The impact of obesity on laparoscopic liver surgery: a critical reappraisal

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Comment on: Ome Y, Hashida K, Yokota M, et al. The safety and efficacy of laparoscopic hepatectomy in obese patients. Asian J Surg 2019;42:180-8.

Received: 30 April 2018; Accepted: 16 May 2018; Published: 18 May 2018.
doi: 10.21037/ls.2018.05.04
View this article at: http://dx.doi.org/10.21037/ls.2018.05.04

Laparoscopic liver surgery has been demonstrated to be a safe and efficient approach in the treatment of several hepatic lesions (1-3). Laparoscopic liver resections (LLR) are increasingly performed worldwide (4); nevertheless, their utility in patients with increased body mass index (BMI) remains ill-determined. Obesity rates escalate significantly during the last decades whereas a strong association between obesity and poor postoperative outcomes is reported (5-8). Surgical procedures in these patients are considered highly challenging due to concomitant comorbidities including diabetes, cardiovascular pathologies, non-alcoholic fatty-liver disease as well as intraoperative technical limitations (9,10). Vigano *et al.* showed that severe morbidity and mortality rates in obese patients undergoing open liver resection (OLR) *versus* non-obese were similar even in cases of major hepatectomy or underlying cirrhosis (11). On the other hand, only a limited number of studies have aimed to evaluate the safety and adequacy of LLR in this particular high-risk group (10,12,13). According to the available literature, laparoscopic hepatic resections in obese patients may be safely performed with no additional risk compared to non-obese patients (12).

Ome *et al.* published their institutional experience with LLR in obese patients with regards to short-term outcomes (14); the authors' objective was to evaluate the safety and efficacy of LLR *versus* OLR in obese patients as well as that of LLR in obese *versus* non-obese patients. Significantly reduced blood loss, fewer intraoperative transfusions, fewer positive surgical margins, and shorter postoperative hospital stay were shown in the obese LLR group compared to the obese OLR group. Additionally, when the LLR obese group *versus* the LLR non-obese group was compared, only operation time was found significantly protracted in obese patients. Finally, no differences were detected in morbidity or mortality between the LLR obese group and either the OLR obese or the LLR non-obese groups.

The definition of obesity in their study is a critical limitation as also acknowledged by the authors. The same limitation was also met in two previous similar studies (15,16). Their patients of Asiatic origin were considered obese with a BMI of 25 kg/m^2 contrary to the World Health Organization (WHO) standard of BMI of 30 kg/m^2 (5,6). As a result, whether the results of Ome *et al.* are substantially different from that of European or American studies, which comprised patients with similar BMI must be evaluated. Our group published a meta-analysis of ten European studies, which assessed results from LLR *versus* OLR in patients with HCC (17). Four out of 10 studies reported patient BMI for the laparoscopic and open group; the mean BMI in LLR patients ranged from 25.0 to 28.7 kg/m^2 whereas in the OLR group the mean BMI ranged from 24.2 to 27.5 kg/m^2. Our analysis consistently showed reduced blood loss, transfusion rates and hospital stay in the LLR group similar to the study by Ome *et al.* Additionally it should be noted that 5 out of 10 studies included studies assessing results exclusively from cirrhotic patients. Therefore, one might argue that the study by Ome *et al.* did not exhibit new evidence on the beneficial role of LLR in patients with a median BMI of 26.9 kg/m^2, thus confirmed the results of previous non-Asiatic studies, which comprised patients who were not characterized as obese.

On the other hand, the subgroup comparison between 13 (out of the 63) highly obese patients who underwent LLR (median BMI of 32.0 kg/m^2; range, 30.0–33.9 kg/m^2) and 16 highly obese patients who underwent OLR (median BMI of 31.1 kg/m^2; range, 30.1–35.9 kg/m^2) is of more interest (14). LLR in the highly obese group was associated with reduced blood loss and blood transfusion compared to the open group, whereas no differences were shown in operative time, hospital stay, complication or mortality rates. Nonetheless, the patient sample size is too small to draw safe conclusions (13 *versus* 16 patients).

Cauchy *et al.* evaluated risk factors of conversion in laparoscopic major liver resection and showed that increased BMI (>28 kg/m^2) was an independent risk factor for conversion to OLR (18). An international survey of laparoscopic liver surgeons aimed to evaluate the perceived degree of difficulty of factors previously reported to affect the difficulty of LLR; increased BMI (>30 and >35 kg/m^2) was found to add moderate difficulty in LLR performance (19). Hasegawa *et al.* recently published their proposal of a novel model for prediction of LLR surgical difficulty (20); In their multivariate analysis, obesity (BMI >30 kg/m^2) was found significantly correlated with protracted operative times. Moreover, another study showed that dense abdominal wall as increased with higher BMI presents a significant limitation in the movement of trocars during laparoscopy, whereas mobilization of the liver can be difficult as a result of increased liver size (21).

Obese and morbidly obese patients represent high-risk groups that require particular management. Indeed, the number of patients included in the study by Ome *et al.* is the largest compared to previous similar studies and might show some utility when addressing exclusively to Asian populations (14-16). Whatsoever, generalization of the outcomes by Ome *et al.* must be viewed with caution, as they do not apply to obese non-Asian patient populations. Additional larger studies including patients with BMI >30 kg/m^2 and furthermore >35 kg/m^2 are needed in order to properly evaluate the impact of obesity on patients undergoing LLR *versus* OLR. Moreover, studies need to provide further information on the effect of tumor location on the outcomes given the fact that the body structure of obese and morbidly obese patients might constitute a technically major surgical challenge particularly in the case of LLR for lesions in posterosuperior segments.

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/10.21037/ls.2018.05.04). 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.2018.05.04
Cite this article as: Machairas N, Sotiropoulos GC. The impact of obesity on laparoscopic liver surgery: a critical reappraisal. Laparosc Surg 2018;2:27.

