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Native-tissue pelvic organ prolapse (POP) repair with perineorrhaphy for Level III support results in reduced genital hiatus size and improved quality of life in sexually active and inactive patients

Anke R. Mothes\textsuperscript{1,2}, Isabel Raguse\textsuperscript{1,3}, Angela Kather\textsuperscript{1}, Ingo B. Runnebaum\textsuperscript{1*}

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AR Mothes Idea and project design, project conception and development, surgery, data collection, management and interpretation, manuscript writing and editing;
I Raguse Data collection and statistical analysis and interpretation, literature review;
A Kather Data statistical analysis and interpretation, manuscript editing;
IB Runnebaum Project conception and development, interpretation of data, editing of manuscript with substantive revision

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\textsuperscript{1} Department of Gynaecology and Reproductive Medicine, Jena University Hospital, Friedrich-Schiller-University Jena, Am Klinikum 1, 07747 Jena, Germany.

\textsuperscript{2} Current address: Department of Gynaecology, St. Georg Hospital Eisenach, Academic Teaching Hospital of University of Jena, Jena, Germany.

\textsuperscript{3} Department of Traumatology Hand and Reconstructive Surgery, Jena University Hospital, Friedrich-Schiller-University Jena, Am Klinikum 1, 07747 Jena, Germany.

*Corresponding author:
Prof. Ingo B Runnebaum (MD, MBA), Department of Gynaecology and Reproductive Medicine, Jena University Hospital, Adress: Department of Gynaecology and Reproductive Medicine, Jena University Hospital, Friedrich-Schiller-University Jena, Am Klinikum 1, 07747 Jena, Germany.

Phone: +49 3641 9 329 101, Fax: +49 3641 9 329 102, Email: direktion-gyn@med.uni-jena.de
Abstract

Introduction and hypothesis Recent findings address the importance of Level III defects with increased genital hiatus being associated with pelvic organ prolapse (POP), correlated with Level I defects and strongly related to POP recurrence. We hypothesised that concomitant perineorrhaphy in POP repair reduces genital hiatus (gh) and increases perineal body (pb), that gh would be larger with number of vaginal deliveries and that patients’ QoL was not different comparing sexually active vs. inactive patients with overall judgement of cure comparable to the literature at evaluation.

Methods Retrospective observational study including consecutive patients with indications for posterior repair and Level III support between 2016 and 2018. Concomitant perineorrhaphy was indicated due to complaints of wide introitus or genital hiatus of $\geq 3.5$cm. Primary objective was to compare pre- and post-operative gh and pb according to POP-Q, secondary objectives were pre-operative gh and pb values by parity, POMs obtained with P-QOL/D comparing sexually active vs. inactive patients, and subjective judgement of cure according to EGGS system.

Results In n = 121 patients, mean gh value was reduced post-operatively by 29.5% (31 ± 6 vs. 44 ± 10 mm, $p < 0.001$), mean pb value increased by 25.5% (47 ± 8 vs. 35 ± 8 mm; $p < 0.001$). Influence of parity on pre-operative gh ($p = 0.020$), but not pb values ($p = 0.119$) was observed. All P-QoL/D domain scores improved significantly postoperatively without differences seen in sexually active vs. inactive patients. EGGS responses indicated partial/full goal achievement in 90% and cure in 87%.

Conclusions In the study cohort, perineorrhaphy as concomitant in POP repair led to Level III support reflected by decreased genital hiatus size. Functional QoL was improved regardless of sexual activity status and the majority of patients reported partial or full cure.
Keywords: Pelvic organ prolapse, POP, Level III defect, Perineorrhaphy, Quality of life, Sexual activity

Summary We observed 29.5% reduction of genital hiatus and 25.5% increase of perineal body after defect specific native tissue POP repair with perineorrhaphy for Level III support as a concomitant procedure. Additionally, influence of parity on Level III support mirrored by pre-operative gh values (p = 0.020), but not on preoperative pb values (p = 0.119) was found. Preoperative gh values were higher after four vaginal deliveries compared with primiparous patients (p = 0.034) and compared to patients after two vaginal deliveries (p = 0.047). Within the evaluation interval, we observed reduction of all prolapse symptoms reflected by improved P-QOL/D scores in all domains regardless of patients’ sexual activity status, 87% of patients felt partially or fully cured and would recommend such surgery to friends with same complaints. Our findings contribute to the discussion on perineorrhaphy for Level III defect repair as an important part of defect specific native tissue POP surgery.
Introduction

