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Hanne Albert
Mona Godskesen
Jes Westergaard

Evaluation of clinical tests used in classification procedures in pregnancy-related pelvic joint pain

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H. Albert (✉) · M. Godskesen
Department of Physiotherapy,
Odense University Hospital,
Sdr. Boulevard,
5000 Odense C., Denmark
e-mail: hanne.albert@image.dk,
Tel.: +45-65413530/66111179,
Fax: +45-66125977

J. Westergaard
Department of Gynaecology and Obstetrics,
Odense University Hospital, Denmark

Abstract Pain in the pelvic joints and lower back, a major problem for pregnant women, has proved resistant to precise measurement and quantification. To develop a classification system, the clinical tests used must be able to separate pelvic from low back pain; they must also have a high inter-examiner reliability, sensitivity and specificity, and preferably be easy to perform. The aim of this study was to describe a standardised way of performing tests for examining the pelvis, and to evaluate inter-examiner reliability, and establish the sensitivity and specificity of 15 clinical tests. It was designed as a longitudinal, prospective, epidemiological cohort study. First, 34 pregnant women were examined by blinded examiners to establish inter-examiner reliability. Second, a cohort of 2269 consecutive pregnant women, each responded to a questionnaire and underwent a thorough and highly standardised physical examination (15 tests with 48 possible responses) of the pelvic joints and surrounding areas. The 535 women who reported daily pain from the pelvic joints and had objective findings from the joints were divided, according to symptoms, into four classification groups and one miscellaneous group. The results of the study showed inter-examiner agreement of the tests was high, calculated in percentage terms, at between 88 and 100%. Using the Kappa coefficient, most tests kept the high agreement: six tests had an inter-examiner agreement of between 0.81 and 1.00, three between 0.61 and 0.80, and two between 0.60 and 0.41. Five tests showed superior sensitivity. The specificity of the tests was between 0.98 and 1.00, except the value for pelvic topography, which was 0.79. These results show that it is possible to standardise examination and interpretation of clinical tests of the pelvic joints, resulting in a high degree of sensitivity, specificity and inter-examiner reliability.

Key words Pelvic pain · Pregnancy · Clinical examination · Classification procedures · Clinical tests

Introduction

Pelvic joint pain and low back pain must be considered a major problem for pregnant women, with reported incidences varying from 4 to 78% [1, 7, 13, 14]. The disparity between these figures suggests the need for consistent classification criteria. It also suggests a certain level of diagnostic confusion, which increases the likelihood of inappropriate treatment.

Previous investigations, as well as clinical experience, reveal that symptom complexes in those suffering pain from the pelvic joints differ sharply from symptom complexes related to pain coming from the lower back [5, 14, 16, 19]. The therapy differs too [7, 8, 19].

Numerous methods of varying complexity have been used in the attempt to establish a classification of symptoms in pregnant women with pain from the lower back and pelvic girdle. The spectrum runs from asking a woman to point out the source of pain on a drawing of the body [14], to subjecting her to a complex and large-scale physical examination comprising more than 40 objective tests [22]. Kristiansson et al. [9] classified the pelvic pain suffered by pregnant women in their study into four different groups: pain in the symphysis, pain in the symphysis and sacral area, pain in the symphysis, sacral and lumbar area, and pain in the trochanteric area.

To develop a classification system, any clinical tests used must fulfil several criteria. They must facilitate separation of pelvic from low back pain and have a high inter-examiner reliability [11], sensitivity and specificity. Ease of performance is also recommendable.

The pelvic region is gauged by two main types of test:

1. Topographic/palpation tests, by which anomalies of pelvic alignment are observed
2. Pain-provoking tests, the aim of these being to stress the structures, thus attempting to reproduce the patient's symptoms [10]

As demonstrated in previous studies [8, 17, 20, 22], assessment of the topographic relations in the pelvis, not to mention movements in the pelvic joints, is difficult to perform in an objective manner and with adequate inter-examiner consistency. The authors of these studies concur, moreover, with Laslett and Williams [10] and Östgaard et al.[15], that only pain-provoking tests yield the required objectivity and reproducibility.

The difference in results, and often low inter-examiner reliability in different tests is often due to the fact that many tests, even if they are called the same, are performed and evaluated differently. It is important that clinical tests are not rejected because of low reliability due to lack of standardisation of technique or interpretation of test results [18]. Where the effects of idiosyncratic behaviours of examiners are restricted, much higher inter-examiner reliability has been shown [18].

