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Physical Characteristics of Women With Severe Pelvic Girdle Pain After Pregnancy

A Descriptive Cohort Study

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Study Design. Descriptive cohort study.

Objective. This study aims to further elucidate the differences in physical characteristics of women with severe pregnancy-related pelvic girdle pain (PGP).

Summary of Background Data. There is increasing interest in pelvic girdle pain (PGP). To our knowledge, this is the first study on a large population of patients with severe PGP, after pregnancy, based on high cutoff scores on diagnostic PGP tests.

Methods. Two hundred five patients were selected from the outpatient clinic of a rehabilitation center. Patients were divided in 3 inclusion groups based on the total number of positive scores on 5 diagnostic tests; *i.e.*, active straight leg raise test, posterior pelvic pain provocation test, long dorsal sacroiliac ligament test, and hip abduction and adduction strength tests. These inclusion groups were related to the data on trunk strength test, general provocation tests, Quebec Back Pain Disability Scale (QBPDS) and activities of daily living.

Results. A typical pattern of PGP emerges from this study. The mean group score on the active straight leg raise, posterior pelvic pain provocation, and long dorsal sacroiliac ligament tests became higher when more than 3 inclusion tests were positive. Hip abduction and adduction strength became lower with more positive tests. The QBPDS score was overall high and significantly higher for 5 positive tests compared with 3 and 4 positive tests. This shows that the number of positive tests, the individual score on the diagnostic tests, and the QBPDS could all be an indicator for severity of PGP. Among the general pain provocation tests, both the passive hip flexion test and the upper and middle sacral thrust test scored high. The maximal isometric strength of trunk muscles was below the 10th percentile compared with women without complaints and was even less for 5 positive inclusion tests. It is confirmed that there is a typical order for difficulties with daily activities for PGP patients as follows (most difficult first): standing still, cycling, walking, sitting, and lying.

Conclusion. The study shows that the level of severity in PGP can be adequately assessed by a combination of specific tests.

Key words: pelvic girdle pain, pelvis, severity, chronic low back pain, sacroiliac joint. **Spine 2008;33:E145–E151**

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There is increasing interest in pelvic girdle pain (PGP), particularly for pregnancy-related PGP. Pregnancy and childbirth elicit both psychosocial and physical changes, with pain in the pelvic or low back region as a possible complication.[1]

Many terms are used to describe pain in the pelvic and low back area, including posterior pelvic pain,[2,3] symptom-giving pelvic girdle relaxation in pregnancy,[4,5] peripartum pelvic pain,[1] pregnancy-related low back pain,[6] and pregnancy-related pelvic (joint) pain.[7–9]

Not only does the terminology differ, but also the reported prevalence of pain in the pelvic and low back area. Pain during pregnancy is reported to occur in 14% to 81% of women.[5,10–15] Larsen *et al*[5] and Östgaard *et al*[14] found specifically for PGP during pregnancy, a prevalence of 14.2% and 31.2%, respectively. The recent European guideline on PGP concludes that there is strong evidence that the incidence point or incidence prevalence of pregnant women suffering from PGP is about 20%.[16] After delivery the complaints usually disappear within a period of 6 months; however, in a small percentage of patients the complaints become chronic and symptoms may persevere for years. Prevalence for pelvic and/or low back pain after delivery ranges from 5% to 37%.[13,17,18]

Comparison of the prevalence in different cohort studies is hampered by the use of different inclusion and exclusion criteria and different study designs. Another factor is the difficulty of characterizing PGP, which might be related to the lack of agreement on criteria that differentiate between normal and pathologic peripartum relaxation, effective differentiation between low back and pelvic pain, and/or the use of different diagnostic tests for inclusion of PGP.[19,20] In addition, the social acceptance of lumbo pelvic pain and differences between countries regarding sickness benefits may also play a role.[9]

For the sake of clarity, in the present study the definition is used proposed by the Working Group 4 on PGP of the European COST guideline committee.[16]

PGP generally arises in relation to pregnancy, trauma, or reactive arthritis. Pain is experienced between the iliac crests and the gluteal fold, particularly in the vicinity of the sacroiliac joints (SIJ).

The pain may radiate in the posterior thigh. The pain can also occur in conjunction or separately in the symphysis with possible pain radiation in the anterior thigh.