In the context of defect specific reconstructive surgery and the search for risk factors related to prolapse recurrence after native tissue repair, surgical anatomy of vagina and vaginal introitus has been further described. [1-4] Recent findings suggest that Level III defects [5,6] mainly reflected by an increased genital hiatus size are strongly associated with prolapse development [7,8] and correlate with Level I defects [4]. Furthermore, increased genital hiatus was related to risk for multi-compartment prolapse recurrence [3,9,10]. Therefore, and with regard to a revised interpretation of surgical anatomy [1,2] including MRI studies, [3,4,11] perineorrhaphy as an easy to perform surgical step for Level III support seems to have reached growing importance in pelvic floor reconstructive surgery.

In this study, we investigated the effect of defect specific pelvic organ prolapse (POP) surgery involving perineorrhaphy for Level III repair with reconstruction of enlarged genital hiatus. As primary objective, we evaluated gh and pb measurements according to POP-Q and compared pre- and post-operative values. We hypothesised that after reconstructive surgery including perineorrhaphy for clinical Level III defects performed in the manner described, genital hiatus (gh) would be reduced and perineal body (pb) would be increased compared to pre-operative measures.

As genital hiatus size is considered an important marker for pelvic muscle damage [12] mainly related to obstetric history, we examined pre-operative gh and pb values by parity as secondary objective.

In our clinical experience and as reported in the literature, patients with Level III defects presenting an enlarged genital hiatus complain of discomfort and the feeling that vulva or vaginal outlet is wide and relaxed [13–15]. Urogynaecologists debate on clinical benefit or harm of concomitant perineorrhaphy in POP procedures with regard to pain and dyspareunia as possible side effects of scars and narrowing [13,16-19]. However, limited data are available on functional outcome and patient’s perception of a post-surgical decrease in genital hiatus width.
so far. Therefore, we evaluated patient related outcomes in the three dimensions of cure: objective anatomical and functional cure, and patients’ subjective judgement. Additional secondary outcome measures were POMs obtained with the prolapse quality-of-life questionnaire (P-QOL/D, German version) [20,21] comparing sexually active and inactive patients and the expectations, goal setting, goal achievement and satisfaction (EGGS) system [22,23]. It was hypothesized that patients’ QoL after such surgery resulting in reduced genital hiatus was not different comparing sexually active vs. inactive patients and the overall judgement of cure was comparable to the literature.

Materials and methods

1) Sample and surgery

This retrospective observational study was conducted with data from consecutive patients who underwent defect-specific native tissue vaginal pelvic-floor reconstructive surgery with perineorrhaphy for symptomatic POP presenting indications for posterior repair and Level III support defects at the Jena University Pelvic Floor Centre, between 2016 and 2018. Perineorrhaphy was indicated due to patients’ complaints of a wide introitus or intra-operatively according to the finding of an enlarged genital hiatus. The former was defined as larger than 3.5cm being taken with a ruler, the equivalent of two fingers on intra-operative examination [1].

Informed consent was given by all patients prior to surgery and questionnaire survey as well as in the context of data use. The study was designed and performed in accordance with the relevant guidelines and regulations and the proposal was covered by the research approval for data use and clinical studies of the General Ethics Commission, Faculty of Medicine, Jena University Hospital, Germany (No. 4224-09/14). Ethical approval was granted on the 6th of January, 2015.
The modified surgical method for perineorrhaphy performed at the Jena surgical school consists of the following steps [15,24,25]. A transverse incision is made at the musculocutaneous border of the posterior hymen, depending on the size of the vaginal outlet. A triangular posterior epithelial flap is then removed. The procedure is usually combined with recto- and enterocele or other compartment repairs depending on individual defect patterns. Depending on intra-operative findings, tissues proximal and distal of the hymen are included. Proximal of the hymen, the perirectal connective fascia tissue is approximated over the distal part of the rectocele using one to three deep interrupted sutures depending on the size of the vaginal outlet and extent of the posterior compartment defect, no levator plication is performed. Where the bulbocavernosus muscles deviate, they are re-approximated with one or two sutures; in most cases it might be appropriate to re-approximate transverse perineal muscles in addition. The skin is then trimmed and closed (Figure 1 a-f). Technically, we have found that the avoidance of tissue bridges and steps potentially leading to dyspareunia is especially important. Therefore, the posterior hymenal edge should emerge at a level similar to that of the posterior vaginal wall at the end of the operation to prevent dyspareunia and tightness [19,26]. In the Jena University´s vaginal surgical school, single stiches are performed for all sutures in every layer of pelvic floor repairs. PDS™ 2-0 SH (Ethicon Inc., Somerville, NJ, USA) sutures are used for fascial repair, PDS™ 2-0 SH-1 (Ethicon Inc., Somerville, NJ, USA) sutures for enterocele repair, Serafit® 2/0 HRT-26 (SERAG WIESSNER, Naila, Germany) for sacrospinous fixations and Vicryl™ 3-0 (Ethicon Inc., Somerville, NJ, USA) for skin closure.

