

## Robotic liver surgery is the optimal approach as bridge to transplantation

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### Abstract

The role of minimally invasive liver surgery as a bridge to transplantation is very promising but still underestimated. However, it should be noted that surgical approach for hepatocellular carcinomas (HCC) is not merely a technical or technological issue. Nowadays, the epidemiology of HCC is evolving due to the increasing role of non-alcoholic fatty-liver-disease, and the emerging concerns on direct-acting antivirals against hepatitis C virus in terms of HCC incidence. Therefore, a fully multidisciplinary study of the cirrhotic patient is currently more important than ever before, and the management of those patients should be reserved to tertiary referral hepatobiliary centers. In particular, minimally invasive approach to the liver showed several advantages compared to the classical open procedure, in terms of: (1) the small impact on abdominal wall; (2) the gentle manipulation on the liver; (3) the limited surgical trauma; and (4) the respect of venous shunts. Therefore, more direct indications should be outlined also in the Barcelona Clinic Liver Cancer model. We believe that treatment of HCC in cirrhotic patients should be reserved to tertiary referral hepatobiliary centers, that should offer patient-tailored approaches to the liver disease, in order to provide the best care for each case, according to the individual comorbidities, risk factors, and personal quality of life expectations.

**Key words:** Hepatocellular carcinomas; Liver transplant; Robotic surgery; Bridge to transplantation; Da Vinci; Barcelona Clinic Liver Cancer; Patient safety

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**Core tip:** We read with great interest the manuscript

by Dr. Memeo *et al.* The role of minimally invasive liver surgery as a bridge to transplantation is very promising but still underestimated. In particular, minimally invasive approach to the liver showed several advantages compared to the classical open procedure in cirrhotic patients, and currently it deserves more direct indications that should be outlined also in the Barcelona Clinic Liver Cancer model.

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## TO THE EDITOR

We read with great interest the paper by Memeo *et al.*<sup>[1]</sup>, recently published on *World Journal of Hepatology* and titled "Innovative surgical approaches for hepatocellular carcinoma". In their well written and complete analysis of surgical planning and treatment for hepatocellular carcinomas (HCC), the authors affirm that the well-known advantages of minimally invasive liver surgery (MLS) compared to the classic "open" approach (OLS) may result in an easier access to the abdomen in case of future liver transplantation (LT). We completely agree and compliment them for highlighting this issue, which is currently underestimated. In July 2014 we started a robotic program at University of Modena and Reggio Emilia and in a period of two years 69 procedures have been performed. A total of 47 robotic liver procedures were ruled out, and among those 24 resection for HCC in cirrhotic patients. In this cohort of patients there were no conversions to laparotomy, mean operative time was 318 min (docking time included), and the mean in-hospital stay was 5.1 d. No readmission nor recurrences were observed. Our robotic cohort of HCC patients is included in an ongoing study funded by "Regione Emilia Romagna" (Regional Public Health System) that aims to investigate the role of robotic surgery in bridging patients with HCC to LT. Up to now, in our Institution two patients successfully underwent LT after MLS and four are on the waiting list.

The robotic platform is expanding its field of application on liver surgery for HCC including the so-called "difficult segments", and should be considered as a valuable tool for bridging patients to LT<sup>[2-6]</sup>. Although OLS has been classically limited to a strictly selected population of patients, several studies demonstrated that MLS is safe, feasible and particularly effective for parenchyma-sparing procedures, as needed in cirrhotic patients<sup>[7]</sup>. However, it should be noted that surgical approach for HCC is not merely a technical or technological issue. Nowadays, the epidemiology of HCC is evolving due to the increasing role of non-alcoholic fatty-liver-disease and direct-acting antivirals against

hepatitis C virus<sup>[8]</sup>. Therefore, a fully multidisciplinary study of the cirrhotic patient is currently more important than ever before, and the management of those patients should be reserved to tertiary referral hepatobiliary centers. Moreover, it should be taken into account that the intraoperative management as well is not only a matter of individual ability to perform certain procedures. MLS seems more effective than OLS in patients affected by HCC within a cirrhotic liver due to several reasons. First of all, in a setting of reduced liver function and reduced functional reserve, we can benefit from less impact on the abdominal wall, gentle manipulation on the liver, respect of the venous shunts and limited surgical trauma. In addition, the perioperative perspiration is consistently less with MLS compared to OLS: Consequently, fluids administration can be more conservative since generous substitutions are not needed. Finally, a better control of post-operative pain and early mobilization of the patient after MLS reduce respiratory complications by enhancing respiratory movements<sup>[9]</sup>. Currently, there is no formal evidence of the superiority of robotic approach vs conventional laparoscopy and also oncological results are similar<sup>[10]</sup>. The correct timing and criteria for choosing between liver resection or LT is still debated, and optimizing organ allocation is still our priority<sup>[11]</sup>. MLS offers an opportunity to safely treat HCC patients even with a Child A-B cirrhotic liver, with lower rates of overall morbidity when compared to OLR, and lower incidence of local recurrence when compared to radiofrequency ablation<sup>[12]</sup>. In conclusion, minimally invasive liver procedures can be considered as an independent field of surgery, with particular indication for Child A and B patients and parenchyma-sparing procedures, that should be better classified in the classical Barcelona Clinic Liver Cancer model<sup>[13-15]</sup>.

We compliment again the Authors for their work and their effort as a referral center of technological innovation to improve both surgical performances and patients' safety. We believe that a modern hepatobiliary center should offer patient-tailored approaches to the liver disease, in order to provide the best care for each case, according to the individual comorbidities, risk factors and personal quality of life expectations.

