Pelvic floor symptoms after gynaecological surgery
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Citation for published version (APA):

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Chapter 10

The effects of hysterectomy on vaginal wall sensibility, vaginal vasocongestion and sexual function

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Laan E

Submitted
Abstract

Background: The effects of hysterectomy on vaginal physiology are not well understood. Better understanding of the effects of hysterectomy on vaginal vasocongestion and innervation may be relevant, as it could help to explain why some women develop sexual dysfunction after hysterectomy.

Methods: A prospective mono-centre study was performed including patients scheduled for vaginal or abdominal hysterectomy. Participants underwent measurements before and 6 months after surgery, during non-erotic and erotic visual stimuli, using a validated vaginal combi-probe. This combi-probe includes vaginal photoplethysmography to assess Vaginal Pulse Amplitude (VPA), representing vaginal vasocongestion, and four pulse-generating electrodes to measure vaginal wall sensibility, representing vaginal innervation. Sexual function was assessed before and after surgery using validated questionnaires (FSFI, FSDS-R, SSAQ). Pre- and postoperative vaginal vasocongestion, vaginal sensation thresholds and sexual function scores were compared.

Results: Seventeen (89%) of 19 included patients underwent pre- and post-operative measurement. No statistically significant differences were observed in vaginal vasocongestion and sensation threshold between pre- and postoperative measurements. Sexual function, as assessed with questionnaires, was not significantly affected. Two trends were noted in the subgroup analyses: the first towards decreased vaginal wall sensibility in the proximal posterior vaginal wall after vaginal hysterectomy (p=0.08), and the second towards better scores on the FSFI pain domain after abdominal hysterectomy (p=0.07).

Conclusion: This prospective study does not provide firm evidence that hysterectomy negatively affects vaginal innervation or vasocongestion.
Introduction

Hysterectomy is one of the most commonly performed gynaecological operations. It is often performed for benign conditions such as menorrhagia, metrorrhagia, abdominal pain and dysmenorrhoea. One of the main concerns of doctors as well as patients has been the impact of simple hysterectomy on sexual function. Hypothetical reasons for this relationship include anatomical considerations (damage to the innervation and vascularisation of the small pelvis), removal of the cervix, which is possibly involved in the sexual response, and for some women concerns that the uterus contributes to a sense of well-being and femininity.

Overall, most previous studies report that women are likely to report improved sexual function after surgery when their symptoms have been alleviated. However, studies comparing women whose symptoms have been alleviated by transcervical endometrial resection/ablation or embolisation and women whose symptoms have been alleviated by simple hysterectomy, have shown an increased prevalence of sexual problems in the latter group. A possible explanation for this finding is that negative effects of changes in vaginal vasocongestion and innervation due to hysterectomy-related surgical trauma partly negate the positive effect of the elimination of symptoms, whereas during endometrial ablation techniques or embolisation, vaginal innervation is not affected, and vaginal vasocongestion might only be affected to a limited extent.

During sexual stimulation increased vaginal vasocongestion causes clitoris engorgement and subsequent lubrication. The same occurs for the vagina, which becomes engorged during sexual stimulation and forms a plasma transudate that is critical during the sexual arousal phase. The autonomic innervation responsible for this response to sexual stimuli originates from the pelvic plexus and travels inside the uterosacral and cardinal ligaments. During hysterectomy these ligaments are dissected, hereby possibly also damaging the autonomic innervation. Further damage might be related to removal of the cervix, which is densely innervated by branches of the hypogastric inferior plexus. We hypothesize that as a result of surgical trauma associated with hysterectomy, vaginal vasocongestion and vaginal wall sensibility will be negatively affected.

There are a few previous studies which evaluated vaginal vasocongestion after simple hysterectomy. These studies have shown conflicting results, with two studies showing no negative effect and one study showing a decrease in vaginal vasocongestion after hysterectomy. None of the above studies employed a prospective design. As VPA levels appear highly variable between women, the most reliable method to assess the effect of hysterectomy on vaginal vasocongestion is to compare pre- and post-operative measurements.

