Pain Ther (2025) 14:1443–1459
https://doi.org/10.1007/s40122-025-00760-4

ORIGINAL RESEARCH

Cervical Tenderness (Parametropathy) is a Diagnostic Tool for the Chronic Pelvic Pain Syndrome

Stefan Weinschenk · Thomas Strowitzki · Nura Fitnat Topbas Selcuki · Oliver Zivanovic · Axel Gerhardt · Manuel Feisst

Received: April 30, 2025 / Accepted: June 9, 2025 / Published online: July 10, 2025

ABSTRACT

Introduction: Chronic pelvic pain syndrome (CPPS) is a diagnosis of exclusion in the absence of pathological findings. We aimed to test the hypothesis that cervical motion tenderness (or parametropathy) may serve as a diagnostic tool for CPPS.

Methods: We examined the prevalence of parametropathy in patients with and without chronic pelvic pain by analyzing consecutive vaginal examinations in 155 women ≥ 18 years. Patients with malignant pelvic tumors, acute inflammatory disease, abnormal bleeding, genital atrophy, or pregnancy were excluded. Results from repeat examinations were also excluded. Parametropathy was defined as tenderness at three different points (left, middle, and right vaginal fornix) on bimanual examination, expressed by the patient on a three-digit scale: Pain index 0, absent; 1, slight tenderness; 2, remarkable tenderness. A pain index (PI) of 2 at one or more sites was considered positive.

Results: We included 155 first examinations, 125 for preventive screening (control group), and 30 examinations from patients with lower abdominal pain for ≥ 6 months. Parametropathy with a PI ≥ 2 in ≥ 1 site was found in 96.7% of the pain group, and in 7.2% of the control group ($p < 0.001$). The diagnostic value of parametropathy for chronic pelvic pain was 96.7% sensitivity and 92.8% specificity. Vaginal ultrasound probe pressure revealed a similar tenderness rate

Axel Gerhardt and Manuel Feisst contributed equally to the publication.

S. Weinschenk (✉) · O. Zivanovic · A. Gerhardt
Department of General Gynecology, Women's Hospital, Heidelberg University, Im Neuenheimer Feld 440, 69120 Heidelberg, Germany
e-mail: stefan.weinschenk@med.uni-heidelberg.de

S. Weinschenk · T. Strowitzki
Department of Gynecological Endocrinology and Fertility Disorders, Women's Hospital, Heidelberg University, Im Neuenheimer Feld 440, 69120 Heidelberg, Germany

S. Weinschenk · A. Gerhardt · M. Feisst
on behalf of The Heidelberg University Neural Therapy Education and Research group (The HUNTER group), Heidelberg, Germany

N. F. Topbas Selcuki
Nuffield Department of Women's and Reproductive Health, University of Oxford, Oxford, UK

N. F. Topbas Selcuki
Department of Obstetrics and Gynecology, University of Health Sciences Turkey Sisli Hamidiye Etfal Training and Research Hospital, Istanbul, Turkey

M. Feisst
Institute of Biometrics, Heidelberg University, Im Neuenheimer Feld 130.3, 69120 Heidelberg, Germany

(agreement kappa 0.94–1.00), but with a lower sensitivity of 86.7% and specificity of 92.0%. The prevalence of parametropathy in both groups was higher on the left side ($p=0.03$).
Conclusions: Parametropathy, defined as cervical motion tenderness, is a positive sign of chronic pelvic pain syndrome. The cervical motion test to detect parametropathy can be used both as a screening tool and to confirm suspected chronic pelvic pain syndrome. We suggest including this easy-to-perform clinical test in every gynecological examination. By doing so, chronic pelvic pain syndrome will no longer be a diagnosis of exclusion.

Keywords: Cervical motion tenderness; Chronic pelvic pain syndrome; Diagnostic value; Gynecological pain; Lower abdominal pain; Paracervical region; Plexus Frankenhäuser; Test sensitivity; Test specificity; Uterovaginal plexus

Key Summary Points

Why carry out this study?

Chronic pelvic pain syndrome is an unresolved burden for many women. It has a high prevalence and poses a significant financial strain on healthcare systems.

This prospective observational study investigated the prevalence of cervical motion tenderness (parametropathy) as part of a gynecological examination and its diagnostic value (sensitivity and specificity) in chronic pelvic pain.

What was learned from this study?

Testing for parametropathy in bimanual gynecological examination has a high diagnostic value for the chronic pelvic pain syndrome.

The test will expand the clinical examination in two ways: (a) in a screening setting, it will detect patients with a chronic pelvic pain syndrome with a high sensitivity; (b) in the absence of signs of acute inflammatory disease, this test will confirm chronic pelvic pain with a high specificity.

This simple clinical test should be incorporated into every gynecological examination.

INTRODUCTION

CPPS as a Diagnosis of Exclusion

Chronic pelvic pain (CPP) in women is defined as lower abdominal pain of unclear origin lasting for more than 6 months [1]. CPP is a multifactorial condition with a reported prevalence of 5–25% [2], and it poses a significant financial strain on healthcare systems [3]. It encompasses a wide range of etiologies including gynecological, urological, gastrointestinal, musculoskeletal, and psychological factors [1, 4, 6]. The condition is referred to by various names, including chronic pelvic pain syndrome, CPPS [4–6], chronic lower abdominal pain [7, 8], pelvipathy [9], and "parametropathy" [10–13]. In this publication, we define chronic pelvic pain as the symptom, and CPPS as the syndrome.

Gynecological causes such as endometriosis and pelvic congestion syndrome (PCS) are well-documented contributors to CPP. Endometriosis is defined by the presence of endometrial-like tissue outside the uterus, leading to cyclic pelvic pain, dysmenorrhea, and infertility [35]. In contrast, PCS is characterized by chronic, dull pelvic pain caused by dilated pelvic veins, which typically worsens with prolonged standing and improves with rest [19, 20].

Musculoskeletal disorders, particularly pelvic floor dysfunction (PFD), also contribute significantly to CPP. PFD includes myofascial pain syndromes, muscle hypertonicity, and trigger points within the levator ani and obturator internus muscles [14–16]. These disorders often present with non-cyclic pain that may be triggered or

exacerbated by movement, palpation, or prolonged postural stress.

Some researchers have identified increased tension and tenderness of the pelvic floor muscles in patients with CPP, thus giving rise to the alternative term *myofascial pelvic pain* [14–18]. Conversely, other clinicians have observed an association with venous pelvic congestion and have therefore used the term *pelvic congestion syndrome* [8, 19, 20]. However, none of these studies have demonstrated a strict association between these covariates and CPPS, which is why CPPS remains a diagnosis of exclusion [1].

A taxonomy based on "absence of any other disease" is unsatisfactory because it may encompass distinct, unrelated disorders. It is therefore necessary to identify a positive diagnostic sign to define the disease more precisely. A non-invasive screening tool would enable the investigation of disease covariates and thus help determine the need for further screening with invasive measures, thereby laying the foundation for the development of improved therapeutic strategies.

In this study, we introduce the term "parametropathy" as a clinical sign, rather than a disease entity, defined as tenderness in the parametrium elicited during bimanual gynecological examination. It was first described by H. Martius and later by his coworkers [10–13], who named it "parametropathy". This term has not been used since then in the literature on CPPS [1–3, 7, 8]. However, the symptom of cervical motion tenderness is well known to gynecologists, commonly associated with acute lower abdominal diseases such as pelvic inflammatory disease (PID) [21, 22] or ectopic pregnancy [23]. A similar symptom described as adnexal tenderness is observed when pressure is applied towards the adnexa during bimanual palpation [22]. However, even in acute conditions, the sensitivity and specificity of cervical motion tenderness for PID remain low [24–26].

