

Peer Review File

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Reviewer A

The authors present a video of a robotic left hepatectomy. It is a well-edited video of a well-executed surgical intervention. This manuscript needs some changes to be accepted for publication, such as the following:

1. The authors mention that there were savings in performing this procedure because they only used 3 robotic instruments. However, it is clear from the video analysis that the authors used a robotic hemolock applicator. The premise of the video of using 2 additional ports for laparoscopic assistance and cost reduction is not supported. The use of additional port for laparoscopic assist is essential for the use of the CUSA instrument which is not yet commercially available for the Da Vinci robotic platform. The use of the laparoscopic stapler may represent a cost reduction and was adequately employed in the present case and would need more emphasis in the discussion.

Reply 1- Text changed to. 4 instruments used in the surgery viz., Maryland bipolar forceps, monopolar diathermy scissors, ProGrasp forceps & robotic clip applicator. CUSA was not used in this case. The laparoscopic ports used were for the insertion of the vascular stapler and for suctioning. Use of laparoscopic stapler has been stressed in the discussion as a method for reducing cost.

Changes in text - We were able to reduce the cost of the procedure with the use of only 4 robotic instruments i.e., Maryland bipolar forceps, monopolar diathermy scissors, ProGrasp forceps and robotic hemolok applicator. Utilizing the laparoscopic port for stapling further reduced the overall cost of the procedure vis-à-vis using a robotic stapler

2. The authors did not use the Pringle maneuver or other maneuver to reduce bleeding (Glissonian access, selective clamping of the hepatic artery). Indeed, we see that there was an estimated blood loss of 600 ml, which is a little above the usual for a left hepatectomy. I think it deserves a comment about it and some reference, such as:

- Nomi T, Fuks D, Agrawal A, Govindasamy M, Araki K, Gayet B. Modified Pringle maneuver for laparoscopic liver resection. *Ann Surg Oncol*. 2015 Mar;22(3):852.

- Machado MA, Mattos BH, Lobo Filho M, Makdissi F. Intrahepatic Glissonian approach for robotic left hepatectomy. *Surg Oncol*. 2021 Sep;38:101601.

-Huang JW, Su WL, Wang SN. Alternative Laparoscopic Intracorporeal Pringle Maneuver by Huang's Loop. *World J Surg*. 2018 Oct;42(10):3312-3315.

The pictures are not in acceptable quality. Moreover, they could be grouped together to reduce space and improve reading dynamics.

Reply 2- Pringle manoeuvre was not used in this case, however we use the Pringle manoeuvre selectively depending on the intraoperative need. A comment on the same has been added in the discussion with a reference for selective use of the Pringle Maneuvre in robotic hepatectomy.

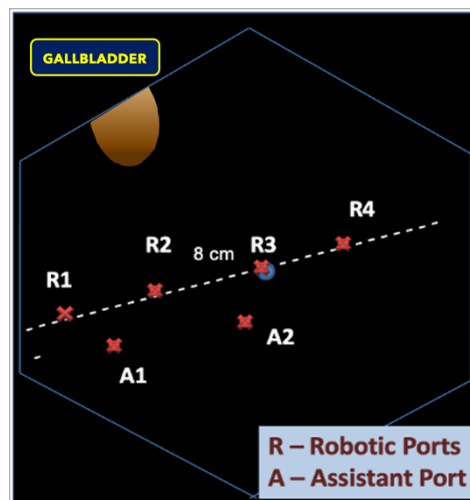
All pictures are intraoperative screen grabs and are of the highest recorded quality that the robotic camera could provide. All photos are grouped towards the end of the manuscript with legends as advised.

Changes in text - The intermittent Pringle maneuver can be an effective method of reducing intraoperative hemorrhage in minimally-invasive hepatectomy. We use this maneuver selectively using the Huang Loop technique (not utilized in this case). (11)

3. Video - at time 0:45 we see a picture of trocar placement that are certainly not from the same patient, since we see in another scene, terminal colostomy (compatible with operated rectal cancer). It needs to be removed and replaced with a figure.

Reply 3 – Photo of a different patient was shown for clear depiction of port placement. This photo has been removed as advised replaced with a diagram to show the port placement.

Change in video -



4. It is mentioned that the patient was operated on for cancer of the rectum but we find no mention of the type of treatment in the manuscript. Was it open, laparoscopic, robotic, what was the TNM staging, CEA value, neoadjuvant chemotherapy and radiotherapy, adjuvant chemotherapy before hepatectomy and very important what difficulties were encountered related to the previous surgery and how long after. Finally mention something of the late evolution of the patient. Is he alive, without disease how long after?