The endurance capacity for standing, walking, and sitting is diminished. The diagnosis of PGP can be reached after exclusion of lumbar causes. The pain or functional

disturbances in relation to PGP must be reproducible by specific clinical tests.

Diagnostic tests to validate PGP should be objective with acceptable intra- and interobserver reliability, and sensitive and specific for the examined population.

The following tests are based on these criteria and are frequently used as diagnostic tools for PGP: posterior pelvic pain provocation test or thigh thrust test (PPPP test), active straight leg raise test (ASLR test); hip abduction and adduction resistance tests, the Patrick's fabere test, and palpation of the long dorsal sacroiliac ligament (LDL test), (see Appendix for reviews on these tests).

The present study assumes that PGP is a specific form of low back pain that can be diagnosed if appropriate reliable tests are used.[16] Based on the ASLR test, PPPP test, LDL test, and hip adduction and abduction strength the present study aims to elucidate in more detail the differences in physical characteristics of women with PGP. To be able to do this, the cutoff score of the ASLR test, PPPP test, and LDL test was raised to such a level to include only women with severe PGP after pregnancy. To our knowledge, this is the first study to investigate a large population of women with PGP, based on high cutoff scores of diagnostic tests for PGP.

Subsequently, different levels of severity in the population will be identified. The level of severity is related to the data on trunk strength tests, general pain provocation tests, and the score on the Quebec Back Pain Disability Scale (QBPDS) and activities of daily living score.

■ Methods

Patients were selected from the outpatient clinic of the Spine and Joint Rehabilitation Centre (Rotterdam, The Netherlands). The centre is specialized in the treatment of severe chronic spinal and PGP. During 1999 and 2000, 1145 patients consulted the center for spinal or PGP. From this group, 500 female patients were randomly selected and all these patients completed questionnaires on general, social and medical history and the QBPDS, pain drawing and a visual analogue scale (VAS) for pain.

The following tests were used: ASLR test, PPPP test, LDL test, hip abduction and adduction strength, and isometric muscle strength of the trunk in the B200-isostation.

Inclusion Criteria (Preselective and Final Inclusion Criteria)

Of these 500 patients, the following preselection inclusion criteria were used for admittance for diagnosis and possible treatment in the center:

- Pain in the pelvic girdle region between the iliac crests and the gluteal fold, which started during pregnancy or within 3 weeks after delivery. Pain shown in the pain drawing according to the definition of COST[16] (please see the definition in the Introduction on page 3).
- Admittance only after failure of previous care (physiotherapy, exercise and postural therapy, manual therapy/medicine, rehabilitation care).
- Not being pregnant at the moment of consultation (minimally 6 months after delivery).

After classifying the patients on these criteria, 378 patients were included. To select a group of severe PGP patients, finally the following inclusion criteria were applied:

At least 3 of the following 5 diagnostic inclusion tests, with increased cutoff scores, should be positive to be classified as a severe PGP patient. For a more detailed description of the tests, see the website of the European COST committee on European guidelines under WG4: www.backpaineurope.org.

Inclusion Tests

ASLR Test (Mens *et al*[21]). The ASLR test was performed in a supine position with straight legs and feet 20-cm apart. The test was performed after the instruction: "try to raise your legs, one after the other, above the couch for 20 cm without bending the knee." The patient was asked to score impairment (scoring the inadequacy to raise the legs, but not the pain) on a 6-point scale: not difficult at all = 0; minimally difficult = 1; somewhat difficult = 2; fairly difficult = 3; very difficult = 4; unable to do = 5.

The scores of both sides were added, so that the summed score ranged from 0 to 10.

In the present study, the ASLR-test is positive when the bilateral score is at least 2. This is based on a validity and reliability study showing that with a cutoff score of 2, the sensitivity is 80% and the specificity 96%.

PPPP Test (Östgaard *et al*[14]). The PPPP test was performed with the patient supine and the hip flexed to an angle of 90° on the examined side. A light manual pressure was applied on the patient's flexed knee along the longitudinal axis of the femur. The test was positive when the patient felt a familiar, well-localized deep pain in the gluteal area on the provoked side. Pain generated at the place where the body of the patient was in contact with the hands of the examiner or with the couch, was ignored.