In chronic pain disorders without acute symptoms, the prevalence of cervical motion tenderness has not yet been described. This sign is also distinct from gynecologic pathologies such as endometriosis and PCS, and from musculoskeletal conditions like PFD. The identification of such a sign may facilitate the recognition of chronic pelvic pain syndrome (CPPS) as a diagnosable condition rather than one of exclusion.

Aim of the Study

We aimed to investigate the prevalence of paracervical tenderness (parametropathy, PMP) in both healthy and unhealthy cohorts. To our knowledge, there is no current data on the prevalence of paracervical tenderness in women suffering from CPP or in a healthy female population. Here, we present the results of our prospective data collection from women with and without pelvic symptoms. Ultimately, our goal is to assess the diagnostic value of cervical motion tenderness (parametropathy) during clinical examinations.

If parametropathy is found to be strongly correlated with CPP, it will enhance the diagnosis of CPP, moving beyond its current status as merely a diagnosis of exclusion. The PMP sign will facilitate the screening and confirmation of CPPS, leading to the development of better therapeutic strategies for CPPS based on this new taxonomy.

MATERIALS AND METHODS

Patients

Cohort

Examinations were performed between July 2018 and December 2020 in 205 consecutive non-pregnant female patients ≥ 18 years attending an OB/GYN and chronic pain clinic in Karlsruhe, Germany. All patients were examined by the same gynecologist with many years of experience in treating chronic genital pain disorders in women. The cohort consisted of two distinct groups: a group of patients with chronic pelvic pain, and a control group of individuals examined for preventive reasons.

Inclusion criteria were admittance for preventive care without medical conditions or complaints, and patients complaining of lower abdominal pain lasting ≥ 6 months. The data evaluation was conducted independently

from treatment and did not influence medical procedures.

Exclusion criteria. *Examinations*. In the case where a patient attended several appointments during the study period, only the first examination (visit 1) was included in the data evaluation (323 out of 414 examinations, 78.1%).

Patients were excluded from data evaluation for the following reasons: pregnancy, post hysterectomy status, chronic neurological diseases with loss of neuronal sensitivity (e.g., multiple sclerosis), systemic inflammatory disease, genital atrophy (age > 60 without hormonal replacement therapy), vulvodynia, or for presenting with acute complaints lasting ≤ 6 weeks. These complaints included but were not limited to bleeding, chemotherapy lasting ≤ 3 months, acute pain disorders such as acute abdominal pain, vaginitis, or cystitis, malignant pelvic tumors; those for which a cervical examination (as in upper vaginal stenosis) was rendered impossible, and anyone who was ≤ 3 months post lower abdominal surgery. As a result, 155 patients were included in data evaluation. The selection flow chart is depicted in Fig. 1.

Gynecological Examination

Physical examination was performed according to standard operation procedures of the clinic involving inspection of vulva, vagina, and uterine cervix with a speculum, swab smear for bedside microbiology and hormonal cell analysis, bimanual palpation of the pelvic organs, and transvaginal ultrasound. All women had a workup to exclude organic or severe mental disease and other causes of CPPS. Body weight, height, body mass index (BMI), and age were taken from the patient's records or measured during the first examination.

Determining Paracervical Motion Tenderness

A cervical motion test was performed during bimanual palpation to determine the paracervical (parauterine) tenderness (parametropathy, PMP), as expressed by the patient on a standardized scale (see Sect. "Pain Measurement Scale"). The mobilization of the cervix (cervical motion) was performed in three dimensions: to the left, to the right, and ventrally, see Fig. 2.

We want to emphasize that the tenderness level as reported by the patient is not identical to the examiner's findings of "ligamental tension". Tenderness is a more valid measure than the estimation of the paracervical tension by the examiner, as shown in investigations of other body areas comparing patients' expression with the examiner's findings. For instance, in the examination of neck reflex points (NRPs), palpation findings were not reproducible [27], whereas determining patients' tenderness was a highly reproducible means to detect chronic silent inflammations [28–30]. Therefore, we chose to include the information on pain and tenderness as given by the patients and exclude the perceived muscle tension as reported by the examiner.

In the second step, during transvaginal ultrasound examination, sagittal pressure was performed with the vaginal probe at three sites: left paracervical, median (towards the cervix), and right paracervical, see Fig. 3.

Pain Measurement Scale

Paracervical tenderness upon cervical motion or pressure from a vaginal probe was reported by the patient on a three-level scale with the pain index: absent (pain index, PI = 0), or mild (PI = 1), or remarkable (painful, PI = 2) tenderness. This three-level scale was introduced and evaluated by Brandt [31] to describe the pain intensity of trigger points. It has been proven as a reliable and easy-to-understand means for categorial measures of tenderness and pain [28–30]. "Remarkable tenderness", or pain, was ascribed to PI = 2 especially when the patient expressed pain verbally *and* non-verbally, e.g., by squinting, twitching, or recoiling from touch.

Statistical Analysis

All analyses were done using statistical software R version ≥ 4.2.0. (R-Foundation for Statist. Computing, Vienna, Austria). Demographic variables of the patients were described as frequencies and percentages for categorical variables, and

