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Robotic approach in complex ventral hernias: anterior component separation technique

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Open onlay ventral hernia repair is still one of the most-used surgical techniques for the repair of hernias worldwide. The robotic anterior component separation technique uses the surgeon's usual anatomical expertise on onlay mesh placement with the manipulation and advantages of minimally invasive surgery. It maintains the precepts of reestablishment the midline integrity and insertion of mesh in the preaponeurotic space, without contact with the viscera. The use of this technique is simple and quite reproducible if you compare it with other techniques. Also, the time spent in surgery does not last long.

Keywords: Ventral hernia, Surgical mesh, Minimally invasive surgical technique

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INTRODUCTION

The use of anterior component separation in surgeries of ventral hernias repair with onlay mesh placement is an excellent way when we need to switch sublay mesh after posterior component separation in low-risk patients [1]. Onlay open ventral hernia repair is still one of the most-used surgical techniques for the repair of hernias worldwide [2,3]. The use of this technique is simple and quite reproducible if you compare it with other techniques. Also, the time spent in surgery does not last long [2,4–6]. This technique maintains midline integrity, and the mesh is inserted in the preaponeurotic space [7]. However, the use of this technique also can cause complications, such as infection, flap ischemia, hematomas, seromas, and wound infections [7].

The robotic anterior component separation (RACS) technique applies the anatomical knowledge in onlay technique along with minimally invasive surgery to avoid important complications related to a wound incision [7].

We aim to report a case and technique of a patient with a ventral hernia who underwent RACS in a large academic center. This is a descriptive, retrospective study of a patient who underwent ventral hernia repair with onlay mesh placement in an academic center.

CASE

We present a case of a 50 years-old female patient, with a body mass index of 34.8 kg/m^2, hypertension, diabetes mellitus,

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asthma, and incisional hernia after C-section (she had three incisional hernia repairs with recurrence and the last repair was 4 years ago), early-stage endometrial cancer, and history of laparoscopic sleeve gastrectomy 3 years ago. She reported that she started developing a recurrent painful bulge which has increased in size about 9 months after her last surgical hernia repair. A computed tomography (CT) scan showed a large midline ventral recurrent hernia containing loops of small and large bowel with focal increased protrusion inferior to the mesh without evidence of bowel obstruction. The patient was elected to have her hernia repaired in a conjoined case with gynecology to allow hysterectomy and robotic repair of recurrent incisional hernia repair with mesh, bilateral myofascial release, and lysis of adhesions at the same time due to significant symptoms.

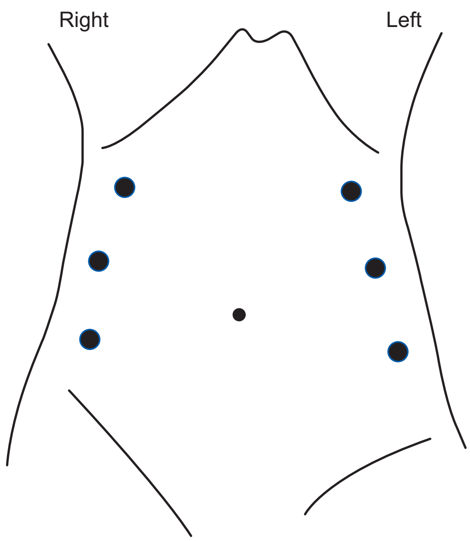

Fig. 1. Schematic diagram of the port location and instrument location.

The patient was placed in a modified lithotomy in a bed with some degree of flex. Pneumoperitoneum was established. Gynecology team proceeded with the robotic hysterectomy with no complications. The trocars, three in total, were inserted laterally under direct visualization (Fig. 1). After lysis of adhesions was completed, we identified the medial border of the rectus sheath (Fig. 2A) and started developing the subcutaneous plane anterior to the contralateral rectus muscle (Fig. 2B, C).

