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REVIEW

Robotic Ventral Mesh Rectopexy: Where do we Stand?

Robotik Ventral Meş Rektopeksi: Güncel Olarak Neredeyiz?

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ABSTRACT

This paper aims to review the current status of robotic ventral mesh rectopexy (VMR). The articles reporting the outcomes of patients who underwent robotic VMR were reviewed and evaluated. Complications of robotic VMR ranged between 0% to 25%, the majority of them were minor complications. Longer operating time and higher hospital expenses are the major limitations of robotic surgery compared to laparoscopy. As an emerging technique, robotic VMR promises good outcomes. Robotic VMR seems to be a safe and effective surgical technique in the treatment of rectal prolapse.

Keywords: Robotic, rectopexy, ventral mesh repair

ÖZ

Bu makalede robotik ventral meş rektopeksi (VMR) operasyonunun güncel tekniği ve sonuçları gözden geçirilmiştir. Robotik VMR ile ilişkili komplikasyonlar %0 ile %25 arasında değişen ve çoğunluğu minimal komplikasyonlardır. Daha uzun ameliyat süresi ve daha yüksek hastane maliyeti, laparoskopiye kıyasla robotik cerrahinin en önemli kısıtlamalarıdır. Gelişen bir teknik olarak, robotik VMR iyi sonuçlar vaat etmekte ve rektal prolapsus tedavisinde etkili bir cerrahi teknik olarak görünmektedir.

Anahtar Kelimeler: Robotik, rektopeksi, ventral meş onarım

Introduction

Rectal prolapse and related conditions such as rectocele and enterocele are socially debilitating conditions.[1,2] Among many effective surgical and medical treatment options defined, there is no standard treatment for rectal prolapse. Proper management of rectal prolapse should be tailored individually based on presence of pelvic floor defects, vaginal prolapse, severe constipation, prior perineal trauma and surgical history.[3,4] Similar to many other disorders of the pelvic floor, multidisciplinary approach is required for treatment of rectal prolapse.[4] Surgical treatment of rectal prolapse has evolved substantially after the introduction of laparoscopy.[5] Currently, laparoscopic ventral mesh rectopexy (VMR) is the main surgical treatment of choice for rectal prolapse. The original procedure, described by D'Hoore et al.[6], involves re-placing of the prolapsed rectum by suspending it to the anterior longitudinal ligament of the sacrum using a mesh anteriorly. Laparoscopic VMR improves the symptoms of obstructed defecation by fixing the rectal prolapse without creation of an anastomosis.[7,8] However, laparoscopic technique has some limitations while working in confined spaces such as deep pelvis, intracorporeal suturing and positioning the mesh.[9] Robotics, which has been developed to overcome limitations of laparoscopy, provides better visualization and increased maneuverability in confined spaces and complicated conditions.[10] This paper aims to review the current status of the robots in VMR for the treatment of rectal prolapse.

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Review Content

Articles reporting the outcomes of patients who underwent robotic VMR were extracted. The extracted articles were reviewed in terms of operation times, presence of conversion to conventional laparoscopy or open surgery, postoperative complications, length of hospital stay, long-term functional results, recurrences, and costs.

Perioperative Course

Mechanical bowel preparation is used preoperatively in all patients. For deep vein thrombosis prophylaxis, compression stockings and low molecular weight heparin (before and after 12 hours of surgery) are used. After induction of anesthesia, an orogastric tube is inserted and it is removed before extubation, following completion of the surgical operation. Patient is positioned in a modified lithotomy position. The arms are tucked and the body is stabilized with the pads around the shoulders. The *da-Vinci Xi*® platform is used in our operations, exclusively. After routine cleaning with povidone-iodine, the ports are placed in a straight-line 8 cm apart horizontally. An 8 mm accessory port with air seal may be placed in the right lower quadrant in complicated cases. The robot is docked at a 30-degree angle along the left side. The key steps of the procedure were identification of the promontorium, creation of the peritoneal flaps, dissection of the recto-vaginal/vesical septum down to the pelvic floor, mesh placement and closure of the peritoneal flaps. We previously published our operative technique in details.[11] Patient-controlled analgesia is used for all patients. Patients are asked to walk and to perform breathing exercises within the first postoperative day. Oral feeding is also started in postoperative day 1. The urinary catheter is removed one day after surgery. Discharge criteria include tolerance of meals without nausea or vomiting, established bowel function, adequate pain management with oral analgesia and independent walk.