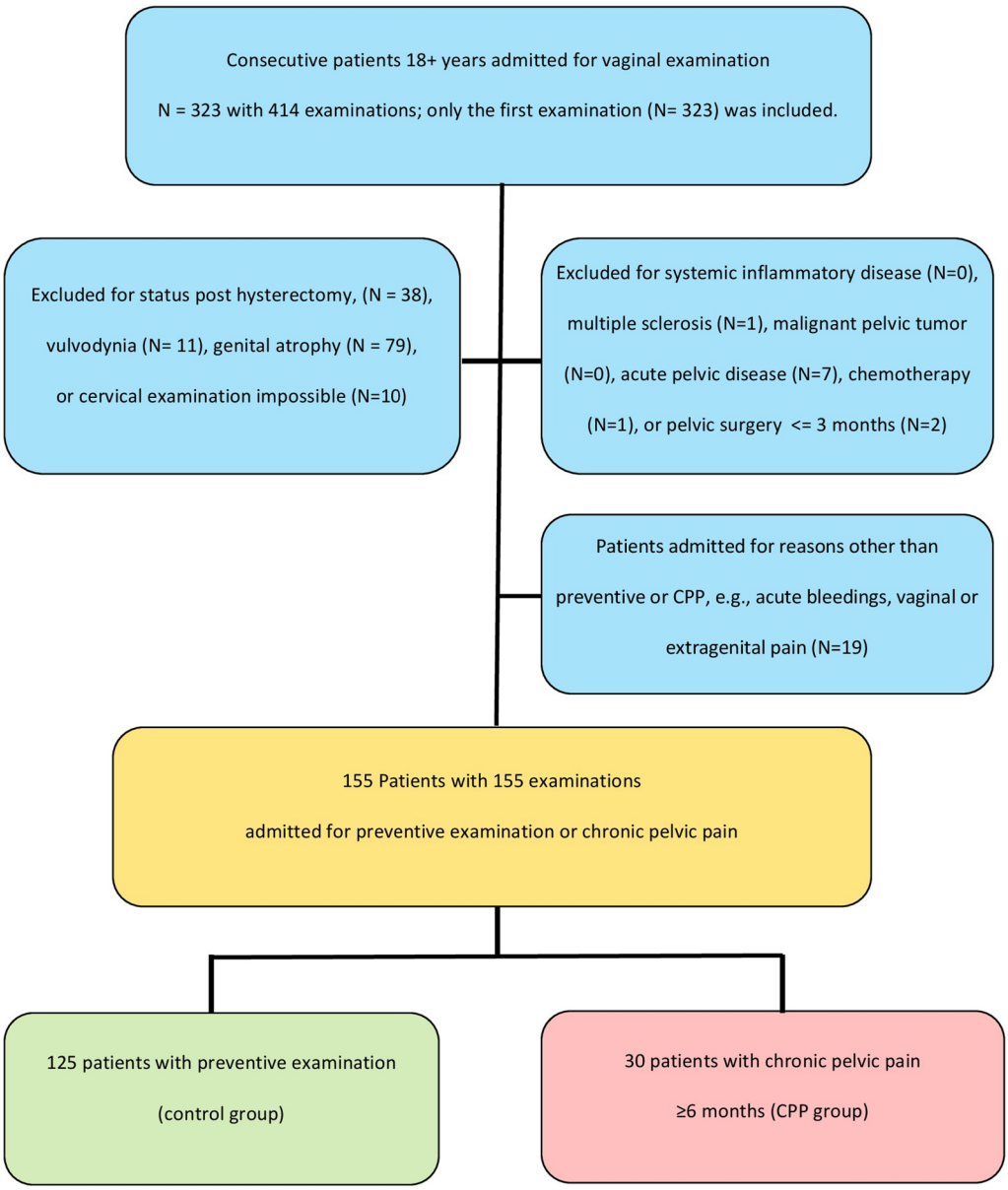

Fig. 1 Patient selection according to the STARD criteria [36]. All patients were consecutively recruited and registered between July 2018 and December 2020. Yellow: all patients included into data evaluation; green: controls; red: patients suffering from CPP

as means and standard deviations, or median and range, respectively, for continuous variables. Differences between subgroups were evaluated for categorical variables by chi-squared tests, whereas for continuous variables, *t* tests were performed.

To examine reliability between localizations, hands, or procedures, Cohen's kappa was used together with corresponding 95% confidence intervals. The diagnostic value of the proposed procedure was evaluated by values of sensitivity and specificity.

As a result of the exploratory character of the study, no missing data was imputed, and *p* values given here have a descriptive meaning.

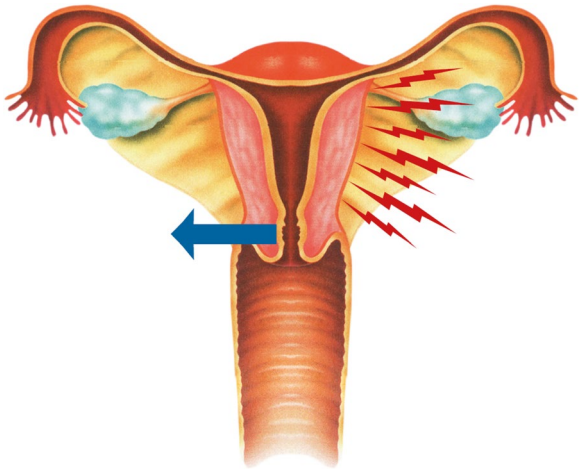

Fig. 2 Bimanual motion test of the paracervical region to examine cervical motion tenderness (parametropathy). The figure demonstrates the motion to the right side of the patient, testing for left side parametropathy (PMP)

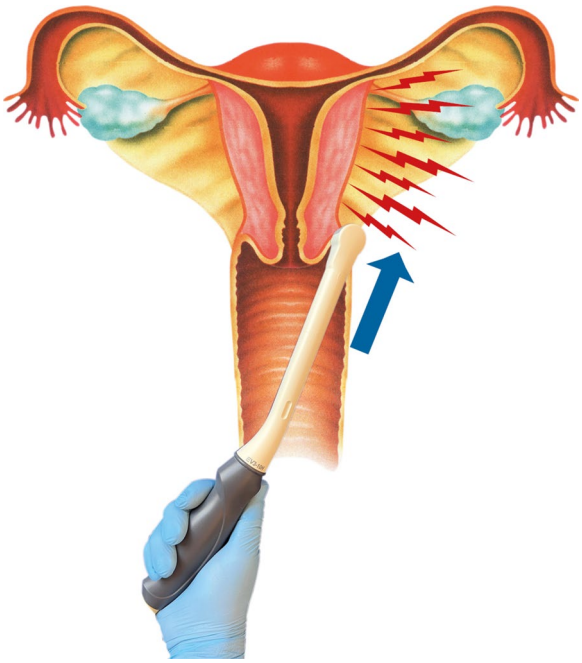

Fig. 3 Ultrasound probe pressure on the paracervical region to examine adnexal tenderness (parametropathy). The test was performed at three sites: left, right, and posterior vaginal fornix. The figure shows the example of left-side pressure to test for left-side parametropathy (PMP)

p values < 0.05 were labelled as statistically significant.

Statement of Ethics Compliance

This study was approved by the Heidelberg University Ethics Committee (approval no. S-487/2011 on September 6, 2011). The authors confirm that the study was performed in accordance with the Helsinki Declaration of 1964, and its later amendments. The authors also confirm that all subjects provided informed consent to participate in the study and consent for publication if any identifying information is included in the manuscript.

RESULTS

Patients

In this prospective observational study, 185 patients with their first examination were included in the evaluation; 155 of them visited a doctor for a preventive examination (annual Pap smear), or other preventive reasons such as contraceptive controls, whereas 30 women sought medical advice for chronic pelvic pain (CPP) for ≥ 6 months. The selection of patients is seen in Fig. 1. Patients' average age was 45.7 ± 10.2 years; average body mass index (BMI) was 22.5 ± 3.8 kg/m^2. There was no significant difference between the two groups for age (p = 0.369) or BMI (p = 0.118) (Table 1).

Examination Findings and Diseases

Genital ultrasound results (p = 0.428), a history of dysmenorrhea (p = 0.449), and analgesics intake (p = 0.772) were not different between the two groups (Table 1). None of the patients had diabetic neuropathy. The average duration of chronic pelvic pain on admission in the CPP group was 111 months (median 71 months, 5.9 years), with a range of 6.4–354 months (0.53–29.5 years), see Table 1.

Table 1 Characteristics of two groups of patients, examined for preventive examination (control) and for chronic pelvic pain (CPP)

	Preventive ($N = 125$)	CPP ($N = 30$)	All ($N = 155$)	p value
Age (years)	46.0 ± 10.3	44.2 ± 10.0	45.7 ± 10.2	0.369
BMI (kg/m^2)	22.7 ± 3.8	21.5 ± 3.6	22.5 ± 3.8	0.118
HRT use (N/%)	17/118 (13.8%)	3/26 (11.5%)	20/149 (13.4%)	0.709
Dysmenorrhea	40/88 (45.5%)	13/24 (54.2%)	53/112 (47.3%)	0.449
Analgetic usage	3/125 (2.4%)	1/30 (3.3%)	4/151 (2.6%)	0.772
Neuropathy	0%	0%	0%	–

BMI body mass index, *CPP* patients with chronic pelvic pain > 6 months, *HRT* hormonal replacement therapy, *N* number of individuals

Differences to the total number of 125 and 30 are due to missing values

Prevalence of Parametropathy (Cervical Motion Tenderness) on Bimanual Palpation

The prevalence of parametropathy (PMP) on bimanual examination (Fig. 2) differed significantly between women without complaints and women with CPP, see Table 2 and Fig. 4.

