# *Mid term outcome of robotic mesh sacrocolpopexy*

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BELSANTE M, MURRAY S, DILLON B, ZIMMERN P. Mid term outcome of robotic mesh sacrocolpopexy. *Can J Urol* 2013;20(1):6656-6661.

***Introduction:*** *Use of robotic mesh sacrocolpopexy (RMS) has increased for management of pelvic organ prolapse (POP). We present our experience with mid term follow up.*
***Materials and methods:*** *A retrospective chart review of consecutive patients who had RMS was performed. Patients underwent history and physical exam including POP-Q classification. In cases of bladder involvement a standing voiding cystourethrogram and urodynamics with vaginal pack reduction of the prolapse were done. Indication for RMS was patient preference, BMI < 30, no prior major abdominal surgery, and age < 80. We utilized Marlex mesh and absorbable polyglactin sutures to anchor the mesh to the vaginal wall and apex. Follow up was at 6 weeks, 6 and 12 months and yearly thereafter. The Urogenital Distress Inventory (UDI-6), Incontinence Impact Questionnaire (IIQ-7) and a quality of life (QoL) questionnaire (range 0 excellent to 10 terrible) were obtained pre and postoperatively.*
***Results:*** *Thirty-five patients underwent RMS from January 2008 to July 2011 with at least 6 months follow up. Thirty-four patients (97%) had previous hysterectomy. Twenty-eight (80%) patients had previous surgery for pelvic organ prolapse (POP) and/or stress incontinence. Mean age and median follow up were 65 years (37-79) and 28 months (7-50) respectively. Mean preoperative C-point was -1.1 (+1 to -4) compared to -9.7 (-12 to -10) postoperatively (p < .0.001). Five intraoperative vaginotomies were repaired primarily. No patients required conversion to open. No patient had recurrent vault prolapse. Three patients had secondary POP procedures. One patient developed a mesh erosion requiring surgical repair. Functional outcome improvement was noted with score reduction for QoL of 4.1 to 1.3 (p < 0.001), UDI-6 of 27.3 to 16.1 (p = 0.002), and IIQ-7 of 18.3 to 3.9 (p = 0.031).*
***Conclusions:*** *RMS performed reliably to correct symptomatic POP. The use of absorbable sutures to secure the mesh to the vaginal walls resulted in satisfactory anatomic outcomes and did not increase the risk of mesh erosion.*

**Key Words:** robotic surgery, pelvic organ prolapse, surgery for pelvic organ prolapse

## Introduction

Pelvic organ prolapse (POP) will occur in over 11% of women who are post-hysterectomy and there is a lifetime risk of 19% in the general female population for undergoing a surgical procedure for POP.[1] There are numerous proven surgical options for women with POP including transvaginal repair with or without mesh interposition, and mesh sacrocolpopexy (MSC) using either an open or a laparoscopic approach. Open MSC is considered the gold standard surgical technique for correction of POP with long term success rates approaching 78%-100%.[2] The main drawback of open MSC when compared with a transvaginal repair is peri-operative morbidity secondary to the large incision necessary for completion of the procedure. Laparoscopic approach has become a more attractive option especially after the advent of the da Vinci robotic system which allows for improved ease of maneuvering and intra-corporeal suturing. Up to this point, there have been few series reported in the literature on robotic sacrocolpopexy (RMS) with mostly short follow up. We report our experience with mid term follow up in regards to anatomical and functional outcomes.

Accepted for publication October 2012

Acknowledgement
We appreciate the assistance of Feras Alhalabi for maintaining our patient database.