It is important to reach the contralateral external oblique muscle (EOM), visualizing the entire anterior rectus sheath. A small incision was made 1 to 2 cm in the lateral direction of the border of the abdominal rectus (lateral to the semilunar line), in order to incise only the EOM fascia (Fig. 2D). No fleshy muscular belly should be visualized at this time. After making sure that the internal oblique space is reached, the dissection was continued in the caudal direction to the inguinal ligament and cranially to the costal border.

Once this relaxation incision was created, the avascular internal oblique plane should be freed by lateral blunt dissection in order to allow all possible sliding of the medial compartment (Fig. 3A). At this point, we measure the size of the defect and the overlap that we are going to have after midline closure. Once

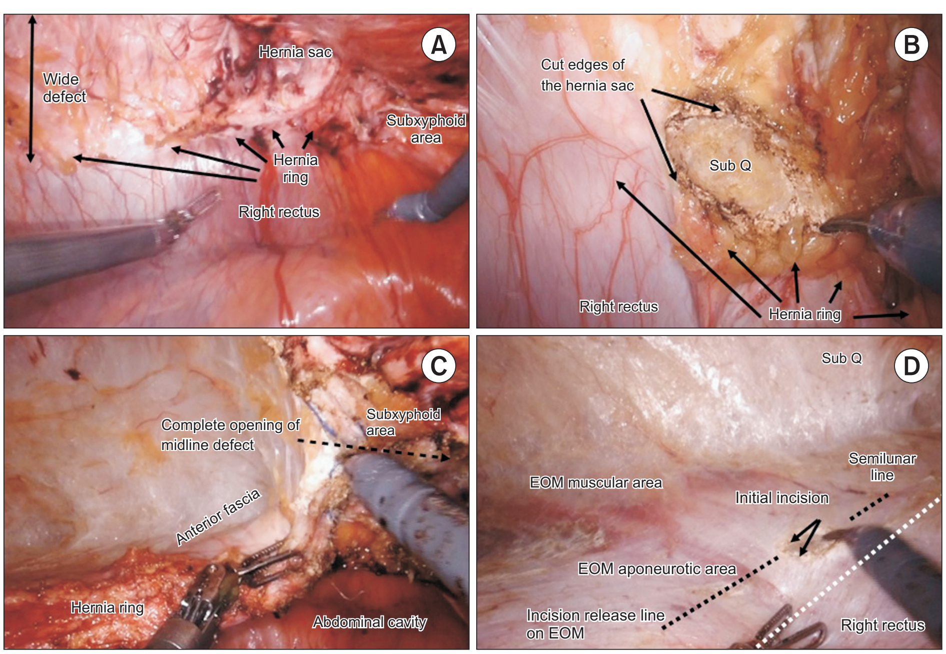

Fig. 2. (A) Initial exposure of right side hernia ring after adhesiolysis with lateral left side ports. (B) Initial incision on top of the hernia defect/edge. Transection of the hernia sac and exposure or the subcutaneous space. (C) Cephalad extension and opening of midline defect. (D) An initial incision of the aponeurosis of the external oblique muscle (EOM) is done, laterally to the semilunar line. Caution should be taken to avoid injury of deeper planes as the internal oblique muscle and transverse muscle, which could lead to a catastrophic injury to the full thickness of the semilunar line.

this dissection was performed, additional trocars were placed under direct vision in the contralateral side, into the subcutaneous space previously dissected (Fig. 3B).

Then a macroporous non-coated mesh was inserted and fixated below the trocars. The mesh was positioned in the subcutaneous space. This technique allows the mesh to be unrolled and fixated to complete the procedure without the necessity of a third re-docking procedure [6–8].

The robot was re-docked in the opposite side. The dissection now is only in the subcutaneous space until adequate overlap is achieved. After that, the anterior component separation steps are repeated. The superficial fascia was closed with V-Loc 0 (Covidien), 180 barbed suture, and running suture technique.