Left Side Predominance of Parametropathy

In the early 1940s, CPPS was denominated "pelvipathia spastica sinistra" by H. Martius [10], as the author had observed that the prevalence of parametropathy on the left side of the uterus was higher than on the right side. In this prospective study, we compared the left and right prevalence of PMP. We also detected a

Table 2 Prevalence of cervical motion tenderness (parametropathy) on bimanual palpation in two groups of patients examined for preventive care, and for chronic pelvic pain. Differences to the total number of 125 and 30 are due to missing values

Paracervical	Pain index	Preventive ($n = 125$)	CPP ($n = 30$)	All ($n = 155$)	p value
Right	0	110 (88.0%)	7 (23.3%)	118 (76.1%)	< 0.001**
	1	10 (8.00%)	7 (23.3%)	17 (11.0%)	
	2	5 (4.00%)	16 (53.3%)	21 (13.6%)	
Center	0	115 (92.0%)	6 (20.0%)	121 (78.1%)	< 0.001**
	1	9 (7.2%)	13 (43.3%)	22 (14.2%)	
	2	1 (0.8%)	11 (36.7%)	12 (7.7%)	
Left	0	103 (83.1%)	1 (3.3%)	104 (67.5%)	< 0.001**
	1	14 (11.3%)	10 (33.3%)	24 (15.6%)	
	2	7 (5.7%)	19 (63.3%)	26 (16.9%)	–

CPP patients with chronic pelvic pain > 6 months, *N* number of individuals, *PI* pain index

*Significant on a $p < 0.05$ level

**Significant on a $p < 0.01$ level

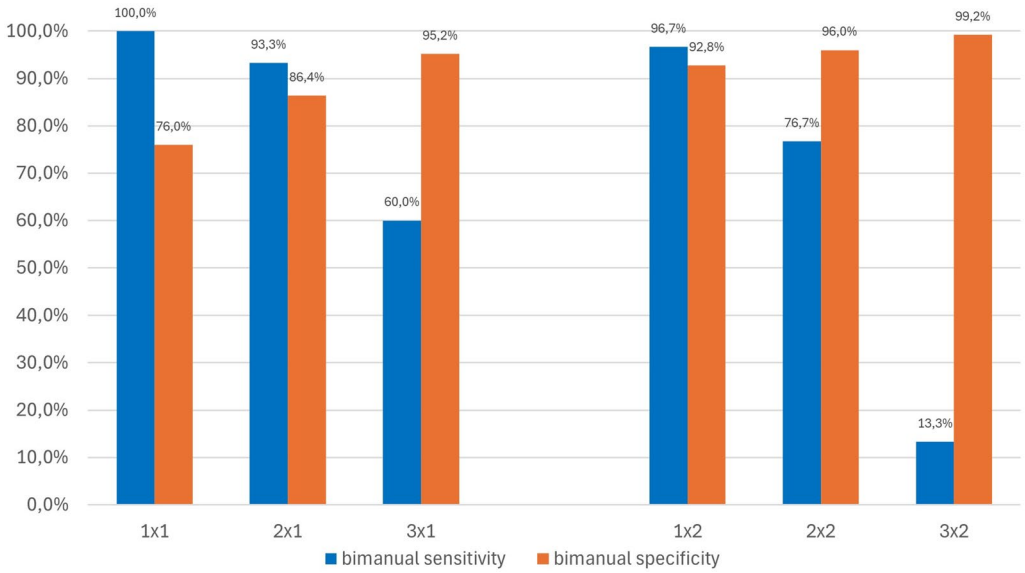

Fig. 4 Prevalence of parametropathy in the right, center, and left parametrium upon cervical motion test. Green: no tenderness, pain index = 0; orange: slight tenderness, pain index = 1; red: marked tenderness or pain, pain index = 2. Left graph: PMP on the right parametrium; right graph: PMP on the left parametrium of the patient. Preventive: Patients without medical conditions or complaints, CPP: Patients with chronic lower abdominal pain of ≥ 6 months

significantly higher prevalence on the left side (97% vs. 77% in patients with CPPS), see rows "left" and "right" in Table 2, and Fig. 4. Consequently, we found a low correlation between left and right tenderness, ranging between 0.01 in the CPP group and 0.31 in the preventive group.

Prevalence of Parametropathy on Vaginal Ultrasound Probe Pressure

Testing paracervical tenderness is also possible using the US probe to apply sagittal pressure. This finding is also called "adnexal tenderness" [22]. During ultrasound examination, we estimated the paracervical tenderness by pressing the probe sagittally towards the paracervical connective tissue. The results were similar to those in bimanual palpation. The reliability of the tests, manual palpation vs. US probe pressure, was measured as agreement. It is given that Cohen's kappa κ values > 0.8 are considered as very good and values > 0.9 as excellent [32]. The agreement given by the κ value was very good or excellent in all sites in both groups, see Table 3.

Table 3 Reliability for parametropathy between manual palpation and ultrasound probe pressure

Kappa κ bimanual vs. US	Right parametrium	Center	Left parametrium
Control group	0.915 (CI 0.843–0.988)	0.944 (CI 0.882–1.006)	0.929 (CI 0.868–0.990)
CPP group	0.942 (CI 0.831–1.053)	0.942 (CI 0.829–1.054)	1.000

Bimanual bimanual gynecological examination, *CI* 95% confidence interval, *CPP* chronic pelvic pain, *US* ultrasound probe pressure

Best Cutoff for Parametropathy in CPPS and Diagnostic Value of the Test

We compared the diagnostic value, i.e., the specificity and sensitivity of a positive finding of parametropathy (PMP) in the CPP and the control group. To define the best diagnostic value, sensitivity and specificity were calculated for different cutoffs.

A simple way to describe the PMP findings is to count the examination findings with the highest value, independent of which site (left/center/right) the sign was found. This value is unambiguous, because the distinction between the ordinal values 1 and 2 does not play a role in scoring. The results are displayed in Table 4.

The best diagnostic value (the combination of highest sensitivity and highest specificity) was found for tenderness of ≥ 1 × 2 on manual palpation, see Fig. 5, marked with an asterisk. The best diagnostic value in US probe pressure was found with the cutoff value of ≥ 1 × 2 as well, with a sensitivity of 86.7% and a specificity of 92.0% (Table 4), which was lower than in bimanual palpation.

Analysis of False Positive and False Negative Findings

For the cutoff "≥ 1 × 2" (i.e., at least one site with PI = 2) which demonstrated the best sensitivity and specificity combination, we found 9/125 false positive cases in the control group and 1/30 false negative case in the CPP group.

Why did patients have a positive PMP in the preventive (control) group (Fig. 6, left column)? We explored the individual cases of all nine individuals with positive results in the control group. Two of them declared that they had suffered from lower abdominal pain in the past (> 2 years ago), two declared a previous endometriosis history, one 56-year-old woman had a 40-year history of dysmenorrhea until she became postmenopausal, one had received chemotherapy for breast cancer half a year ago and suffered from genital atrophy. Finally, in two young women (23 and 31 years old), we found no abnormalities in their history.