The aim of the study was:

1. To describe a standardised performance of pelvic examination tests
2. To evaluate inter-examiner reliability of 15 clinical tests, and to establish the sensitivity, specificity, and accuracy in pain discrimination of those tests.

Materials and methods

In the first part of the study, over a 4-week period 108 consecutive women in their 33rd week of gestation were examined. In the 2 middle weeks, 34 consecutive women were examined on the same day by two therapists to test the inter-examiner reliability. The second assessor was blinded to the examination and results of the first. Patients were instructed not to inform the second assessor of the results of the first examination. The first and second assessor alternated on a daily basis. A test was considered positive if it reproduced or aggravated pain from the exact location of one or more of the pelvic joints. Eight of the women had pelvic pain; 26 were pain free.

To test the sensitivity and specificity, a prospective epidemiological study of 2269 pregnant women booked for delivery at Odense University Hospital or Svendborg County Hospital over a 1-year period was conducted. Each participant was enrolled at week 33 of gestation. The only inclusion criterion was knowing the Danish language.

The participants were separated into a healthy group and a diseased group. To be classified as diseased with pelvic joint pain, all of the following criteria had to be fulfilled:

1. Daily pain at the time of examination (week 33 of gestation)
2. The woman should be able to point out the exact area of one or more of the pelvic joints as the pain area
3. The tests used should be able to provoke or aggravate pain from one or more of the pelvic joints

All others were considered pelvic joint healthy.

On the basis of the results obtained in the pilot study of 108 women, as well as previous clinical experience, the diseased women were classified into five subgroups – four classification groups and one miscellaneous – as described below.

1. *Pelvic girdle syndrome*: Daily pain in all three pelvic joints, confirmed with positive pain provoked by the tests from the equivalent joints.
2. *Symphysiolysis*: Daily pain in the pubic symphysis only, confirmed with positive pain provoked by the tests from the symphysis. Symphysiolysis does not imply an actual lysis, but the nomenclature is used by the Danish Health Authorities as a classification of pregnant women with pelvic pain.
3. *One-sided sacroiliac syndrome*: Daily pain from one sacroiliac joint, confirmed with positive pain provoked by the tests from the same joint.
4. *Double-sided sacroiliac syndrome*: Daily pain from both sacroiliac joints, confirmed with positive pain provoked by the tests from both joints.
5. *Miscellaneous*: Daily pain in one or more pelvic joints, but inconsistent objective findings, e.g. pain history from the pubic symphysis and objective findings from one sacroiliac joint. This category also included findings indicating inflammatory rheumatic diseases.

The examination of participants was divided into two parts: a questionnaire and a physical examination.

The questionnaire consisted of 29 questions on obstetric history, previous back- and pelvic-pain problems, social background and working conditions. This was followed by a meticulous pain history consisting of 33 questions. In this part of the questionnaire, the participant was asked to point, on her own body, to the exact location of the pain. Data were also elicited on pain onset, daily pattern of pain, pain-provoking activity, and changes in ability to perform daily tasks. To test the reproducibility of responses to the questionnaire, the 34 women involved in the tests for inter-examiner reliability were also asked to fill out the questionnaire twice, with an interval of a few hours. Their first and second sets of responses were then compared.

The standardised physical examination included 15 physical tests with 48 possible test results. Of the possible test results, 34 were related to the pubic symphysis and the sacroiliac joints. For instance, to be classified in the symphysiolysis group, a woman had to have just one of the 34 possible test results positive from the symphysis and the equivalent pain history. The remaining 14 test results concerned structures in or related to the pelvis, e.g. the hip joints, gluteal muscles, uterine ligaments, etc. Of the 15 tests, four were differential diagnostic tests in order to exclude spinal-root compression, weakness of the gluteus medius muscle, difference in

the length of the lower extremities, and possible involvement of the hip joints.

After the first part of the study, further training sessions were held to try to perfect the technique in the tests with the lowest inter-tester reliability, and those tests were rigorously evaluated. For the six physiotherapists examining the 2269 women, several training sessions were executed beforehand to ensure standardisation of technique and test interpretation.

Description of the physical tests used in the examination

In all the tests detailed below, localisation of the pain provoked is of utmost importance. Unless otherwise stated, in a positive test, the patient experiences pain in the pubic symphysis and/or the sacroiliac joints. All pain-provoking tests are for classification purposes. All tests are performed on both the lower extremities.

- The tests should be performed in the order likely to induce the least pain, with the fewest possible changes of position during the examination.

