High Levator Myorrhaphy for Transvaginal Suspension of the Vaginal Apex: Long-Term Results

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Purpose: We evaluated the long-term outcome and complications of high levator myorrhaphy for vaginal apical defects.

Materials and Methods: A total of 286 patients underwent high levator myorrhaphy. Patients underwent preoperative and postoperative urogynecologic assessment, including evaluation of prolapse stage according to the international pelvic organ prolapse staging system and conventional urodynamometric testing. Quality of life was evaluated using the prolapse quality of life questionnaire. We considered failure as vaginal prolapse stage 2 or greater according to the pelvic organ prolapse staging system.

Results: A total of 272 patients with a mean age of 60.4 years were available for analysis. Mean followup was 5 years. In 247 patients we associated tension-free cystocele repair with Marlex™ mesh. In 50.7% of patients high levator myorrhaphy was done with curative intent, while in the remaining 49.3% it was a preventive measure. Complications included a rectal tear in 2 cases, Marlex mesh erosion in 23 (8.4%), vaginal vault abscess in 1, pararectal hematoma in 2 and buttock pain in 2. Anatomical evaluation at followup revealed a 96.7% cure rate for apical defects and a 26.8% incidence of cystocele. We observed improvement in filling, voiding and post-void symptoms. Quality of life evaluation showed improvement in all domains. We detected a 9.6% incidence of de novo dyspareunia.

Conclusions: High levator myorrhaphy is a safe and effective procedure for preventing and curing vaginal apical defects. The simplicity of this surgical procedure, its short learning curve, the lack of severe complications and its low costs combined with symptomatic relief and improvement in quality of life encourage its use for the cure and routine prevention of vaginal apical prolapse.

Key Words: vagina, prolapse, quality of life, pelvic floor, reconstructive surgical procedures

M anagement of the vaginal cuff at hysterectomy and of post-hysterectomy vault prolapse is a challenge for the pelvic reconstructive surgeon. Following the DeLancey theory of vaginal support, the concept that vaginal apex fixation is a mandatory step in POP surgery has become clear.1 In the presence of incorrect apical suspension the strain exerted on the vaginal walls by intra-abdominal pressure predisposes to POP recurrence involving the apex and other vaginal segments.

The prevalence of post-hysterectomy vault prolapse is 0.2% to 43% in different reports.2 The incidence of recurrent vaginal vault prolapse is 5% to 10% according to different techniques and studies.3 Vaginal apical defects are caused by damage to the cardinal and uterosacral ligaments (DeLancey level 1).4

More than 40 techniques for uterine or vaginal vault suspension have been described in the literature, including abdominal, vaginal and laparoscopic procedures.3 Sacrocolpopexy, which is the procedure of choice for the abdominal approach, can be performed by open surgery or laparoscopy using various types of prosthetic mesh. The success rate of sacrocolpopexy is 78% to 100% in different studies.5,6 Regarding the vaginal approach, several techniques have been developed. SSF, which was initially described in 1971 by Randall and Nichols,7 can be done bilaterally or unilaterally with a success rate of 8% to 87%.3 Other vaginal approaches are high sacro-uterine ligament suspension, vault suspension to the iliococcygeal fascia, high midline levator plication, infracoccygeal sacropexy8 and high midline levator myorrhaphy.9

Three randomized, controlled studies have been published comparing abdominal and vaginal techniques for vault prolapse repair, of which all deal with sacrocolpopexy and SSF. Two of these trials showed a better outcome for the abdominal approach compared to the vaginal approach.10,11 The third study demonstrated that the 2 approaches were equally effective for vaginal vault prolapse.12 Major differences in patient populations and surgical technique among those studies could explain their different conclusions.

