

# Laparoscopic parenchymal-sparing hepatectomy

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In their recent meta-analysis, Kalil et al. suggested that laparoscopic parenchymal-sparing hepatectomy (PSH) is associated with acceptable short-term outcomes and oncological efficiency, but they acknowledged that the quality of the available data is poor (1). During open surgery, it has long been recognised that PSH, if feasible, is superior to major hepatectomy due to significantly lower morbidity and mortality, with no differences in long-term survival (2-4). The available evidence for PSH, including this study by Kalil et al. is predominantly derived from retrospective data, with an intrinsic risk of selection bias. The fact that there is no internationally agreed definition of PSH further confounds interpretation of data in this field. In the study by Kalil et al. the majority of patients had solitary tumours but data regarding proximity to vascular structures was not available, and PSH was not defined. The size and number of tumours, distribution (unilobar or bilobar), location within a segment and proximity to major vasculobiliary structures are all factors that are taken into account when deciding the surgical approach (e.g., minor vs. major hepatectomy and laparoscopic vs. open). A minor hepatectomy (i.e., atypical/wedge resection or anatomical segmentectomy) for a small, peripheral tumour cannot be considered as a PSH in the current era, since major hepatectomy in this scenario would be considered unnecessary, and is not an acceptable alternative. In my view, PSH should refer specifically to the surgical approach for deeply positioned tumours close to either portal inflow structures or major hepatic veins, where a decision to perform a major hepatectomy may reasonably be considered in order to obtain a marginnegative resection. In such cases, a PSH may be technically more challenging than a major hepatectomy, with an

increased risk of a margin-positive resection, but with the advantage of reduced perioperative morbidity. A PSH that accepts an R1 resection may be the only option in patients with multiple bilobar disease in order to preserve inflow/ outflow to the remnant liver. For solitary deep lesions close to a major portal or hepatic vein, it is not clear whether an R0 major hepatectomy is superior to an R1 PSH (either laparoscopic or open), and a prospective study in a clearly defined patient cohort would be necessary to address this.

Laparoscopic hepatectomy (LH) has become an acceptable alternative to open hepatectomy in selected patients, and the short-term benefits are well established (5). The growth of LH worldwide over recent decades has been exponential, particularly for minor resections (6). Although LH is technically more challenging than OH, the learning curve for second generation laparoscopic liver surgeons has reduced significantly (7-9), and a laparoscopic approach is feasible for tumours in all liver segments (6). The Oslo-Comet randomised trial recently established the superiority of LH over OH for the management of colorectal metastases (10). With respect to PSH, a laparoscopic approach may be feasible in highly selected patients (11-13), but should only be performed by experienced teams working in high volume centres (5). For patients with multicentric bilobar liver metastases, open hepatectomy should still be considered the gold standard, although laparoscopic twostage hepatectomy and laparoscopic ALPPS procedures have been reported (14,15). An important drawback of PSH compared to major hepatectomy is an increased incidence of intrahepatic recurrence, and the need for repeat hepatectomy (2). However, the perioperative morbidity and blood loss associated with repeat hepatectomy may

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be reduced by adopting a laparoscopic approach for both stages (15,16).

The analysis by Kalil et al. included patients with a range of indications, predominantly colorectal metastases and hepatocellular carcinoma<sup>1</sup>. The concept of PSH has been applied mainly to the surgical management of patients with colorectal metastases, for the reasons outlined above. The surgical approach to hepatocellular carcinoma is influenced by the presence and severity of underlying cirrhosis, when a 'PSH' is the gold standard. Anatomical segmental rather than non-anatomical resection for hepatocellular carcinoma has been advocated for oncological reasons, and recent propensity matched cohort studies would support this approach (17,18). Laparoscopic anatomical segmentectomy for hepatocellular carcinoma has been reported for all liver segments, but is a technically challenging procedure, particularly for lesions in the posterior and superior segments (IVa, VII, VIII) (19-21). Introduction of new technologies, such as image-guided navigation, augmented reality and near-infrared fluorescence are likely to facilitate safe expansion of laparoscopic parenchymal-sparing anatomical segmentectomy in the future (22,23).

In summary, a laparoscopic approach can be safely applied to PSH for solitary liver tumours, whilst open surgery should be considered the gold standard approach for patients with multicentric bilobar metastases. Future studies should aim to define *PSH* in terms of the tumour size/number and proximity to major vascular structures.

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