2) Data collection and evaluations

Data on patients’ baseline characteristics and prolapse disease (age, body mass index, parity, symptoms, prolapse stage, sexual activity) were extracted from computer- and paper-based hospital files. Gh and pb measurements were extracted from surgical reports. POP-Q [27] measurements were performed with the patient under anaesthesia in lithotomy position on the
operation table at beginning and end of surgery. Gh was measured from the middle of the external urethral meatus to the posterior aspect of the hymen. [6] Pb was measured from the posterior margin of hymen to the mid-anal opening. [6,12]

For the assessment of patients’ QoL before and after surgery, the validated German version of the P-QOL/D [20,21] was used with better quality of life indicated by lower score. This questionnaire consists of nine domains (general health perceptions, prolapse impact, role limitations, physical limitations, social limitations, personal relationships, emotions, sleep/energy and severity measures) and has been used for evaluation of prolapse surgery outcomes before [22]. To obtain patient-centred outcomes, patients’ subjective judgement of surgical success and cure was assessed using the EGGS system [23] after surgery as used for evaluation of surgical success in POP before [22,23]. The following questions that were posed to the patients: What results did you expect from surgery? Were your expectations influenced by information given to you by friends or family members having the same symptoms, by your physician, or by television, internet, or newspaper? Were your expectations fulfilled (yes/partially/no)? Do you have residual symptoms such as dysuria, urgency, urinary incontinence, vaginal discomfort, and/or difficulty in emptying your bladder (yes/no)? Can you accept the residual symptoms you are experiencing (yes/partially/no)? Do you feel cured (yes/partially/no)? Would you recommend the operation to a close friend having the same symptoms you had before surgery (yes/no)? [22]

3) Statistical analysis

Data were analysed using the Statistical Package for the Social Sciences (version 15.0; SPSS Inc., Chicago, IL, USA). Due to presence of outliers and rather small numbers of patients in compared groups, preconditions for use of parametric tests were not satisfied. This was confirmed by tests for normal distribution of data. Therefore, non-parametric tests (Mann–Whitney U test and Wilcoxon test, respectively) were used as indicated. Preoperative gh and
pb values of primiparous patients and patients who had experienced two, three or four vaginal deliveries were compared with the Kruskal-Wallis test.

Statistical analysis of P-QOL/D questionnaire data was performed according to Lenz et al. 2009 [21]. Preoperative vs. postoperative P-QOL/D scores were compared using Wilcoxon tests for all patients and subgroups of sexually active and inactive patients. Data from patients with and without histories of sexual activity were compared performing Mann–Whitney U tests.

Results

The study cohort consisted of 121 consecutive patients meeting the inclusion criteria with a mean age of 67 ± 10 (range, 47–91) years; 45% of these patients were sexually active. Gh and pb measurements were available for all patients. The P-QOL and EGGS return rate was 53% (n = 64); 50% (n = 32) of patients who returned questionnaires were sexually active.

Patients’ baseline characteristics are summarised in Table 1. All but one patient had undergone at least one vaginal delivery. Information on parity was not available for one patient. Most (74%) patients had stage II–III prolapse; the remaining patients had stage IV prolapse. All patients presented with typical POP symptoms; the majority (94%) reported vaginal discomfort or common bladder symptoms [i.e. urgency, stress urinary incontinence (SUI) and voiding difficulties].

Post-operatively, mean gh values were reduced by 29.5% (31 ± 6 mm versus 44 ± 10 mm, p < 0.001), while pb values were increased by 25.5% (47 ± 8 mm versus 35 ± 8 mm, p < 0.001; Wilcoxon test).