Reply 4 – Details regarding previous treatment were not mentioned in the current manuscript since this video was intended to be a technical demonstration of a robotic hepatectomy and since this surgery was done in the upper abdomen, the rectal surgery did not interfere in the current surgery. Description of the

previous surgery including follow up details added as advised.

Changes in text - The patient received long-course neoadjuvant chemoradiation followed by a laparoscopic abdominoperineal resection for a cT3 N1 rectal tumour. One month after the index surgery he was planned for a formal left hepatectomy using the robotic platform (Da Vinci Xi) after confirmation of an adequate functional liver remnant of 80.9% on a Myrian protocol contrast enhanced computed tomography scan as a staged approach. CEA value was 2.9. The patient received adjuvant CapeOx after hepatectomy and is on regular follow-up and doing well.

5. The quality of the video, the main reason for publishing, is not good. Da Vinci Xi produces a square video and this video is in 16x9 aspect ratio, so it is clearly stretched, which changes the clarity of the anatomy and the intervention. Narration can be improved, but not because of the accent, but because of the diction that is not always clear for the audience, especially for those who are not native speakers. The camera is always dirty and often blurred, which makes it difficult to watch.

The anatomical elements that have been highlighted aid understanding and are well done.

Reply 5 – Although we concede that the video quality could have been better, the aspect ratio has not been stretched and has been submitted as recorded by the Da Vinci video recording system. It could be possible that our recording system is of inferior quality than would be expected although this does not compromise the information being presented and the surgical steps as the structures are appropriately delineated and annotated for better understanding. Narration can definitely be improved if specific pointers could be provided for changes needed.

Editorial Comments

1. To provide context, it might be beneficial to include a statement regarding the prevalence or significance of colorectal liver metastases within the abstract.

Changes in text - . Liver metastases of colorectal origin are seen in about 25-30% of patients and are addressed with surgical resection in appropriately selected cases.)

2. Abstract: “surgeons have pushed boundaries, successfully expanded the indications, and delivered improvement in outcomes of a hitherto feared operation”, could you offer specifics? For instance, which indications have been expanded upon? What metrics showcase the improvement in outcomes?

Reply: The International consensus statements of Louisville (2009) and Morioka (2014) restrict the use of minimally-invasive liver resections to solitary lesions, 5 cm or less, located in segments II-VI. But we now know that these recommendations are restrictive and successful resections have been performed even in patients beyond the above indications as shown in our case as well. In fact with the publications authored by pioneering surgeons like Prof Guido Torzilli and others parenchyma-sparing liver resections are the norm today. Another review by M Lo et al also point towards better outcomes

with MIS liver resections - Lo WM, Tohme ST, Geller DA. *Recent Advances in Minimally Invasive Liver Resection for Colorectal Cancer Liver Metastases-A Review. Cancers (Basel)*. 2022 Dec 26;15(1):142. doi: 10.3390/cancers15010142. PMID: 36612137; PMCID: PMC9817853.)

3. Abstract: “In this article, we present a video vignette of a formal robotic left hepatectomy for colorectal liver metastases with tips and tricks of the operation for easy reproducibility.” please also briefly describe the outcomes of this surgery.

Changes in abstract - Our patient had a blood loss of 600 cc, a specimen weight of 420 g. The operative duration was 340 min. The postoperative course was uneventful, and the patient was discharged on the 7th postoperative day.

4. If there were any specific technical innovations or modifications to the standard robotic hepatectomy, briefly mention them in the abstract. This can highlight the uniqueness of your technique.

Reply: Added in abstract - To some extent, we have been able to contain the procedure cost by using only 4 robotic instruments with other instruments through laparoscopic ports, without compromising on surgical ergonomics and outcomes. A modification of the Rubber Band technique popularized by Choi et al, is employed to improve surgical ergonomics especially during hepatic parenchymal transection.

5. Highlight Box:

(1) Surgical Highlights: Clarify “Formal Left hepatectomy” by briefly explaining what makes it “formal” to give readers a better understanding of the procedure’s specificities.

Changes in text – Resection of segment II, III, IV (transection line running along the left side of gallbladder fossa upto the left margin of suprahepatic IVC – The Cantlie line / Principal plane)

(2) What is conventional and what is novel/modified?: The mention of the “Modification of the Rubber-band technique” is intriguing. Providing a one-line description of how it's modified or why this modification is significant could enhance comprehension.

