Utility of Visceral Organ Hanging Maneuver (VOHM) for Exposure and Stabilization of the Operative Field in Robotic Abdominal Surgery

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Background: *In laparoscopic surgery, hanging techniques have been described in attempt to reduce the number of ports and to guide surgery. However, with the fixed robotic surgical platform, we saw its use for different purposes. We called our technique a "visceral organ hanging maneuver (VOHM)" and have utilized it to expose and stabilize the field, to allow for maximal utilization of the robotic arms, and to mark the bowel resection margins.*
Objective: *The present study was demonstrated the VOHM technique for a variety of reasons on different organs.*
Material and Method: *A retrospectively reviewed our recorded videos of robotic abdominal surgery between July 2010 and September 2016. We used the da Vinci Si Robotic System (Intuitive Surgical Inc. Sunny Vale, Calif).*
Results: *VOHM is a simple technique to suspend various organs to improve the exposure, stabilize the operative field, and guide the resection.*
Conclusion: *VOHM technique was created not only to provide a widely exposed and stable operative field so the surgeon could concentrate on the work, but also to free up an instrument that would otherwise be used as a fixed retractor. The technique allows for an efficient, safe, and oncologically acceptable bowel resection in case of malignancy.*

Keywords: *Visceral organ hanging maneuver, Exposure in robotic abdominal surgery*

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Unlike open and laparoscopic abdominal surgery, exposure and stabilization of the operative field during the da Vinci robotic surgery continue to be a dilemma due to the fixed platform of the system and limited access for assistants. Several novel techniques have been used, including use of an umbilical tape/suture to suspend the liver[1-5]. We have devised a simple technique to suspend various organs to improve the exposure, stabilize the operative field, and guide the resection. The technique and accompanied video clips are reported and shown herein.

Material and Method

We retrospectively reviewed our recorded videos of robotic abdominal surgery between July 2010 and September 2016. Videos of the procedures with VOHM were selected out and classified based on involved organs. Representative clips from each organ-based video were then edited and prepared for the manuscript.

We used the daVinci Si Robotic System (Intuitive Surgical Inc. Sunny Vale, Calif). 2-0 silk sutures were used to suspend the organ to the abdominal wall either at a single or multiple points depending on the circumstances. We used sliding knot first to adjust the position followed by securely tying.

Surgical technique

Stomach hanging maneuver

This maneuver was used to expose the lesser sac during celiac lymphadenectomy and distal pancreatic dissection. Following division of gastrocolic ligament, the posterior wall of the stomach was sutured to the falciform ligament or diaphragm at multiple points using 2-0 silk sutures. With this maneuver, the operative field was exposed and stabilized while the third robotic arm was free to be used for assisting in the dissection instead of just holding the stomach (Fig. 1).

Small and large bowels hanging maneuver

The segment of the bowel to be resected was grasped and its wall was then marked at the proximal

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and distal margins of resection with 2-0 silk sutures, which were then sutured to the abdominal wall. When the bowel was suspended and stabilized in midair, the mesentery and the transection lines could be clearly seen and easily managed. Radical lymph node dissection for a malignant case can also be done accurately and safely. VOHM can be applied to both small bowel and colon (Fig. 2 to 4).

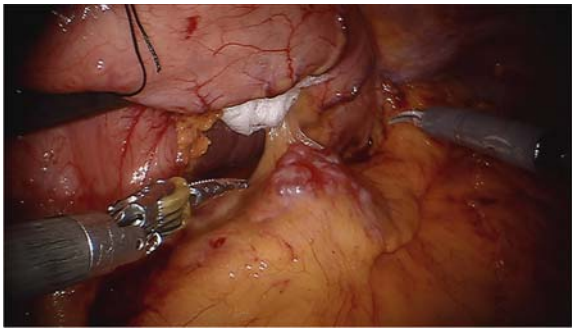

Fig. 1 HM of stomach.

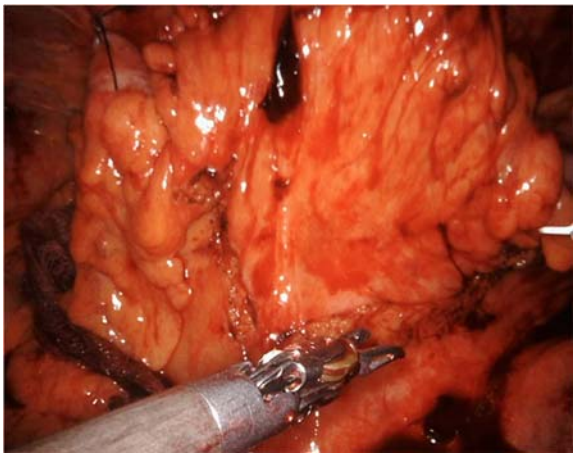

Fig. 2 HM of large bowel.