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## Materials and methods

Following IRB approval, a retrospective review of a prospectively collected and maintained database was performed to evaluate the results of robotic mesh sacrocolpopexy (RMS) for the treatment of symptomatic POP at a single institution. All patients underwent detailed history, review of prior pelvic surgeries, and physical examination including pelvic examination using the POP-Q classification system. In cases of bladder involvement, a standing voiding cystourethrogram[3] and urodynamic testing with vaginal pack reduction of the prolapse was also performed.[4] Pelvic magnetic resonance imaging (MRI) was ordered selectively in cases of POP recurrence to better delineate the compartments involved. Indication for RMS over vaginal repair or open surgery was based on patient preference along with body mass incex (BMI) (≤ 30), absence of major prior abdominal surgeries, age less than 80 (relative contraindication), absence of coronary or pulmonary comorbidity, and/or desire to retain sufficient vaginal width and length to allow existing or possible sexual activity. RMS was done with Marlex mesh and absorbable 2-0 polyglactin sutures to anchor the mesh to the vaginal walls and apex. Patients were followed postoperatively at 6 weeks, 6 months, 12 months and yearly thereafter for evidence of immediate or delayed complications, and for evaluation of the durability of the repair. The Urogenital Distress Inventory (UDI-6), Incontinence Impact Questionnaire (IIQ-7) and a one global quality of life (QoL) questionnaire based on a visual analogue scale (range 0 excellent to 10 terrible) were obtained at office visits before and after surgery.[5] Statistical analysis was performed with SPSS software (Version 19; Chicago, IL).

### *Technique*

The RMS was performed using the da Vinci (Intuitive Surgical, Sunnyvale, CA, USA) robot. This system utilizes two robotic arms, a camera arm and an optional fourth robotic arm. The bladder is drained with a 16 French foley catheter. An EEA clamp is placed in the vagina at the beginning of the procedure to aid with prolapse dissection. After gaining pneumoperitoneum and in maximum Tredelenburg position, the camera is inserted through a 12 mm port at the umbilicus, with the robotic arms inserted following a "W" shape configuration as previously described.[6] An assistant port is placed laterally on the right side, for a total of five ports. Docking the robot was done initially at the foot of the bed, however more recently we have evolved to docking from the side in order to maintain access to the vagina. Any abdominal adhesions are taken down as necessary to free the pelvic cavity. At this point small intestines, omentum and left colon are retracted into the upper abdomen, sometimes aided by the Endo Paddle (a laparoscopic retracting device). Once the pelvis is fully exposed, Figure 1, the trajectory of the right ureter is identified as well as the area of the promontory. Next, the peritoneum is opened at the back wall of the vaginal cuff transversely in order to gain access to the recto-vaginal space. Then, the dissection is continued anteriorly between the vaginal cuff and the base of the bladder when an anterior compartment prolapse is involved. The anterior dissection is carried distally to above the level of the trigone (3 cm-5 cm distal to the vaginal apex). Posteriorly, the dissection is carried down as distally as possible. The peritoneum over the vaginal cuff is left intact whenever possible to diminish the risk of vaginotomy and of secondary erosion by thinning out the vaginal wall in that area. The peritoneum is then incised from the bottom of the enterocele sac to the sacral promontory on the right side of the rectosigmoid. At this point, the anterior vertebral ligament is exposed. Next, on the back table the anterior and posterior components of the mesh are sutured together in a Y-shape fashion and are measured, trimmed and secured with 2-0 polyglactin sutures at each extremity. The prepared mesh is introduced into the abdomen through the assistant port. The mesh is secured as distally as possible over the posterior vaginal

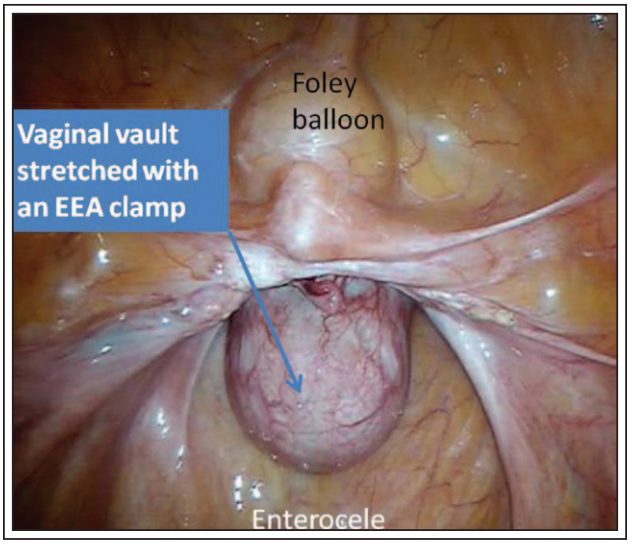


**Figure 1.** Initial intraoperative view after release of pelvic adhesions and mobilization of small intestines and redundant colon to the upper abdomen. The prolapsed vaginal vault is stretched and elevated by an EEA clamp, revealing a large associated enterocele underneath.

