

Highlights of the Third Expert Forum of Asia-Pacific Laparoscopic Hepatectomy; Endoscopic and Laparoscopic Surgeons of Asia (ELSA) Visionary Summit 2017

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The application of laparoscopy for liver surgery is rapidly increasing and the past few years have demonstrated a shift in paradigm with a trend towards more extended and complex resections. The development of instruments and technical refinements with the effective use of magnified caudal laparoscopic views have contributed to the ability to overcome the limitation of laparoscopic liver resection. The Endoscopic and Laparoscopic Surgeons of Asia (ELSA) Visionary Summit 2017 and the 3rd Expert Forum of Asia-Pacific Laparoscopic Hepatectomy organized hepatobiliary pancreatic sessions in order to exchange surgical tips and tricks and discuss the current status and future perspectives of laparoscopic hepatectomy. This report summarizes the oral presentations given at the 3rd Expert Forum of Asia-Pacific Laparoscopic Hepatectomy. ([Ann Hepatobiliary Pancreat Surg 2018;22:1-10](#))

Key Words: Laparoscopy; Hepatectomy; Hepatocellular carcinoma; Living donor

INTRODUCTION

The Endoscopic and Laparoscopic Surgeons of Asia (ELSA) Visionary Summit 2017 was held at the Asan Medical Center in Seoul, Korea, from February 27, 2017 to February 28, 2017. Over 520 participants from 33 countries attended this meeting, and 217 presentations (88 invited lectures, 129 poster presentations) were given during various scientific sessions. More importantly, the 3rd Expert Forum of Asia-Pacific Laparoscopic Hepatectomy was held simultaneously during the hepatobiliary pancreatic sessions. The aim of this meeting was to exchange surgical tips and tricks and discuss the current status and future perspectives of laparoscopic hepatectomy. In this report, the major content of the presentations based on the oral presentations given at the 3rd Expert Forum of Asia-Pacific Laparoscopic Hepatectomy is provided.

SESSION FOR THE OPERATORS ON STARTING LAPAROSCOPIC LIVER SURGERY (THE INITIAL SETTINGS AND CASE SELECTION TIPS)

How to start a laparoscopic major liver surgery

Albert Chan (The University of Hong Kong, Hong Kong) demonstrated how to start laparoscopic major liver surgery. First, knowledge of port positions and placements, hemostasis and parenchymal transection techniques are the core elements needed to undertake a successful laparoscopic major liver resection. In order to become fully trained to perform laparoscopic major liver resections, one requires sufficient prior experience with performing open major hepatectomy in order to gain adequate anatomical knowledge of the caudal-cranial relationship between the liver and the inferior vena cava. A

reverse lithotomy position, pneumoperitoneum pressure maintained at 14 mmHg, and fluid restriction contribute to maintaining a low venous pressure that, in turn, facilitates parenchymal transection. The Laparoscopic Cavitron Ultrasonic Surgical Aspirator (CUSA) is the recommended choice of device for transection since it allows clear exposure for fine tissue transection. The intraparenchymal encirclement and division of the ipsilateral bile duct helps to widen the space between the two transection surfaces. Finally, full isolation and encirclement of the ipsilateral major hepatic vein is mandatory for secure purchase by a vascular stapler before its division. He concluded that the skills for laparoscopic major liver resection are more likely to become widely disseminated if the surgical steps in open hepatectomy can be readily reproduced in laparoscopic settings.

Laparoscopic hepato–biliary–pancreatic surgery through a single incision

Young Kyoung You (The Catholic University, Seoul, Korea) described that he had accumulated the experience of single-port laparoscopic surgery in a large number of cases of appendectomy and cholecystectomy. His inclusion criteria for single-port laparoscopic liver resection (SP-LLR) were not different from those for open surgery. He usually excluded huge tumors and lesions in segment 7 or 8. He also gave tips on SP-LLR which included: using a flexible scope, avoiding underlying cirrhotic liver, estimating the instrument length preoperatively, and using gravity traction with the left lateral position in right-side liver surgery. He concluded that the results compared favorably with those of conventional laparoscopic surgery and open surgery, in spite of the demanding nature of the procedure and the requirement for better instrumentation for SP-LLR.¹

How to start robotic liver resection?

