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## Robotic and hybrid robotic transversus abdominis release may be performed with low length of stay and wound morbidity

Joshua T. Halka, Andrew Vasylyuk, Alexander M. DeMare, Randy J. Janczyk, Anthony A. Iacco\*

Department of Surgery, Oakland University/William Beaumont School of Medicine, William Beaumont Hospital, Royal Oak, 3535 W. 13 Mile Road, Royal Oak, MI 48073, USA

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## ABSTRACT

The objective of our study was to compare length of stay and wound complications after hybrid robotic transversus abdominis release (hrTAR) vs. robotic transversus abdominis release (rTAR). Two cohorts of patients undergoing robotic (rTAR) and hybrid robotic (hrTAR) performed by two surgeons at a single institution were analyzed. Mean length of stay (LOS) and incidence of surgical site occurrences (SSO) were compared. 57 patients undergoing rTAR and 25 patients undergoing hrTAR were analyzed. The hrTAR group had larger mean hernia dimensions and a larger proportion of men but otherwise the patient cohorts were similar. LOS was not statistically different between rTAR and hrTAR (2.8 vs 3.7 days  $p = 0.06$ ). We found no difference in incidence of surgical site occurrences between the two groups (7.0% vs 4.0%  $p = 0.52$ ). Hybrid robotic assisted TAR allows for repair of complex ventral hernias with similar lengths of stay and wound morbidity to pure robotic repairs.

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### 1. Background

Open repair with a wide sublay mesh coverage in the retro-rectus space, first popularized by Rives and Stoppa, is an effective method of repair with recurrence rates reported to be less than 5%<sup>1</sup> and was adopted as the gold standard for ventral hernia repair by the American Hernia Society in 2004.<sup>2</sup> Recent literature in the field of hernia repair has focused on restoration of abdominal wall dynamics by closure of the midline fascia. The Rives repair is limited by the semi-lunar lines and therefore may be inadequate for larger defects with significant loss of domain. The open posterior component separation with transversus abdominis release, which offers substantial medialization of the rectus sheath and wide mesh coverage while minimizing creation of subcutaneous flaps, has been an effective technique for dealing with such hernias with low recurrence rates.<sup>2,3</sup>

While effective, open retro-rectus and posterior component separation techniques are associated with long lengths of stay, post-op morbidity and relatively high incidence of wound complications.<sup>4–6</sup> To overcome these shortcomings, the open retro-

rectus repair with TAR has been successfully reproduced on the minimally invasive robotic platform. While there is little long-term data on such repairs, recent studies have demonstrated that robotic ventral hernia repair is both technically feasible and is associated with a significantly decreased length of stay when compared to similar open operations.<sup>7,8</sup> However, many of these complicated hernia patients may have portions of the operation that are not readily amenable to minimally invasive techniques. For such patients, a partially open or hybrid procedure, performed by opening of the hernia sac, may offer a complete reconstruction with re-creation of the linea alba while maintaining the benefits of minimally invasive surgery. We hypothesized that hybrid robotic assisted transversus abdominis release can be performed with similar favorable outcomes as pure robotic assisted transversus abdominis release with equal complication profile.

### 2. Methods

Robotic assisted transversus abdominis release (rTAR) and hybrid partially open robotic assisted transversus abdominis release (hrTAR) performed by two surgeons from November 2015 to February 2017 were reviewed. Prospectively gathered data from the American Hernia Society Quality Collaborative (AHSQC) was retrospectively analyzed along with institutional electronic medical

\* Corresponding author.

E-mail address: [anthony.iacco@beaumont.org](mailto:anthony.iacco@beaumont.org) (A.A. Iacco).

records. Data gathered included operation performed, patient characteristics such as age, body mass index (BMI), hypertension, diabetes, tobacco use, whether the hernia was recurrent, hernia defect dimensions, dimensions of the mesh used, operative times, surgical site occurrences including wound infection, hematoma, or seroma requiring surgical intervention, along with length of stay. For our statistical analysis T-tests were used for continuous variables and chi-square for categorical and binary variables, Fischer's exact test was used when numbers were small.

Patients with either primary or recurrent ventral hernias were selected for robotic ventral hernia repair using the da Vinci Surgical System (Intuitive Surgical Inc, Sunnyvale CA). During a robotic assisted transversus abdominis release (rTAR), after entrance to the abdomen is gained laparoscopically, robotic ports are placed along the anterior axillary line. Adhesiolysis is performed as needed, hernia sac contents are reduced, and a retro-rectus dissection is performed to the semi-lunar line. The posterior lamella of the internal oblique is then incised and the transversus abdominis insertion is released, dissection is performed between the transversus abdominis muscle and transversalis fascia laterally to the posterior axillary line, the dissection is carried above the costal margin to the central tendon of the diaphragm superiorly and to the retro-pubic space inferiorly. The robot is then re-docked and the same procedure is performed on the contralateral side. Once the dissection has been performed on both sides the posterior rectus sheath is re-approximated with barbed absorbable suture, leaving the robotic arms in the retro-muscular plane for mesh placement in a sublay fashion. For hernia defect widths exceeding the mechanical limits of robotic suturing (generally around 13–14 cm), large voluminous hernia sacs with or without overlying skin issues (thinning or breakdown) and patients with large pieces of prior mesh a hybrid approach is described in which the hernia sac is opened via midline incision, mesh is placed and the linea alba is re-approximated with barbed absorbable suture, and excess skin and hernia sac is then resected via a limited vertical abdominoplasty with sequential medial to lateral imbrication to remove as best as possible any potential space for seroma formation. This