Second, what was the nature of the one negative PMP result in a patient of the CPP group (Fig. 6, right column)? We explored the individual records of this patient. This patient declared a tenderness of PI = 1 on the left, PI = 1 on the center, and PI = 1 on the right side; therefore according to the "≥ 1 × 2" cutoff, she was not declared positive. On request, she reported a former episode of several years of CPP, which had been reduced after the insertion of an intrauterine device about half a year ago.

Table 4 Diagnostic values of different minimum scores in gynecological bimanual, and ultrasound probe pressure examination for cervical tenderness (parametropathy, PMP)

Tenderness	1 × 1	2 × 1	3 × 1	1 × 2	2 × 2	3 × 2
Palpation sensitivity	100.0%	93.3%	60.0%	96.7%*	76.7%	13.3%
Palpation specificity	76.0%	86.4%	95.2%	92.8%*	96.0%	99.2%
US sensitivity	90.0%	86.7%	53.3%	86.7%	63.3%	13.3%
US specificity	75.2%	84.8%	96.0%	92.0%	94.4%	99.2%

Palpation: manual cervical motion to detect parametropathy. US: ultrasound probe pressure. "≥ 1 × 1" means: at least one site with a pain index (PI) of 1 was found. "3 × 2" means: all six sites were painful with a PI = 2

*The best combination of sensitivity and specificity was achieved using the cutoff "≥ 1 × 2" in bimanual palpation (i.e., at least one paracervical site with a tenderness PI = 2)

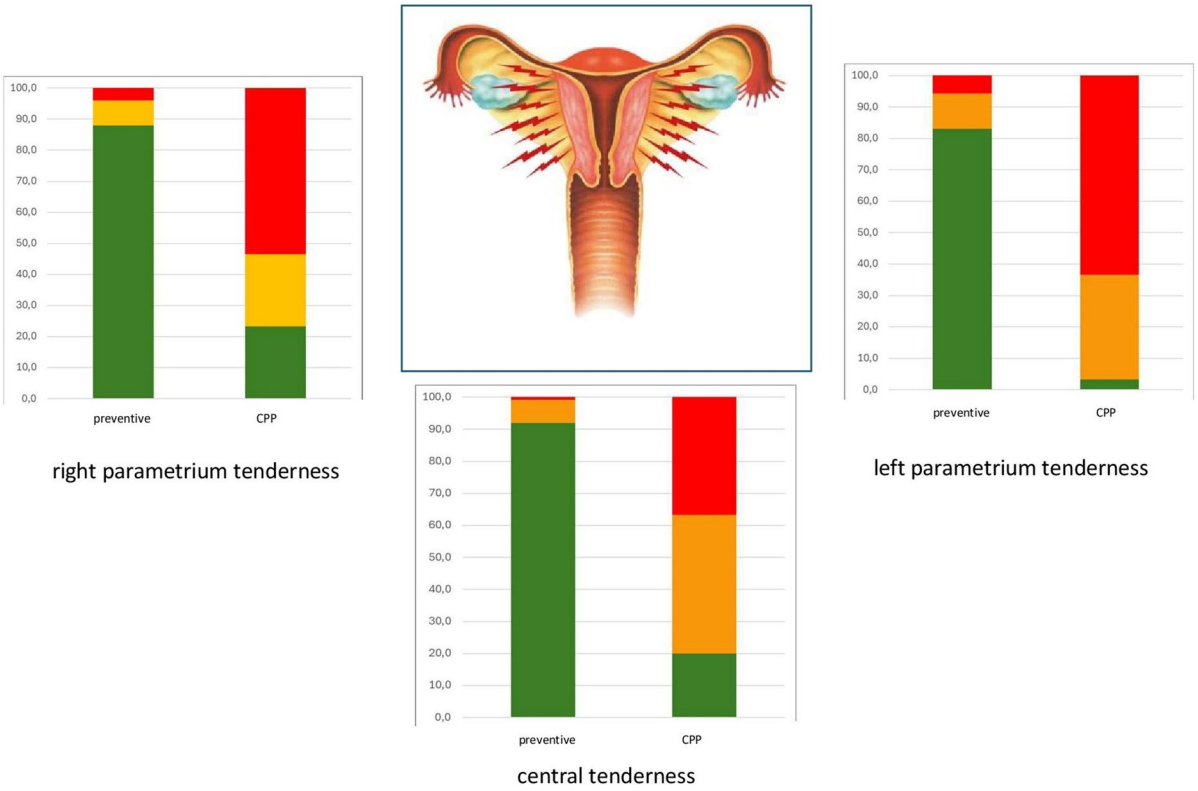

Fig. 5 Diagnostic value of cervical tenderness found on bimanual palpation. The best diagnostic value (sensitivity 96.7% and specificity 92.8%) is found using the criteria "≥ 1 × 2", i.e., pain index of 2, marked pain, in at least one of the sites, marked with an asterisk

DISCUSSION

Principal Findings: Parametropathy and CPPS

CPPS is defined as "chronic pelvic pain in females of more than 6 months without an obvious origin," i.e., the absence of any other disease. However, this definition is unsatisfactory because it is a diagnosis of exclusion. We therefore aimed to find a positive sign to define the disease. Parametropathy was a good candidate for such a positive sign of CPPS.

The term "parametropathy" was first described first by H. Martius in 1942 [10] and later by other German authors [11–13]. At that time, it was used as a *synonym* for chronic pelvic pain syndrome. We suggest using the term "parametropathy" as a specific and sensitive sign of the chronic pelvic pain syndrome (CPPS) with a high diagnostic value instead of a synonym of the disease CPPS, like how it was used in the early literature. We suggest using the term for both signs (cervical motion tenderness and adnexal tenderness) as well. Most probably, these signs were derived from the same pathophysiological origin, see Sect. "Clinical Implications".

Our findings support the role of parametropathy, defined as cervical motion tenderness in the paracervical region, as a potentially valuable clinical sign in the evaluation of CPPS. For potential causes of CPP, such as endometriosis and pelvic congestion syndrome (PCS), the standard diagnostic pathways typically require imaging or laparoscopy [1, 8, 35]. Before that, parametropathy offers a non-invasive, cost-effective tool that may improve early identification and reduce diagnostic delay.