The Committee on Surgery for Pelvic Organ Prolapse of the Third International Consultation on Incontinence concluded that abdominal and vaginal surgery are relatively equivalent in regard to overall outcomes (level 1 evidence).13 While abdominal surgery requires longer operative time, has higher morbidity, a longer time to return to daily activity and increased cost, the main disadvantage of the vaginal

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approach seems to be a higher anterior and apical recurrence rate. These conclusions may be relevant to SSF alone. To our knowledge no other vaginal technique for vault suspension has been compared to the abdominal route in controlled, randomized trials.

We present our long-term experience with LM for correcting and preventing vaginal apical defects. We evaluated the long-term anatomical outcome of this procedure. As a secondary outcome, we evaluated the incidence and type of complications, and the impact of surgery on anorectal function, sexuality and QOL.

METHODS

From May 2000 to November 2004, 286 patients underwent suspension of the vaginal apex to the pubocervical bundle of the levator ani for symptomatic vaginal prolapse, which was stage 2 or greater according to international POP-Q. In all patients surgery was performed by one of us (MC) or under his supervision.

Patients underwent complete preoperative urogynecologic assessment, including a clinical history using a standardized form, evaluation of the degree of incontinence in accordance with Ingelmann-Sundberg, pelvic examination using a standardized form, evaluation of the degree of incontinence in logic assessment, including a clinical history using a standardized form, evaluation of the degree of incontinence in logic assessment, including a clinical history. We evaluated the secondary outcome, we evaluated the incidence and type of complications, and the impact of surgery on anorectal function, sexuality and QOL.

Surgical Technique

Patients are placed in a dorsal lithotomy position. Midline posterior colpotomy extending from vault to perineum is performed. The prerectal fascia is widely dissected to separate the vaginal wall from the underlying rectum. This dissection is extended to the ischiorectal fossa with the aid of Briesky retractors until the sheath of the puborectalis muscle is visualized bilaterally at the superior edge of dissection (part A of figure). Using a single polyglactin-2 suture the right apex of the vaginal cuff is attached to the ipsilateral puborectalis sheath slightly further forward than the ischial spine (parts B and C of figure). The same suture then makes a loose stitch through the proximal end of the prerectal fascia (part D of figure). This procedure is then repeated on the left side using the same suture. The 2 suture ends are tied, bringing together the upper parts of the 2 pubocervical sheaths. Plication of the prerectal fascia is done with continuous polyglactin-0 suture. Finally, perineoplasty is completed using a single polyglactin-1 suture to approximate the bulbocavernous and superficial transverse perineal muscles. When cystocele repair was required, it was done using polypropylene Marlex mesh by TCR, a technique developed by our group that has been described previously. Vaginal apex (point C) stage 0—optimal outcome or 1—satisfactory outcome were considered objective cure. Surgical failure was defined as point C stage 2 or greater.

The study was approved by the ethics committee at our hospital and patients provided written informed consent. Statistical analysis was done using the chi-square test for categorical variables, the Wilcoxon test for nonparametric variables and the t test for parametric continuous variables with p < 0.05 considered statistically significant.

RESULTS

Of the 272 patients available for statistical analysis 137 underwent HLM to correct superior vaginal segment descensus (point C stage 2 or greater, correction group), while in the remaining 135 HLM was performed to prevent superior vaginal segment descensus (point C less than stage 2, preventive group).

Mean followup was 5 years (range 3 to 7). Mean ± SD patient age was 60.4 ± 8.8 years (range 39 to 79), median parity was 2 and 227 patients (83.4% of the sample) were postmenopausal. Mean body mass index was 26.4 ± 3.5 kg/m² (range 19.8 to 43.4). Of the patients 64 (23.5%) had a history of surgery for prolapse, which included vaginal hysterectomy in 50. Some women underwent associated pelvic surgery, including TCR in 247 (90.8%), vaginal hysterec-
tomy in 132 (48.5%), a tension-free vaginal tape procedure in 46 (16.9%) and urethrolysis in 3 (1.1%).