Only one study evaluated the effect of hysterectomy on vaginal wall sensibility. This study found a trend towards decreased vaginal wall sensibility after hysterectomy. Unfortunately, the exact area’s of damage were not localized. As the proposed mechanism of innervational damage is due to incision and dissection of the vaginal wall during surgery, damage might differ between different area’s in the vaginal wall, depending of the performed procedure.

When performing vaginal hysterectomy, the risk of damage to autonomic innervation might be increased, compared to during abdominal hysterectomy. First, because of the increased traction which is applied to the tissue, and second, because of the more lateral dissection of the
uterine and cardinal ligaments. To assess surgery-related damage, our group has developed and validated a method to measure vaginal wall sensibility. The method was incorporated in a standard probe used for vaginal photoplethysmography. This enabled us to measure vaginal wall sensibility concurrent with Vaginal Pulse Amplitude (VPA), which is a validated method to measure vaginal vasocongestion. The first aim of this study is to evaluate the effect of hysterectomy on vaginal vasocongestion and innervation. The second aim is to evaluate whether sexual dysfunction is related to deteriorated vaginal vasocongestion and innervation. The third aim is to evaluate whether surgical route during hysterectomy plays a critical role in the effects of hysterectomy on vaginal vasocongestion, vaginal innervation and sexual function.

**Material and Methods**

We performed a single-centre, prospective, observational study including patients undergoing hysterectomy for benign conditions different from uterine prolapse in the Academic Medical Centre Amsterdam. Exclusion criteria were: prior bowel surgery or pelvic surgical procedures, a history of sexual abuse or pre-existing sexual dysfunction, use of medication that affects sexual wellbeing, diabetes mellitus, hypertensive disorders with vascular disease and presence of a depressive disorder. During a brief telephone interview patients were screened for the presence of any of the exclusion criteria. Depressive symptoms were assessed using the Dutch adaptation of the Beck Depression Inventory- short form, patients were excluded if they scored 14 points or more on this questionnaire. During the visit to the outpatient clinic, all patients were asked if they had any complaints regarding sexual function. If a patient reported her sexual function to be impaired she was excluded from the study.

**Surgical procedure**

Women scheduled for vaginal or abdominal hysterectomy for benign conditions were included. Choice of surgical approach (vaginal or abdominal) was left at the discretion of the surgeon, even though the following general rule was used. Vaginal hysterectomy was the preferred route, but if, in the opinion of the surgeon, the size and the descent of the uterus precluded vaginal hysterectomy, abdominal hysterectomy was performed. Hysterectomy was performed according to a standardized protocol. Peri-operative treatment was the same in all participating patients.

**Measurement of vaginal innervation and vaginal vasocongestion**

All women were asked to undergo measurements of vaginal innervation and vaginal vasocongestion using the vaginal combi-probe (figure 1). This device, sized and shaped as a menstrual tampon, could easily be inserted by the patient herself. The device contains a light source and an optical sensor to measure Vaginal Pulse Amplitude (VPA), and four pulse-generating electrodes to measure vaginal wall sensation threshold. Depth of the combi-probe and orientation of the light source were controlled by a device (a 9x2-cm persplex plate) attached
to the cable within 5cm of the optical sensor. Patients were instructed to insert the combi-probe such that the plate touched their labia. The probe and plate were sterilized in a solution of Cidex-activated glutaraldehyde (CidexOPA; Johnson and Johnson, Amersfoort, The Netherlands).

Psychophysiological assessment.
* VPA. VPA is a validated method to assess phasic changes in vaginal vasocongestion in the peripheral vessels with every heartbeat. Increased amplitudes indicate increased vaginal vasocongestion\(^{17}\).

* Vaginal wall sensibility. Four pulse generating electrodes were used to assess vaginal wall sensibility. These were mounted at the probe at four different locations: three and six centimetres from the introitus in the midline on the caudal anterior and posterior vaginal wall. These four electrodes separately provided a constant current stimulus which was gradually increased in intensity (0-100 mAmpere) until the threshold of sensation was indicated by the patient. Higher values indicate a higher threshold of sensation, and a lower vaginal wall sensibility. The four locations were stimulated in a random order. Each measurement was repeated three times, the first measurement was not included in the analysis to allow the patient to become acquainted with the sensation of the stimulus and to limit the interval between sensation and response. This method was validated in a previous study\(^{16}\).