The initial trocar sites in the abdominal cavity are closed with 2-0 braided absorbable sutures. Closure of the linea alba is accomplished using nonabsorbable #0 barbed suture in a running fashion (Fig. 3C). The mesh now can be unrolled from below the trocars and fixed on the contralateral side (Fig. 3D). Mesh fixation is key on onlay repairs, once there is no muscle support above the mesh to keep it in place. Sutures should quilt the mesh in place to ensure early integration. Drains are placed under direct vision and retrieved in the lowest trocar position. Skin incisions are closed with interrupted 4-0 monofilament absorbable sutures.

The surgical findings were large and recurrent incisional hernia on the midline with prior onlay mesh, incarcerated sigmoid colon and omentum, all defects together measured 18 cm long by 11 cm wide, and dense and multiple adhesions of omentum and sigmoid against the abdominal wall into the hernia defect against prior mesh (Supplementary Video 1).

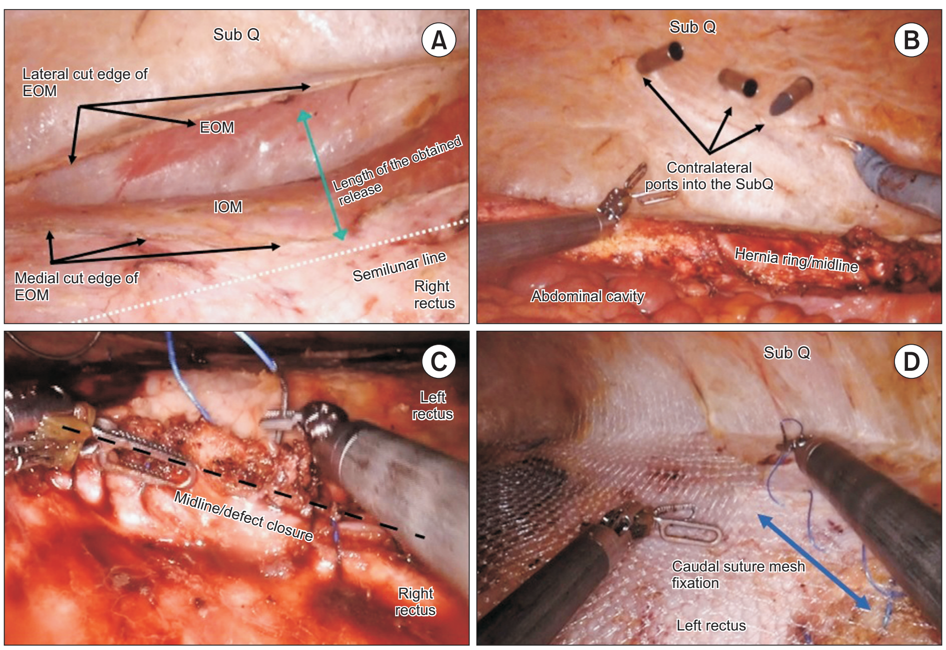

Fig. 3. (A) Final aspect of the unilateral anterior component separation with the separation of the cutted edges of the external oblique muscle (EOM). (B) New three robotics ports insertion into the subcutaneous space at the right side. (C) After the same steps of the anterior component separation are repeated, the midline is closed with a running barbed suture. This suture is performed at the “floor” of the operative field, not in the “roof” as happens on preperitoneal and retromuscular approaches. (D) Suture fixation is performed all around the mesh edges. IOM, internal oblique muscle.