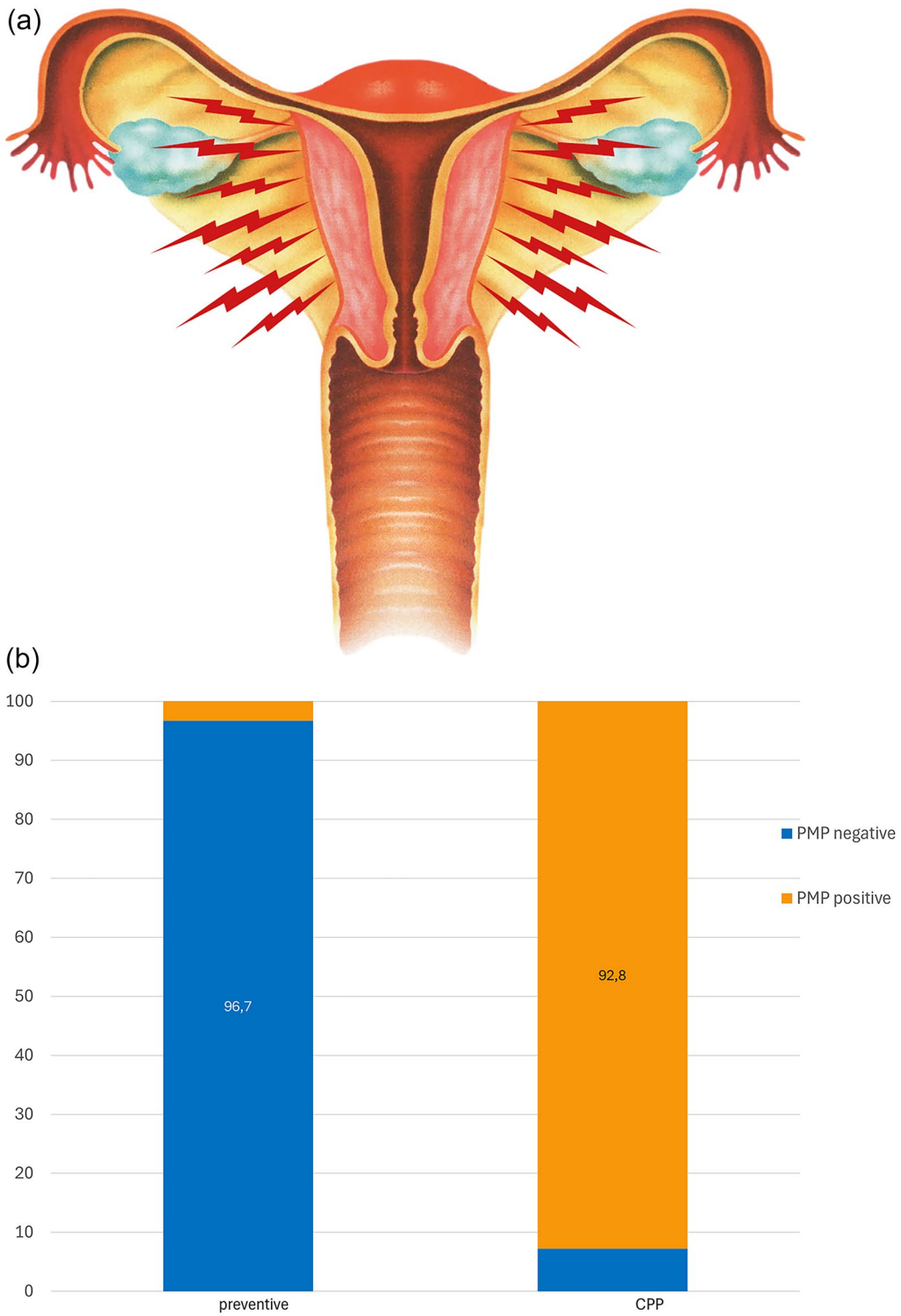

Fig. 6 Sensitivity and specificity of cervical motion tenderness (parametropathy) upon cervical motion test of all three sites. The figure demonstrates the results with a cutoff of "PI ≥ 1 × 2", i.e., at least one site with a pain index of 2. Pain index range is 0, 1, or 2

Results in the Context of What Is Known

Until now, the prevalence of this sign in chronic pelvic pain is still not established. In this study we present a prospective data collection of paracervical tenderness in patients with a history of CPP compared to a population of patients without complaints in preventative care examinations. We found a high diagnostic value (sensitivity and specificity) for parametropathy in patients with chronic pelvic pain. Therefore, screening for PMP can become a non-invasive screening tool to estimate the need for further invasive measures, which will allow a more exact definition of CPPS. This is important for the taxonomy and allows one to investigate covariates of the disease, which yields a base to search for better therapy strategies.

Differentiating Parametropathy from Other Causes of CPP

It is essential to differentiate parametropathy from other overlapping sources of CPP, such as musculoskeletal and urological disorders. Myofascial pelvic pain and pelvic floor dysfunction—present in up to 22% of women with CPP—are often underdiagnosed but respond to specialized physical therapy and trigger point release [14–16]. Similarly, bladder pain syndrome or interstitial cystitis (IC/BPS) presents with chronic pelvic pain accompanied by urinary urgency, frequency, and nocturia, often without overt gynecological abnormalities [5, 6].

Our study excluded individuals with acute inflammation, atrophy, and malignancy, but not with benign conditions such as ovarian cysts or fibroids. This supports the specificity of paracervical tenderness for CPPS. However, future studies are needed to correlate PMP findings with laparoscopic, musculoskeletal, and urological diagnostics to assess overlap and improve specificity.

Tenderness or Tension?

The expression of tenderness or pain given by a patient may look like a subjective and uncertain measure. However, the use of a three-level scale in the context of an all-day clinical situation allows for a quick estimation of pain and tenderness. In this context, the three-level scale obviously is superior to a 10-digit scale of pain [31, 33]. The latter has an intrinsic central tendency bias. This is less probable with the three-digit scale used in this study: patients can easily discriminate between "little tender" and "clear pain". Women with a PI = 0 do not feel tenderness even when the examiner increases the tension on the paracervical tissue. So, "absence of tenderness" is a clear-cut finding. In contrast, the examiner's palpation findings are more variable and less reproducible. This has been shown in other areas, such as neck reflex points of the cervical neck [29].

Manual Palpation or Ultrasound?

Exerting pressure with US probe pressure is not available in all cases, because an US examination may not be applicable in all gynecological examinations. However, the good agreement between bimanual palpation and US probe findings underlines the clinical meaning of bimanual palpation results, so that an extra probe pressure test by US is not necessary for the diagnosis of CPPS.

Left Side Predominance of Parametropathy

In his first description of CPP, H. Martius reported on a left side predominance of cervical tenderness [10]. He therefore named the chronic pelvic pain syndrome "*parametropathia spastica sinistra*" (left-sided spastic parametropathy). Other researchers supported this view, however, without presenting data [11–13], see Table 2. We were able to confirm these early observations in our prospective, controlled survey. The reasons are not clear and need further evaluation.

Calculating the Diagnostic Value of Parametropathy for CPP Examination

To establish a good screening test, it is important to also avoid under- and overdiagnosis. Screening for "the tenderness cutoff "$\geq 1 \times 2$" resulted in a low rate of false positive findings of only

7–8% in healthy women, e.g., in preventive care examinations. At the same time, only approximately 3% of women with CPP will be overseen (high sensitivity). The use of cutoffs higher than "≥ 1 × 2" misses 29–90% of women with CPP, while lower cutoffs, such as "≥ 1 × 1", declare up to 60% of a healthy population as having CPPS, i.e., as false positives. Using the "≥ 1 × 2" cutoff offers the combination of highest specificity and highest sensitivity. With this cutoff, most of the false positive results in the control group could be explained by underlying causes not identified until now, such as genital atrophy in climax praecox, or a history of recurrent pain episodes.

Clinical Implications

Possible Neurophysiological Mechanisms to Explain the Symptoms

The high prevalence of paracervical tissue changes in women suffering from long-standing lower abdominal pain raises the question of a possible common cause. There is increasing evidence for peripheral nerve sensitization in patients with CPP [34]. The paracervical tissue hosts a multitude of nerve endings of the uterovaginal plexus (plexus Frankenhäuser) [34]. We hypothesize that via a sympathetic overloading of the corresponding autonomous centers, the lateral uterine and paracervical ligaments develop increased ligament tension and tenderness, causing lower abdominal pain, and finally become chronic pelvic pain syndrome. Further studies on patients' history landmarks, comorbidities, and confounders will elucidate this question. Based on this hypothesis that the autonomous nervous system significantly contributes to CPPS, new therapeutic effects of desensitization can be developed, and their efficacy can be tested using the PMP bimanual palpation test.