combination of robotic assisted TAR and open fascial approximation and skin/soft tissue debridement is termed hybrid robotic assisted transversus abdominis release (hrTAR). For patients who did not meet these criteria the hernia sac was imbricated down during the robotic anterior fascial closure with a barbed absorbable suture. In the majority of cases, transversus abdominis plane block was performed using 0.25% bupivacaine with epinephrine and in all cases a drain was left in the retromuscular space. No epidurals were used for adjunctive pain control in any case.

### 3. Results

Analysis was performed on data gathered from the AHSQC and the institutional electronic medical record comparing 57 rTAR to 25 hrTAR patients. The two groups being analyzed were well matched and patient characteristics including Age, body mass index, percent of patients with hypertension, diabetes, current tobacco use, and percentage of patients with recurrent hernias. There was a higher proportion of women in the rTAR group. Wound classifications were not statistically different between rTAR and hrTAR. Mean hernia width and mean hernia length were larger for hrTAR. Mean mesh length and width was larger for hrTAR. Mean operative times were similar and did not differ statistically. Concomitant procedures were performed in 11 patients in the rTAR group and 5 in the hrTAR group. These consisted of 3 cholecystectomies, one oophorectomy, one EC fistula takedown and one diaphragmatic hernia repair, the remaining were all unilateral or bilateral inguinal or femoral hernia repairs. These data are summarized in Table 1.

Surgical site occurrences were not significantly different between groups (7.0% vs 4.0%  $p = 0.52$ ). Length of stay was not statistically different between rTAR and hrTAR (2.8 vs 3.6 days  $p = 0.06$ ) (Table 2). The hrTAR group had one superficial wound infection that required antibiotics with incision and drainage with wound packing (POD 33). The rTAR group had 4 patients with deep wound complications. Two patients developed infected hematomas (POD 21 and 33) in the residual hernia sac. Both underwent operative debridement of subcutaneous tissue and anterior fascia,

**Table 1**  
Patient demographics.

| Patient Demographics             | Robotic TAR<br>(N = 57)   | Hybrid TAR<br>(N = 25)    | P- value         |
|----------------------------------|---------------------------|---------------------------|------------------|
| Age (mean, SD)                   | 58.05 ( $\pm$ 13.90)      | 61.52 ( $\pm$ 11.52)      | 0.28             |
| BMI                              | 33.60 ( $\pm$ 7.08)       | 34.67 ( $\pm$ 6.75)       | 0.53             |
| Percent male                     | 33%                       | 64%                       | <b>0.01</b>      |
| <b>Comorbid Conditions</b>       |                           |                           |                  |
| Hypertension                     | 42% (24/57)               | 60% (15/25)               | 0.14             |
| Diabetes Mellitus                | 23% (13/57)               | 28% (7/25)                | 0.61             |
| COPD                             | 3.5% (2/57)               | 0%                        | 0.46             |
| Current Tobacco use              | 17% (10/57)               | 16% (4/25)                | 0.98             |
| ESRD/Hemodialysis                | 1.75% (1/57)              | 0%                        | 0.61             |
| <b>Hernia Characteristics</b>    |                           |                           |                  |
| Mean length (mean, SD)           | 16.26 cm ( $\pm$ 5.82 cm) | 21.52 cm ( $\pm$ 7.05 cm) | <b>&lt;0.001</b> |
| Mean width (mean, SD)            | 9.14 cm ( $\pm$ 3.86 cm)  | 14.24 cm ( $\pm$ 4.82 cm) | <b>&lt;0.001</b> |
| Percent recurrent hernia         | 40% (23/57)               | 56% (14/25)               | 0.20             |
| Number prior hernia repairs      | 47 (mean 2.0 per patient) | 35 (mean 2.5 per patient) | 0.15             |
| <b>Operative Characteristics</b> |                           |                           |                  |
| Wound classification             |                           |                           |                  |
| -Clean:                          | 95% (54/57)               | 92% (23/25)               | 0.63             |
| -Clean/Contaminated:             | 5% (3/57)                 | 8% (2/25)                 |                  |
| Mesh dimensions (mean, SD):      |                           |                           |                  |
| -Mean length                     | 36.40 cm ( $\pm$ 7.05 cm) | 41.96 cm ( $\pm$ 6.56 cm) | <b>&lt;0.001</b> |
| -Mean width                      | 31.88 cm ( $\pm$ 4.36 cm) | 38.88 cm ( $\pm$ 7.26 cm) | <b>&lt;0.001</b> |
| Mean operative time (min)        | 316.65                    | 344.68                    | 0.29             |
| Concomitant Procedure            | 19.2% (11/57)             | 20.0% (5/25)              | 0.38             |
| Drains placed:                   | 100% (57/57)              | 100% (25/25)              | 0.41             |
| Intra-op TAP block:              | 91% (52/57)               | 92% (23/25)               | 0.90             |

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