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ORIGINAL ARTICLE

Genital sensation in women with pelvic organ prolapse

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Abstract
Introduction and hypothesis The objective was to compare vaginal and clitoral sensory thresholds in women with pelvic organ prolapse and women with normal pelvic anatomy.
Methods Quantitative sensory thresholds for warm, cold, and vibratory sensations were measured at the vagina and clitoral area of women with pelvic organ prolapse, pelvic organ prolapse quantification (POP-Q) stage II or higher (study group) and of women without prolapse, POP-Q stage≤I (control group). The quantitative sensory tests were performed with a thermal and vibration Genito-Sensory Analyzer, at the distal third of the anterior and posterior vaginal wall and at the clitoral area. Warm stimuli were used to evaluate unmyelinated C-fibers; cold stimuli for thinly myelinated A-delta; and vibratory stimuli for large A-beta fibers. Independent Student's *t* test and Chi-squared test of association were used for analysis of continuous and categorical parameters respectively.
Results Overall, 66 women, 22 with median POP-Q stage III (range: II–IV) and 44 with POP-Q stage I (range: 0–I), participated in the study. There were no statistically significant differences between the two groups regarding the characteristics examined (health status, medical history, and age). In all regions examined, mean thresholds for vibratory and warm stimuli were significantly higher and mean thresholds for cold stimuli significantly lower in the group with prolapse.
Conclusion Women with pelvic organ prolapse exhibited lower sensitivity in the genital area to vibratory and thermal stimuli than did women without prolapse. Our findings suggest that a neuropathic sensory deficit in the area of the genitalia might be associated with prolapse.

Keywords Neuropathic sensory deficit · Neurophysiological study · Pelvic organ prolapse · Vaginal sensation

Abbreviations

POP-Q	Pelvic Organ Prolapse Quantification
POP	Pelvic organ prolapse
GSA	Genital sensory analyzer

Introduction

The pathogenesis underlying pelvic organ prolapse remains poorly defined. Neurochemical depletion occurring in the somatic nerves targeting the pelvic floor has been proposed as an underlying mechanism in genitourinary prolapse and urinary incontinence [1]. Supporting evidence is the demonstration of abnormal evoked potentials, including pathological perineal nerve motor latency, in electromyography (EMG) recordings of the perineal muscle of women with stress urinary incontinence. Thus, Amarenco et al. [2] hypothesized that progressive denervation of striated pelvic sphincter muscles might be due to repeated stretch injury from innervation of these muscles when the pelvic floor diaphragm is weak [2]. A possible etiology for pelvic floor disorder is trauma, specifically to the pudendal nerve, which occurs at the time of vaginal delivery, and results in impairment of the levator ani muscle. While this is an entirely plausible explanation, there is little clinical evidence of overt neuropathy in women presenting with prolapse [3]. Contreras et al. reported delayed responses of the deep pudendal reflex and the classical bulbocavernosus reflex in

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79 % of women with pelvic organ prolapse [4]. The pudendal nerve supplies both the motor and sensory innervation of the pelvic region [5, 6]. Therefore, motor denervation of the pelvic floor region is presumably accompanied by sensory deficit. However, data regarding the effect of pelvic organ prolapse on genital sensation are sparse.

North et al. [7] recently demonstrated that women with prolapse have reduced threshold to vibratory stimuli at both the clitoral and vaginal areas, compared with a control group. The main limitations of their study were the relatively small number of participants in the control group, the significant differences in the median age of women with and without pelvic organ prolapse, and the heterogeneity of the two groups with regard to the type of prolapse. In addition, the researchers did not evaluate differences in thermal and cold sensation between women with prolapse and the control group [7]. Pelvic organ prolapse is known to affect certain aspects of women's quality of life, such as sexual function. Sexual disorder may be related to changes in the neurological functioning of the genital area. To investigate an association between prolapse and genital sensation, we aimed in this study to compare thresholds to thermal and vibratory stimuli in women with and without pelvic organ prolapse, at both the anterior and posterior vaginal wall and in the clitoral region.