Changes in text - Introduced by Choi et al., the original technique makes use of sterile elastic rubber bands on either side of the transection plane. In this video we used silicon vessel tapes which seem to be more durable and provide graded traction during parenchymal transection

(3) What is the implication, and what should change now?: Consider expanding on “improves procedural ergonomics” by briefly explaining the benefits of improved ergonomics, such as enhanced surgeon comfort, better visualization, etc.

Changes in text - Brings the transection plane in line with the camera (R2 port) providing better visualization of structures crossing the principal plane thereby aiding effective control and minimizing blood loss. Graded traction provides consistency of pull even upto the upper part of transection.

6. For a surgical technique report, the introduction is essential to provide background and set the stage for the technique being presented. Here's what you might consider adding to the original introduction to offer more depth and context:

(1) Epidemiological Context: Briefly touch upon the prevalence or significance of liver resections, particularly in the context of colorectal liver metastases. This will highlight the relevance of the study.

Changes in text - . Liver metastases of colorectal origin are seen in about 25-30% of patients and are addressed with surgical resection in appropriately selected cases. Incidence of synchronous CRLM is ~13.8%–17.1% while that for metachronous CRLM is ~7.6%–15.1%.

(2) Previous Techniques: Offer a brief comparison or mention of previously popular techniques and their drawbacks.

Changes in text - Open liver resections have been the norm traditionally. With the advent of minimally-invasive techniques, laparoscopic and robotic liver surgeries are finding greater utility due to obvious advantages. A meta-analysis comparing open and laparoscopic CRLM resection found no significant differences in long-term oncologic outcomes. The robotic platform provides significant ergonomic advantages over laparoscopy with a greater range of motion with articulating instruments, better 3-dimensional vision and a stable camera. Retrospective studies comparing laparoscopy with the robotic approach however, do indicate longer operative times, inconsistently a higher blood loss and increased cost although perioperative and short-term outcomes seem comparable. However, interest in robotic liver surgeries has peaked in recent times and with promising results, the robotic approach seems to be eminently feasible and a safe alternative in liver surgeries.

(3) Benefits of Robotic Surgery: A brief overview of the specific benefits of robotic over traditional liver surgery, such as precision, dexterity, and visualization, would set the stage for the technique's presentation.

Changes in text - The robotic platform provides significant ergonomic advantages over laparoscopy with a greater range of motion with articulating instruments, better 3-dimensional vision and a stable camera.

(4) Limitations of Current Techniques: Before presenting your technique, it might be useful to highlight what limitations or challenges exist in current practices that your technique addresses.

Changes in text - Parenchymal transection seems to be the 'Achilles heel' of MIS liver resections with

the resulting higher blood loss longer operative times. The rubber-band technique popularized by Choi et al., (choi) seems to be an effective technique for this step which has been employed in our video with a slight modification of using silicon vessel tapes. This technique brings the transection plane in line with the camera (R2 port) providing better visualization of structures crossing the principal plane thereby aiding effective control of vessels and minimizing blood loss. Graded traction provides consistent pull even up to the upper part of transection.

7. Preoperative Preparations and Requirements

(1) In reference to the “Myrian protocol contrast enhanced computed tomography scan”, please cite “Figure 1” within this context rather than with “The alpha fetoprotein level was normal (Figure 1).”

Corrected as advised.

(2) Kindly provide details about the primary members of the surgical team, including the main surgeon, assistants, anesthetist, and technicians. Relevant experience and qualifications, such as the number of similar surgeries the lead surgeon has performed, any specialized training, and its duration, would be insightful.

Response – Our early experience published in literature - Chandarana M, Patkar S, Tamhankar A, Garg S, Bhandare M, Goel M. Robotic resections in hepatobiliary oncology - initial experience with Xi da Vinci system in India. *Indian J Cancer*. 2017 Jan-Mar;54(1):52-55. doi: 10.4103/ijc.IJC_132_17. PMID: 29199663.

Pubmed link - <https://pubmed.ncbi.nlm.nih.gov/29199663/>

(3) In light of statements: “the patient selection being a key factor” (Abstract); “... with carefully selected patients subjected to the robotic platform” (Introduction, 1.2 Rationale), could you specify the criteria utilized in selecting the patients?

Changes in text - Our current criteria for selecting patients for a robotic liver resection in CRLM include solitary or multiple lesions in the same lobe, 5 cm or less in size, in segments II, III, IV, V or IV as per the Louisville consensus statement.