The PPPP test was performed at both sides. Additionally to the original description of the test, the pain was not only scored positive or negative, but additionally scored on a modification of a pain scale proposed by the American College of Rheumatology to grade tender points in fibromyalgia. No pain = 0; complaint of pain without grimace, flinch, or withdrawal = 1 (mild); pain plus grimace or flinch = 2 (moderate); the examiner is not able to complete the test because of withdrawal = 3 (unbearable).[22] The scores of both sides were added, so that the summed score ranged from 0 to 6. In the present study, the PPPP test is positive when the bilateral score is at least 2 to include more severe patients.

LDL Test (Vleeming *et al*[23]). The LDL test, was performed in prone position.

The LDL ligament, can be palpated directly caudal to the posterior iliac spine, as a taut superficial structure, 1 to 1.5 cm wide, frequently mimicking the feeling of a tight bony structure. The ligament runs caudomedially from the PSIS to the laterodorsal border of the sacrum for approximately 4 to 5 cm.

The patients were tested on specific bilateral tenderness by palpation of the ligament and scored on the same modification scale) as the PPPP test (score both sides maximally 0–6).[22] In the present study, LDL test is positive when the bilateral score was at least 2 or more. When identical pain is felt directly in the vicinity, but outside of the borders of the ligament, the test is not deemed as positive.

Table 1. Scores on the 5 Diagnostic Tests Used to Define a Patient as Having Severe Pelvic Girdle Pain

		ASLR Test			PPPP Test			LDL Test		
No. Positive Tests	No. Patients	No. Positive Tests	Mean Score (SD)	Median	No. Positive Tests	Mean Score (SD)	Median	No. Positive Tests	Mean Score (SD)	Median
5	100	100	6.50 (2.16)	7	100	4.45 (1.14)	5	100	4.50 (1.27)	5
4	63	63	5.37 (2.13)	5	43	2.67 (2.01)	2.50	49	2.75 (1.76)	3
3	42	41	4.38 (1.63)	4	23	2.21 (2.11)	2	16	2.45 (2.05)	2

		Hip Adduction Strength (Newton)		Hip Abduction Strength (Newton)	
No. Positive Tests	No. Patients	No. Positive Tests	Mean Score (SD)	No. Positive Tests	Mean Score (SD)
5	100	100	62 (28)	100	112 (42)
4	63	58	87 (32)	39	172 (61)
3	42	23	128 (48)	25	209 (46)

ASLR test indicates active straight leg raise test, bilateral score from 0 to 10; PPPP test, posterior pelvic pain provocation, bilateral score from 0 to 6; LDL test, palpation of the long dorsal sacroiliac ligament, bilateral score from 0 to 6.

Hip Adduction Strength (Mens[6]). This was measured with a handheld dynamometer (Microfet, Hoggan Health Industries Inc., West Jordan, UT) in supine position, the knees at 90°, and the feet placed on the couch. The examiner placed the dynamometer with his right hand against the medial aspect of the right knee. The patient was asked to squeeze the instrument between the knees during 5 to 7 seconds as forcefully as possible. This test was repeated twice. The highest value of all measurements was used. Cutoff point is set as 129 Newton. Thus, below 129 Newton the hip adduction strength is considered weak.

Hip Abduction Strength (Mens[6]). This was measured in the same position with the same instrument. The device was placed with the right hand of the examiner against the lateral aspect of the left knee and the examiner holds the right knee by means of his left hand placed against the lateral aspect of the right knee. The patient is asked to spread the legs during 5 to 7 seconds as forcefully as possible; the examiner holds the knees in position. This test was repeated twice. The highest value of all measurements was used.

Cutoff point is set as 196 Newton.

Exclusion Criteria

- Insufficient knowledge of the Dutch language.
- Signs indicating radiculopathy: asymmetric Achilles tendon reflex and/or (passive) straight leg raise test restricted by pain in the lower leg; positive radiographs, and/or magnetic resonance imaging for disc herniation.
- History of fracture, neoplasm or previous surgery of the lumbar spine, the pelvic girdle, the hip joint, or the femur.
- Specific causes like ankylosing spondylitis and systemic disease of the locomotor system.

Statistical Analysis

SPSS statistical software was used for data analysis. Analysis of variance, *t* test, the Kruskal Wallis, and Mann-Whitney *U* test were used to analyze differences between the inclusion tests and other parameters. A P value ≤ 0.05 was considered statistically significant for all tests. Bivariate correlations were tested with the Pearson test and Spearman rank correlation. A P value ≤ 0.05 was considered statistically significant, correlations coefficients ≤ 0.5 were considered as weak.