In 3 patients with point Bp stage 3 a rectal tear was repaired intraoperatively, of whom 2 had previously undergone vaginal posterior repair. Erosion of the Marlex mesh through the anterior vaginal wall occurred in 23 of the 247 patients (8.4%) in whom we performed TCR. Of these patients 19 had point C stage 3 and 4 had point C stage 2. Of the 23 patients 21 underwent vaginal hysterectomy. The visible graft was excised in 21 patients and the vagina was sutured using polyglactin-0. No recurrence or subsequent related symptoms were observed. Other postoperative complications were a vaginal vault abscess, which required incision and drainage in 1 patient with large vaginal vault prolapse (stage 4), conservatively managed pararectal hematoma in 2 and buttock pain in 2, which resolved spontaneously in 6 to 8 weeks. Of these 4 patients with complications pararectal hematoma and buttock pain occurred in 1 patient each with point C stage 1, while the other 2 had point C stages 2 and 3, respectively.

We observed good suspension of the vaginal apex with point C stage less than 2 in 96.7% of the sample according to POP-Q. Table 1 shows preoperative and postoperative POP Q scores.

Subanalysis of preoperative stages at the point C level showed that 2 of 135 patients at stage 1 had failure at stage 2, 3 of 74 at stage 2 had recurrence at the same stage, only
2 of 56 at stage 3 had recurrence at the same stage and 2 of 7 at stage 4 had recurrence at stage 3. We found no correlation between anatomical results and other variables, such as patient age, parity and body mass index.

Evaluation of TVL showed no significant variation at a mean of 8.7 cm before surgery and 7.9 cm postoperatively ($p < 0.05$). Evaluation of urethral mobility using the cotton swab test showed a decrease in hypermobility from 75.4% to 38.6% ($p < 0.001$).

Table 2 lists preoperative and postoperative symptoms. Data analysis showed significant improvement in filling, voiding, post-void symptoms and dyspareunia ($p < 0.01$). A structured original questionnaire on sexual activity revealed no significant functional alteration in sexually active patients, while 29 of the 96 sexually inactive patients resumed sexual activity following surgery.

Urodynamics were performed at each followup visit. We noted no statistically significant modification of any parameters with respect to baseline except a decrease in detrusor overactivity and an increase in urodynamic stress incontinence. In particular we observed a statistically significant decrease in detrusor overactivity only at 1 year and thereafter. Also, we observed a statistically significant increase in urodynamic stress incontinence at all visits except in year 7 (table 3).
The QOL survey, which was performed in 96 patients, demonstrated a statistically significant improvement in all domains (p < 0.05) except personal relationship (p = 0.09). The procedure had no impact on anorectal function according to analysis of the Wexner score for constipation (p = 0.05).

**DISCUSSION**

We report the long-term outcome following HLM, a vaginal technique for correcting and preventing vaginal apical defects. This procedure is similar to high midline levator myorrhaphy, as proposed by Lemack et al.\(^9\) In the latter procedure a No. 1 absorbable suture is placed in the levator muscle approximately 3 cm above its junction with the rectum. Another suture is placed 1 cm proximal to the previous one. Similar sutures are placed contralaterally. Each of the 2 sutures is then tied sequentially across the midline to the contralateral suture. Before closing the vaginal mucosa 1 more medial and, therefore, more distant from the ureters compared to that in the procedure of Lemack et al.\(^9\) As a result of this modification, no ureteral injury or hydronephrosis was observed in our sample. Moreover, using a single suture for vaginal vault suspension makes this procedure rapid and easy to perform compared to the double stitch procedure of Lemack et al and to more complex and lengthy techniques, such as SSF or high sacro-uterine ligament suspension. Blood loss is minimized through careful preparation of the pararectal spaces using a blunt technique.

We found that the learning curve of HLM was relatively short and easily attained by a pelvic surgeon. Finally, the cost of the procedure is negligible compared to that of other minimally invasive techniques using prosthetic material and special tunnelers, such as posterior infracoccygeal sacropexy.