Trendelenburg test

The standing woman turns her back to the examiner and, standing on one leg, flexes the other at 90° (hip and knee). The test is considered differential diagnostic positive if the hip is descending on the flexed side.

- If pain is experienced in the pelvic joints, the test becomes a test for classification.

Pelvic topography

The examiner notes the following details: the level of both major trochanters, the level of both posterior and anterior iliac spinae, the level of iliac cristae and the direction of the rima nates. If the anterior and posterior iliac spinae as pairs are at the same horizontal level, the pelvis is in proper alignment. If not, the pelvic is misaligned. If the four spinae tilt on opposing planes – if, that is, their configuration is that of a wet rag being wrung – then the test is positive for pelvis torque.

Measurements of the length of the lower extremities

The subject is supine. The distance is measured from the upper edge of the pubic symphysis to the lower edge of the medial tibial malleoli. This measurement is repeated at least twice. The test is considered positive if there is a difference of 1 cm or more between the legs.

Lasègue test

The subject is supine. The examiner elevates each leg in turn. If pain in the affected dermatome is reported, the test is considered positive, in which case an expanded Lasègue manoeuvre is performed, i.e. the leg is lowered until the pain disappears; then a dorsal flexion of the foot is performed. If the result is the same pain as before, the extended test is positive.

Patrick's fabere test

The subject is supine. One leg is flexed, abducted, and rotated out so that the heel rests on the opposite kneecap. If the test results in pain on the medial side of the knee and femur or in the inguinal region, this indicates that the hip joint is affected.

If pain is experienced in the pelvic joints, the test becomes classificatory.

Posterior pelvic pain provoking test (P4 or thigh thrust test)

The subject is supine. One leg is flexed 90° at the hip and knee joint. With hands on the raised knee, pressure is exerted down the femur into the pelvis.

Menell's test

The subject is supine. One leg, moved into 30° abduction and 10° flexion in the hip joint, is first pushed into, then pulled out from, the pelvis, causing sagittal movement.

Compression test or gapping

With the subject supine, the examiner, crossing arms, places his or her palms inside the crista iliac, close to the superior anterior iliac spinae on both sides. A firm lateral pressure is applied on both sides.

Passive abduction in the hip joint

The subject lies supine. Each leg in turn is abducted by the examiner. The angle at which pain is first reported either from the pubic symphysis or the sacroiliac joint is recorded.

Passive adduction in the hip joint

The subject is supine. Each leg in turn is adducted by the examiner. The angle at which pain is first reported from either the pubic symphysis or the sacroiliac joints is recorded.

Passive flexion in the hip joint

The subject is supine. The examiner flexes the hip and knee joints and records the angle of flexion in the hip joint at which pain is first reported by the patient.

Palpation of the pubic symphysis

The subject is supine. The entire front side of the pubic symphysis is palpated gently. If the palpation causes pain that persists more than 5 s after removal of the examiner's hand, it is recorded as pain. If the pain disappears within 5 s, it is recorded as tenderness.

Palpation of the long dorsal sacroiliac ligaments [21]

The subject lies on her side with slight flexion in both hip and knee joints. The areas above both sacroiliac joints are palpated. If palpation causes pain that persists 5 s after removal of the examiner's hand, it is recorded as pain. If the pain disappears within 5 s, it is recorded as tenderness.

Separation test

The subject lies on her side. The palm of the examiner's hand is placed on the outside of the uppermost anterior superior iliac spina. The examiner then presses gently with the other hand on the back of the first hand.

Piedallus test

The subject sits on the edge of the examining table with her legs spread and as far back on the examining table as possible. Her feet should be free of the floor and her arms should hang between the legs. The examiner places a thumb on each posterior superior iliac spina. As the patient bends slowly forward note is taken of whether the two thumbs move at the same level or whether one rises higher than the other. In the first case, the test is negative; in the second, the thumb rises on the normally painful joint.

The nomenclature used for tests of compression and separation varies among different investigators depending on whether a given test is described in relation to the pubic symphysis or to the sacroiliac joints.

For each test the percentage agreement between therapist and the Kappa coefficient were calculated. The Kappa coefficient effectively discounts the proportions of agreement expected by chance [3].

All participants gave informed consent. The study was in accordance with the Helsinki 2 declaration and approved by the local ethics committee.

Results

Out of 2269 women, 535 (23.6%) fulfilled the classification criteria for pelvic joint pain. The classification distribution of subjects is shown in Table 1. The 148 (6.5%) with pain coming solely from the lower lumbar region were classified as healthy with respect to pelvic joint pain.