Materials and methods

Following IRB approval, all women with apical Pelvic Organ Prolapse Quantification (POP-Q) stage II [8] or more, who were scheduled for surgical prolapse repair at our institution from October 2013 to April 2014, were invited to take part in the study. Exclusion criteria were urinary incontinence, previous gynecological or pelvic surgery or any neurological disorder. Informed consent was obtained from all participants. The control group comprised an age- and parity-matched group, in a ratio of 2:1, of healthy women with no history of previous vaginal surgery and with no complaints of urinary incontinence or pelvic organ prolapse (POP-Q≤I). These women were recruited for our initial study of the determination of normative values of sensation in the genital area [9].

Data on demographics, medical and surgical history including parity, menopausal and hormonal status, and POP-Q staging [8] were collected from the medical records of the women in the study and control groups. All participants underwent quantitative sensory testing when they were not menstruating. Women in the study group were tested 1 day before undergoing surgery for pelvic organ prolapse repair. Both groups underwent genital sensory testing using the same methodology [9].

Quantitative sensory tests

The quantitative sensory tests were performed using a thermal and vibration Genito-Sensory Analyzer (GSA; Medoc, Ramat Yishai, Israel) for the clitoral and vaginal area. The GSA is a computer-controlled diagnostic device for the evaluation of sensory impairment. The GSA generates repetitive transient temperature stimuli and records sensory threshold measurement. Cold sensation thresholds evaluate small-caliber A-delta fibers, warm sensation thresholds evaluate C-fibers, and vibratory sensation thresholds evaluate large-caliber A-beta fibers. The thermal probe has a working range of 10–50 °C. The vibration frequency is fixed at 100 Hz, with an amplitude range of 0–130 μm.

Psychophysical methodology

We employed the method of limits for threshold determination of vibratory and coldness for the vagina, and a warm sensation for both the vagina and the clitoris [9, 10]. Accordingly, stimulus intensity was linearly increased until the participant indicated, by pressing a button, that she had started to feel a sensation of temperature or vibration. Pressing the button automatically set the probe back to the adaptation temperature/no vibration. The adaptation temperature was 37 °C, and the rate of temperature change was 1 °C/s. The rate of vibratory amplitude increase was 1 μm/s. Four successive stimuli were given in each of the three modalities. A standard deviation of the mean of four thresholds above 0.5 was interpreted as non-optimal performance, probably due to distraction, and was an indication to repeat the stimulatory test.

Statistical analysis

For data management and statistical analysis SPSS version 21.0 for Windows (SPSS, Chicago, IL, USA) was used. Independent Student's *t* test and Chi-squared test of association or Fisher's exact test were used to compare continuous and categorical data accordingly. A 0.05 significance level was used for all statistical tests. All tests were two-sided.

Power analysis

Sample size was calculated using Open-Epi version 3. Sixty-six participants were allocated to the study (22 women to the POP group and 44 women to the control group), on the assumption that the POP group will have an increase in the threshold for warm stimuli in the anterior vaginal wall of 1.7 °C more than the control group [11], with 95 % confidence interval and 80 % power.

Results

A total of 66 patients were included in the analysis, 22 women with pelvic organ prolapse (POP-Q median III [II–IV]) and 44 in a control group (POP-Q median I [0–I]). There were no statistically significant differences between the two groups with regard to age and medical history, other than hypertension, which was more common in the study group than in the control group (41 % vs 16 %, $P<0.001$ respectively, Table 1). Statistically significant differences between the study and control groups regarding genital sensation threshold to warm and cold stimuli were found at the anterior and posterior vaginal walls (Table 2). Similarly, reduced sensation (higher thresholds) to vibratory stimuli was found in the vaginal wall of the study group compared with the control group (6.6±1 μm vs 2.5±1 μm, $P<0.02$ respectively). Thresholds of vaginal and clitoral sensation were not associated with the severity of prolapse; values were similar for women with prolapse POP-Q stage II and those with POP-Q stage≥III ($P>0.05$).

In both the study and the control group the most sensitive region to warm stimuli was the clitoral area, followed by the posterior wall, and finally the anterior vaginal wall; for cold stimuli the posterior vaginal wall was more sensitive than the anterior wall.