Pre-operatively, we observed increasing gh and declining pb values with increasing number of vaginal deliveries (Table 2). Using the Kruskal-Wallis test, our data show an influence of parity on preoperative gh values (p = 0.020), but not on preoperative pb values (p = 0.119). Post-hoc analysis revealed significantly higher preoperative gh values in patients who had...
experienced four vaginal deliveries compared with those of primiparous patients ($p = 0.034$) and patients who had experienced two vaginal deliveries ($p = 0.047$).

Mean evaluation interval concerning P-QOL and EGGS questionnaires was 15.8 (SD 5.2) months. Compared to baseline, all nine P-QOL/D domains had improved postoperatively in the total cohort and in the sexually active and inactive subgroups (Table 3). Only the postoperative prolapse impact score differed between sexually active and inactive patients ($p = 0.016$); it was lower in the former group (Table 3).

EGGS responses indicated that patients expected absence of prolapse ($n = 15/54; 28\%$), general improvement of QoL ($n = 14/54; 26\%$), improvement of bladder dysfunction ($n = 14/54; 26\%$) and discomfort/pain reduction ($n = 11/54; 20\%$) relative to their preoperative situations. In 95\% ($n = 59/62$), patients’ expectations were influenced by their physicians; other influencers were friends and family ($n = 7/62; 11\%$) and the media ($n = 6/62; 9\%$). Most ($n = 54/60; 90\%$) patients reported full or partial goal achievement; 45\% ($n = 28/62$) reported that they had no residual symptoms and 55\% ($n = 34/62$) reported residual symptoms such as SUI, urgency, residual volume and prolapse. Of the latter, eight patients found the residual symptoms to be unacceptable and sought further treatment, whereas 87\% ($n = 55/63$) felt fully or partially cured and would recommend the surgery to friends with the same problems.

**Discussion**

In this study on 121 cases with perineorrhaphy performed for Level III defect as a concomitant procedure in defect specific native tissue POP repair, we observed 29.5\% reduction of genital hiatus and 25.5\% increased perineal body, significantly changed relative to baseline ($p < 0.001$). Additionally, our data show an influence of parity on Level III support mirrored by pre-operative gh values ($p = 0.020$), but not on pre-operative pb values ($p = 0.119$). Pre-operative gh values were higher after four vaginal deliveries compared to primiparous patients ($p = 0.034$) and compared to patients after two vaginal deliveries ($p = 0.047$). Within the evaluation interval,
we observed reduction of prolapse symptoms reflected by improved P-QOL/D scores in all domains regardless of patients’ sexual activity status, 87% of patients felt partially or fully cured and would recommend such surgery to friends with same complaints. Our findings contribute to the discussion on perineorrhaphy for Level III defects as an important part of defect specific native tissue POP surgery.

**Level III defects and perineorrhaphy**

Gh and pb contribute to the anatomical appearance of the external genitalia and level III pelvic floor support [2-4,8,12,28], and they have clinical implications. While low pb values indicated the risk of unsuccessful pessary treatment [29,30], increased gh values are related to prolapse disease. Handa et al. estimated the time to develop prolapse being 33.4 years with persistent gh of 3cm vs. 5.8 years when gh reached ≥ 4.5cm [8].

According to clinical and histological investigations by Haylen et al., vaginal introitus includes all areas distal to the hymen: the anterior and posterior vestibules and the perineum. Vaginal introitus defined as level III represents the lowest level of the vagina [2]. Findings by Haylen et al. [2] modify the original cadaver dissection-based definition by DeLancey [5] being consistent with the more recent definition by IUGA and ICS [6]. In our study, gh measurements were taken according to POP-Q. Considering gh being the proximal limit of level III (introitus), a comprehensive description of introitus gaping or narrowing could not be given by gh measures. From a clinical and functional point of view it might be meaningful to standardized measure the width of vaginal introitus in addition to gh, correlate such measures and further investigate “vaginal/introitus gaping” and “vaginal/introitus stenosis”. Haylen et al. [31] introducing a “posterior repair quantification (PR-Q)” terming perineal gap (PG), posterior vaginal vault descent (PVVD), mid-vaginal laxity (MVL-vault undisplaced/displaced), and recto-vaginal fascial laxity (RVFL), total posterior vaginal length (TPVL) and from POP-Q, TVL amongst indicators. Authors recommend such measurements for comparability of vaginal
surgery in the posterior compartment. Additionally, the same group introduced and used a perioperative perineorrhaphy assessments (Pe-QA) and presented data of n=50 consecutive surgeries [32]. Authors took the following measures: perineorrhaphy width (PW; equals PG), perineorrhaphy depth (PD), perineal length (PL), midperineal thickness (MPT), genital hiatus (GH), total vaginal length (TVL) and total posterior vaginal length (TPVL). For future investigations of anatomical and functional outcomes of vaginal surgery in the posterior compartment, it would be of interest to conduct prospective studies including such measurements to comprehensively answer question on anatomical and functional success of reconstructive surgery in the posterior compartment. Additionally, this would be of interest for comparing surgical approaches and techniques of vaginal native tissue repair.