Regarding reproducibility of questionnaire results, a comparison of the responses to the questionnaires that were filled out twice, with an interval of a few hours, revealed a concordance of 96.2%. The main source of errors were patients with intermittent pain episodes having difficulties in consistently reproducing their responses about pain, for the question regarding pain during different daily activities. The most precise data came in response to the subjective questions regarding such matters as daily physical stress, relation to husband, and so forth. These responses, registered on a Visual Analogue Scale, showed a concurrence of 99.7%.

The results of the first part of the study show a inter-examiner reliability, calculated as a percentage, of between 88 and 100%. With the chance agreement discounted in the Kappa coefficient, most tests kept the very high agreement (Table 2). The reliability levels of six tests are almost perfect, and 11 of the tests are above 0.40, which is normally regarded as sufficient. Three tests are below Kappa 0.40, two of which are topographic tests. The only topographic test with a Kappa above 0.40 is Pelvic topography (Table 2).

In the three classification groups where pain is evident in the sacroiliac joints, three tests have superior sensitivity: Posterior pelvic pain provocation test, Menell's test and Patrick's fabere test. In the two classification groups where pain is evident in the symphysis pubis, two tests are superior with regard to sensitivity: Trendelenburg's test and Palpation of the symphysis (see Table 4).

The specificity of the chosen tests was between 98 and 100%, except for the Pelvic topography, which was 79% (see Table 4).

Table 1 Distribution of pregnant women (n = 2269) among the four classification subgroups and the miscellaneous and "pelvic healthy" groups

Classification group	*n*
Pelvic girdle syndrome	136
Symphysiolysis	47
One-sided sacroiliac syndrome	127
Double-sided sacroiliac syndrome	180
Miscellaneous	45
Pelvic healthy	1734

Table 2 Inter-examiner agreement for the 15 tests, (n = 34)

Test	Kappa	Agreement
Palpation of the pubic symphysis	0.89	97%
Passive hip abduction	0.89	97%
Menell's test	0.87	97%
Passive hip adduction	0.87	97%
Passive hip flexion	0.84	97%
Separation	0.84	97%
Compression	0.79	97%
Posterior pelvic pain provocation test	0.70	91%
Trendelenburg test	0.63	94%
Pelvic topography	0.55	91%
Patrick's fabere test	0.54	88%
Palpation of the long dorsal ligm. of the SI joint	0.34	91%
Length of the lower extremities	0.06	92%
Piedallus test	>0	88%
Lasègue	*	100%

* Kappa not calculated due to no positive tests

Table 3 Guidelines for interpreting the strength of the Kappa statistic

Strength of agreement	Value of Kappa
Poor	<0
Slight	0.00–0.20
Fair	0.21–0.40
Moderate	0.41–0.60
Substantial	0.61–0.80
Almost perfect	0.81–1.00

Discussion

This study describes a standardised way to perform tests for examining the pelvic joints, and assesses inter-examiner reliability and the sensitivity and specificity of 15 clinical tests.

Table 4 The sensitivity and specificity of the classification test related to the four different classification groups. For maximum sensitivity or maximum specificity the value is 1.00

Test	Sensitivity				Specificity (n = 1734)
	Pelvic girdle syndrome (n = 136)	Symphysiolysis (n = 47)	One-sided sacroiliac syndrome (n = 127)	Double-sided sacroiliac syndrome (n = 180)	
Positive pelvic pain provocation test	0.90	0.17	0.84	0.93	0.98
Menell's test	0.70	0.09	0.54	0.65	1.00
Patrick's fabere test	0.70	0.40	0.42	0.40	0.99
Trendelenburg test	0.60	0.62	0.19	0.18	0.99
Pelvic topography	0.26	0.19	0.32	0.46	0.77
Palpation of the pubic symphysis	0.81	0.60	0.00	0.00	0.99
Piedallus test	0.14	0.00	0.69	0.21	0.98
Compression test	0.70	0.13	0.25	0.38	1.00
Passive hip abduction	0.70	0.17	0.25	0.37	1.00
Passive hip adduction	0.67	0.38	0.30	0.30	1.00
Palpation of the sacroiliac joints	0.49	0.00	0.15	0.11	1.00
Separation test	0.40	0.13	0.04	0.14	1.00

The results showed a high inter-examiner reliability, high sensitivity and high specificity. These results are probably due to the following factors:

1. The tests are very simple to perform.
2. Using standardised performance and interpretation of tests, disallows idiosyncrasies.
3. The tests use a highly standardised and precise way of localising pain; though the woman in the test has to point out the exact location of the pain focus, pain patterns are noted but not considered in classification.
4. For classification purposes, mainly pain provocation tests are used.