Figure 1. Vaginal combi-probe which is used during this study to measure vaginal vasocongestion and vaginal wall sensibility.

Questionnaires
1. **Subjective sexual arousal and affect questionnaire (SSAQ)**\(^{17}\). Immediately following erotic film exposure participants filled out a 37-item questionnaire measuring sexual feelings and affect, consisting of 5 scales: sexual arousal (Cronbach’s α=0.87); genital sensations (Cronbach’s α=0.96); sensuality (Cronbach’s α=0.73); positive affect (Cronbach’s α=0.93);
Chapter 10  Part two: Gynaecological surgery and sexual function

and negative affect (Cronbach’s α=0.65). Each question was preceded by the sentence: “During the video, I felt:” after which a positive, negative, physical or sexual experience was described, for instance, pleasant; worried; genital pulsing or throbbing; sexually aroused. The items were measured on a 1 (not at all) to 7 (intensely) scale.

2. The Female Sexual Function Index (FSFI): This is a validated questionnaire evaluating sexual function. The questionnaire consists of 6 domain scores: desire, arousal, lubrication, orgasm, satisfaction and pain. The total score range is 2-36, with higher scores indicating better sexual functioning. The psychometric quality of the Dutch version is as satisfactory as the original version.

3. The Female Sexual Distress Scale- Revised (FSDS-R). This is a validated questionnaire consisting of 13 questions assessing the level of sexual problems-related distress. A total score is calculated, with higher scores indicating a higher level of distress. Again, the psychometric quality of the Dutch version is as satisfactory as the original version.

Study procedure
Objective and subjective measurements were performed one to six weeks before surgery, and six months after surgery. This post-operative period was chosen based on a study providing evidence that innervation damage can recover up to six months after a pelvic floor trauma. The experiment was carried out by a female researcher. During the whole experiment the patient was alone in the laboratory, with the researcher in the adjacent room. Patients were instructed to insert the probe and take a seat in front of the monitor. First, baseline value was determined by showing non-erotic documentary for 3 minutes. After that, the VPA measurements were performed under neutral and erotic conditions using film fragments. The 3 minute neutral film excerpt was taken from “Pearls of the Caribbean”. The 3 minute sexual film excerpt consisted of an erotic scene taken from erotic films known to significantly increase vaginal vasocongestion and subjective sexual arousal, depicting foreplay, cunnilingus, and intercourse (One size fits all by Candida Royalle). After each fragment the patient was asked to fill out the SSAQ. At the end of the VPA measurements the non-erotic film was continued to allow genital response to return to baseline. If after two minutes genital response had not returned to baseline level, patients were asked to count backwards until baseline level was reached. Subsequently another three minute neutral film fragment was shown. After this film fragment the measurements of vaginal wall sensibility were performed. were made containing comparable, but different, neutral and erotic film fragments. Half of the subjects were randomly allocated to version A for the pre-surgery test and version B for the post surgery test. The other half was allocated to the stimulus versions in the reverse order.

Power calculation
In a previous study using an electrode attached to the investigators finger to assess vaginal wall sensibility, we found a decrease in vaginal wall sensibility after vaginal hysterectomy combined with anterior and/or posterior colporrhaphy with an effect size of 0.30. Another study in women who underwent proctocolectomy with ileo-anal pouch anastomosis, genital response was found
to be significantly decreased 6 months after surgery, with a median effect size (d=0.25). With an alpha of 0.05, a power of 80% and an effect size of 0.25 a minimum of 18 patients is needed for the within subject effect. Therefore we decided to try to include 18 patients.

Data reduction

VPA was registered during the entire experiment. Data were entered into a computer program developed at the department of psychology. After VPA artefact deletion, peak-to-through amplitude was calculated for each remaining pulse, averaged over 10-s epochs and converted to mV. Mean VPA values (\(VPA_{\text{mean}}\)) for erotic and neutral film stimuli were computed by averaging peak-to-through amplitudes across the entire duration of both films. An increased peak-to-through amplitude indicates increased vaginal vasocongestion. VPA response was calculated by subtracting the participant’s \(VPA_{\text{mean}}\) value of the erotic stimuli, minus the participant’s \(VPA_{\text{mean}}\) value of the preceding neutral film fragment.

