Laparoscopic Parenchymal-Sparing Resections for Nonperipheral Liver Lesions, the Diamond Technique: Technical Aspects, Clinical Outcomes, and Oncologic Efficiency

Federica Cipriani, MD, Vishal G Shelat, MD, FRCS, FICS, Majd Rawashdeh, MD, Elisa Francone, MD, Luca Aldrighetti, MD, PhD, Arjun Takhar, MD, FRCS, PhD, Thomas Armstrong, MD, FRCS, PhD, Neil W Pearce, MD, FRCS, Mohammad Abu Hilal, MD, FRCS, PhD, DocEurp

BACKGROUND: Surgical management of liver lesions has moved toward "parenchymal-sparing" strategies. Although open parenchymal-sparing liver resections are supported by encouraging results, the applicability of the laparoscopic approach for nonperipheral tumors is still questionable. Our aim was to assess the feasibility, safety, and oncologic adequacy of laparoscopic parenchymal-sparing liver resection for nonperipheral lesions with a description of the technique adopted in this setting.

STUDY DESIGN: A prospectively collected single-center database of 517 laparoscopic liver resections was reviewed. Laparoscopic nonperipheral parenchymal-sparing liver resections (LapPSLRs), that is, entirely intraparenchymal limited resections performed on nonperipheral lesions, were selected. Intra- and perioperative outcomes were analyzed along with 3-year actuarial survival for patients with colorectal liver metastases.

RESULTS: The group comprised 49 LapPSLRs. Colorectal liver metastases were the most frequent diagnosis (n = 24 patients). Lesions were located in segments 8, 7, 4a, and 3 in 51%, 8.2%, 36.7%, and 4.1% of cases, respectively. Conversion occurred in 4 patients (8%). Intra- and postoperative short-term outcomes were calculated for the 24 isolated LapPSLR (not associated with any concurrent liver resection). Median operative time and blood loss were 215 minutes and 225 mL, respectively. Pringle maneuver was used in 75% of cases. Postoperative 90-day mortality was nil and morbidity rate was 12.5%. Median postoperative stay was 3 days. Median tumor-free margin was 4 mm and 100% R0 rate was achieved for all LapPSLRs with curative intent. Three-year overall, recurrence-free, and disease-free survival rates were 100%, 65.2%, and 69.6%, respectively.

CONCLUSIONS: Laparoscopic parenchymal-sparing liver resections for nonperipheral liver lesions are feasible and can be performed safely without compromising perioperative and oncological outcomes. (J Am Coll Surg 2015;221:265–272. © 2015 by the American College of Surgeons)

Parenchymal-sparing liver resections (PSLRs) have been advocated in the last several years, especially for colorectal liver metastases.[1,2] This approach allows radical resections with the maximum preservation of parenchyma, decreasing the risk of postoperative liver failure,[3,4] and allows for future resections in case of recurrence, extending survival in a now chronically managed disease.[5]

Although open PSLRs and laparoscopic PSLRs (LapPSLRs) for peripheral lesions are supported by encouraging results, their applicability for nonperipheral

Disclosure Information: Nothing to disclose.

Received January 25, 2015; Revised March 16, 2015; Accepted March 17, 2015.

From the University Hospital Southampton NHS Foundation Trust, Southampton, UK (Cipriani, Shelat, Rawashdeh, Francone, Takhar, Armstrong, Pearce, Abu Hilal) and San Raffaele Hospital, Milan, Italy (Aldrighetti).