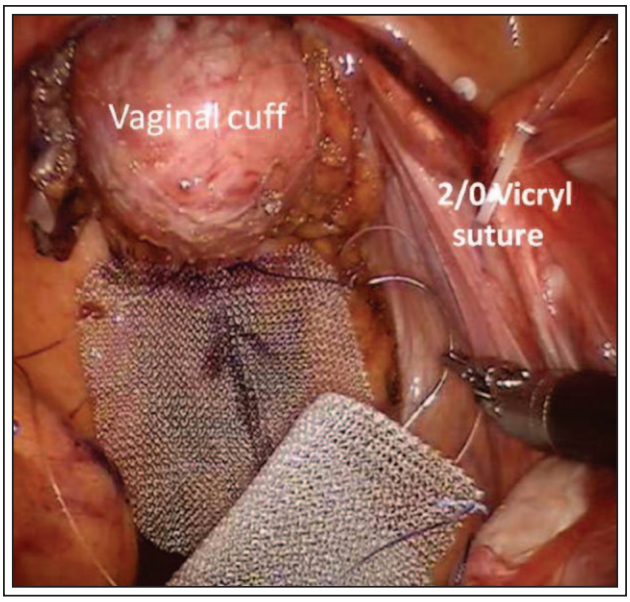


**Figure 2.** After dissection of the vaginal cuff with preservation of the peritoneal layer over the cuff (to minimize the risk of erosion), the prepared Marlex mesh is positioned behind the posterior vaginal wall for securement with 2/0 polyglactin sutures.

wall with the preplaced absorbable sutures, Figure 2. Additional sutures are placed more proximally and bilaterally over the posterior vaginal wall near the vaginal apex. Because these sutures are absorbable, there is no concern about possibly transfixing the vagina and obtaining a strong vaginal purchase. The anterior portion of the mesh is then secured to the anterior vaginal wall in a similar fashion. Once secured to the vagina, the mesh is then laid in its prepared peritoneal groove extending up to the anterior vertebral ligament. The mesh is secured to the anterior vertebral ligament using two, 2-0 Ethibond non-absorbable, sutures. The mesh is positioned to follow the concavity of the sacrum, under no tension to ensure vaginal cuff support in a normal anatomic configuration. The peritoneum is then closed over the mesh using running 2-0 polyglactin sutures. A pack is placed in the vagina for 24 hours. The robot is undocked and the port sites are closed in a standard fashion. After IV injection of indigo carmine, cystoscopy is performed to confirm no bladder or ureteral injury.

## Results

Thirty-five consecutive patients underwent RMS between January 2008 and July 2011 and had at least 6 months follow up, Table 1. All but one patient (97%) had previous hysterectomy. Twenty-eight patients (80%) had undergone previous surgery for POP and/or stress incontinence including anterior vaginal wall suspension,[7] Burch procedure or urethral suspension. Nineteen patients were on hormone replacement therapy (7 systemic, 10 local, 2 both). Eleven patients had apical and posterior compartment defect repairs, while 24 had a triple compartment prolapse repair with 2 including preservation of the cervix. A concomitant procedure was performed in six patients including supracervical hysterectomy, lysis of adhesions (3), fulguration of trigone with urethral dilation and excision of a breast melanoma, fulguration of the trigone alone, and excision of a urethral caruncle. Mean age was 65 years (37-79) with median follow up of 28 months (7-50). Mean BMI was 24.5 (18.0-30.1) and mean parity was 3.0 (1-7). Mean estimated blood loss was 71 mL, and mean operating room time including anesthesia induction, docking, additional repairs and extubation phase was 4.8 hours (3.5-6.5). Total OR time was obtained from anesthesia records. No patients required a blood transfusion. Mean length of hospitalization was 1.7 days (1-3). Mean preoperative C-point was -1.1 (+1 to -4) compared to mean postoperative C-point of -9.7 (-12 to -10) ($p < 0.001$) as measured at the patient's most recent clinic visit. There were five intraoperative complications all of which were vaginotomies at the anterior vagina or vaginal apex that were immediately oversewn with 2-0 polyglactin sutures. No patients required conversion to open. In cases of vaginotomy, the mesh was placed away from the vaginotomy repair to minimize the risk of secondary mesh erosion. There were three cases of secondary POP (one distal rectocele, and two cystoceles), two of whom were not treated by the initial RMS mesh placement. The three repeat POP surgeries occurred at 4 (cystocele), 8 (cystocele), and 31 (rectocele) months post-RMS. No patients had recurrent vault prolapse. One patient (who had an intraoperative vaginotomy) developed apical mesh erosion noted

