Ann Surg Oncol (2022) 29:6522–6523
https://doi.org/10.1245/s10434-022-11885-7

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

EDITORIAL – HEPATOBILIARY TUMORS

Assessing the Role of 3D Vision Technology for Laparoscopy

Eric C. H. Lai, MBChB, FRACS

Department of Surgery, Pamela Youde Nethersole Eastern Hospital, Chai Wan, Hong Kong SAR, China

The use of laparoscopic hepatectomy has been increasing since it was first reported in 1991. As compared with open hepatectomy, laparoscopic hepatectomy for suitable patients offers the advantage of significantly less complications, less blood loss, and shorter hospital stay.[1] The oncological outcomes of laparoscopic hepatectomy and open hepatectomy are comparable, also.[2] However, in comparison with other gastrointestinal surgery, laparoscopic development for hepatectomy has slower progress because of its technical difficulty and bleeding risk. Two-dimensional (2D) laparoscopic vision and the lack of dexterity of conventional laparoscopic instruments are major hurdles. The use of a three-dimensional (3D) vision system in laparoscopic surgery has been suggested to facilitate laparoscopic skills by providing the depth perception and spatial orientation not available with traditional 2D displays. After reviewing 138 articles, the European Association for Endoscopic Surgery (EAES) consensus of 2018 recommended the use of 3D vision in laparoscopy to reduce the operative time.[3] It also found that a significant reduction in complications was observed when 3D vision was used, particularly for surgeries involving laparoscopic suturing. The application of 3D vision in laparoscopic hepatectomy has the potential advantages of shorter operative time or better surgeon's performance such as vascular/bile duct dissection, bleeding point suture plication, and perception of margins. However, it has not been widely adopted due to a lack of evidence of benefit. Only limited small retrospective studies and case reports have investigated the impact of 3D vision system on surgical outcomes of laparoscopic hepatectomy. Furthermore, the impact of 3D vision in beginners and experienced surgeons may be different also, as experienced surgeons can overcome the limitations of 2D vision by experience of repetitive tactile and visual information. Velayutham et al. evaluated the effect of 3D vision on operative performance during laparoscopic hepatectomy in a case-matched study.[4] Twenty patients undergoing laparoscopic hepatectomy by high-definition 3D laparoscope between April 2014 and August 2014 were matched to a retrospective control group of patients who underwent laparoscopic hepatectomy by 2D laparoscope. The operative time was significantly shorter in the 3D group when compared with 2D (225 versus 284 min). There was no significant difference in blood loss in the 3D group when compared with the 2D group (204 versus 252 ml). The major complication rates were similar (5% versus 7.5%). The development of 3D vision in laparoscopic and robotic surgical systems also raises the question of whether these two procedures are equivalent. Lim et al. evaluated the data for operative time, morbidity, margins, and survival between 3D laparoscopic hepatectomy and robotic hepatectomy from 2011 to 2017.[5] Forty-nine patients and 44 patients with hepatocellular carcinoma underwent 3D laparoscopic hepatectomy and robotic hepatectomy, respectively. No difference was observed in operative time (269 versus 252 min), overall (27% versus 16%) and severe complications (4% versus 2%), or resection margin (9 versus 11 mm). The 3-year overall and recurrence-free survival rates after 3D laparoscopic hepatectomy and robotic hepatectomy were 82% and 24%, and 91% and 48%, respectively. The 3D laparoscopic hepatectomy and robotic hepatectomy systems provide comparable surgical outcomes. Due to the limited studies, the added value of 3D vision systems in laparoscopic hepatectomy is currently unclear.

First Received: 25 April 2022
Accepted: 26 April 2022
Published Online: 30 July 2022

E. C. H. Lai, MBChB, FRACS
e-mail: elaichun@gmail.com

Although 3D vision technology for laparoscopy has substantially improved, it is still not the common standard for laparoscopic surgery. Some 3D laparoscopic systems have been introduced since the 1990s, but not popularized, and the enthusiasm to evaluate this technology quickly subsided because most of these early studies showed no advantage of 3D vision in laparoscopic surgery, while it caused adverse effects in surgeons, such as dizziness, eye strain, and headache. Modern high-definition 3D laparoscopic system still has limitations, e.g., no 5-mm scopes, specific glasses needed, and optimal monitor position needed. Further studies are required to address the role of the 3D vision system in laparoscopic hepatectomy. In this issue of *Annals of Surgical Oncology*, in "Impact of Three-Dimensional (3D) Visualization on Laparoscopic Hepatectomy for Hepatocellular Carcinoma," Au et al. publish their data on 144 patients with propensity score analysis.[6] Use of 3D vision in laparoscopic hepatectomy was potentially associated with less complications, and enhanced feasibility in laparoscopic major and difficult hepatectomy. This study adds additional evidence to the current literature.

DISCLOSURE The author reports no conflicts of interest.

REFERENCES

1. Lai EC, Tang CN, Ha JP, Li MK. Laparoscopic liver resection for hepatocellular carcinoma: ten-year experience in a single center. *Arch Surg*. 2009;144:143–7.
2. Lai EC, Tang CN. long-term survival analysis of robotic versus conventional laparoscopic hepatectomy for hepatocellular carcinoma: a comparative study. *Surg Laparosc Endosc Percutan Tech*. 2016;26:162–6.
3. Arezzo A, Vettoretto N, Francis NK, et al. The use of 3D laparoscopic imaging systems in surgery: EAES consensus development conference 2018. *Surg Endosc*. 2019;33:3251–74.
4. Velayutham V, Fuks D, Nomi T, Kawaguchi Y, Gayet B. 3D visualization reduces operating time when compared to high-definition 2D in laparoscopic liver resection: a case-matched study. *Surg Endosc*. 2016;30:147–53.
5. Lim C, Goumard C, Salloum C, Tudisco A, Napoli N, Boggi U, Azoulay D, Scatton O. Outcomes after 3D laparoscopic and robotic liver resection for hepatocellular carcinoma: a multicenter comparative study. *Surg Endosc*. 2021;35:3258–66.
6. Au KP, Chan MY, Chu KW, Kwan CL, Ma KW, Wong HS, Tsang SH, Dai WC, Cheung TT, Chan AC. Impact of three-dimensional (3D) visualization on laparoscopic hepatectomy for hepatocellular carcinoma. *Ann Surg Oncol*. 2022. https://doi.org/10.1245/s10434-022-11716-9.