Diagnostic Value of Parametropathy

This straightforward test, which assesses three potential tender sites using a simple three-level scale ("no tenderness," "mild tenderness," and "painful," scored as 0, 1, and 2, respectively), requires only an additional minute of examination time without adding any further costs, and provides valuable and comprehensive information on chronic pelvic pain. Using PMP examination in patients with CPPS also allows short-term and long-term therapy control of any measures performed in these patients. We suggest using the term "parametropathy" (PMP) for this specific sign of cervical tenderness in CPPS in the future.

We did not exclude patients with ovarian cysts and fibroids. These benign tumors did not seem to induce CPPS. In none of the cases (all > 25 ml volume) was paracervical tenderness found. Thus, the diagnostic value of the PMP testing is not impaired by these pathologies causing anatomical changes.

Do analgesic drugs influence the rate of negative PMP results in the control group? The use of analgesics in the control group is significantly lower than in the CPP group (5% vs. 23%), which argues against the potential concealing effect of analgesics on paracervical pathology.

With the PMP test performed by bimanual palpation using the cutoff described here, only approximately 3% of the CPP cases will be overlooked (false negative), and only 7–8% in an asymptomatic female population will be false positively described as CPPS using the three criteria displayed in Fig. 7.

Consequently, diagnosis of CPPS will become more secure, confounders can be better defined, and new therapy strategies addressing the paracervical pathology can be developed. We therefore suggest including the examination of paracervical tenderness as part of every gynecological examination, in preventive care, as well as in CPP and endometriosis workup.

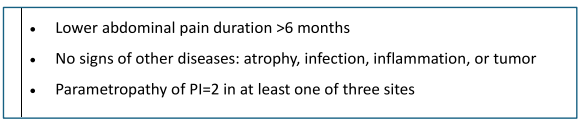

Fig. 7 The Heidelberg Diagnostic Criteria of Chronic Pelvic Pain Syndrome. Parametropathy is defined as cervical motion tenderness upon bimanual gynecological examination at three sites (left, center, and right parametrium), on a scale of 0 (no tenderness), 1 (slight tenderness), and 2 (tenderness, pain)

Research Implications

Further research is needed to evaluate the interobserver reliability (reproducibility) of the PMP test. Additionally, its reproducibility in cases of acute pelvic inflammatory disease (PID) has not yet been established. This clinical test could serve as a basis for refining the diagnostic criteria for PID.

In the context of CPPS, this simple screening tool provides a more precise indication for further diagnostic measures, including invasive procedures such as laparoscopy. Investigating these cases would help correlate PMP findings with intra-abdominal pathology. Further studies based on this novel clinical sign including potential confounders have the potential to refine the currently ambiguous definition of CPPS, identify associated covariates, and pave the way for new neurophysiological-based therapeutic strategies for women suffering from this severe and debilitating condition.

Limitations and Strengths

Monocenter and single-examiner design. We only observed a limited number of patients in this institution, and the findings were not controlled by a second examiner. The reproducibility (interobserver agreement) is to be clarified in future research. Nonetheless, this prospective, descriptive data reveals early insight into the diagnostic value of this test.

Exclusion bias of genital atrophy. Women with genital atrophy were excluded from the study. This condition can be a specific cause of genital pain and therefore does not meet the CPPS definition of "without obvious origin". Genital atrophy can be treated with local or systemic hormonal replacement therapy. Conclusions or therapy recommendations for CPPS diagnosis and treatment in elderly women therefore cannot be drawn from our data.

Exclusion bias of patients with hysterectomy. In these individuals, a cervical motion test cannot be performed. Amongst these patients, a significant number may suffer from CPP and need CPP therapy as well. It will be a challenge to identify these patients, but perhaps a similar clinical examination could be used. Finding effective therapy strategies, such as those for patients in our study with a uterus, requires further investigation.

No correlates with invasive diagnostic findings. We do not have enough information on the intra-abdominal situs in our patients with CPP to correlate it with our clinical findings. However, should the PMP test become a base for decision-making for invasive measures, we will obtain more information about intra-abdominal causes of this condition in the future.

Hidden rate of endometriosis. In this study, we did not exclude patients with previously diagnosed endometriosis. However, information on the presence or absence of endometriosis was available for only approximately 45% of patients in both groups, which was insufficient for a meaningful comparison. Given that endometriosis is a significant potential cause of CPPS, and it affects 10% of women of reproductive age [35], its detection in a preventive care setting, such as during a Pap smear examination, is crucial. As a result of the design of our study, we cannot rule out undiagnosed cases of endometriosis, particularly those with retroperitoneal implantation. Despite this limitation, our findings suggest that the prevalence of previously diagnosed endometriosis was higher in the CPP group. However, there was no significant difference in the rate of dysmenorrhea between patients with CPP and those undergoing preventive care.

The simple, non-invasive PMP test described in this study may help identify patients who require further evaluation for endometriosis. A positive PMP result could serve as a justification for additional diagnostic measures, including invasive procedures such as a porphyria workup or laparoscopy. Implementing this approach may enhance the detection of affected patients in both groups, leading to more timely and accurate diagnoses.

Strengths of the study. The study is based on a prospective observational design and therefore there were no dropouts which could have caused a data selection bias. Second, we examined a large population of 150 individuals including a large control group of 120. Third,

our data delivers a base for a simple clinical test which can be immediately included in regular gynecological examinations.

By recognizing parametropathy as a distinct clinical sign, clinicians may be empowered to diagnose CPPS with greater confidence, triage patients more effectively, and tailor therapies on the basis of neurophysiological or structural contributors to pain [34]. This paradigm shift may ultimately lead to better outcomes for a condition long considered diagnostically elusive.

CONCLUSION

We found a high correlation between paracervical tenderness and CPPS. We conclude that this clinical sign is a good candidate for a positive diagnosis of CPPS.

We suggest introducing the term "parametropathy" for paracervical tenderness not as a diagnosis but as a sensitive and specific sign of CPPS.

Clinical application: We suggest including the paracervical tenderness examination in every gynecological examination, in a screening situation, as well as in a CPP workup. CPPS will then no longer be a diagnosis of exclusion.

ACKNOWLEDGEMENTS

We want to express our thanks to all participants in the study.

Medical Writing Assistance. The authors wish to thank Mrs. McKaley Brennfleck, Bachelor of Arts, Karlsruhe, Germany, and Mrs. Siying Pek, Medical Student, Heidelberg, for their invaluable assistance in editing the final English version. A large language model was not used for the writing of this article.

Author Contributions. Stefan Weinschenk: Protocol/project development; data collection and management; data analysis; manuscript writing/editing. Thomas Strowitzki: Study design, manuscript writing/editing. Nura Fitnat Topbas Selcuki: Data presentation, manuscript writing/editing; Oliver Zivanovic: manuscript writing/editing. Axel Gerhardt: data analysis, data interpretation, manuscript writing/editing; Manuel Feisst: data analysis, data interpretation, manuscript writing/editing. All authors agree to be accountable for all aspects of the work and ensure that any questions regarding the accuracy or integrity of any part of the work are properly addressed and resolved.

Funding. The authors received no financial support for the research and authorship of this article. Publication costs were funded by the Heidelberg University Publication Fund and the internal departmental budget.