TABLE 1. **Preoperative patient demographics**

| | **Mean (range)** |
|---|---|
| Age (years) | 65 (37-79) |
| Follow up time (months) | 29 (7-50) (median 28 months) |
| Parity | 3 (1-7) |
| Body mass index | 24.6 (18-30) |
| Previous hysterectomy | 34 (97%) |
| Hormone replacement | 19 (54%) |
| C-point | -1.1 (-4 to +1) |

at her 6 month follow up and returned once to the operating room for local excision and primary vaginal closure. In addition, one patient developed a port site hernia and has undergone surgical repair. At last follow up, a significant improvement in quality of life was noted with an improvement in the visual analog scale of 2.8 (4.1 to 1.3, $p < 0.001$). Additionally, the mean UDI-6 score dropped by 9.0 (27.3 to 16.1, $p = 0.002$), and the IIQ-7 dropped by 17.5 (18.3 to 3.9, $p = 0.031$) when compared with baseline. No new onset dyspareunia has been reported and all patients who were sexually active preoperatively (n = 18) have remained so postoperatively. All sexually active patients have maintained local and/or systemic hormonotherapy. Two patients reported secondary incontinence, both of whom wore one pad/day for protection.

## Discussion

Because availability of the daVinci robot represents a recent technological advance, few series of RMS with comparable follow up are available, Table 2. Our data indicates that RMS performed with absorbable sutures to secure the mesh to the vaginal wall is efficacious with respect to both anatomical results and patient satisfaction at mid term follow up (28 months). Three secondary POP procedures were needed over time, but no recurrence of apical prolapse was noted. Using accepted, validated outcome tools, a significant improvement in functional outcomes and patient satisfaction were noted.[8] Overall, our results are consistent with series of similar length of follow up.[9-11] This body of literature indicates a justified interest for this robotic application, but cost and long term results need further investigations.[12]

Another series of RMS used polyglactin suture to secure the mesh to the vaginal wall. In 21 patients, Kramer et al reported no mesh erosion and one case of recurrent apical prolapse over a mean follow up of 25 months.[10] These findings match those in our own series of a single case of mesh erosion and no recurrent apical prolapse. Initially in their series, absorbable sutures were used to secure the mesh to the vaginal wall and apex, as well as to the sacral promontory. In the one case of recurrent apical prolapse, the mesh had been secured with absorbable sutures and subsequently

TABLE 2. **Review of published robotic sacrocolpopexy series (2006-2011)**

| Authors reference | N | Type of mesh | Type of suture for vaginal mesh anchoring | Anatomic results | Mesh erosion | Re-operation for POP | Follow up (mths) |
|---|---|---|---|---|---|---|---|
| Moreno Sierra et al[11] | 31 | polypropylene | Non-absorbable | 0% recurrent apical prolapse | NR | None | 24.5 |
| Tan-Kim et al[19] | 43 | Gynemesh | 2-0 polypropylene | 0% recurrent apical prolapse | 5% | NR | 6 |
| Akl et al[20] | 80 | polypropylene (unspecified) | 2-0 prolene | 1.25% recurrent apical prolapse | 6% | 2 rectocele/ cystocele repairs, 1 revision of MSC | 4.8 |
| Kramer et al[10] | 21 | polypropylene (AMS) | 2-0 polyglactin | 5% recurrent apical prolapse, 57% recurrent vaginal wall prolapse | 0% | 12 secondary cystocele or rectocele repairs | 25.2 |
| Geller et al[6] | 73 | Intepro | CV-2 polytetrafluoroethylene | NR | NR | None | 1.5 |
| Daneshgari et al[21] | 12 | polypropylene (unspecified) | permanent (unspecified) | 0% apical prolapse reported | NR | NR | 3.1 |
| Elliott et al[9] | 21 | Intepro | 1-0 polytetrafluoroethylene | 5% recurrent apical prolapse | 9.5% | 1 transabdominal MSC | 24 |