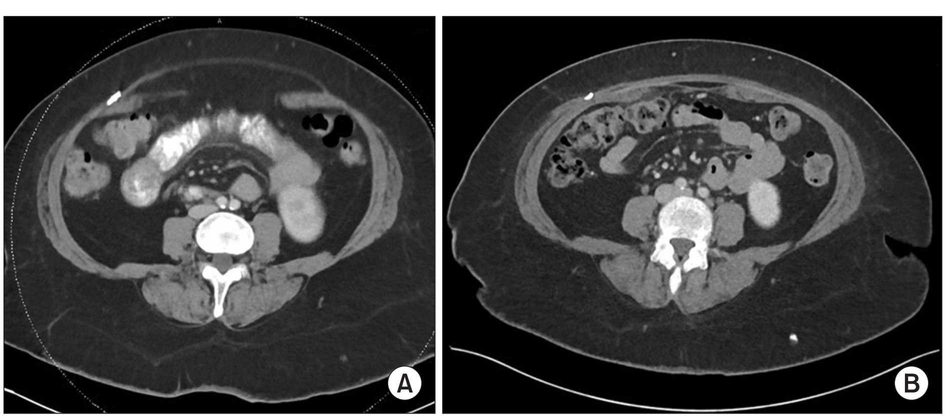

Fig. 4. Computed tomography scans before (A) and after surgery (B).

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The operative time was 369 minutes, with 70 mL of estimated blood loss. The patient was discharged 3 days after surgery. One week later, the patient was readmitted for intractable nausea and vomiting. The patient reported worsening pain with nausea and vomiting when attempting to eat or drink. During hospitalization, the patient was investigated with no clear abdominal cause. After more than 3 days without vomiting, tolerating a regular diet, and having no abdominal pain, the patient was discharged home. In the first follow-up visit with surgery, the patient has been doing well, tolerating diet, having a normal bowel movement, and with no further complaints. She denies the presence of a bulge. The CT scans before and after surgery for comparison are depicted in Fig. 4.

DISCUSSION

The RACS technique is a combined approach that includes characteristics from open hernia onlay repair and a robotic-assisted platform [6]. This technique allows no hernia specialist, “regular surgeon,” to apply this minimally invasive abdominal wall surgery without the wound morbidity associated with open onlay repairs. It will also allow the closure of the hernia defect and restoration of the linea alba and will prevent the mesh from being in contact with the abdominal viscera, by avoiding the use of expensive coated meshes [9].

In massive hernias, additional maneuvers are necessary to achieve linea alba medialization and reestablish a functional abdominal wall with autologous tissue repair. The procedure involves dividing the external oblique aponeurosis, elevating the rectus abdominis muscle from its posterior rectus sheath, and then mobilizing the myofascial flap consisting of the rectus, internal oblique, and transverse abdominis medially, as described originally by Ramirez in 1990. In the classic technique, prosthetic material was not necessary (a benefit in contaminated fields), but the procedure was updated to be used in more complex abdominal wall reconstruction with the use of mesh [10].

In this case, due to prior multiple repairs, a large hernia sac into the subcutaneous and slim rectus associated with the wide defect, we chose to proceed with a bilateral myofascial release of the external oblique to allow the proper closure of the defect and mesh position without excessive tension. The combination with a clean-contaminated procedure (hysterectomy) was an additional reason to avoid coated mesh since this type of prosthesis performs poorly in contaminated fields.

This study has limitations as it is only a case report with a description of a new surgical technique. Studies with larger samples are needed to demonstrate the feasibility, safety, and reproducibility of this new surgical technique.

This new approach may bring an opportunity to offer less elaborated techniques to achieve defect closure in large defects with a minimally invasive approach. More studies are necessary to analyze the impact of robotic onlay approaches in minimally invasive ventral hernia repair.

NOTES

Ethical statements

This study is in agreement with the Institution Review Board (IRB) of Montefiore Medical Center and all HIPPA (Health Insurance Portability and Accountability Act) compliant mechanisms were followed. Exemption of further ethical review for this study was approved by the IRB (No. 2020-11160).

Author’s contribution

Conceptualization: FM, RN
Investigation: RN
Writing–original draft: All authors
Writing–review & editing: All authors
All authors read and approved the final manuscript.

Conflict of interest

FM discloses consulting fees from BD, Intuitive, Integra, Allergan, DeepBlue & Medtronic, outside the submitted work. EP discloses consulting fees from BD & Intuitive, outside the submitted work. The other authors have no conflict of interests to declare.

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Supplementary materials

Supplementary materials can be found via https://doi.org/10.7602/jmis.2023.26.2.88.

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