Discussion

Laparoscopic VMR has gained popularity for the surgical treatment of rectal prolapse since it was first described.[9,12] Many studies have reported the safety of this procedure and good functional results with acceptable complication rates post-operatively.[7] However, two-dimensional imaging, limited mobility of laparoscopic instruments and working in a confined space such as pelvis are the factors that increase the complexity of VMR when performed laparoscopically.[9] Due to those factors, the learning curve of laparoscopic VMR is remarkably long and lack of experience has been shown to be associated with worse outcomes.[9,13] It has been reported that the number of cases needed to be performed to gain dexterity for providing clinically good quality of life was in between 82 and 105 cases and for standardizing the operating time was around 54 cases.[13] Considering all the advantages of the robotic platform including better visualization and increased maneuverability in confined spaces and complicated conditions, VMR seems as an ideal procedure for robotic technique.[9] Taking into account its technical advantages, the learning curve of robotic VMR also may be shorter (18 cases) compared to laparoscopy.[9,14] Thus, VMR is being increasingly performed with robotic technique.[2,7,15,16]

Complications

After the adoption of laparoscopic surgery, the complication rates of rectopexy significantly reduced.[17] Overall complication rates were between 0 and 23.5% after laparoscopic VMR, major complication rates ranged from 0 to 7.7%, and perioperative mortality was reported to occur between 0 and 1.1%.[7] Similarly, complications of robotic VMR ranged from 0% to 25%, and the majority of them were minor complications.[14,16,18,19,20,21,22,23,24] The largest series of robotic VMR reported a 1.9% intraoperative complication rate, and 1.9% and 7.0% major and minor early postoperative complication rates, respectively. The mortality rate was found to be 0.4%. In this study, late major and minor complications were seen in 3.5% and 7.1% of the patients, respectively.[2]

Intraoperative complications of minimally invasive VMR were vaginal perforation, rectum perforation and hemorrhage.[2,18,25] Postoperative complications were wound hematoma, surgical site infection, subcutaneous emphysema, urinary retention, urinary tract infections, ileus, mesh erosion, fistula formation, sacral discitis and incisional hernia.[9,24,25,26,27,28] The studies reporting the outcomes of robotic VMR were summarized in Table 1.

In a meta-analysis comparing robotic and laparoscopic VMR, reviewing 242 patients, robotic surgery was shown to have less operative morbidity.[29] Another meta-analysis that reviewed 3 studies for early complications of robotic and laparoscopic VMR reported fewer wound complications, urinary tract infection, postoperative ileus and abdominal pain in the robotic group, but those trends were not statistically significant.[26] Male sex and history of having previous abdominal surgeries were the risk factors associated with operative morbidity in patients undergoing VMR.[9] Dyspareunia and recto-vaginal fistula are common mesh related complications related to VMR.[7,30] A study conducted by Evans et al.[31] including 2203 patients reported 2% general mesh erosion in a median time of 23 months after laparoscopic VMR. In other studies, mesh related complications were reported between 0 and 6.7%.[7]