Discussion

Our findings demonstrate significantly less sensitivity to warm and cold stimuli at the vaginal region among women with pelvic organ prolapse than among women in a control group. These differences may result from anatomical changes at the vaginal region or may represent part of the etiology causing pelvic organ prolapse. Our findings concur with a previous study conducted by North et al., which demonstrated that the majority of women with prolapse have abnormal sensory thresholds for the detection of genital vibration [7].

Table 1 Demographic characteristics of participants

	Women with prolapse (n=22)	Control group (n=44)	P value
Age, median (range)	61 (40–77)	60 (51–69)	0.89*
Preoperative POP-Q stage, median (range)	III (II–IV)	I (0–I)	<0.001**
Parity, median (range)	3 (1–7)	2 (1–8)	<0.27**
Hypertension, n (%)	9 (41)	7 (16)	<0.03**
Diabetes,, n (%)	3 (14)	4 (9)	0.68***
Cardiac disease, n (%)	0	3 (7)	0.55***

$P<0.05$ indicated statistical significance

*Independent t test

**Chi-squared test of association

***Fisher's exact test

Table 2 Comparison of patients with and without prolapse with regard to thresholds for thermal and cold stimuli

Sensory modality	Anatomical site	Study group (n=22)	Control group (n=44)	P value
Warm (°C)	Anterior vagina	41.6±0.5	39.8±0.2	<0.001
	Posterior vagina	40.9±0.4	39.3±0.2	<0.0001
	Clitoris	39.4±0.3	38. ± 0.1	<0.0001
Cold (°C)	Anterior vagina	30.2±0.6	32.5±0.3	<0.0001
	Posterior vagina	30.9±0.5	33±0.3	<0.001

Data are described by a combination of sensory modality and anatomical site. Thresholds are given as mean±SEM

The clinical relevance of our findings is still unknown. Helpman et al. demonstrated that women complaining of arousal and/or orgasmic sexual disorders have a decreased threshold to thermal and vibratory stimuli in the genital region [11]. These observations were supported by a study conducted by Connell et al., which demonstrated decreased tactile sensation in the clitoral region in women with sexual dysfunction such as desire disorder and arousal disorder. Moreover, in women with arousal disorder, the reduced tactile sensation was shown to also involve the perineal region [12].

Over the last few decades, interest in the field of sexual function has increased among urogynecologists [13]. Pelvic organ prolapse is known to affect sexual function, mainly sexual desire and the ability to climax; other complaints, such as desire and arousal are also more common among women with prolapse [14]. Female arousal and orgasm disorders may be a consequence of psychological factors such as body image, or of physiological factors such as anatomical abnormalities and poor sensation in the genital region [15]. The current study reveals a correlation between genital sensation and pelvic organ prolapse. However, whether these findings are in sufficient to affect sexual function is still unknown and beyond the scope of this study. To better understand the correlation among pelvic organ prolapse, vaginal sensation, and sexual function, future studies should include validated questionnaires.

Our findings did not demonstrate any inverse correlation between prolapse degree and genital sensitivity. A larger study is needed to examine this correlation in more depth. Another issue that remains open is the clinical significance of our findings. In previous studies that evaluated quantitative sensory tests in the genital regions, a difference of ~1 °C was considered to be statistically significant [16, 17]. Still, no data are yet available that correlate these figures with the clinical symptoms of reduced sensation. For example, from our experience, women with a moderate degree of uterovaginal prolapse often report having irritable symptoms of bulging, while women

with a more severe degree of prolapse tend to be symptomless. This highlights the question of the relationship between prolapse and sensation in the genital area. Future studies that address data from quantitative sensory tests and prolapse symptoms using validated questionnaires may contribute to our understanding of this subject.

In conclusion, women with pelvic organ prolapse were shown to have reduced sensitivity to thermal and vibratory sensation in the genital region. Future studies are needed to explore the mechanisms involved, and to evaluate the clinical significance of these findings.

Conflicts of interest None.

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