



Assessment of applicability of laparoscopic liver resection after previous abdominal surgery

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Comment on: Cipriani F, Ratti F, Fiorentini G, *et al.* Effect of Previous Abdominal Surgery on Laparoscopic Liver Resection: Analysis of Feasibility and Risk Factors for Conversion. *J Laparoendosc Adv Surg Tech A* 2018;28:785-91.

Received: 29 August 2018; Accepted: 30 September 2018; Published: 07 October 2018.

doi: 10.21037/ls.2018.09.04

View this article at: <http://dx.doi.org/10.21037/ls.2018.09.04>

Adoption of laparoscopic liver surgery for primary disease of the liver and metastatic disease to the liver is becoming increasingly adopted across centers around the world. After the first report of laparoscopic liver surgery in 1992 by Gagner and colleagues (1) for focal nodular hyperplasia and colorectal liver metastases, there has been a steady increase in the application of the laparoscopic approach for hepatic resection. Several consensus conferences have been held to review the available literature and provide guidance for the appropriate use of minimally invasive liver resection (2,3). While a laparoscopic approach has gained some increasing acceptance amongst hepatobiliary surgeons, it has been slow to gain widespread acceptance. Among the many reasons for the slow adoption, technical challenges and long learning curve are frequently cited as barriers for surgeons that diminish enthusiasm despite the well-documented perioperative benefits for patients.

In the current article, the authors have highlighted the importance of consideration of patients having undergone previous abdominal surgery and the impact on attempts at laparoscopic liver resection (LLR) in subsequent surgeries. The authors address feasibility, safety and oncologic adequacy of patients undergoing LLR in the setting of previous abdominal surgery compared to those with no prior history of intra-abdominal procedures with a further subgroup analysis on previous upper abdominal surgery (UPS). The authors matched patients with respect to baseline characteristics to allow for appropriate matching, fair comparison and minimal confounding of results. All groups were similar with regard to baseline patient

demographics, diagnoses, tumor characteristics, type and extent of hepatectomy performed with the only difference being history of previous abdominal surgery.

The authors reported that patients with previous surgery (PS) had a higher rate of conversion compared with patients with no previous surgery (NPS) (13.7% and 5.1%, respectively, $P=0.021$), particularly in case of UPS (23.0%, $P=0.015$). Furthermore, at multivariable analysis, previous abdominal surgery emerged as a factor independently associated with the risk of conversion [HR, 1.70 (1.31–1.98), $P=0.033$]. The most common reason for conversion in patients in the PS and UPS subgroup was difficult adhesiolysis (5.7%, 11.8%, compared to 0 cases in the NPS group, PS *vs.* NPS, $P=0.004$, PS *vs.* UPS, $P=0.002$). Patients in the UPS group had higher rates of conversion due to difficult adhesiolysis ($P=0.002$). Similarly, conversions for intraoperative bleeding occurred more frequently in the PS group compared with NPS group (3.4% *vs.* 1.4%, respectively, $P=0.004$). The authors showed that there was no significant difference in postoperative morbidity and mortality amongst the PS and NPS groups.

With respect to oncologic adequacy, the incidence of conversions related to inadequate radicality of the procedure was not statistically significant amongst the two groups (9 patients in PS group =2.5% *vs.* 7 patients in NPS group =2.0%, $P=0.892$). Moreover, the authors report a low rate of R1 resection at final histopathological examination (PS: 6 patients: 1.7% *vs.* NPS: 5 patients, 1.4%, $P=0.130$). Based on this, the authors conclude that laparoscopic resection in this subset of patients is comparable to open

surgery with regards to oncologic outcomes, but that care should be taken to ensure thorough use of intraoperative ultrasound and adequate mobilization to allow for complete inspection and visualization when dealing with patients with significant intraabdominal adhesions.

Nguyen and colleagues (4) conducted a review of the literature with respect to reasons for conversion from laparoscopic approach in a review of 127 published articles including a total of 2,804 patients in the literature. Their findings were consistent with the current article wherein the common reasons for conversion from a laparoscopic to open or hand-assist approach were adhesions, anatomical limitations, poor exposure, proximity to major vascular structures, lack of progression, gross positive tumor margin, equipment failure, satellite lesions beyond planned resection, requirement of associated surgical procedure, or large tumor size. Less frequent causes for conversion were wound bleeding in a cirrhotic patient, air embolism, injury to other structures (bile duct, diaphragm), adherence to transverse colon, or risk of cyst rupture. In 23 cases, there was no documented reason for conversion.

The reported conversion rate amounted to 116 cases leading to a 4.1% conversion rate. The most common cause was for bleeding (1.4%). The current authors reported a higher conversion rate of 9.8% and at analysis felt that the inability to perform a complete laparoscopic adhesiolysis before liver resection accounted for the commonest reason for conversion in patients who underwent PS and in those who had UPS. Of note, bleeding as a cause of conversion was related to hepatic vein or portal pedicle bleeding during liver transection rather than bleeding secondary to adhesiolysis of vascular adhesions.

Ciria *et al.* (5) compared case-matched LLR to open liver resection (OLR) in 2,900 cases. There was no increased mortality and significantly less complications, transfusions, blood loss, and hospital stay observed in the laparoscopic group compared to the open group.

The authors confirm growing safety of LLRs when performed in selected patients and by trained surgeons and suggest this approach may offer improved patient short-term outcomes compared with OLR. To this end, there have been numerous articles (6) as well as the Oslo-COMET (7) trial highlighting the advantages and non-inferiority of the laparoscopic approach in patients with liver disease.

We congratulate the authors in conducting a single center study with a large cohort with appropriate matching to facilitate fair comparison between patients undergoing laparoscopic surgery in a virgin abdomen compared those

who had previous abdominal surgery. Many surgeons are faced with difficult decision making when applying a laparoscopic approach in patients who have undergone previous abdominal surgery. This is likely related to concerns for adhesions, bleeding, injury to hilar structures based on distribution of adhesions after abdominal surgery and oncologic adequacy. While this paper demonstrates the risk factors for conversion, it also shows that outcomes after conversion are not different from what would be expected for open surgery indicating that little is lost in the attempt of a minimally invasive procedure. In fact, one might expect some benefit to an initial laparoscopic approach if division of adhesions and mobilization could result in smaller open incisions after a controlled conversion. What one hopes is that publications like this one can begin to change the narrative around conversion from one of a “failure” of laparoscopic surgery to one of a natural part of an aggressive minimally invasive approach and a component of the learning curve.

The authors have shown in their series that these factors certainly should be considered but should not defer laparoscopy as a feasible option in these patients. Given the natural history of disease such as colorectal liver metastases wherein patients have a high rate of recurrence, requiring increasing need for operative interventions, consideration of this approach is a key component in the management of such diseases. Careful consideration and awareness to potential challenges when patients have had previous abdominal surgery can assist with navigating intraoperative complications such as bleeding, adhesiolysis and potential risk of injury to vasculobiliary structures. This study contributes valid information for hepatobiliary surgeons who will frequently encounter these types of patients with improvements in multidisciplinary care and treatment sequencing and improving survival of malignancies.

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: Both authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org>).

[org/10.21037/ls.2018.09.04](https://doi.org/10.21037/ls.2018.09.04)). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are 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.2018.09.04

Cite this article as: Yohanathan L, Cleary S. Assessment of applicability of laparoscopic liver resection after previous abdominal surgery. *Laparosc Surg* 2018;2:45.