Robotic liver resection (RLR) offers potential advantages such as three-dimensional vision, consistency, flexibility, and elastic tissue manipulation compared with laparoscopic procedure. Yao-Ming Wu (National Taiwan University, Taipei, Taiwan) emphasized that the second international consensus conference held in Morioka claimed that it is easier to learn minimally invasive liver surgery with the use of the robotic approach. In addition, an initial phase that consisted of 15 cases and an intermediate phase that consisted of 25 cases were found to overcome the learning curve in robotic major hepatectomy,² while the learning phase of laparoscopic major hepatectomy included 45 to 75 patients.³ With the assistance of the robotic system, he increased the proportion of not only minimally invasive liver resections but also major liver resections.⁴ He concluded that team work and case selection are the key factors to conduct a successful program of robotic liver surgery.

LIVE DEMONSTRATION: LAPAROSCOPIC RIGHT HEPATECTOMY USING THE ANTERIOR APPROACH

A live demonstration of laparoscopic right hemihepatectomy was conducted by Ki-Hun Kim at the Asan Medical Center in Seoul, Korea. The patient was a 63-year-old female with hepatocellular carcinoma (HCC) (10.5×9.5×6.5 cm) in the right lobe of the liver and a Child-Turcotte-Pugh (CTP) score of 5. After performing the glissonian approach, the Pringle maneuver was performed during hepatic parenchymal transection. For transection, a laparoscopic CUSA was used. Small hepatic vein branches along the middle hepatic vein and small glissonian pedicles were sealed and divided with Thunderbeat™ (Olympus), which is the device that allows for the integration of both bipolar and ultrasonic energies delivered simultaneously. The iDrive™ Ultra Powered Stapling Device (Medtronic) was used for the division of the right glissonian pedicle, right hepatic vein, and inferior vena cava (IVC) ligament. The specimen was retrieved using an endo-plastic bag through the Pfannenstiel incision.

CURRENT STATUS AND FUTURE PERSPECTIVES OF LAPAROSCOPIC HEPATO-BILIARY-PANCREATIC SURGERY

Current status of laparoscopic liver surgery

Kuo-Hsin Chen (Far-Eastern Memorial Hospital, New Taipei City, Taiwan) presented the current status of laparoscopic liver surgery. Despite all the advances in minimally invasive surgery, laparoscopic liver resection (LLR) remains one of the most challenging procedures. Regular indications include tumors less than 5 cm in diameter that are located in the anterolateral segments. Difficulties with surgical exposure, lack of effective bleeding control tools, and procedure complexity are obstacles to the widespread use of this approach; although, an increasing number of published studies have demonstrated better perioperative outcomes and compatible oncological results compared to open hepatectomy. Furthermore, a steep learning curve is also a major concern. Since the 2nd international consensus meeting on LLR was held in Morioka, Japan in 2014, many conceptual changes regarding LLR have been suggested; although the evidence level was generally low at that time. Laparoscopic hepatectomy can be a more reproducible procedure even for major hepatectomy. Currently, anatomical resection of HCC, whenever possible, and parenchymal-sparing resection of colorectal liver metastasis (CRLM) have been recommended. Laparoscopic major hepatectomy has become a more standardized procedure including donor hepatectomy for living donor liver transplantation (LDLT). Until recently, some expert centers advocated for either a pure laparoscopic or robotic approach in donor hepatectomy for adult-to-adult LDLT. However, this procedure is highly sophisticated and should be very cautiously performed to ensure donor safety. He concluded that with the introduction of new imaging modalities for preoperative evaluation, surgical planning and navigation, 3-dimensional imaging, Indocyanine green (ICG) fluorescence imaging, and augmented reality, laparoscopic major hepatectomy has become increasingly reproducible.

Tips and tricks in laparoscopic liver surgery

Goro Honda (Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital, Tokyo, Japan) provided some tips for the maximum utilization of

