Minimally invasive liver resections for cancer: moving forward

Compared to other general surgery specialties, the diffusion of laparoscopic technique was much slower in the field of hepatobiliary surgery: although the postoperative outcomes were very appealing, the challenges associated with the liver as an organ (large dimensions, variable anatomy, rich vascularization, "hidden" structures), hampered the initial growth.

The first laparoscopic hepatectomies were reported in 1991 by Reich *et al.* in a paper describing 3 wedge resections for benign lesions with one conversion and a 24-hour discharge (1); subsequently, the first left lateral sectionectomy and the first right hepatectomy were described in 1996 and 1997 by Azagra *et al.* and Huscher *et al.* (2,3). Later, case series, comparative studies, and multicenter experiences reported that laparoscopic liver resections (LLRs) provided the same advantages as those disclosed by other disciplines (4-7). Despite the initial reports were promising, the diffusion was much slower compared to the other surgical specialties. The steepness of the learning curve, the challenges in controlling a potential major bleeding, and the unknown risk for gas embolism and for inadequate surgical margins were impeding its worldwide validation (8). Yet, the advantages were clear: less abdominal wall trauma, the earlier return to daily activities, the reduced postoperative pain, improved cosmetic results, decreased blood loss, less postoperative ascites in cirrhotics, fewer pulmonary complications and facilitation of subsequent surgery or liver transplantation were reported by most authors and later validated in many publications, and the interest soon started to rise (9-12).

In 2008, sufficient knowledge of this "innovative approach" was acquired and the first Consensus Conference in Louisville created the foundations for a different vision of liver surgery. Laparoscopy was no longer a novelty but rather considered as an essential option in the armamentarium of a referral center for the treatment of liver diseases, to be applied depending on the characteristics of the patients and of the diseases. The number of LLRs increased exponentially thereafter. Surgeons worldwide adopted, implemented and standardized the technique in their centers. As a result, it was necessary to gather for the Second International Consensus Conference in 2014, in Morioka, Japan to critically reevaluate the steps forward that were made over years and promote the validation of the procedures with rigorous scientific method, taking into account the level of evidence of the studies and reports of the time. This consensus conference produced the statements on which the current clinical research is based (13).

According to the most recent review of the literature, more than 9,000 LLRs have been described by 2014 with confirmed benefits in terms of the postoperative morbidity, blood loss, length of hospitalization and pain management (14). Many advances have been made since the initial reports in which the outcomes of a new technique needed validation; from feasibility and safety in the early reports reaching standard practice for selected indications, and pushing the limits in new and pioneering applications (5,13,15).

Despite initial skepticism, LLR is now considered a safe option for patients affected by primary and secondary liver malignancies (14). Overall, almost all histological types of cancers have been resected by minimally invasive techniques: colorectal liver metastases, hepatocellular carcinoma, cholangiocarcinoma, gallbladder cancer, neuroendocrine tumors, non-colorectal metastases, sarcomas and stromal tumors represent the most common but not the only malignancies reported.

In this special series, I have invited worldwide experts on the field of laparoscopic liver surgery to discuss the benefits and the controversies of minimally invasive approach to malignancies. From East to West, I have the honor of exploiting the friendship of extremely talented and scientifically valid surgeons. Specifically, I would like to draw the attention on the contributions to this special series, which are not only made of the opinion of clever minds from different parts of the world, but also of young surgeons, who are the future and fuel of our interesting subspecialty.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Laparoscopic Surgery* for the series "Minimally Invasive Resections for Liver Malignancies: Among Certainties and Controversies". 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-2020-mirlm-08). The series "Minimally Invasive Resections for Liver Malignancies: Among Certainties and Controversies" was commissioned by the editorial office without any funding or sponsorship. GB served as the unpaid Guest Editor of the series. The author has no other 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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Received: 02 January 2021; Accepted: 18 January 2021; Published: 25 July 2021.
doi: 10.21037/ls-2020-mirlm-08
View this article at: http://dx.doi.org/10.21037/ls-2020-mirlm-08

doi: 10.21037/ls-2020-mirlm-08
Cite this article as: Berardi G. Minimally invasive liver resections for cancer: moving forward. Laparosc Surg 2021;5:28.