■ Results

After selection, 205 patients scored at least 3 of 5 inclusion tests positive.

Three-patient groups were finally selected based on the number of 3 positive inclusion tests (3-PIT), or 4 positive inclusion test (4-PIT) and all 5 tests positive (5-PIT), indicating the different levels of severity.

Inclusion Tests

In total, 100 patients scored positive on all inclusion tests (5-PIT) (Table 1). The mean score on the ASLR, PPPP, and LDL tests became higher when more than 3 tests were positive (4-and 5-PIT groups). The mean group score on the ASLR test was raised from 4.4 (3-PIT) to 6.5 (5-PIT), the PPPP test score was raised from 2.2 to 4.5 (mean), and the LDL test score was raised from 2.5 to 4.5 (mean) (Table 1).

The Mann-Whitney *U* test showed a significant difference for the ASLR, PPPP, and LDL tests when comparing 3-PIT and 4-PIT with 5-PIT, but was not significant when comparing 3-PIT and 4-PIT. This clearly indicates that in the 5-Pit group (n = 100) with 5 different positive tests, the individual tests scored significantly higher, also indicating increased severity.

As expected, hip adduction and abduction strength was significantly diminished in the presence of more PIT. For example, adduction strength decreased from 128 Newton (3-PIT) to 62 Newton (5-PIT).

The correlations between the separate inclusion tests were weak. Only the correlation between hip adduction strength and hip abduction strength (0.64) was moderate.

Because there was a significant difference between the 3 groups (3, 4, and 5-PIT) in the mean score on the various inclusion tests, the following parameters were reviewed in relation to these 3 groups.

Social and Medical History of Severe PGP Patients

Almost half (46.6%) of the finally selected women had 1 child. The number of children was not significantly dif-

Table 2. Pain Scores on Hip, Pelvic, and Sacral Tests

Tests	Pain Score (%)*				Kruskal Wallis Test Significance	Mann-Whitney *U* Test Significance		
	0	1	2	3		3 and 4	4 and 5	3 and 5
Passive hip flexion left	16.7	21.1	37.3	25	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Passive hip flexion right	13.7	21.6	40.7	24	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Passive exorotation left	37.4	21.2	28.6	12.8	$P < 0.01$	NS	$P < 0.01$	NS
Passive exorotation right	34.5	26.1	24.1	15.3	$P < 0.01$	NS	$P < 0.01$	$P < 0.05$
Passive endorotation left	31	25.1	28.6	15.3	$P < 0.05$	NS	$P < 0.01$	$P < 0.01$
Passive endorotation right	33	26.6	26.1	14.3	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Pelvic compression test	57.3	21.6	16.1	5	$P < 0.01$	NS	$P < 0.01$	NS
Sacral thrust low	43.3	26.6	23.2	6.9	NS	—	—	—
Sacral thrust mid	23.3	17.8	40.1	18.8	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Sacral thrust upper	13.2	27.9	34.3	24.5	NS	—	—	—

*No pain = 0; complaint of pain without grimace, flinch, or withdrawal = 1 (mild); pain plus grimace or flinch = 2 (moderate); the examiner was not able to complete the test because of withdrawal = 3 (unbearable).
NS indicates nonsignificant.

ferent between patients scoring more or less positive on the inclusion tests.

At the time of diagnostic consultation, the age of the women was between 24 and 50 years (mean 32.9 ± 4.6 years). The duration of complaints was between 0.6 and 24 years (mean 3.3 ± 3.5 years). More than 85% of the women had complaints for more than 1 year. There was no significant difference in the mean duration of the complaints between the patients in the 3 categories (3, 4, or 5 positive).

The severity of pain was scored on a 100-mm VAS. The VAS for current pain was 57.0 ± 21.0 (mean ± SD) There was no significant difference for the VAS between the 3-, 4-, and 5-PIT groups.

From the group of women with more than 1 child, 29.4% had complaints before the last pregnancy. There was a significant difference in the mean duration of complaints between women with 1 child and women with more then 1 child (*i.e.*, more than doubled: 2.10 *vs.* 4.39years, respectively). There was no significant difference in the duration of complaints for women with more than 1 child between the 3 categories.