CUSA in laparoscopic liver surgery. He emphasized that the concept of liver dissection involves excavation in a dry operative field. A dry operative field requires the following conditions: inflow control with the Pringle maneuver, outflow control with a reduction in the central venous pressure, and application of useful devices and appropriate techniques. He focused on the appropriate techniques for using CUSA, and demonstrated how to utilize CUSA in a very interesting manner. CUSA vibrates longitudinally; therefore, the device can suck fluid through its tip. We can use the tip edge as a CUSA. There are multiple ways to move the tip edge of CUSA. One way is shoveling which by inserting it obliquely, CUSA becomes a scoop. A second way is through boring; by inserting it longitudinally, CUSA becomes a boring machine. Third, back scoring is another alternative; by back scoring or scratching, CUSA becomes a spatula. He also provided several tips on handling skills using CUSA in bleeding situations. CUSA vibrates longitudinally; therefore, the lateral aspect of the metal tip is atraumatic. We can utilize the lateral aspect of the metal tip for pushing off the vessel with a flank and ablating the parenchyma behind the vessel with the tip edge, compressing the bleeding point in a flank, and applying cauterization to stop the bleeding. The caudo-dorsal view of laparoscopy is well known for providing a good view of the dorsal side of the liver from the IVC to the adrenal gland.⁵ In addition, he demonstrated that blood flows downwards during a parenchymal transection such that the dissected portion does not remain dry with the ventral view of open surgery because of the accumulation of blood; however, it remains dry with the upstroke movement in the caudo-dorsal view of laparoscopy surgery. He also reported that the caudo-dorsal view of laparoscopy is useful for access to the glissonean tree. He stated that we can identify the border of the glissonean tree by advancing from the root side on a caudo-dorsal view. He concluded that the concept of liver dissection involves excavation in a dry operative field, and it can be achieved more easily by using CUSA with multiple functions, as a standardized technique.

The current status of laparoscopic hepatectomy in China

Xiao-Ping Chen (Tongji Hospital, Tongji Medical College Huazhong University of Science and Technology,

Wuhan, China) demonstrated the exponential growth of LLR in China. With the support of the Chinese chapter of the International Hepato-Pancreato-Biliary Association (IHPBA), a survey of more than 120 hospitals in 30 provinces and cities nationwide was recently conducted. It was found that 15,277 cases of LLR were performed from 1994 to 2016 in China. He also stated that effective bleeding control is the key factor for successful liver resection. In open liver surgery, he established three effective techniques for bleeding control, and these three methods have been used in LLR. The first technique is the ligation of the inflow and outflow vessels without hilar dissection.⁶ The second technique is the occlusion of the infrahepatic IVC with the Pringle maneuver to control bleeding during hepatectomy.⁷ The third technique, liver double-hanging maneuver, is a tunnel that is established through the retrohepatic avascular area on the right side of the IVC.⁸ The occlusion of the IVC and Pringle maneuver offer advantages since surgeons have the initiative during surgery; while the controlled low central venous pressure technique requires an anesthesiologist. He claimed that it is a simple, easy, and very effective method, and IVC taping can be completed within one minute. Chen's liver double-hanging maneuver has several advantages. First, the operator can feel the retrohepatic tissues with the index finger, which is safer than blind dissection using forceps as in Belghiti's hanging maneuver. He also described that a true avascular space that contains loose connective tissue exists only behind the liver parenchyma on the right side of the IVC. Second, the leftward and rightward tractions on the tapes contribute to better exposure of the deeper parenchymal tissue during liver transection. Tightening the tapes helps to control bleeding from the branches of the hepatic veins.

Current status and future perspectives of robotic hepato–biliary–pancreatic surgery

Chung-Ngai Tang (Pamela Youde Nethersole Eastern Hospital, Hong Kong) stated that the robotic approach allows for performing an increased number of major hepatectomies in a purely minimally invasive manner.^{4,9,10} Several recent comparative studies between RLR versus LLR have demonstrated the feasibility and safety of robotic surgery for treating HCC, with a favorable short-term outcome; however, most of these studies exhibited significantly longer operation time in the robotic group.^{4,11-19}

Additionally, a recent meta-analysis that compared RLR with conventional LLR demonstrated that RLR and LLR exhibited similar safety, feasibility, and effectiveness for hepatectomies. However, further studies are needed, especially in terms of oncologic and cost-effectiveness outcomes.²⁰

THE 3rd EXPERT FORUM OF ASIA-PACIFIC LAPAROSCOPIC HEPATECTOMY. VIDEO SESSION: HOW I DO IT?

Laparoscopic left lateral sectionectomy

Ji Hoon Kim (Eulji Hospital, Eulji University, Daejeon, Korea) stated that laparoscopic left lateral sectionectomy (LLS) is a routine approach in selected patients, and laparoscopic living donor left lateral sectionectomy for adult-to-child LDLT is considered a standard practice in many experienced centers.²¹ He presented a video clip of LLS and laparoscopic left hepatectomy (LLH) using the modified hanging maneuver. He proposed that the modified hanging maneuver changes the location of the upper end of the hanging tape to the lateral side of the left hepatic vein for left lateral sectionectomy or left hepatectomy. He emphasized that the proposed technique is simple, safe, and reproducible because the dissection of the anterior surface of the IVC and between the middle and left hepatic veins is not required as in the conventional liver hanging maneuver.^{22,23}

There was a question from the audience. The question was how the presenter usually transects the bile duct in the case of LLR for a patient with an intrahepatic stone because the usage of a stapler may be limited in these cases. To this question, Ji Hoon Kim answered that he usually performs left hepatectomy, and not left lateral sectionectomy, for patients with a left intrahepatic stone and prefers performing suture closure after transecting the left bile duct.