Correspondence address: Mohammad Abu Hilal, MD, FRCS, PhD, DocEurp, University Hospital Southampton NHS Foundation Trust, E Level, Tremona Rd, Southampton SO166YD, UK. email: abuhilal9@gmail.com

http://dx.doi.org/10.1016/j.jamcollsurg.2015.03.029
ISSN 1072-7515/15

Abbreviations and Acronyms

CRLM = colorectal liver metastases
CUSA = Cavitron Ultrasonic Surgical Aspirator
DFS = disease-free survival
LapPSLR = laparoscopic nonperipheral parenchymal-sparing liver resection
OS = overall survival
PSLR = parenchymal-sparing liver resection
RFS = recurrence-free survival

liver tumors is still questionable.[6-8] Lesions requiring these resections are frequently located in the posterosuperior segments or elsewhere deep within the parenchyma and are therefore difficult to approach in the absence of tactile feedback.[7,9] However, with growing experience, a few centers are pushing boundaries to extend the role of laparoscopy to these difficult settings.[10-12]

Here we report our results of LapPSLRs for nonperipheral liver lesions and describe our technique intended to facilitate such resections without affecting safety and oncologic efficiency. To our knowledge, this is the largest series reporting on the technique and results of LapPSLRs for nonperipheral lesions.

METHODS

Study design

A prospectively collected single-center database of 517 consecutive patients undergoing laparoscopic liver resections (August 2003 to December 2014) at Southampton University Hospital was reviewed. Laparoscopic nonanatomical segmentectomies were selected (n = 137). Peripheral PSLRs accomplished with a wedge resection were excluded even if the lesions were in the posterior segments. In this article, only entirely intraparenchymal lesions requiring a circumferential resection margin (n = 50), as shown in Figure 1, were considered (LapPSLRs).

Analysis of intra- and postoperative outcomes was performed exclusively on isolated LapPSLR, excluding patients who received any concomitant liver resection to clear possible biases. Intraoperative unfavorable incidents and postoperative complications were classified (Satava approach to Surgical Error Evaluation adapted for laparoscopic liver resections and Accordion Severity Grading System of Surgical Complications, respectively).[12-14] Liver resections were described according to the Brisbane 2000 Nomenclature.[15]

Evaluation of oncologic outcomes was selectively performed for patients affected by colorectal liver metastases (CRLM). Overall survival (OS) was estimated from LapPSLR until death, recurrence-free survival (RFS) was estimated from LapPSLR until the first documented recurrence of disease, and disease-free survival (DFS) was defined as survival from LapPSLR until incurable recurrence.

Surgical procedure

Pure laparoscopic procedures were attempted in all patients. With growing experience, the technique for

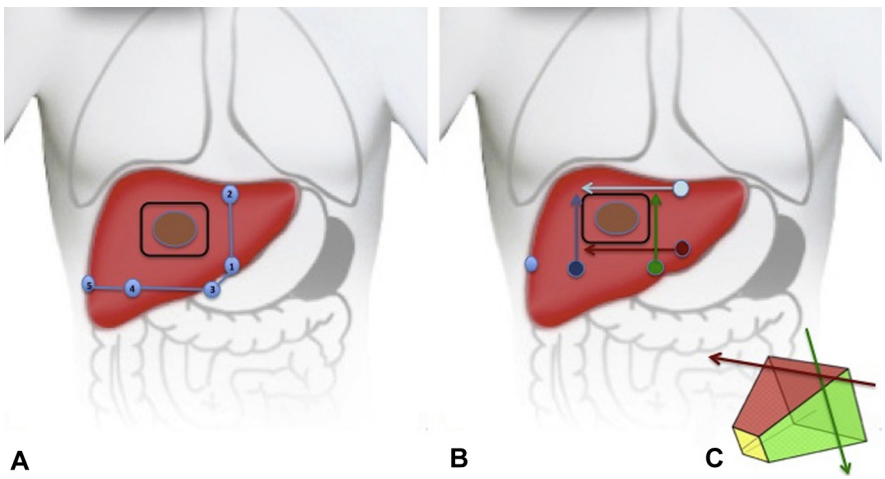

Figure 1. (A) L-shaped port configuration and square-shaped transection area for a lesion located in segment 8. (B) Relation between L-shaped port configuration, transection planes and "square-shaped" transection area: 4 transection planes can develop in line with the transection device. (C) Each transection plane is run perpendicularly to the planes aside and progressively toward the deeper parenchyma, allowing the creation of a semi-diamond–shaped specimen rather than a cone.