On average, the 205 women had 426 pregnancies; 12.4% of the women had miscarriages and 2.6% had an abortion, overall resulting in the birth of 360 children. In total, 8.3% of the children were delivered by a Caesarean section. For these different case histories no differences were found between the 3 inclusion groups.

General and Specific Pain Provocation Tests

During routine diagnosis also pain was scored on passive mobility tests of the hip, pelvic compression test and sacral thrust tests (Table 2). Pain was scored on a modification of the scale proposed by the American College of Rheumatology (as described in the Methods). More than 50% of the group had no pain on the pelvic compression test performed lying on the side with flexed hips and knees while lateral compression was performed. Passive hip flexion (left and right) and sacral thrust (upper cranial border and middle sacrum), scored the highest (2 and 3, respectively, *i.e.*, moderate and unbearable pain) and increased with 5-PIT. Sacral thrust (low and upper) did not differ between the 3 inclusion groups. Most of the other pain provocation test showed increased pain for 5-PIT, but no difference between 3-PIT and 4-PIT (Table 2).

Strength of Trunk Muscles

The maximal isometric trunk muscle strength was measured with the B200 Isostation, (Isotechnologies, Inc., Hillsborough, NC) (Table 3). Compared with a nonsymptomatic female population all the mean strength values (rotation, flexion, lateral flexion, extension) were below the 10th percentile.[24] All strength tests showed a lower score for 5-PIT, but did not differ between 3-PIT and 4-PIT (Table 3).

Activities of Daily Living

The mean QBPDS score was 60.07 ± 11.1 (range 29–84). QBPDS was significantly higher (62.69) for 5-PIT

Table 3. Maximum Isometric Torque (Nm) on the Isostation B-200 (n = 201)

	Mean (SD)	ANOVA	Unpaired *t* Test		
			3 and 4	4 and 5	3 and 5
Rotation right	21.65 (10.81)	$P < 0.01$	$P < 0.05$	$P < 0.01$	$P < 0.01$
Rotation left	22.09 (10.61)	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Flexion	38.28 (22.86)	$P < 0.01$	$P < 0.05$	$P < 0.01$	$P < 0.01$
Extension	58.05 (27.39)	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Lateral flexion right	54.16 (22.51)	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$
Lateral flexion left	48.63 (23.16)	$P < 0.01$	NS	$P < 0.01$	$P < 0.01$

NS indicates nonsignificant.

compared with 3-PIT and 4-PIT (56.98 and 57.98, respectively).

The time of standing, walking, cycling, sitting, and laying down without a considerable increase of pain was measured on an ordinal scale. More than 50% of the women had problems with standing within 5 minutes. Fore more than 50% of the group laying down was possible for more than 1 hour. Only walking was significantly worse for the 5-PIT group. For the whole group, standing still represents the greatest disability, and cycling triggers the pain more than walking.

Correlations

Correlations between all the tests vary considerably. Although trunk muscle strength and QBPDS score show significant correlations ($P < 0.05$) with the separate inclusion tests, the power of the correlations is weak or very weak. Only mutual correlations of hip adduction and abduction strength and trunk muscle strength are strong or very strong.

■ Discussion

Inclusion Tests

The results of this study show that patients can be divided into 3 main groups, defined by the number of PIT. It is remarkable that, although the cutoff scores on the inclusion tests were substantially raised to be positive, the largest group is those patients scoring positive on all 5 inclusion tests (48.8%). This finding is in line with the conclusion that the mean individual score of all 5 diagnostic inclusion tests becomes higher as the number of PIT increases. Both the number of positive tests and the individual score on each test can be regarded as an indicator for the severity of PGP complaints. Thus, the severity of complaints is correlated with a higher number of PIT and to worse individual scores of the 5 inclusion tests. The ASLR test (2 or higher) was most frequently scored positive among the tests with the raised cutoff score (204 of 205 women). It should be noted only women with an ASLR of 1 or higher were initially allowed by their health insurance company to be referred to our clinic. The remaining inclusion tests are positive between 164 and 171 women. The strength of the correlations between the 5 tests was mostly weak. This indicates that each test provokes typical aspects of dysfunction of PGP patients; this is in agreement with Mens *et al.*[21]

