Editorial

Diffusion of laparoscopic liver resections: are we there yet?

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Laparoscopic liver surgery has undergone a major evolution during the last 20 years (1). Albeit initially confronted with restrain and skepticism from the surgical community, laparoscopic liver resections (LLR) have gained significant ground and are currently acknowledged as safe and efficient procedures in the hands of hepatobiliary surgeons with experience in laparoscopic surgery (2,3). Over the last years, multiple studies and meta-analyses have evaluated the short- and long-term outcomes of LLR in a plethora of benign and malignant lesions (4-8). Moreover, the laparoscopic approach has been shown to equally merit high-risk groups of patients including cirrhotic, geriatric and obese patients (9-13). LLRs have been associated with improved short-term outcomes as well as equivalent long-term outcomes in the cases of hepatocellular carcinoma (HCC) and colorectal liver metastases (CRLM) (7,14). More recently, the results of the first randomized controlled trial (RCT) on LLR versus open liver resection (OLR) specifically for CRLM were published (15). Parenchyma-sparing LLRs for CRLM were associated with significantly reduced hospital stay and complications' rate compared to OLR while the oncologic adequacy of the procedure was not compromised.

Despite the fact that favorable results for LLR have been clearly documented, the question whether the approach is widely adopted still remains (16). Studies have showed that LLRs are increasingly performed in these specialized centers however others have questioned the diffuse adoption of the laparoscopic approach outside high-volume centers (17-20). To that end, Goutte *et al.* sought to evaluate the adoption and short-term outcomes of laparoscopic left lateral sectionectomy (LLS)—a procedure considered a "gold-standard"—compared to the open approach using a French national database (19). According to their results, over a 6-year period, only approximately 30% of LLS were performed through the laparoscopic approach. Moreover, laparoscopic LLS was independently associated with a reduced hospital stay regardless of the nature of the hepatic lesion as well as a lower transfusion rate for patients with benign or primary hepatic lesions.

As far as the short-term outcomes in patients who underwent laparoscopic LLS are concerned as presented by Goutte *et al.*, they align with previously published studies (21,22). Liu *et al.* in a recently published meta-analysis, assessed the outcomes from 12 studies which comprised 685 patients who underwent laparoscopic or open LLS (22). Their analysis showed that laparoscopic LLS were associated with a significantly reduced hospital stay (P<0.001), lower blood transfusion (P=0.007) and a lower morbidity rate (P=0.01), compared to the open approach. Another later published study by Goh *et al.* consistently showed reduced hospital stay in patients who had undergone laparoscopic LLS compared to open approach (23).

In the question whether specifically laparoscopic LLS and moreover laparoscopic surgery was widely adopted as a standard procedure by surgeons, Goutte *et al.* state that according to their results, adoption of the laparoscopic approach for LLS was low, and did not show overall improving rates (19). The laparoscopic approach for LLS was performed in 28.5% of the patients and was applied in roughly 33% of the institutions, which performed laparoscopic LLS. Moreover, they showed an increase in

the use of the laparoscopic LLS only in university hospitals and high-volume centers (>50 annual liver resections). Studies assessing outcomes from several high-volume centers worldwide have shown significant increase in the number of LLR performed. Kawaguchi *et al.* showed that LLS (in 27 specialized centers) was performed though the laparoscopic approach in 61.8% of patients compared to 38.2% who underwent open LLS (18). Another recent study from 4 specialized hepatobiliary units showed an average annual percentage change of 12.5% *vs.* –4.1% over a 15-year period for laparoscopic and open procedures, respectively (17).

The small number of cases addressing to peripheral institutions could be partially explained by the limited surgical experience in LLR. Additionally, more complex cases are treated in high-volume centers through the laparoscopic approach rather than more "simple" LLRs, as is the case of LLS. As a result, reduced overall percentage of LLS performed throughout a national healthcare network could be explained. Moreover, laparoscopic LLS performed for a segment II and/or III lesion by a non-proficient surgeon in a peripheral hospital may translate into a more limited and adequate resection when performed by an advanced laparoscopic hepatobiliary surgeon therefore decreasing even more the number of laparoscopic LLS performed in specialized centers.

The way forward for the establishment of LLR are RCTs. Recently the results from the OSLO-COMET trial were published (15). Two more ongoing RCTs, namely the ORANGE II PLUS (NCT01441856) and the ORANGE SEGMENTS (NCT03270917) will further provide evidence on the merits of LLR compared to the traditional open approach. The road to wide diffusion of LLR is still long; the number of these procedures when performed in high volume centers has been shown to increase thus that might not the case in lower volume centers (19,20,24). Acquisition of experience in these procedures outside specialized centers should proceed with caution and is rationally delayed (3,25). Unavoidable centralization of cases in specialized centers ought to emphatically promote stepwise education of younger surgeons in this field (24). Updated data that derive from national databases are mandatory with the aim to further elucidate how the efficient adoption of this approach proceeds over time.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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