Table 1. Main outcomes of robotic ventral mesh rectopexy

Study	Operation	No of operations	Follow-up time (median)	Complications	Recurrence	Efficiency
de Hoog et al.[32]	RR vs LR vs OR. Wells or VMR	14 robot-19 lapaproscopy (1 conversion)	Short term	Robot 2 postop constipation-laparoscopy 3 postop constipation	N/A	N/A
Wong et al.[38]	RVMR or LVMR	15 robot-23 laparoscopy-3 laparotomy	12 months	2 recurrence	2 patients (7-3 months)	ODS score >6 achieved a significant improvement in postoperative scores
Wong et al.[16]	RVMR or LVMR	19 robot-41 laparoscopy-3 laparotomy	6 months	2 ileus (laparotomy)-3 UTI	None	N/A
Abet et al.[27]	RVMR or LVMR	15 robot-23 laparoscopy-3 laparotomy	7 months	3 UTI-1 Urinary retention	None	Better sexual comfort
Perrenot et al.[14] (2002-2006 17 patients delorme.)	Robotic assisted laparoscopy	72 robot-5 laparotomy (16 ventral-52 alateral-9 sigmoid res)	52.5 months	3 rectal wound-2 urinary infection-2 presacral collection-1 hemorrhage	9 patients-> 5 resurgery->3 second recurrence (1 ventral rectopexy recurrence)	Statistics N/A
Mäkelä-kaikkonen et al.[18]	RVMR-LVMR	20 robot-20 laparoscopy	3 months	1 vaginal perforation (robot complications) -1 UTI	None	Subjective benefit (%80)
Mantoo et al.[34]	RVMR	50 robot-1 laparotomy	14 months	3 UTI-3 recurrence	3 patients	N/A
Mantoo et al.[19]	RVMR	44 robot (1 conversion) vs 74 laparoscopy (3 conversion)	16 months	4 UTI-2 Ileus	3 patients	ODS-CCF scores increased, sexual improvement
Mehmood et al.[20]	RVMR-LVMR	17 robot-34 laparoscopy (1 conversion)	12 months	None in robot-hematoma, infection, ileus, confusion, UTI, readmission with abdominal pain in lap	None	Wexner postop score better in both-robot better QOL
Mäkelä-Kaikkonen et al.[33]	RVMR-LVMR	16 robot-14 laparoscopy	3 months	Robot- fever, hematoma of rectus Laparoscopy-perineal pain	None	Reduction of prolapses in MR defecography
Faucheron et al.[21]	RVMR-LVMR	10 robot-10 laparoscopy	1 month	None	None	N/A
van Iersel et al.[7]	RVMR	51 robot (1 conversion)	12.5 months	Constipation 3- UTI-hematoma-abscess of proximal bladder-Hypokalemia (early) ACNES 2- Perforating vaginal suture- 2 UTI (late) . Erosion of mesh (1)	1 distal rectocele-1 asymptomatic cystocele	Anatomical, functional increase Pescatori, Wexner, Vaizey, QOL better scores, better sexual health

RR: Robotic rectopexy, LR: Laparoscopic rectopexy, OR: Open rectopexy, VMR: Ventral mesh rectopexy, LVMR: Laparoscopic ventral mesh rectopexy, RVMR: Robotic ventral mesh rectopexy, N/A: Not applicable, ODS: Obstructed defecation score, UTI: Urinary tract infection, ACNES: Anterior Cutaneous Nerve Entrapment syndrome, QOL: Quality of life, MR: Magnetic resonance

After robotic VMR, to our knowledge, only one case of mesh erosion was stated in a study of 258 patients after a mean time of 23.5 months.[2] However, larger studies with longer follow-up are needed to evaluate postoperative complications after robotic VMR.

Operation Time

The operation times were significantly longer in robotic VMR compared to laparoscopy in all clinical studies and two meta-analyses, except 2 of them showing no differences.[15,16,18,19,20,21,26,29,32,33] While robotic VMR seems disadvantageous when compared to laparoscopic VMR due to prolonged operation time, operative experience and standardization of the surgical technique may reduce duration of surgery.[34] Long operation time in the robotic VMR was not associated with increased risk of postoperative morbidity in any of the prior studies.

Conversion to Open Surgery

Conversion to open surgery from laparoscopic VMR was reported between 0-10%.[7,16] Majority of conversions were due to extensive intra-abdominal adhesions.[7] Up until now, no differences were reported so far in any of the clinical trials or in either of the two meta-analyses comparing laparoscopic and robotic VMR in terms of conversion to open surgery.[15,16,18,19,26,29,33]

Length of Hospital Stay

The length of hospital stay was generally reported as similar after laparoscopic and robotic VMR.[15,16,18,19,20] Only in the study by de Hoog et al.,[32] the length of hospital stay after robotic VMR was significantly shorter than the laparoscopy and the open surgery group. While a meta-analysis conducted by Ramage et al.[26] showed no differences in terms of length of stay (LOS) between laparoscopic and robotic VMRs, other meta-analysis conducted by Rondelli et al.[29] showed shorter LOS after robotic VMR.