General and Specific Pain Provocation Tests

Two recent studies by Laslett *et al*[19] and van der Wurff *et al*[20] investigated the evidence of diagnostic procedures for SIJ. Both groups concluded that to optimally identify a lesion of the SIJ, 2 or more positive tests were needed. Laslett *et al*[19] reported an optimal diagnosis when performing the following tests; distraction, PPPP test, compression, and sacral thrust. The present study did not include the distraction test. The PPPP test was used in our study as 1 of the 5 diagnostic tools and was positive for 81% of the women. In our study, the compression test and sacral thrust upper cranial border and middle sacrum were positive for 43%, 86%, and 77% of the women, respectively. Thus, only the compression test did not score sufficiently high compared with the other tests.

Strength of Trunk Muscles

In the present study, maximal isometric strength of trunk muscles on the B200 Isostation was below the 10th percentile compared with women without complaints. Unpublished data of women in our rehabilitation center with chronic low back pain with no onset of complaints during pregnancy or delivery showed significantly higher outcomes, although the mean is still below the 25th percentile of the nonsymptomatic female population using the B200. Hutten *et al*[25] tested 18 women with chronic low back pain on a waiting list for treatment at a rehabilitation center. The mean isometric strength parameters were also below the 10th percentile. However, the strength of the trunk muscles in the presence of PGP was less than the strengths measured by Hutten *et al*[25]; only trunk extension was almost the same in both studies.

Strength of Hip Abduction and Adduction Muscles

The hip abduction and adduction strength was significantly diminished in the presence of more PIT. For example, adduction strength decreased from 128 Newton (3-PIT) to 62 Newton (5-PIT). It is hypothesized that weakness of the hip strength in patients with PGP is not caused primarily by weakness of the hip muscles, but mainly by pain and/or fear of getting pain in combination with disturbed proprioception or fatigue.[26]

Activities of Daily Living

The QBPDS score was 60.1 ± 11.1 (range 29–84). Our back group (unpublished data) had a slightly lower score of 52.6 ± 14.7. The chronic patients (men and women with back and/or neck pain) of the rehabilitation program by Vendrig *et al*[27] had a lower QBPDS score of 33.5.

Most PGP patients have problems with the continuation of daily activities. Mens *et al*[1] found in 394 patients with PGP the following percentage of women who had pain provoked by standing, walking, cycling, sitting, and lying for more than 30 minutes of 90, 81, 63, 49, and 8, respectively. The women in the present study have almost the same order for these activities, but can better cycle than walk.

The 5-PIT Group

Based on the data of this study, it can be concluded that the women with 5-PIT scored worse on the diagnostic tests and on many other parameters. The 5-PIT group was more disabled on the ASLR test, scored more pain on the PPPP and LDL test and had less strength on hip adduction and abduction tests. Also the isometric trunk strength was less compared with the other 2 groups. Pain on other general and specific pain provocation tests was higher for the 5-PIT group except for the compression test. Disability measured with the QBPDS was higher for the 5-PIT group compared with the 3-PIT and 4-PIT group.

In conclusion, the level of severity of PGP can be adequately assessed by a combination of tests. Most of the evaluated tests, and all of the chosen tests, have a very high specificity indicating that, if they are negative, it is likely that the patient does not suffer from pain in the pelvic girdle. The sensitivity is, however, lower; therefore, it is recommended to perform all of the tests, not to rule out PGP, if 1 test might be negative.

However, a gold standard test is lacking and therefore validity is difficult to evaluate.

The patients in the present study could be divided into 3 categories based on the total number of PIT. The 5-PIT group was the largest. Mean group scores on the ASLR, PPPP, and LDL tests became higher when more than 3 tests were positive. The hip adduction and abduction strength decreased in the presence of more positive tests. The QBPDS score was significantly higher (62.69) for 5-PIT compared with 3-PIT, and 4-PIT (56.98 and 57.98, respectively). This shows that the number of PIT and the individual score on the inclusion tests together with the QBPDS could be an indicator for the severity of PGP.

The maximal isometric strength of trunk muscles is below the 10th percentile in the PGP group compared with women without complaints and was even less for 5 PIT.

The diagnostic inclusion tests (ASLR, PPPP, LDL test, and hip abduction and adduction strength) did not have strong correlations, which might reflect that different aspects of PGP are being tested.