8. Step-by-step Description

(1) When mentioning a specific instrument, consider including its precise size or type for clarity.

Reply: All robotic instruments used are of the standard size and type. (Monopolar scissors, Prograsp forceps, Bipolar forceps & Hemolock applicator)

(2) Please separate out actions within each step for better readability.

Changes incorporated as advised

(3) Please specify the locations or anatomical landmarks for each port to guide placement more accurately.

– Changes in text - Robotic ports are inserted 8cms apart on an oblique line running from the right iliac fossa along the umbilicus to the left hypochondrium. Assistant ports are placed 4 cm below this line between the R1-R2 and the R2-R3 ports as shown in the schematic. (FIGURE 2)

(4) Upon retrieval, it would be informative to detail any steps taken to inspect the cavity for potential issues like bleeding, bile leakage, or other complications. Changes in text - Any leaking bile ducts are clipped, meticulous hemostasis achieved and an absorbable hemostat is placed over the cut surface of liver.

(5) Please note the operative time and blood loss during the procedure. Changes in text - Our patient had a blood loss of 600 cc, a specimen weight of 420 g and the operative duration was 340 min.

9. Postoperative Considerations and Tasks

(1) Describe specific interventions or monitoring techniques to manage and prevent PHLF. Changes in text – Figures added with legends.

(2) Consider expanding on the biochemical parameters and imaging features used to identify pre-operative predictors. Are there specific thresholds or markers the readers should know about? Changes in text - The colorectal liver metastases resection consensus guidelines (2006) recommend the acceptable FLR to be > 20% of Total liver volume (TLV) in normal livers, > 30% in the presence of steatosis and >40% in the presence of fibrosis/cirrhosis.

(3) Please touch upon the significance of early detection of complications and when to consider re-operation. Changes in text - Significant hemorrhage with hemodynamic instability, undrained perihepatic collections in the postoperative period might require a low threshold for re-interventions depending on the clinical situation.

10. Tips and Pearls

(1) “Proper assessment and recognition of anatomical variations” It would be helpful to further describe some of the common anatomical variations encountered, and perhaps suggest ways to manage them during the procedure. – Changes in text- Ligation of left hepatic artery (LHA) after confirmation of intact right hepatic artery (RHA) pulsation upon clamping, awareness about the Segment IV branch arising occasionally from the RHA, preservation of the occasional caudate lobe portal vein branch arising from the left branch of portal vein (LPV) by ligating the LPV between the caudate branch and the insertion of ligamentum venosum, awareness of right sectoral biliary ducts draining into the left hepatic duct are some commonly encountered variations to be aware of.

(2) “Rubber-band technique for ergonomic parenchymal transection” Could you further highlight why the rubber-band technique is superior or preferred, and maybe contrast it briefly with other methods. – Changes in text - One of the major challenges in MIS liver resections is the spatial relationship of the three-dimensional liver anatomy and the limited range of motion and fulcrum effect of the rigid instruments especially in laparoscopy. Therefore, successful outcomes can be achieved by aligning the transection plane with the camera so that hemostasis, biliostasis and tumour-free margins can be ensured. The rubber-band technique is a good approach in this direction as it exposes the transection plane and the structures crossing it for easy access and durable control improving the procedural ergonomics.

(3) Consider offering a short rationale or conditions under which one would choose to use the suprapubic Pfannenstiel incision over joining two robotic ports. Changes in text - Retrieval of the specimen through either of these incisions is feasible. The Pfannenstiel incision is preferred due to obvious advantages of reducing postoperative pain and improved respiratory mechanics.

(4) Discuss the importance of hemostasis and measures to ensure it during the procedure. -Changes in text - Ensuring good hemostasis and biliostasis – One of the significant causes of PHLF is blood loss >1200ml and consequent intraoperative transfusions. (ray) Meticulous hemostasis with clips and ligatures help mitigate these issues. Meticulous biliostasis can avoid infective complications and interventions in the post-operative period.

11. Discussion

(1) Consider comparing robotic hepatectomy with other techniques in terms of procedural outcomes and not just the conversion rates. And discuss more about how the robotic platform can potentially reduce the operative risks associated with conventional laparoscopy.

(2) Consider structuring the Discussion section as below:

6.1 Surgical highlights

6.2 Strengths and limitations

6.3 Comparison with other surgical techniques and researches

6.4 Implications and actions recommended

Changes in text - Discussion has been revised with advised changes