POP = pelvic organ prolapse; NR = not reported; MSC = mesh sacrocolpopexy

detached from the sacrum. On return to the operating room, the mesh was still attached appropriately to the vaginal wall. The authors now use permanent sutures to secure the mesh to the sacral promontory. Their surgical technique was similar to our own with the exception that we evolved to side-docking while in their series, the robot was docked at the foot of the bed.

The impetus for absorbable suture use during RMS stems from the concern for transfixing the vaginal wall with permanent suture material, a situation that may be associated with an increased rate of mesh erosion. During RMS, vaginal access is limited and therefore, it is not easy to ensure that the sutures did not transfix the vaginal mucosa. Limitations to vaginal access include the need to use a vaginal molding instrument during prolapse compartment dissection and subsequent mesh placement. Also, the location of the robot between the legs during traditional docking limits vaginal inspection. For that reason, side-docking has been advocated as it facilitates vaginal examination as well as permits an anti-incontinence procedure.[10] To mitigate against these limitations and not be fearful to purchase a strong segment of vaginal wall during securing of the mesh, we used absorbable (2-0 polyglactin) sutures. Polyglactin suture is completely absorbed within 56-70 days and retains its strength in the first few weeks while tissue in-growth incorporates the mesh within the vaginal wall. At our 6 week follow up visit, the sutures had dissolved in all patients and no apical recurrence was noted.

Another concern with MSC, in general, relates to mesh erosion. The documented mesh erosion rate following open MSC with permanent sutures ranges from 2%-10%.[13,14] Additionally, it has been reported that the mesh erosion rate increases when the mesh overlies a freshly closed vaginal cuff incision.[13,14] In a series of 188 robotic and laparoscopic MSC, a 23% mesh erosion rate was reported when the procedure was done in conjunction with a transvaginal hysterectomy compared with 5% for patients who underwent concomitant supracervical hysterectomy or were post-hysterectomy.[15] Indeed, in our two patients who underwent RMS with cervical preservation, no mesh erosion was noted. Additional risk factors for mesh erosion were identified in a recent case series showing that anterior vaginotomy and early learning curve were significantly associated with mesh erosion. Securing the mesh to the vaginal wall with Ethibond sutures instead of prolene had a relative risk of 3.08 for mesh erosion, but this was not statistically significant (lower 95% CI 0.98). The suggestion made by the authors was that suture choice and violation of the vagina may lead to mesh erosion.[16] In our experience with anterior vaginotomy, we tried to prevent secondary mesh erosion by fashioning the mesh and securing it away from the vaginotomy site. Ethibond was only used to secure the mesh to the promontory.

Strengths of our series include that all procedures were done by the same surgeon, using the same surgical technique, with adequate follow up. A third party reviewer assessed the series and performed all analyses. Limitations to this study include lack of randomization and a limited cohort of patients. Ideally, long term data at 5 years or more after RMS is desirable. As reported in other series and confirmed in this report, recurrence or secondary POP after MSC tends to occur early on.[17,18] Therefore, we do not anticipate more recurrences of POP in this cohort of patients over the long term but might observe a few symptomatic secondary prolapses. Although the challenges in obtaining long term follow up data after POP repair have been recently outlined,[18] we do intend, nonetheless, to pursue long term monitoring because of concern for late mesh erosion.

## Conclusion

With a median follow up of 28 months, RMS performed reliably to correct symptomatic, multi-compartment POP. The use of absorbable sutures to secure the mesh to the vaginal walls resulted in satisfactory anatomical and functional outcomes and did not increase the risk of mesh erosion.

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