Data Availability. The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of Interest. Stefan Weinschenk, Thomas Strowitzki and Manuel Feisst are employees of the University Hospital Heidelberg, Justus Benrath is an employee of the BG Hospital, Tübingen, Germany, and Nura Fitnat Topbas Selcuki is an employee of the Sisli Hamidiye Etfal Training and Research Hospital, Istanbul, Turkey. Stefan Weinschenk is a member of the scientific board of the German Society of Acupuncture and Neural Therapy (DGfAN e. V.). Axel Gerhardt and Oliver Zivanovic have nothing to disclose.

Ethical Approval. This study was approved by the Heidelberg University Ethics Committee (approval no. S-487/ 2011 on September 6, 2011). The authors confirm that the study was performed in accordance with the Helsinki Declaration of 1964, and its later amendments. The authors also confirm that all subjects provided informed consent to participate in the study; and all participants provided consent for publication if any identifying information is included in the manuscript.

REFERENCES

1. Vercellini P, Somigliana E, Vigano P, Abbiati A, Barbara G, Fedele L. Chronic pelvic pain in women: etiology, pathogenesis and diagnostic approach. Gynecol Endocrinol. 2009;25(3):149–58.

2. Ahangari A. Prevalence of chronic pelvic pain among women: an updated review. Pain Physician. 2014;17(2):E141–7.

3. Mathias SD, Kuppermann M, Liberman RF, Lipschutz RC, Steege JF. Chronic pelvic pain: prevalence, health-related quality of life, and economic correlates. Obstet Gynecol. 1996;87(3):321–7.

4. Dal Farra F, Aquino A, Tarantino AG, Origo D. Effectiveness of myofascial manual therapies in chronic pelvic pain syndrome: a systematic review and meta-analysis. Int Urogynecol J. 2022;33(11):2963–76.

5. Kronenberg RM, Ludin SM, Fischer L. Severe case of chronic pelvic pain syndrome: recovery after injection of procaine into the vesicoprostatic plexus-case report and discussion of pathophysiology and mechanisms of action. Case Rep Urol. 2018;2018:9137215.

6. Peng PW, Tumber PS. Ultrasound-guided interventional procedures for patients with chronic pelvic pain—a description of techniques and review of literature. Pain Physician. 2008;11(2):215–24.

7. American College of Obstetricians and Gynecologists. ACOG technical bulletin. Chronic pelvic pain. Number 223–May 1996 (replaces no. 129, June 1989). American College of Obstetricians and Gynecologists. Int J Gynaecol Obstet. 1996;54(1):59–68.

8. Beard RW, Reginald PW, Wadsworth J. Clinical features of women with chronic lower abdominal pain and pelvic congestion. Br J Obstet Gynaecol. 1988;95(2):153–61.

9. Mink E. Spondylogenic pelvipathy. Zentralbl Gynakol. 1965;87(29):997–1005.

10. Martius H. Spastische Parametropathie Z Ärztl Fortbildg. 1942;39:289–90.

11. Seese SA. Neurotherapeutic aspect of parametropathy. Zentralbl Gynakol. 1961;83:925–7.

12. Dietsch H. Spastic parametropathy and its treatment. Med Welt. 1963;43:2188–9.

13. Kamocsay D. Ultrasonic therapy in spastic parametropathy (martius). Rehabilitation (Bonn). 1964;17:77–9.

14. Kotarinos R. Myofascial pelvic pain. Curr Pain Headache Rep. 2012;16(5):433–8.

15. Spitznagle TM, Robinson CM. Myofascial pelvic pain. Obstet Gynecol Clin North Am. 2014;41(3):409–32.

16. Bonder JH, Chi M, Rispoli L. Myofascial pelvic pain and related disorders. Phys Med Rehabil Clin N Am. 2017;28(3):501–15.

17. Stein SL. Chronic pelvic pain. Gastroenterol Clin North Am. 2013;42(4):785–800.

18. Wozniak S. Chronic pelvic pain. Ann Agric Environ Med. 2016;23(2):223–6.

19. Koo S, Fan CM. Pelvic congestion syndrome and pelvic varicosities. Tech Vasc Interv Radiol. 2014;17(2):90–5.

20. Basile A, Failla G, Gozzo C. Pelvic congestion syndrome. Semin Ultrasound CT MR. 2021;42(1):3–12.

21. Curry A, Williams T, Penny ML. Pelvic inflammatory disease: diagnosis, management, and prevention. Am Fam Physician. 2019;100(6):357–64.

22. Iwata H, Sugiyama Y, Satoi Y, Sasamoto N, Aoki T, Matsushima M. Diagnostic accuracy of pelvic examination in pelvic inflammatory disease: a meta-analysis. J Gen Fam Med. 2022;23(6):384–92.

23. Rueangket P, Rittiluechai K. Predictive analytic model for diagnosis of ectopic pregnancy. Front Med (Lausanne). 2021;8:646258.

24. Farrukh S, Sivitz AB, Onogul B, Patel K, Tejani C. The additive value of pelvic examinations to history in predicting sexually transmitted infections for young female patients with suspected cervicitis or pelvic inflammatory disease. Ann Emerg Med. 2018;72(6):703-12.e1.

25. Korn AP, Hessol N, Padian N, et al. Commonly used diagnostic criteria for pelvic inflammatory disease have poor sensitivity for plasma cell endometritis. Sex Transm Dis. 1995;22(6):335–41.

26. Peipert JF, Ness RB, Blume J, et al. Clinical predictors of endometritis in women with symptoms and signs of pelvic inflammatory disease. Am J Obstet Gynecol. 2001;184(5):856–63.

27. Choi KE, Grunert J, Werner M, et al. Low interrater reliability and reproducibility of neck reflex/"Adler-Langer" points in neural therapy diagnostics but increased pressure pain threshold after therapy: results of a randomized controlled observer-blind trial. Complement Med Res. 2024;2024:1–8.

28. Weinschenk S, Gerhardt A, Wibmer C, Strowitzki T, Feisst M. Neck reflex points: a new clinical test? Prevalence in two cohorts and its covariates. Diagnostics (Basel). 2024. https://doi.org/10.3390/diagnostics14192185.

29. Weinschenk S, Gollner R, Hollmann MW, et al. Inter-rater reliability of neck reflex points in women with chronic neck pain. Forsch Komplementmed. 2016;23(4):223–9.

30. Weinschenk S, Hollmann MW, Gollner R, et al. Injections of local anesthetics into the pharyngeal region reduce trapezius muscle tenderness. Forsch Komplementmed. 2016;23(2):111–6.

31. Brandt M, Sundstrup E, Jakobsen MD, et al. Association between neck/shoulder pain and trapezius muscle tenderness in office workers. Pain Res Treat. 2014;2014:352735.

32. Cohen J. Weighted kappa: nominal scale agreement with provision for scaled disagreement or partial credit. Psychol Bull. 1968;70(4):213–20.

33. Andersen LL, Hansen K, Mortensen OS, Zebis MK. Prevalence and anatomical location of muscle tenderness in adults with nonspecific neck/shoulder pain. BMC Musculoskelet Disord. 2011;12:169.

34. Rogerio LSR, Chung MK, Butrick CW, et al. A pain desensitization algorithm for phenotyping and treating chronic pelvic pain. JSLS. 2024. https://doi.org/10.4293/JSLS.2024.00009.

35. Zondervan KT, Becker CM, Missmer SA. Endometriosis. N Engl J Med. 2020;382(13):1244–56.

36. Bossuyt PM, Reitsma JB, Bruns DE, et al. Towards complete and accurate reporting of studies of diagnostic accuracy: the STARD initiative. BMJ. 2003;326(7379):41–4.