■ Key Points

- This is the first study to investigate a large population of women with severe pregnancy-related pelvic girdle pain (PGP), based on high cutoff scores of diagnostic tests for PGP.
- The number of positive tests for PGP, the individual score on the selected diagnostic tests and the Quebec Back Pain Disability Scale, could all be an indicator for severity of PGP.
- The maximal isometric strength of trunk muscles was below the 10th percentile in the pregnancy-related PGP group compared with women without complaints and was even less for 5 positive inclusion tests.
- It is confirmed that there is a typical order for difficulties with daily activities for PGP patients.

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■ Appendix

Review of Applied Tests

Östgaard *et al*[1] used the PPPP test to distinguish between lumbar and pelvic pain. A group of pregnant women showed a strong correlation between posterior pelvic pain and a positive test; the sensitivity was 81% and specificity was 80%. In a group of 2269 pregnant women, Albert *et al*[2] found a sensitivity for the PPPP test of 84% and 93% in patients with pain in 1 and 2 of the SIJ, respectively; the specificity was 98%. In a group of 34 pregnant women, the κ score was 0.70 for interexaminer agreement for the PPPP test.[2] Mens *et al*[3] found a sensitivity of 69% for the PPPP test in patients after delivery. Although sensitivity and specificity outcomes vary

between different studies, the PPPP test seems to be a reliable pain provocation test.

Mens *et al*[3–7] developed the ASLR test and the hip abduction and hip adduction strength tests as diagnostic instruments for PGP. There is a significant relation between impaired active straight leg raising and PGP; the sensitivity was 0.87 and the specificity 0.94 and the test retest reliability was 0.87. Damen[8] found a lower sensitivity of 58% and a specificity of 97%; however, the latter study included patients with a pain score of 3 and higher on a visual analogue scale (VAS) (score 0–10). Mens *et al*[3] did not explicitly use these inclusion criteria, because the ASLR test is designed to score effective load transfer between spine, pelvis, and legs, and is not a pain provocation test. The ASLR test seems to be a suitable test to discriminate between PGP patients and healthy subjects, and is a specific functional test.

The test for hip adduction strength has a sensitivity of 0.61 and hip abduction strength 0.51.[6] The Pearson correlation coefficient (PCC) for intra- and intertester reliability for hip adduction was 0.79, as was the intraclass correlation coefficient (ICC).[6] For intratester reliability of hip abduction the PCC was 0.82 and the ICC was 0.79.[4] For intertester reliability of hip abduction the PCC was 0.85 and the ICC was 0.67.[4] The difference between PCC and ICC for hip abduction strength values might be explained by differences in the physical strength of the examiners themselves.[6] The hip abduction and adduction strength tests score specifically the relation between leg strength and pelvic girdle function.

Vleeming *et al*[9] found a sensitivity of 76% for the LDL test. Sensitivity in a group of 133 women that scored positive on both the ALSR and PPPP tests was 86%. When the cutoff score for inclusion of PGP was raised even further, to include only severe pelvic patients (ASLR test $\geq$3 and PPPP test $\geq$2; a modification of a pain scale proposed by the American College of Rheumatology to grade tender points in fibromyalgia[10]), the sensitivity of the LDL test was 98%. Njoo[11] found a κ of 0.76 for an experienced examiner and Verkerk (unpublished data) 51% for nontrained examiners.

Wormslev *et al*[12] found that the Patrick's fabere test was 1 of the 8 tests (out of 53) that discriminate between a pain and control group (women in both groups were pregnant). The κ for the right side was 0.62 and for the left side 0.42. In a group of pregnant women, Albert *et al*[2] found a κ of 0.54, sensitivity 0.40 to 0.70, and a specificity of 0.99.

There are few studies on the correlation between the various tests. Mens *et al*[3–5] and Vleeming *et al*[9] found no correlations above 0.5 between diagnostic tests for PGP. The low correlation between the various tests may be explained by measuring different aspects of PGP. A multivariate analysis by Hansen *et al*[13] showed that women with a high number of positive clinical tests suffered from more intense pain, had pain for a longer time during the day, and more often suffered from muscular tenderness compared with women with a small number of positive clinical tests. For confirmation of PGP it seems to be necessary that more than 1 diagnostic test is positive.[1]

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