Laparoscopic left hepatectomy

Yang Seok Koh (Chonnam National University Hwasun Hospital, Chonnam National University, Hwasun, Korea) reported that the extrafascial glissonean approach is a very safe and easy approach for inflow control during laparoscopic left hepatectomy, and he showed a video clip of LLH using the extrafascial glissonean approach.

After his presentation, there were two questions from the audience. The first question was how does the presenter control bleeding during parenchymal transection. To this question, Yang Seok Koh answered that he basically performs the Pringle maneuver at the time of bleeding. Above all, gauze compression and transient elevation of the pneumoperitoneum pressure of up to 20 mmHg are very useful for achieving control of the bleeding. The second question was whether a bile duct anomaly is troublesome in left hepatectomy. Which approach would be better between the individual division and glissonean pedicle approach in left hepatectomy? Panelists were asked to answer this question. Daniel Cherqui and Ki-Hun Kim stated that they prefer individual division in the left hepatectomy. Hironori Kaneko stated that he fundamentally used individual division in LLR because of the safety of the approach.

Laparoscopic right hepatectomy

Young-In Yoon (Korea University Medical Center, Korea University, Seoul, Korea) presented a video clip of laparoscopic right hepatectomy (LRH) using the glissonean pedicle division and anterior approach. In addition, she emphasized that laparoscopic surgery must be performed using essentially the same principles applied in the open procedure.²⁴⁻²⁸ Moreover, she discussed their recent study, which assessed the feasibility of LRH in a large cohort of HCC patients with liver cirrhosis.²⁹ She stated that even in patients with cirrhosis, pure LRH is not less safe than the traditional open approach, and the oncological outcomes were also comparable.

There were some questions from the panel and floor after the presentation. The first question was about major hepatectomy for a 1.4 cm-sized HCC. Daniel Cherqui stated that he thought right hepatectomy was too large a resection for the tumor size. Hironori Kaneko also stated that he was concerned about performing right hepatectomy for a small HCC in patients with liver cirrhosis. He inquired about what the other researchers thought of parenchymal-sparing hepatectomy instead of right hepatectomy in this case. To this question, Ki-Hun Kim answered that if HCC patients have good liver function, sufficient remnant liver volume, and a good ICG R15 test result, the best way to reduce tumor recurrence is by performing major hepatectomy. If possible, major hep-

atectomy in HCC patients is his policy and the Asan Medical Center's policy as well.

Second, Hong-Jin Kim inquired about any problems in LRH after portal vein embolization. Ki-Hun Kim answered that a portal vein embolization-induced inflammation can be reduced by embolization of a more distal portal vein. It is important to communicate with the interventional radiologist. When the tumor is too close to the glissonean pedicle, he does not transect the right anterior and posterior glissonean pedicles separately; instead, he usually transects the right glissonean pedicle. If the length of the glissonean pedicle is long enough to leave behind a sufficient portal vein stump even though the tumor is of a large size and close to the glissonean pedicle, he transects the right anterior and posterior glissonean pedicles separately similar to the live demonstration case presented yesterday.

Lastly, there was a question from the floor about the method to check a bile leak after laparoscopic hepatectomy. Ki-Hun Kim answered that he does not check for a bile leak additionally after hepatectomy because he always uses CUSA, and the magnified vision of laparoscopy is helpful with identifying bile leak sites during parenchymal transection.

Laparoscopic right posterior sectionectomy

Kai-Chi Cheng (Kwong Wah Hospital, Hong Kong) presented a video clip of laparoscopic right posterior sectionectomy. He stated that due to the difficulty with achieving bleeding control and visualization of the surgical field, the lesions in the postero-superior liver segments were generally not considered to be suitable for laparoscopic resection. However, with increasing experience and improvement in technology, the safety and feasibility of laparoscopic major resection, including that in the postero-superior segments, have been reported in recent years. He concluded that in order to perform successful laparoscopic right posterior sectionectomy, proper preoperative case selection, optimal operative theater set-up, and correct identification of the anatomical landmarks during the operation are essential.

