.1007/s00464-014-3924-9]

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