Recent MRT studies on surgical anatomy found a strong correlation between Level I and Level III support, the latter being reflected by a wide urogenital hiatus [2,4]. Haylen et al. [1] concluded that surgery concomitantly addressing Level I and Level III repair would limit the need for additional Level II support. This finding seems especially important for future research due to the contribution of Level II to urethral support and the associated functional finding of SUI after some POP procedures. Enlarged gh has been described as a risk factor for recurrent prolapse and as a strong predictor for surgical failure in native tissue repair. Vaughan et al. [9] found a 4.4-fold increased recurrence risk after native tissue repair when pre-operative gh values of > 4 cm persisted after surgery. Guiahi et al. [33] found that sacropexy without concomitant vaginal repair restored the posterior anatomy in most cases, with a mean gh value of 31 mm at 1 year postoperatively. This compares to our results achieved with vaginal native-tissue surgery. Guiahi et al. [33] did not report pb values, preventing comparison with our findings. Further comparison of sacropexy techniques and vaginal surgery with respect to level III support and external genital appearance in patients
with introitus dehiscence and the feeling of a wide introitus or vagina would be thus of interest.

Bradly et al. [10] found a 5.3-fold increased risk for early anatomic failure in the posterior compartment after robotic sacropexy with post-operative gh of > 4cm. Recent research is underlining the importance of perineorrhaphy as concomitant surgical procedure for Level III defect repair in defect specific POP surgery.

In our study, POP-Q measurements for the assessment of Level III defects were taken directly using a ruler at the vaginal surgical field under anaesthesia and therefore in the absence of straining. This strategy was discussed controversially by some authors. In a recent MRI study on Level III defects, Schmidt et al. found resting rather than straining measures more precisely reflecting the structural pelvic floor support, not being biased by the ability or inability of individual patients to perform Valsalva maneuvers [3]. The comparison of such anatomical measurements with those obtained with perineal ultrasound and/or magnetic resonance imaging would thus be of interest.

Pre-operative gh and pb and parity

In our cohort, patients who had experienced more than one vaginal delivery had higher gh and lower pb values than did primiparous women. Statistically, our data show an influence of parity on preoperative gh values, but not on preoperative pb values. However, because of low number of patients with four vaginal deliveries, data should be interpreted with caution and larger studies are required. Our results are in line with studies showing parity as a risk factor for POP [34-37] and gh and pb are quantitative parameters used for POP assessment [27]. Dunivan et al [12] found parity independently affecting gh and pb values, and that gh (but not pb) values were larger in the parous group for each prolapse stage. Given the lack of nulliparous patients in our cohort, we could not examine the influence of parity in more detail. Normal gh and pb values in adult women without prolapse have not been defined [38]. Standardised gh values have been
found to be larger in patients with POP than in healthy controls (53.7 ± 19.1 vs. 44.3 ± 10.3 mm), depending on the history of vaginal deliveries, other obstetric history factors and delivered infants’ birth weight [38].

In our investigation, we found mean preoperative gh value in POP was 44 mm, similar to pre-prolapse surgery values reported by other authors including studies on MRI measurements [2,4,9,33]. Other authors found mean pre-operative gh values of 36 mm [12] and 37 mm [39] in prolapse. Due to gh measures depending on prolapse stage increasing through stage 3 POP [12], differences in pre-operative gh values of different study cohorts reported in the literature are explained.

**Surgical procedure**

In a survey amongst surgeons, Kanter et al. [40] found a significant heterogeneity of techniques performed for Level III repair depending on examination. Most surgeons stated to re-approximate bulbocavernosus muscles combined with or without transverse perineal muscles according to intra-operative findings. We think it is important to step by step plan and perform reconstructive surgery according to repeated intra-operative inspection and palpation.