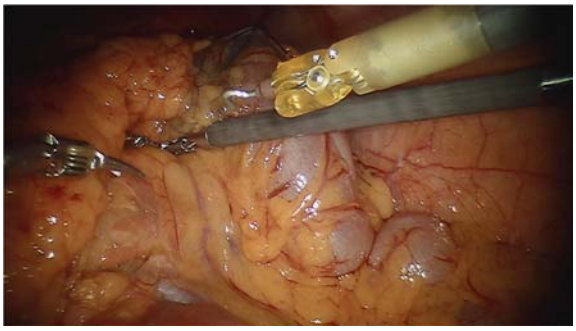

Fig. 3 HM of transverse colon.

Gallbladder hanging maneuver

This maneuver was done to eliminate the need for gallbladder retraction with an instrument. The serosal wall of the gallbladder fundus including the edge of the liver was sutured, without entering the lumen to avoid bile leak and contamination, then secured to the diaphragm. The gallbladder could be dissected retrogradely while the liver remained suspended (Fig. 5).

Uterus hanging maneuver

This maneuver was used to create space in the pelvis during pelvic surgery. Silk 2-0 sutures were passed under both round ligaments and ovarian tubes to suspend the uterus to the abdominal wall.

Discussion

Although minimal access surgery was developed to minimize trauma to the abdominal wall

Fig. 4 HM of small bowel.

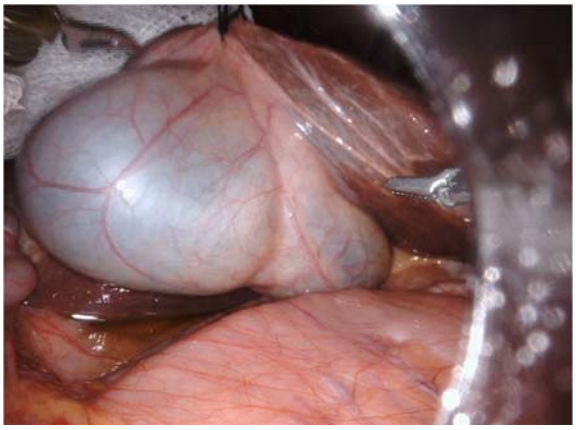

Fig. 5 HM of gall bladder.

and reduce postoperative complications[6,7], it presented a dilemma concerning limited working space, exposure, and stabilization of the operative field that is often crowded with non-fixed organs such as bowels. This situation could be further complicated when a crisis, such as accidental bleeding, occurs. In open surgery, a surgeon has the flexibility to either increase the incision or use the retractors or additional assistants to provide exposure. Similarly, in laparoscopic surgery, a surgeon can add additional ports, move the scope to a different port, or reposition the bed to provide gravity-aided exposure. Although various hanging or suspension techniques have been described in laparoscopic surgery, their main objectives were either an attempt to reduce the number of ports or retraction of a specific solid organ for exposure[8-10]. For liver retraction, Lee reported simple sutures to lift up the left lobe of the liver during gastrectomy[1], Shabbir added sutures at falciform ligament[4], Woo combined gauze and sutures to retract the left lobe of the liver to minimize trauma[5], Bann used a Nathanson retractor[11], while Brenkman preferred an endo-paddle retractor[12]. For colon or small bowel, hanging techniques, similar to those used for upper abdominal surgery, have been described[2,13]. In robotic surgery, visceral organ hanging maneuver (VOHM) is applied for two main reasons: to improve the exposure without an extra port or assistance and to mark the extent of dissection or delineate the transection margins. The maneuver is necessary because, as contrary to open or laparoscopic surgery, the robotic platform is less flexible in terms of port exchangeability and, secondly, there is limited space for assistant ports and restricted mobility for a bedside assistant because of the fixed and space-occupying robotic platform. In general, the third arm and/or an assistant surgeon provide retraction and exposure. For example, during celiac lymphadenectomy for radical gastrectomy, the third arm or an assistant's graspers is used to retract the left lobe of liver to provide exposure[14-16]. By utilizing VOHM, not only an extra port is eliminated, the third arm can now be freed to be utilized as an additional active arm, which is especially significant during crisis management such as control of bleeding. Furthermore, VOHM provides stability of the exposed surgical field so that surgery can proceed in a calm manner. For long and mobile GI tract organs, VOHM can be applied at multiple points to hang up the organ for resection and dissection of mesentery. It can be used to mark the proximal and distal margin lines of transection and keep them stationary on the abdominal wall during mesenteric dissection. With effective VOHM, surgery can sometimes be performed solo, which is necessary in a situation when there is minimal or no bedside assistance.