Cost

There are only two studies comparing the costs of laparoscopic and robotic VMR.[15,21] In both of these studies, the robotic procedures were associated with higher costs. Heemserk et al. reported that costs were 557.29 Euros (or: 745.09 dollars) higher in robotic surgery when compared to laparoscopy.[15] Faucheron et al[21] reported that robotic rectopexy was associated with 5359 Euros additional cost per procedure (9088 vs 3729 euros per procedure, $p<0.001$) compared to laparoscopic VMR.[21] As seen from these trials and considering the expense of the dock console and devices, and also the longer occupation time of the operating room, robotic technique is apparently more expensive in the short term. However, a long-term analysis for cost-effectiveness of robotic and laparoscopic VMR is still lacking.

Long Term Outcomes: Functional Results and Recurrence

The purpose of rectal prolapse surgery is to correct the prolapse together with its consecutive functional impairments and to protect or restore fecal continence, without causing a new onset or worsened constipation.[6] VMR, which avoids full rectal mobilization and transection of the lateral stalks, and thus limits the autonomic nerve damage, was developed in the search to reduce postoperative constipation.[6] As compared with other techniques, meta-analyses confirmed that VMR was associated with less constipation postoperatively.[7,35,36] Also, the laparoscopic VMR procedure was demonstrated to decrease obstructed defecation (52-84.2%) and incontinence (50-93%).[7]

After the introduction of robotic surgery, a number of studies reported their functional results of robotic VMR, both for prolapse and rectocele.[2,19,20,27,32,37,38,39] van Iersel et al.[2] reported a significant overall improvement in obstructive defecation (78.6%) and fecal incontinence (63.7%) in 258 consecutive patients with rectal prolapse. Other studies also showed an improvement in obstructive defecation symptoms[19,38,39], fecal incontinence[19,20,37], and sexual function[27,28,39] following robotic VMR.

While two clinical studies comparing the outcomes of robotic and laparoscopic VMR found no difference regarding anorectal functions[32,39], two other papers reported advantages of robotic VMR over laparoscopic VMR such as significant improvement in obstructed defecation[19], fecal incontinence and emotional status[20].

As an important indicator of long-term success, recurrence of rectal prolapse following minimally invasive repair stays similar to open surgery.[7] The largest observational study of laparoscopic VMR described a 10 year recurrence rate of 8.2% for patients undergoing external rectal prolapse repair.[40] The implementation of advanced technology to prolapse surgery does not seem to have changed the recurrence rates. In the studies comparing the two techniques of VMR, recurrences are reported to be from 0 to 7% for the robotic and 0 to 8% for the laparoscopic procedures, and were comparable to observational laparoscopic VMR studies.[7] A meta-analysis reviewing 5 studies and 307 patients, and another reviewing 4 studies and 244 patients for recurrence found no significant differences in the recurrence of rectal prolapse between robotic and laparoscopic VMR.[26,29] However, the follow-up periods of these clinical studies comparing the two procedures are relatively short. The only study that observed the long-term results (52.5 months of mean follow-up time) of robotic VMR reported a recurrence rate of 12.8%.[14]

Conclusions

While robotic VMR seems as a safe and effective surgical technique for treatment of rectal prolapse, data about long term outcomes are needed to reveal its role for treatment of rectal prolapse.

Ethics

Peer-review: Internally peer-reviewed.

Authorship Contributions

Concept: B.O.B., E.A., E.E., V.Ö., B.B., İ.H., T.K., Design: B.O.B., E.A., E.E., V.Ö., B.B., İ.H., T.K., Data Collection or Processing: B.O.B., E.A., E.E., V.Ö., B.B., İ.H., T.K., Analysis or Interpretation: B.O.B., E.A., E.E., V.Ö., B.B., İ.H., T.K., Literature Search: B.O.B., E.A., E.E., V.Ö., B.B., İ.H., T.K., Writing: B.O.B., E.A., E.E., V.Ö., B.B., İ.H., T.K.

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