Laparoscopic central hepatectomy

Tran Cong Duy Long (University Medical Center, Ho Chi Minh City, Vietnam) presented a video clip of laparo-

scopic right anterior sectionectomy. He stated that nowadays, liver resections have decreased the gap between open and laparoscopic surgery. The indication has been extended, and most of the tumors located in the liver can be treated laparoscopically. There are many reports of laparoscopic major hepatectomies and laparoscopic hepatectomy in difficult tumor locations, where they are no longer a contraindication.³⁰⁻³³ The most important issues of surgical treatment for cancer are respecting oncologic principles and ensuring long-term survival. Therefore, as in the open approach, anatomical liver resection and parenchymal-preserving resection of portal territories, including right anterior sectionectomy, can be performed laparoscopically.

Robotic liver resection

Gi Hong Choi (Severance Hospital, Yonsei University, Seoul, Korea) stated that the advantage of the robotic approach over the laparoscopic approach is that meticulous dissection of the hepatic hilum and IVC is possible. He used the rubber band retraction technique during parenchymal transection, similar to that applied in open liver resection (OLR) and in LLR. While the transection plane was exposed automatically by the elastic power of the rubber band, he used all three robotic arms during parenchymal transection. The 3rd robotic arm was used to compress the bleeding site or to further expose the transection plane. Liver parenchyma was transected by using the harmonic scalpel in the surgeon's left hand and Maryland bipolar forceps in the right hand.^{34,35} While performing transection of the bile duct, the Da Vinci Fluorescence imaging vision system provided a clearer segmental boundary of the liver parenchyma, which facilitated a true anatomical liver resection as well as bile duct transection in robotic living donor hepatectomy. He concluded that the feasibility and safety of RLR in all types of procedures have been demonstrated; but a multicenter and collaborative study is needed to obtain stronger evidence of RLR.

KEY NOTE LECTURE

Laparoscopic liver resection: an ongoing revolution

The key note lecture, entitled "Laparoscopic Liver Resection: An Ongoing Revolution", was presented by

Daniel Cherqui (Paul Brousse Hospital, Villejuif, France). The adoption of LLR has been slower than that of other laparoscopic procedures. This difference reflects the perceived risks of uncontrollable bleeding, oncological inadequacy, and a degree of skepticism regarding a major change in practice for an unproven benefit. LLRs require expertise in liver surgery and advanced laparoscopy. An increasing number of hepato-biliary-pancreatic (HBP) surgeons have explored the possibility of LLR, which resulted in two international consensus meetings and publications involving more than 9,000 patients. Of the two major consensus meetings, the first meeting established the feasibility and safety of LLR in selected patients and created recommendations on the indications. The second meeting was a rigorous conference with an independent jury comprised of surgeons who performed open liver surgery. Although the jury recommendations emphasized the limited level of available evidence, they validated minor resections as a standard practice; while major resections and/or complex anatomical resections were still considered to be in the exploration stage. LLR is continuously evolving, and it must be based on open resection. However, there are specific issues that require attention. It is clear that LLR has gained a specific and irreversible place in the practice of liver surgery as a result of the recognized short- and long-term advantages. Minor resections in peripheral segments are now being performed laparoscopically by a majority of HBP teams, and the diffusion of major and complex resections is increasing annually. In laparoscopic living donor hepatectomies, laparoscopic living donor left lateral sectionectomy (LDLLS) for adult-to-child LDLT is gaining wider acceptance; however, full right or left laparoscopic donor hepatectomy has been reported by a limited number of highly experienced surgeons, and it is still considered to be in the developmental phase. The short-term outcome is excellent, in terms of morbidity, blood loss, transfusion requirement, and hospital stay compared with open surgery. The oncological results are not compromised with identical surgical margins, R1 resection rates, and long-term survival rates. He emphasized that he believes that LLR should be available in all centers. All liver surgeons should learn to perform laparoscopy. He concluded that we should keep in mind that improvement in patient care is meaningful through the diffusion of LLR.³⁶⁻³⁸