In short, our VOHM technique was created not only to provide a widely exposed and stable operative field so the surgeon could concentrate on the work, but also to free up an instrument that would otherwise be used as a fixed retractor. The technique allows for an efficient, safe, and oncologically acceptable bowel resection in case of malignancy.

What is already known on this topic?

Minimal access surgery was developed to minimize trauma to the abdominal wall and reduce postoperative complications. However, it presented a dilemma concerning limited working space, exposure, and stabilization of the operative field that is often crowded with non-fixed organs. The robotic platform is less flexible in terms of port exchangeability, there is limited space for assistant ports, and there is restricted mobility for a bedside assistant because of the fixed and space-occupying robotic platform.

What this study adds?

Our technique, a "visceral organ hanging maneuver (VOHM)", is used to expose and stabilize the field, to allow for maximal utilization of the robotic arms, and to mark the bowel resection margins.

Potential conflicts of interest

None.

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เทคนิคการเย็บ Visceral Organ Hanging Maneuver (VOHM) เพื่อช่วยในการผ่าตัดช่องท้องด้วยหุ่นยนต์ช่วยผ่าตัด

ไชยรัตน์ ทรัพย์สมุทรชัย, พงศธร ตั้งทวี, อนุศักดิ์ เยี่ยงพฤกษาวรรณ

ภูมิหลัง: การผ่าตัดแบบบาดแผลเล็กด้วยการส่องกล้องนั้นการใช้วิธีเย็บแขวนอวัยวะส่วนที่ต้องการผ่าตัดที่เรียกว่า Hanging technique มีการศึกษาแล้วว่าช่วยในการผ่าตัดและลดจำนวนช่องสำหรับใส่อุปกรณ์ผ่าตัด (port) ขณะที่การผ่าตัดแบบใช้หุ่นยนต์ช่วยผ่าตัด (Robotic-assist surgery) การเย็บแขวนอวัยวะ มีวัตถุประสงค์ที่แตกต่างไปและยังมีประโยชน์เพิ่มเติมในการผ่าตัดหลายอวัยวะในช่องท้อง รายงานการใช้วิธีการผ่าตัดดังกล่าวในประเทศไทย และทั่วโลกยังมีไม่มาก การศึกษานี้ช่วยแสดงวิธีการ และประโยชน์ของการใช้วิธีการผ่าตัดที่เรียกว่า Visceral Organ Hanging Maneuver (VOHM)

วัตถุประสงค์: การศึกษานี้แสดงถึงการทำ VOHM ในการผ่าตัดหลายอวัยวะในช่องท้องและประโยชน์ของ VOHM

วัสดุและวิธีการ: ศึกษาย้อนหลังจากวิดีโอบันทึกผู้ป่วยที่ได้รับการผ่าตัดในช่องท้องแบบใช้หุ่นยนต์ช่วยผ่าตัด the da Vinci Si Robotic System ตั้งแต่เดือนกรกฎาคม พ.ศ. 2553 ถึง เดือนกันยายน พ.ศ. 2559

ผลการศึกษา: VOHM เป็นวิธีการผ่าตัดที่ทำได้ไม่ยุ่งยาก สามารถทำได้ในหลายชนิดของการผ่าตัดในช่องท้อง ในหลากหลายอวัยวะ ช่วยทำให้การผ่าตัดท้องแบบใช้หุ่นยนต์ช่วยผ่าตัดสะดวกมากขึ้น เนื่องจากพื้นที่ในการผ่าตัดนิ่งไม่ขยับจากผู้ช่วยผ่าตัด สามารถทำให้เข้าถึงอวัยวะที่ต้องการผ่าตัดได้โดยง่าย ลดการใช้งานแขนหุ่นยนต์ผ่าตัดที่ต้องใช้จับอวัยวะเพื่อยกขึ้น ทำให้มีแขนหรือช่องสำหรับการผ่าตัดเพิ่มมากขึ้น

สรุป: การผ่าตัดแบบใช้หุ่นยนต์ช่วยผ่าตัด (Robotic-assist surgery) การเย็บแขวนอวัยวะที่เรียกว่า Visceral Organ Hanging Maneuver (VOHM) เป็นวิธีการผ่าตัดที่ทำได้ไม่ยุ่งยาก สามารถทำได้ในหลายชนิดของการผ่าตัดในช่องท้องในหลากหลายอวัยวะปลอดภัย สะดวกต่อการผ่าตัดและสามารถใช้ในการผ่าตัดมะเร็งของอวัยวะต่าง ๆในช่องท้องได้