Editorial

Time to take another look at perceived disadvantages of robotic hepatectomy

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Robotic hepatectomy remains controversial to date, despite continuous advances in the technology and more surgeons gaining experience with the method. Melstrom *et al.* (1) recently published an interesting article in *Hepatobiliary Surgery and Nutrition*, titled "*Selecting incision-dominant cases for robotic liver resection: towards outpatient hepatectomy with rapid recovery.*" The authors evaluated 97 cases of robotically-assisted liver resection (RLR) arguing that it is difficult to reach the superior-posterior liver segments with the straight instruments used in conventional laparoscopic liver resection (LLR). The articulated instruments of the surgical robot are better suited for hepatectomies in these difficult-to-reach areas of the liver. They concluded that cases where the incision of an open approach would be large and affect recovery results in the highest likelihood of patients benefitting from a robotic approach. We think that the authors present an interesting perspective by focusing on the strong points of RLR compared to LLR.

In reports on LLR, tumors located in segments 7 or 8 were more difficult to resect compared to those in other locations as reflected in longer operative times and more intraoperative bleeding (2,3). Guerra *et al.* (4) argued that robotics might greatly improve results and expand the applications of minimally invasive liver resection especially in segment 7 tumors because they increase the surgeon's dexterity, provide a three-dimensional view, and integrate ultrasonography. However, concerns remain not only regarding the port placements and performance of the Pringle maneuver but also when the need for a conversion to open surgery requires an immediate response from the surgeon (5). These disadvantages are likely to be overcome with experience and the further development of RLR in the near future.

An international consensus statement on robotic hepatectomy was published in 2019 (6). Its seven recommendations were generated by the grading of recommendations, assessment, development and evaluations method and focused on the safety, feasibility, indications, techniques, and cost-effectiveness of the procedure. However, the current evidence level for RLR was graded as low to very low because no randomized-control trials have been performed so far, and the numbers of patients undergoing RLR are still limited. In other words, RLR is a developing technique. Randomized-controlled trials and large-scale case-control studies are required to evaluate the outcomes of RLR and validate the recommendations.

Guan *et al.* (7) performed a meta-analysis of thirteen articles involving 938 patients that compared RLR with LLR in 2019. RLR had longer operative times and higher intraoperative blood loss and cost than LLR. However, in the subgroup analysis of surgeries performed after 2010, a lower conversion rate was observed in RLR while other clinical outcomes were comparable between RLR and LLR. Another systematic review assessed the reasons for conversion to open surgery during RLR in more than 1,000 patients (8). The conversion rate was 4.8%. Among the reasons were bleeding in ten patients, oncological considerations in seven patients, and difficult location or technical problems in four patients each. These results were almost predictable, but the evidence level was again low. More cases are required to understand the outcomes and challenges of RLR.

Chong *et al.* (9) compared RLR with LLR based on a difficulty score and found that the perioperative outcomes were similar in cases of low and intermediate difficulty. Moreover, the difficulty scoring system was significantly correlated with surgical outcomes in patients who underwent RLR. Consequently, surgeons should start with low-difficulty cases before proceeding to cases presenting high levels of difficulty. The learning curve of RLR was also described by Chen *et al.* (10), and they suggested that surgeons' confidence when performing major hepatectomy results from not only the assistance of robotic instruments but also their experience with LLR. Sound knowledge of liver anatomy, substantial experience with both liver surgery and laparoscopy, and adequate training in robotic surgery are required before attempting RLR (11). These findings are similar to what has been described for the learning process of conventional LLR (12).

Robotic platforms cause startup costs that include the equipment, time dedicated to the surgeon's learning of the procedures, and training of support staff to implement the technology efficiently. Several articles mention the high cost of RLR. However, Cortolillo *et al.* (13) analyzed a nationwide database in the United States and reported that RLR was associated with a favorable cost when comparing its outcomes with LLR and open liver resection. RLR had a lower mortality rate during initial admission and readmission, shorter length of stay, and lower total cost of the initial admission compared to both other procedures.

RLR is a developing method that is continuously improving. As with any new method, and similar to the initial phase of conventional LLR, this results in a patient selection bias. Just as LLR has its advantages such as less bleeding due to the pneumoperitoneum and magnification, RLR theoretically possesses its distinct advantages, such as providing a clear, stable, three-dimensional, and magnified field of vision, flexibility, dexterity, seven-degree freedom instruments, an ergonomic position for the surgeon, and a tremor filter. Specifically, we believe that the higher flexibility and seven-degree freedom instruments might overcome the major disadvantages of conventional LLR. Melstrom *et al.* (1) emphasized the characteristics features of RLR and proposed that it surmounts the weak points of conventional LLR.

We think that the possibilities of robotic surgery are still underutilized. More efforts should be made to explore its strong points and potential clinical superiority.

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Footnote

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