Domain scores of the FSFI, the total FSFI score, the total FSDS-R score and SSAQ domain scores were calculated.

Statistical analysis

Pre- and postoperative \(VPA_{\text{mean}}\), vaginal sensation thresholds, SSAQ scores and domain scores of the FSFI and FSDS-R were compared using a Wilcoxon signed rank test for paired data. To inspect possible differences in change in VPA response over time (\(VPA_{\text{response}}\)), 10-second VPA epochs were submitted to a 2 (pre- and post-operative) x 15 (change in response over time) repeated measures analysis. Sub-group analyses were performed for vaginal and abdominal hysterectomy to inspect for any surgical route related effects.

To evaluate if changes in vaginal sensation thresholds, \(VPA_{\text{mean}}\) and \(VPA_{\text{response}}\) were related to sexual dysfunction, we dichotomized the pre-, and post-operative total FSFI score into normal (FSFI total score> 26.55) and dysfunctional (FSFI total score< 26.55)\(^{21}\) and compared the sensation thresholds and \(VPA_{\text{mean}}\) between these two groups using a Mann-Withney-U test and \(VPA_{\text{response}}\) using a repeated measures analysis.

Results

In 24 months, 96 eligible patients were approached for participation, nineteen patients agreed to participate in this study (20% participation rate). It proved to be difficult to recruit patients for this study, most women refused because they did not want to be questioned about sexual function and did not want to be exposed to erotic film material. Other patients declined because they felt that the study would take too much of their time. Seventeen patients completed the six months follow-up visit, the other two patients (one underwent vaginal hysterectomy, the other underwent abdominal hysterectomy) did not want to spend time undergoing the post-operative measurement. The post-operative VPA measurements of one patient were lost due to technical failure of the vaginal combi-probe. The baseline characteristics of the included women are shown...
in Table 1. Thirteen women underwent abdominal hysterectomy and six women underwent vaginal hysterectomy.

**Table 1.** Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>N= 19</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI in kg/m²</td>
<td>26.2  (18.3-40.7)</td>
</tr>
<tr>
<td>Age in years</td>
<td>45.1  (34.8-52.6)</td>
</tr>
<tr>
<td>Parity (n)</td>
<td>1     (0-3)</td>
</tr>
<tr>
<td>Performed procedure</td>
<td></td>
</tr>
<tr>
<td>Abdominal hysterectomy</td>
<td>13    (68%)</td>
</tr>
<tr>
<td>Vaginal hysterectomy</td>
<td>6     (32%)</td>
</tr>
</tbody>
</table>

Values are median (range) or n (%)

**VPA**

**VPA** mean values during non-erotic stimuli did not significantly change after surgery (pre-operative 2.5mV (range 1.5mV-4.8mV) vs post-operative 2.0mV (range 0.5-5.7mV)). The repeated measures ANOVA showed a significant increase in VPA during erotic film (p<0.05) (Figure 2). There was no significant negative effect of the operation on the VPA response during erotic stimulation (p=0.94). Similarly, the interaction of the operation x change in genital response over time was not significant (p=0.37).

**Figure 2.** Pre- and post-operative mean increase in vaginal pulse amplitude (VPA) response during erotic visual stimuli relative to preceding neutral film.

![Graph showing pre- and post-operative VPA response](image-url)
Vaginal wall sensibility and vasocongestion after hysterectomy

**Vaginal wall sensibility**

Sensation thresholds, as indicated by the patient before and after surgery, are shown in table 2. We found no statistical differences between sensation thresholds before and after surgery.