SESSION FOR RECENT ISSUES & CONTROVERSY REGARDING LAPAROSCOPIC HEPATO-BILIARY-PANCREATIC SURGERY

Living donor hepatectomy

Pure LDLLS for adult-to-child LDLT is considered a standard practice in experienced centers.³⁹ Pure laparoscopic living donor right hepatectomy (LDRH) performed by well-experienced surgeons was a safe and feasible procedure in selected donors.^{40,41} Ki-Hun Kim (Asan Medical Center, University of Ulsan, Seoul, Korea) emphasized that a strict indication is essential for ensuring donor safety. The selection criteria for LDRH at Asan Medical Center are as follows. The first indication was single and longer segments of the right hepatic artery, the right portal vein, and the right hepatic duct. The second indication involved fewer segments of the 5 and 8 veins and no sizeable inferior hepatic vein was reconstructed for easier operation; and the final indication had a graft weight of less than 700 grams. These strict selection criteria have resulted in no donor morbidities to date.^{29,42,43} He stated that laparoscopic major hepatectomy in living donors for adult-to-adult LDLT has not yet been recognized as a standardized procedure with respect to donor selection and surgical technique.^{42,44} In addition, he concluded that pure LDRH needs further evaluation in expert centers in order to determine the postoperative outcomes and to establish the safety levels.

Safety indication of major hepatectomy for liver disease

Yuichiro Otsuka (Toho University Faculty of Medicine, Tokyo, Japan) presented the safety indication of major hepatectomy for liver disease. For a safe major LLR, careful patient selection and technical stylization are essential. First, the patient and disease factors are considered for careful patient selection. The assessment of a sufficient hepatic functional reserve before hepatectomy is needed, and the lesions involving the hepatic hilum, inferior vena cava, confluence of major hepatic veins, and adjacent organs are considered contraindications. Tumors larger than 10 cm would not be suitable for achieving sufficient working space under the pneumoperitoneum; therefore, in major LLR, the tumor's diameter needs to be less than

10 cm. However, there is no limitation on the tumor number. Second, according to the tumor location, there is a proper position and trocar placement in LLR. There is usually a choice between two positions such as the supine or French position for right sided to left sided regions, and the left decubitus position for the postero-superior regions. In addition, two methods of hilar vascular isolation, the individual approach and the glissonian pedicle approach, can usually be applied in a manner similar to open surgery. He concluded that appropriate patient selection and accumulation of each minor fundament can lead to major progress towards the safe expansion of the indication of LLR.

Oncological outcome of laparoscopic hepatectomy

Tan To Cheung (Queen Mary Hospital, The University of Hong Kong, Hong Kong) presented the oncological outcomes of laparoscopic hepatectomy. The frequency of LLR continues to increase with more than 9,000 cases reported to date.⁴⁵ LLR compared to OLR is associated with less complications, transfusion, blood loss, and hospital stay.⁴⁶ This comparison confirms the increasing safety when it is performed by trained surgeons in selected patients, and this suggests that LLR may offer improved short-term patient outcomes compared with OLR. Recent comparative studies that used the propensity score analysis model to eliminate potential bias of case-match selection have shown no significant differences in overall survival and disease-free survival.^{29,47-52}

CONCLUSIONS

After two international consensus conferences on LLR were held in Louisville, USA, in 2008 and in Morioka, Japan, in 2014, LLR has been performed worldwide and it has expanded from minor LLR such as left lateral sectionectomies or non-anatomical resections of anterolateral segments to more complicated and difficult areas, including laparoscopic major hepatectomy, robot-assisted liver resection, and laparoscopic living donor hepatectomy.^{53,54} Although randomized controlled trials (RCT) that compared the oncologic safety between LLR and OLR for HCC or CRLM have not been reported, there are two representative multi-institutional Japanese studies that compared perioperative and long-term outcomes of LLR with

those of OLR for HCC and CRLM and the largest studies of pure LRH to date. They developed a comparison with a control group that underwent open right hepatectomy for HCC during the same period at a single institution. The use of propensity score matching to reduce the differences in the distribution of covariates demonstrated that LLR is superior to OLR in terms of operative outcomes without compromising the oncological outcomes in selective patients.^{29,48,55} Currently, a single-center RCT on parenchymal-sparing liver resection for CRLM (Oslo-CoMet study, NCT01516710) reported that laparoscopic surgery was associated with significantly less postoperative complications and was cost-effective compared to open surgery. The rate of tumor-free resection margins was the same in both groups.⁵⁶ Another RCT comparing open and laparoscopic left lateral sectionectomy (Orange II study, NCT00874224) was recently halted after it failed to recruit patients;⁵⁷ however, another multi-center RCT on hemihepatectomy for various indications (ORANGE II plus study, NCT01441856) is still recruiting patients. We hope that the results will clarify the benefits and disadvantages of LLR. Through this meeting, we are confident that LLR will become a more standardized procedure with wider application in the near future by overcoming the limitations involved in the application of advanced techniques and accumulation of experience.⁵⁸

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