The overall recurrence rate of apical segment prolapse in our patients was 3.3% at a mean followup of 5 years. Of our sample of patients only 50.7% had point C stage 2 or greater before surgery. The others had no severe involvement of the apical segment. Nevertheless, we also decided to perform HLM as a preventive measure in the latter group. Vaginal apex fixation as a preventive measure has been previously recommended by other investigators in patients with extreme laxity of the cardinal and/or uterosacral ligaments. On analysis of the 2 patient subgroups we found no significant difference in the incidence of postoperative apical prolapse, including 1.5% in the correction group and 1.8% in the prevention group. Our results are more than satisfactory compared to those of other apical suspension techniques through the vaginal route, given the 73% to 98% success rate of SSF and the 82% to 92% success rate of uterosacral suspension.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preop</th>
<th>6 Mos</th>
<th>1 Yr</th>
<th>2 Yrs</th>
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<th>5 Yrs</th>
<th>6 Yrs</th>
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<tr>
<td>No. pts</td>
<td>272</td>
<td>272</td>
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<td>272</td>
<td>210</td>
<td>156</td>
<td>103</td>
<td>45</td>
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<td>No. detrusor overactivity (%)</td>
<td>81 (29.8)</td>
<td>56 (20.1)</td>
<td>52 (19.1)*</td>
<td>48 (17.6)*</td>
<td>44 (16.2)*</td>
<td>32 (15.2)*</td>
<td>25 (16.1)*</td>
<td>17 (16.5)*</td>
<td>7 (15.5)*</td>
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<td>Detrusor pressure at max flow (cm H(_2)O); Mean ± SD</td>
<td>1–117</td>
<td>13–48</td>
<td>15–45</td>
<td>12–47</td>
<td>4–51</td>
<td>10–65</td>
<td>11–29</td>
<td>15–26</td>
<td>16–28</td>
</tr>
<tr>
<td>Max flow (ml/sec); Mean ± SD</td>
<td>2–43</td>
<td>7–26</td>
<td>8–35</td>
<td>8–42</td>
<td>5–27</td>
<td>9–26</td>
<td>11–25</td>
<td>13–19</td>
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<tr>
<td>No. urodynamic stress incontinence (%)</td>
<td>24 (8.8)</td>
<td>60 (22.1)*</td>
<td>56 (20.1)*</td>
<td>54 (19.9)*</td>
<td>46 (16.9)*</td>
<td>30 (14.3)*</td>
<td>27 (17.3)*</td>
<td>18 (17.5)*</td>
<td>5 (11.1)*</td>
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\(\ast\) Vs baseline p < 0.05.
In regard to anatomical results in the anterior segment, we observed a 26.6% postoperative incidence of cystocele stage 2 or greater. Of these 73 patients 63 had recurrent cystocele, while 10 had a de novo defect. The problem of anterior vaginal wall recurrence has been largely discussed in relation to SSF with up to a 92% incidence of cystocele documented following this procedure. The posterior shift in the vaginal axis occurring with SSF has been suggested to predispose to anterior vaginal wall prolapse, as we discussed. To correct cystocele in our patients we adopted TCR. The combination of a tension-free technique with a tension-based procedure such as HLM may possibly have a role in the unsatisfactory anterior vaginal wall outcome. It should be emphasized that only 14 of 73 patients (5.1%) with postoperative cystocele were symptomatic in this regard, while most patients were not aware of the defect, which was only noted at physical examination.

We observed a significant postoperative improvement in voiding symptoms, post-micturition symptoms, symptoms related to POP and storage symptoms. De novo symptoms developed in 35 patients, including 30 in the vault prolapse group and 5 in the cystocele repair group. All patients with de novo symptoms had recurrent prolapse or postoperative complications. Of these patients 14 had anterior recurrence, 9 had apical recurrence and 6 had recurrence in the posterior vaginal segment. The patient with vaginal vault abscess later reported de novo symptoms. In 5 patients vaginal erosion of the Marlex mesh was associated with filling and voiding de novo symptoms.