<table>
<thead>
<tr>
<th></th>
<th>Preoperative (N=19)</th>
<th>Post operative (N=17)</th>
<th>P value (non par)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal posterior wall</td>
<td>10.5 (3.9-52.9)</td>
<td>14.5 (4.9-43.8)</td>
<td>0.49</td>
</tr>
<tr>
<td>Proximal anterior wall</td>
<td>18.7 (4.6-78.6)</td>
<td>23.7 (5.3-46.6)</td>
<td>0.80</td>
</tr>
<tr>
<td>Distal posterior wall</td>
<td>5.5 (2.1-15.4)</td>
<td>4.6 (3.4-14.9)</td>
<td>0.74</td>
</tr>
<tr>
<td>Distal anterior wall</td>
<td>7.6 (2.0-30.0)</td>
<td>5.0 (3.1-22.5)</td>
<td>0.46</td>
</tr>
</tbody>
</table>

* using paired tests  
Values are median (range)

**Sexual function**

Table 3 shows pre- and postoperative subjective sexual arousal and affect after erotic film viewing. Subjective sexual arousal and affect were found to be unaffected by surgery.

Table 4 shows the results of the FSFI before and after surgery. The total FSFI score did not significantly alter after hysterectomy. We found a trend towards increased scores on the FSFI pain domain after surgery (p=0.07), indicative of a reduction in sexual pain.

The women who had FSFI scores within the dysfunctional range did not seem to have larger changes in vaginal wall sensibility or VPA measurements (data not shown).

**Analyses according to surgical approach**

To further explore if vaginal or abdominal hysterectomy was related with damage to vaginal innervation or vasocongestion, we performed a subgroup analysis for each of these two surgical groups (see Table 1).

VPAmean and VPAreponse were not significantly affected after surgery in both surgical groups. After abdominal hysterectomy sensation thresholds remained unaltered. After vaginal hysterectomy a trend was noticed towards increased sensation thresholds in the proximal posterior vaginal wall (10.4mA vs 14.7mA, p=0.08) (table 5).
### Table 4. Pre- and post-operative Female Sexual Function Index (FSFI) domain- and total scores and the Female Sexual Distress Scale-Revised (FSDS-R) total score.

<table>
<thead>
<tr>
<th></th>
<th>Pre-operative</th>
<th>Post-operative</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FSFI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire</td>
<td>3.6 (1.2-6.0)</td>
<td>3.6 (1.2-5.4)</td>
<td>0.81</td>
</tr>
<tr>
<td>Arousal</td>
<td>5.4 (0-6.0)</td>
<td>5.1 (0-6.0)</td>
<td>0.47</td>
</tr>
<tr>
<td>Lubrication</td>
<td>5.9 (0-6.0)</td>
<td>5.1 (0-6.0)</td>
<td>0.51</td>
</tr>
<tr>
<td>Orgasm</td>
<td>5.2 (0-6.0)</td>
<td>5.6 (0-6.0)</td>
<td>0.61</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5.2 (0-6.0)</td>
<td>5.2 (0-6.0)</td>
<td>0.92</td>
</tr>
<tr>
<td>Pain</td>
<td>3.8 (0-6.0)</td>
<td>5.0 (0-6.0)</td>
<td>0.07</td>
</tr>
<tr>
<td>Total</td>
<td>28.3 (1.2-34.8)</td>
<td>29.4 (7.6-33.2)</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>FSDS total</strong></td>
<td>4.0 (0-34.0)</td>
<td>4.0 (0-34.0)</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Note: For the FSFI, higher scores indicate better sexual functioning. For the FSDS-R, higher scores indicate more sexual distress.

### Table 5. Pre- and post-operative sexual function and vaginal wall sensibility broken down by abdominal and vaginal hysterectomy.

<table>
<thead>
<tr>
<th></th>
<th>Vaginal hysterectomy</th>
<th>Abdominal hysterectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-operative</td>
<td>Post-operative</td>
</tr>
<tr>
<td><strong>Sexual function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSFI domain and total score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Arousal</td>
<td>5.4</td>
<td>4.5</td>
</tr>
<tr>
<td>Lubrication</td>
<td>5.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Orgasm</td>
<td>5.6</td>
<td>5.6</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5.2</td>
<td>5.6</td>
</tr>
<tr>
<td>Pain</td>
<td>4.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Total score</td>
<td>29.4</td>
<td>29.7</td>
</tr>
<tr>
<td><strong>FSDS total score</strong></td>
<td>15.0</td>
<td>6.0</td>
</tr>
<tr>
<td><strong>SSAQ domain scores</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual arousal</td>
<td>3.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Genital sensation</td>
<td>4.6</td>
<td>4.7</td>
</tr>
<tr>
<td>Sensuality</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Sensuality</td>
<td>4.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Negative affect</td>
<td>1.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Sensation thresholds in mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal posterior wall</td>
<td>10.4</td>
<td>14.7</td>
</tr>
<tr>
<td>Proximal anterior wall</td>
<td>15.9</td>
<td>29.7</td>
</tr>
<tr>
<td>Distal posterior wall</td>
<td>5.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Distal anterior wall</td>
<td>7.2</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Scores on the subjective sexual arousal and affect (SSAQ), sexual function (FSFI) and sexual dysfunction (FSDS-R) questionnaires, were not significantly altered after surgery, for both patients undergoing vaginal and abdominal hysterectomy (table 5). We found a trend towards better scores on the FSFI pain domain after surgery among women after abdominal hysterectomy (p=0.06). This trend was not found after vaginal hysterectomy (p=1.0).