## REFERENCES

- 1 Memeo R, de'Angelis N, de Blasi V, Cherkaoui Z, Brunetti O, Longo V, Piardi T, Sommacale D, Marescaux J, Mutter D, Pessaux P. Innovative surgical approaches for hepatocellular carcinoma. *World J Hepatol* 2016; 8: 591-596 [PMID: 27168871 DOI: 10.4254/wjh.v8.i13.591]
- 2 Panaro F, Piardi T, Cag M, Cinquabre J, Wolf P, Audet M. Robotic liver resection as a bridge to liver transplantation. *JSLs* 2011; 15: 86-89 [PMID: 21902950 DOI: 10.4293/108680811X13022985131417]
- 3 Giulianotti PC, Coratti A, Sbrana F, Addeo P, Bianco FM, Buchs NC, Annechiarico M, Benedetti E. Robotic liver surgery: results for 70 resections. *Surgery* 2011; 149: 29-39 [PMID: 20570305 DOI: 10.1016/j.surg.2010.04.002]
- 4 Di Benedetto F, Ballarin R, Tarantino G. Totally robotic isolated caudate-lobe liver resection for hydatid disease: report of a case. *Int J Med Robot* 2016; 12: 254-261 [PMID: 26183233 DOI: 10.1007/s12220-016-0020-0]

- 10.1002/res.1685]
- 5 **Spampinato MG**, Coratti A, Bianco L, Caniglia F, Laurenzi A, Puleo F, Ettorre GM, Boggi U. Perioperative outcomes of laparoscopic and robot-assisted major hepatectomies: an Italian multi-institutional comparative study. *Surg Endosc* 2014; **28**: 2973-2979 [PMID: 24853851 DOI: 10.1007/s00464-014-3560-4]
  - 6 **Giulianotti PC**, Bianco FM, Daskalaki D, Gonzalez-Ciccarelli LF, Kim J, Benedetti E. Robotic liver surgery: technical aspects and review of the literature. *Hepatobiliary Surg Nutr* 2016; **5**: 311-321 [PMID: 27500143 DOI: 10.21037/hbsn.2015.10.05]
  - 7 **Di Sandro S**, Lauterio A, Giacomoni A, Concone G, Mangoni I, Mihaylov P, De Carlis L. Totally robotic liver resection for hepatocellular carcinoma in cirrhotic patients: safety and feasibility. *J Robot Surg* 2014; **8**: 357-364 [PMID: 27637844 DOI: 10.1007/s11701-014-0479-7]
  - 8 **Rinaldi L**, Di Francia R, Coppola N, Guerrera B, Imparato M, Monari C, Nevola R, Rosato V, Fontanella L, Franci G, Porta G, Messina V, Ascione A, Adinolfi LE. Hepatocellular carcinoma in HCV cirrhosis after viral clearance with direct acting antiviral therapy: preliminary evidence and possible meanings. *WCRJ* 2016: e748
  - 9 **Costi R**, Scatton O, Haddad L, Randone B, Andraus W, Massault PP, Soubrane O. Lessons learned from the first 100 laparoscopic liver resections: not delaying conversion may allow reduced blood loss and operative time. *J Laparoendosc Adv Surg Tech A* 2012; **22**: 425-431 [PMID: 22670635 DOI: 10.1089/lap.2011.0334]
  - 10 **Salloum C**, Lim C, Malek A, Compagnon P, Azoulay D. Robot-assisted laparoscopic liver resection: A review. *J Visc Surg* 2016 [PMID: 27665393 DOI: 10.1016/j.jviscsurg.2016.08.005]
  - 11 **Adam R**, Bhangui P, Vibert E, Azoulay D, Pelletier G, Duclos-Vallée JC, Samuel D, Guettier C, Castaing D. Resection or transplantation for early hepatocellular carcinoma in a cirrhotic liver: does size define the best oncological strategy? *Ann Surg* 2012; **256**: 883-891 [PMID: 23108125 DOI: 10.1097/SLA.0b013e318273bad0]
  - 12 **Vitali GC**, Laurent A, Terraz S, Majno P, Buchs NC, Rubbia-Brandt L, Luciani A, Calderaro J, Morel P, Azoulay D, Toso C. Minimally invasive surgery versus percutaneous radio frequency ablation for the treatment of single small ( $\leq 3$  cm) hepatocellular carcinoma: a case-control study. *Surg Endosc* 2016; **30**: 2301-2307 [PMID: 26534770 DOI: 10.1007/s00464-015-4295-6]
  - 13 **Torzilli G**, Belghiti J, Kokudo N, Takayama T, Capussotti L, Nuzzo G, Vauthey JN, Choti MA, De Santibanes E, Donadon M, Morengi E, Makuuchi M. A snapshot of the effective indications and results of surgery for hepatocellular carcinoma in tertiary referral centers: is it adherent to the EASL/AASLD recommendations?: an observational study of the HCC East-West study group. *Ann Surg* 2013; **257**: 929-937 [PMID: 23426336 DOI: 10.1097/SLA.0b013e31828329b8]
  - 14 **Livraghi T**, Brambilla G, Carnaghi C, Tommasini MA, Torzilli G. Is it time to reconsider the BCLC/AASLD therapeutic flow-chart? *J Surg Oncol* 2010; **102**: 868-876 [PMID: 20886553 DOI: 10.1002/jso.21733]
  - 15 **Szold A**, Bergamaschi R, Broeders I, Dankelman J, Forgione A, Langø T, Melzer A, Mintz Y, Morales-Conde S, Rhodes M, Satava R, Tang CN, Vilallonga R. European Association of Endoscopic Surgeons (EAES) consensus statement on the use of robotics in general surgery. *Surg Endosc* 2015; **29**: 253-288 [PMID: 25380708 DOI: 10.1007/s00464-014-3916-9]

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