A possible factor that may have influenced the results in a positive direction is that the examiners were not blinded to the patients' subjective pain history. The reason for this lack of blinding was the wish to evaluate the test in a simulated clinical setting, and in daily practice physicians and physiotherapists are rarely blinded to the patient's history.

To classify pregnant women with lumbar and pelvic pain, a distinction must first be drawn between pelvic and lumbar pain. Blower and Griffin [2], show that tests for the sacroiliac joints are reliable tools for distinguishing between sacroiliac joint pain and low back pain.

A precise pain location must then be obtained. This is in agreement with McCombe et al. [11], who recommend specificity in pain location. Blower and Griffin [2] also emphasise the importance of knowing the exact location of the provoked pain, and they regard lack of precision as a source of errors and of disagreement between studies. The disparity and lower sensitivity of the Posterior pelvic pain provocation test in the study performed by Kristiansson and Svärdsudd [8] compared with the results of the present study can probably be explained by this. They [8] consider the test positive if pain is felt *generally* in the buttock, while this study tightened the criteria so the pain tests are only considered positive if the pain is located in or directly adjacent to the joints.

The uniform examination techniques and test interpretation in this study were obtained through numerous training sessions. However, we want to stress that none of the six therapists was specially trained in manipulative techniques. This concurs with Laslett and Williams [10], who also demonstrate a high inter-examiner reliability with therapists who have standardised the performance and interpretation of the tests. Herzog et al. [6] show that examiners with high levels of clinical experience have a lower intra-examiner reliability than examiners with less experience. They assume that this is due to better and more scientific training of the latter. On the other hand, it might also be due to the fact that examiners with little experience have not yet developed their own idiosyncratic ways of examining. We therefore agree with Strender et al. [18], who emphasise that physical examination must be made with a higher degree of standardisation than is the case today, if a higher inter-examiner reliability is to form a part of daily practice.

In the study of Dreyfuss et al. [4], concerning the value of physical tests to non-pregnant persons with intra-articular sacroiliac joint pain origin, they found poor association between the clinical tests and pain relief by intra-articular injections. Of the 12 tests used, however, a combination of sacal sulcus tenderness and pointing to the spinae ileac posterior superior (SIPS) had the best predictive value. These tests are also used in the present study, though they are named Palpation of the long dorsal ligaments and Pointing to the joint. Of the nine pain provocation tests Kristiansson et al. [9] performed on the sacroiliac joints, the two most sensitive ones were Palpation of the symphysis and Painful femoral compression – in this study called Posterior pelvic pain provocation test. This

concords with the present study, where these two tests were among the five most sensitive.

Pain provoking tests had a better inter-examiner reliability than that of topograpic/palpation tests, but as Kristiansson et al. [9] showed, they also have a better specificity. This is also confirmed in the present study, which shows an almost identical specificity in the compression and separation tests.

Several investigators argue that pain provoking tests are most efficacious in establishing a diagnosis [10, 12, 17, 22]. However, the Separation and Compression tests were the only such tests used by these investigators [12, 17, 22]. The present study, while in agreement with regard to pain provocation tests, demonstrates that the Separation and Compression tests shows lower sensitivity and overall efficacy than other pain provoking tests such as Menell's test, the Posterior pelvic pain provocation test and Patrick's fabere test. McCombe et al. [11] recommend using the Separation and Compression tests with caution. We would go further than this by recommending discarding these tests in favour of the more reliable tests.

The Piedallus test is used as a test for a "blockage" of one of the sacroiliac joints, though such a blockage has never been shown. Van Deursen et al. [20] use six similar tests and show a low congruence, but when the examiners were allowed to use only a few tests or a single test, the congruence was higher. As we only used one test, this is may be the reason for our high congruence.

Conclusion

The optimum tests should be simple to perform and be in every aspect reliable. This study looked at 15 tests, finding some of them more efficacious than others. There is no doubt that pain provocation tests are more reliable than tests where the examiner has to palpate or evaluate topography or movements. Standardisation of techniques and practice can overcome a large part of this problem, but there is still reason to believe that patients' answers to tests are more reliable that the judgement of changes made by skilled examiners. Hence, the next challenge must be to develop the palpation/topographic tests, and the skills of examiners, in order to improve these tests to the standards of pain provocation tests.

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