Discussion

The present study is one of the first prospective studies comparing pre- and postoperative vaginal innervation, vaginal vasocongestion and subjective sexual function in women who underwent hysterectomy. With this explorative study we could not show a significant impact of hysterectomy on vaginal innervation, vaginal vasocongestion and sexual function.

Before further interpreting these results, some limitations need to be addressed. The main limitation of this study is the small sample size. We based our power calculation on a previous prospective study measuring vaginal vasocongestion after proctocolectomy with ileo-anal pouch anastomosis. In this study a difference with an effect size of 0.25 was found. As compared to hysterectomy, proctocolectomy is a more radical procedure, which might potentially cause more innervational and vascular damage, and is therefore likely to show a detrimental effect with fewer subjects. Maybe after hysterectomy, the effect size is smaller and therefore more women are needed to demonstrate an effect.

It proved to be difficult to recruit patients for this study as it is an intimate experiment and may be experienced as invading on one’s privacy. The nature of this study could therefore have introduced a volunteer bias, as it is known that patients willing to participate in a sexuality study have a more positive attitude towards sexuality and are more sexually active. This is particularly true for subjects who are asked to undergo a study with psychophysiological assessments. Patient characteristics of the participants are comparable to groups included in previous studies, but this does not exclude an inclusion bias.

The strength of this study is, that we were the first to perform simultaneous measurements of vaginal innervation and vasocongestion, before as well as after hysterectomy. This prospective design allowed us to detect differences in vaginal innervation and vasocongestion related to hysterectomy.

With our data, we did not find support for our hypothesis that vaginal vasocongestion would be reduced after hysterectomy. The limited sample size could have limited the opportunity to observe such effect. Based on the fact that the uterine artery is occluded during hysterectomy, one would expect to see reduced vasocongestion. However, it is known that the human vagina receives arterial blood supply not only from the vaginal branch of the uterine artery, but also from the vaginal artery, the internal pudendal artery and the vaginal branch of the middle rectal artery. All of the mentioned arteries form a network of anastomoses located in the adventitia. The absence of blood supply from one of the arteries might therefore be compensated by blood supply from the other arteries.
Another explanation is that the damage done to the autonomic innervation during hysterectomy is too limited to affect vaginal vasocongestion. This hypothesis is supported by the observation of a quantitative analysis of nerve disruption which observed that the risk of nervous trauma is proportional to the extent of uterosacral ligament excision. During simple hysterectomy the extent of uterosacral ligament excision remains limited, especially as compared to after radical surgery.

Previous studies on vaginal vasocongestion after simple hysterectomy have shown conflicting results. Two previous studies measuring VPA in hysterectomized women showed no decrease in VPA measurements in these women, as compared to a nonsurgical, age matched, control group. Both of these studies performed measurements of VPA during erotic and non-erotic conditions. In contrast to these findings, one study was identified in which the authors did show decreased VPA measurements after hysterectomy, during erotic and non-erotic conditions. However, in this study women with uterine fibroids served as a control group. It is known that women with uterine fibroids have more blood supply to the uterus, simply because the uterus is larger and therefore demands more blood supply. Although it is unclear whether this would also impact the blood supply to other genital areas such as the vagina, it is imaginable that in this study, levels of VPA were higher among this control group for this reason only.