Recently, Haylen et al. [32] reported 30.8% reduction of gh and 27.6% increase in perineal length after perineorrhaphy. Our surgery resulted in a similar gh reduction of 29.5% and a pb increase of 25.5%.

**QoL and patients’ judgement**

Data on functional outcome of decreased genital hiatus width after surgical reconstruction are sparse. This might be related to the fact that perineorrhaphy is solely performed as a concomitant procedural step at the end of posterior repair if indicated. Therefore, a clear assessment of its direct effect on functional outcome after POP repair remains challenging. We decided to evaluate overall function with regard to quality of life and patient’s satisfaction after
POP surgeries that included a Level III repair as concomitant procedural part. Quality of life improvement and patient’s satisfaction should be the main aim of functional, reconstructive surgery in which more than one surgical step contributes to defect specific reconstructions with more than one organ function being affected.

We observed postoperative reduction of all prolapse symptoms, including improved sexual function in sexually active patients. Reconstructive pelvic floor surgery aims on improving quality of life by restoring anatomy and function. According to this philosophy, we focussed on the assessment of prolapse symptoms related to areas of life. Therefore, the disease specific validated P-Qol/D questionnaire was used [20,21]. Domaine 6 (“Personal relationships”) contains questions on partnership and sexual life. In sexually active as well as in sexually inactive patients, domain 6 of P-Qol/D significantly improved after surgery. Other authors reported dyspareunia in 10% of patients, but did not perform functional evaluation using a validated instrument [13]. Other groups reported postoperative rates of dyspareunia [19,26]. Our findings do not confirm some pelvic floor therapists’ argument that perineorrhaphy leads to pain and dyspareunia [13,18]. Woodward et al. demonstrated improvement of dyspareunia and increased coital frequency after revision perineorrhaphy for postpartum dyspareunia in a small patient cohort [17]. EGGS results of subjective patients’ judgement of cure with a high subjective cure rate of 87% was similar to other studies on vaginal native tissue prolapse repair [22].

Limitations

Main limitations relate to the study designs’ potential bias of retrospection. A prospective comparative study on outcomes of posterior repair with and without perineorrhaphy would be of interest. Additionally, the majority of pelvic floor defects in which perineorrhaphy was indicated required posterior vaginal repair as well as repair of other concomitant defects. The
nature of such combined reconstructive procedures makes the separate functional evaluation of either procedural step difficult. Further limitation relates to questionnaire return rate. Another limitation relates to unavailable data on menopausal status and local vaginal estrogen treatment, which might influence satisfaction with sexual activity.

The significant improvement in gh achieved with surgery in our study can be interpreted as reflecting anatomical restoration with level III pelvic-floor support but functional outcomes mirrored by QoL improvement and patient’s satisfaction is the result of the combined performance of multi-compartment repair procedures according to the defect pattern, and thus not attributable solely to perineorrhaphy.

**Summary**

The findings of this study demonstrate that defect-specific native-tissue POP repair surgery including perineorrhaphy successfully repairs the pelvic floor anatomy with special regard to level III [28], resulting in lower gh and higher pb values. Post-operatively, the patients reported improvement in all P-QOL/D domains of functional outcome, with no difference between sexually active and inactive patients. The majority of patients in this study reported satisfaction with the surgical outcomes due to partial or full goal achievement, and would recommend the operation to a friend. These results suggest that perineorrhaphy is a necessary technical step in anatomical restoration that does not lead to functional impairment, including the impairment of sexual activity and QoL.

**Data availability**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
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Conflict of interest statement

Authors report no conflicts of interest.
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Figures legends

**Figure 1** Typically wide introitus in POP prior to surgery (a), surgical reconstruction of anterior (b), posterior compartment (c, d), perineorrhaphy (e), result (f).