In our sample of 57 patients (56.1%) with preoperative dyspareunia reported resolution of this symptom following surgery, while in 25 the problem persisted. Previous studies of different POP repair procedures have shown similar findings. In the study by Maher et al of SSF 40% of women with preoperative dyspareunia experienced resolution of discomfort following surgery, while Nieminen et al reported improvement in sexual function in 33% of their sample. Our data also indicate a positive impact of our surgical technique on sexuality. On the other hand, we observed de novo dyspareunia in 26 patients. Unfortunately we do not have enough information to discuss this finding, partially because we do not know whether the main complaint was of superficial or deep dyspareunia. Such information might shed some light on this complaint because perineorrhaphy was performed in all patients. Superficial dyspareunia following perineorrhaphy is a well-known complication that has been previously reported. Colombo and Milani discussed this occurrence in their study of 62 patients after SSF. They found that almost all cases of dyspareunia in their sample were related to introital narrowing after posterior vaginal wall repair. We presume that in our sample as well new onset dyspareunia could be in part related to concomitant perineorrhaphy. Furthermore, in 6 of 26 patients dyspareunia correlated with wide erosion of the anterior vaginal wall due to the polypropylene mesh used for anterior repair. The complaint resolved after mesh removal.

**CONCLUSIONS**

HLM is a safe and effective procedure for restoring vaginal apical support. In addition to excellent anatomical results, patients benefit from improved filling, voiding, post-micturition and prolapse related symptoms with consequent improvement in QOL. Given the relative simplicity of this surgical procedure, its short learning curve, the lack of severe complications and its low costs, we believe that HLM for vaginal apical support is a valid tool in the hands of the pelvic reconstructive surgeon for treatment and for routine prevention of post-hysterectomy vault prolapse. Prospective, randomized studies are needed to compare this procedure with other surgical techniques for vaginal apex suspension.

**Abbreviations and Acronyms**

HLM = high levator myorrhaphy  
POP = pelvic organ prolapse  
POP-Q = POP quantification system  
P-QOL = prolapse QOL questionnaire  
QOL = quality of life  
SSF = sacrospinous fixation  
TCR = tension-free cystocele repair

**REFERENCES**

EDITORIAL COMMENT

These authors provide a long-term assessment of their technique of HLM to prevent and repair vaginal apical prolapse in a large group of patients. Their technique involves a slight modification of a prior published procedure and relies on only 1 absorbable suture. The studied population included 137 women who underwent this procedure as corrective repair, while 135 did so as preventive repair of the vault, presumably at vaginal hysterectomy. Several associated procedures were done at the time of this pelvic surgery, which renders the real assessment of the results of HLM alone somewhat confusing but reflects real-life practice. The results are impressive with a high success rate based on POP-Q in compliant patients, of whom most apparently returned yearly for the first 3 years for questionnaires, examination and complete urodynamic testing. As the result of this amazing degree of patient compliance, which is so rarely seen in contemporary series, one of the unique features of the study is the urodynamic table, which compiles a stable rate of stress urinary incontinence and detrusor overactivity year after year.

A few complications are worth noting, including dyspareunia, which was hard to trace to its roots, given the combination of mesh erosion in some patients along with systematic perineorrhaphy in all. Interestingly cystoscopy to exclude ureteral injury was not done at the time of the procedure. Instead renal ultrasound was subsequently performed in all patients to search for hydronephrosis. This is arguable because it is preferable to recognize an injury at the time of the procedure and take the necessary steps to correct it then, rather than after the fact. These authors are clearly confident that with their technique the medial location of the suture will not endanger the ureters. For less experienced vaginal surgeons cystoscopy after vault and/or enterocoele repair is worth considering to prevent this well-known complication.

The authors share their long-term experience with a simple vaginal procedure to correct and prevent vault repair. Given their success at retaining patients in this study, it is hoped that longer followup at 7 to 10 years will 1 day be available to confirm the longevity of this HLM technique.

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