Regarding vaginal sensation, one previous study assessed vaginal sensation before and three months after hysterectomy. Lowenstein et al measured quantitative sensory thresholds for vibratory sensations at the vagina and clitoris in 22 women. In contrast to our findings, they found a tendency towards a decrease in the perception of vibratory stimuli. The authors conclude that although significant, this decrease in sensitivity appears to be quite minor in absolute terms. Therefore, in our study with a limited sample size, we may have missed this change in vaginal wall sensibility. Alternatively, the measurements in the study from Lowenstein et al were performed three months after surgery. As recovery of nerve damage may take up to six months, Lowenstein et al’s current differences in vaginal wall sensibility may have dissolved at six months post-surgery.

When analyzing the subgroup of women who underwent a vaginal hysterectomy, we found a trend towards decreased vaginal wall sensibility in the proximal posterior vaginal wall. This finding should be regarded cautiously, because the number of women in the subgroups is very small. Nevertheless, this finding of decreased vaginal wall sensibility after surgery is in line with findings of two of our previous studies. In these studies we included patients scheduled for pelvic organ prolapse surgery. We concluded that the decrease in vaginal wall sensibility, which we found in both studies, was probably caused by the extensive dissection of the vaginal epithelium and fascia that is performed during colporraphy. This dissection might affect the free nerve endings in the vaginal epithelium and damage the peripheral blood vessels, which are important for vaginal lubrication. However, in the current prospective study we only included women scheduled to undergo hysterectomy, without concomitant procedures. Therefore we cannot exclude that vaginal hysterectomy itself, or even vaginal surgery in general, might also affect vaginal wall sensibility. The common factor in vaginal hysterectomy and vaginal prolapse surgery is the continuous downwards traction that is exerted to the uterus and/or vaginal
Vaginal wall sensibility and vasocongestion after hysterectomy

wall during these procedures to enable adequate visualisation. A possible explanation for the decrease in vaginal wall sensibility is that this continuous downwards traction may cause damage to the innervation. Also, overstretcheding of the vagina might induce a constant input to the afferent nerves causing the afferents to be less sensitive to other stimuli. It would be interesting for future studies to evaluate the impact of other vaginal surgical procedures on vaginal wall sensibility and to study its effect on subjective sexual function.

In accordance with our findings, the previously mentioned studies also could not demonstrate an association between changes in vaginal innervation and vasocongestion, and sexual function. This could be due to limited power of all the studies concerned. Another explanation may be that, even though the FSFI adequately discriminates between women with and without sexual dysfunction, it is less able to pick up more subtle changes related to sexual arousability. A related explanation is that sexual function is a multicausal, multidimensional phenomenon, which is not fully addressed by a 19-item questionnaire. Previous studies evaluating the influence of psychological factors on post-hysterectomy sexual well being have reported that preoperative psychiatric morbidity, depression and unsatisfactory preoperative sexual function were associated with poor sexual outcome whereas education about possible negative outcomes, the decrease in chronic pelvic pain and pain during intercourse, the elimination of menstrual pain and dysfunctional uterine bleeding improved post-hysterectomy sexual function. Changes in these psychological and contextual factors are not accounted for in the used questionnaires and may well compensate for the negative effects of changes in vaginal innervation and vasocongestion. Our current study mainly focused on physiological factors. The addition of changes in physiological factors to the knowledge of the influence of psychological and contextual factors might increase our understanding of sexual dysfunction after hysterectomy. Therefore we advocate that future studies should take the multidimensional nature of female sexual function into account.

Conclusion

This prospective study does not provide firm evidence that hysterectomy negatively affects vaginal innervation or vasocongestion. Two trends were noted: the first towards decreased vaginal wall sensibility in the proximal posterior vaginal wall after vaginal hysterectomy, and the second towards better scores on the FSFI pain domain after abdominal hysterectomy. The finding of decreased vaginal wall sensibility after vaginal hysterectomy was only found in a small subset of women. It is therefore unknown whether these findings would be replicated in a larger sample. But if further studies show that vaginal physiology and sexual function are more affected by vaginal surgery, this might make the option of performing laparoscopic hysterectomy more attractive.
Chapter 10  Part two: Gynaecological surgery and sexual function

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