![Figures](image.png)

Tables

**Table 1** Baseline patient characteristics and concomitant procedures (n = 121)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD (range) or n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>67 ± 10 (47–91)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>27 ± 4 (18–48)</td>
</tr>
<tr>
<td>Parity</td>
<td>2 ± 0.7 (1–4)</td>
</tr>
<tr>
<td>Sexually active</td>
<td>54 (45)</td>
</tr>
<tr>
<td><strong>Main symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>Symptom</td>
<td>Count (Percentage)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Feeling of prolapse</td>
<td>70 (58)</td>
</tr>
<tr>
<td>Urgency</td>
<td>22 (18)</td>
</tr>
<tr>
<td>SUI</td>
<td>11 (9)</td>
</tr>
<tr>
<td>Voiding difficulties</td>
<td>7 (6)</td>
</tr>
<tr>
<td>Pain</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>7 (6)</td>
</tr>
</tbody>
</table>

**Prolapse stage**

- II–III: 89 (74)
- IV: 32 (26)

**Concomitant procedures**

- Hysterectomy: 66 (54)
- Anterior repair: 111 (91)
- Posterior repair: 118 (97)
- Level I repair: 115 (95)

SD, standard deviation; SUI, stress urinary incontinence.
Table 2 Preoperative POP-Q gh and pb values by parity; (in one patient, parity not known; n = 120)

<table>
<thead>
<tr>
<th>POP-Q variable</th>
<th>Parity</th>
<th>p&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I (n = 27)</td>
<td>II (n = 63)</td>
</tr>
<tr>
<td>gh (mm)</td>
<td>42 ± 9</td>
<td>43 ± 8</td>
</tr>
<tr>
<td>pb (mm)</td>
<td>38 ± 8</td>
<td>35 ± 9</td>
</tr>
</tbody>
</table>

Values are means ± standard deviations. <sup>a</sup>Kruskal-Wallis test. <sup>b</sup>Post-hoc test. <sup>c</sup>Group 1 compared to group 4. <sup>d</sup>Group 2 compared to group 4. P-value for all other pairwise comparisons was > 0.05. POP-Q, pelvic organ prolapse quantification system; gh, genital hiatus; pb, perineal body.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Group</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>p&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>General health perceptions</td>
<td>All</td>
<td>58.6 ± 25.7</td>
<td>27.7 ± 17.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td>53.9 ± 23.9</td>
<td>25.0 ± 14.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>63.3 ± 26.9</td>
<td>30.5 ± 19.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prolapse impact</td>
<td>All</td>
<td>78.1 ± 28.0</td>
<td>32.8 ± 26.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td>77.1 ± 24.6</td>
<td>25.0 ± 23.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>79.1 ± 31.4</td>
<td>40.6 ± 27.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Role limitations</td>
<td>All</td>
<td>63.3 ± 29.3</td>
<td>23.7 ± 27.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td>63.5 ± 23.7</td>
<td>19.3 ± 26.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>63.0 ± 34.3</td>
<td>28.1 ± 28.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physical limitations</td>
<td>All</td>
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<td>24.6 ± 29.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td>58.3 ± 24.7</td>
<td>19.8 ± 27.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>60.4 ± 37.6</td>
<td>29.6 ± 31.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Social limitations</td>
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<td>31.6 ± 33.2</td>
<td>11.5 ± 22.2</td>
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</tr>
<tr>
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<td>Active</td>
<td>20.4 ± 19.3</td>
<td>5.4 ± 13.1</td>
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<tr>
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<td>42.4 ± 40.1</td>
<td>17.6 ± 27.5</td>
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<tr>
<td>Personal relationships</td>
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</tr>
<tr>
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<td>Active</td>
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<tr>
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<td>Inactive</td>
<td>56.5 ± 42.3</td>
<td>30.7 ± 32.0</td>
<td>0.002</td>
</tr>
<tr>
<td>Emotions</td>
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<td>21.3 ± 29.8</td>
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</tr>
<tr>
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<td>Active</td>
<td>43.0 ± 31.5</td>
<td>17.0 ± 28.3</td>
<td>&lt;0.001</td>
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<tr>
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<td>Inactive</td>
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<td>25.3 ± 31.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sleep/energy</td>
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<td>&lt;0.001</td>
</tr>
<tr>
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<td>Active</td>
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<td>16.7 ± 25.1</td>
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<tr>
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<tr>
<td>Severity measures</td>
<td>All</td>
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<td>22.2 ± 18.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Active</td>
<td>47.7 ± 21.1</td>
<td>18.1 ± 15.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>47.0 ± 26.7</td>
<td>26.1 ± 20.5</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Values are means ± standard deviations. a Wilcoxon test, preoperative vs. postoperative;

b Sexually active vs. inactive, $p = 0.016$ (Mann–Whitney $U$ test). P-QOL/D, prolapse quality-of-life questionnaire, German version. [20,21] A lower score indicates a better quality of life.