Chapter 4

Validity and Reliability of The Active Straight Leg Raise Test in Posterior Pelvic Pain since Pregnancy

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CHAPTER 4

Abstract

Study Design. A cross-sectional analysis was performed in a homogenous group of women meeting strict criteria for posterior pelvic pain since pregnancy (PPPP). The Active Straight Leg Raise Test (ASLR test) and common severity measurement scales of lumbopelvic pain were scored. The scores on the ASLR test were compared with the scores of healthy controls.

Objectives. To develop a new diagnostic instrument for use in patients with PPPP. The objectives of the present study were to assess the validity and reliability of the ASLR test.

Summary of Background Data. Various diagnostic tools are used to categorize patients with PPPP, but there is still a need for simple tests with high reliability, sensitivity and specificity.

Methods. Reliability of the ASLR test was assessed in a group of 50 women with lumbopelvic pain of various etiology and various degrees of severity. Sensitivity was assessed in 200 patients with PPPP and specificity in 50 healthy women. Validity of the ASLR test as severity scale was investigated by comparing the test score with the medical history, scores on self-reported scales on disability, pain and tiredness and pain provocation tests. Sensitivity and specificity of the ASLR test was compared with the posterior pelvic pain provocation test (PPPP test), and usefulness as severity scale with the Québec Back Pain Disability Scale (QBPDS). The influence of several demographic and anthropometric variables on the ASLR score was investigated.

Results. The test-retest reliability measured with Pearson's correlation coefficient between the two ASLR scores one week apart was 0.87. The intraclass correlation coefficient (ICC) was 0.83. Pearson's correlation coefficient between the scores of the patient and the scores of a blinded assessor was 0.78; the ICC was 0.77. In the patient group the ASLR score ranged from 0-10; in the control group from 0-2. The best balance between specificity and sensitivity was found when scores 1-10 are designated as positive and zero as negative. With this cut-off point sensitivity of the test was 0.87 and specificity 0.94. The sensitivity of the ASLR test is higher than the sensitivity of the PPPP test; advantage of the ASLR test is the simplicity of measuring the score. The ASLR score correlated as expected with all severity scales. The correlation between the scores on the ASLR and the QBPDS test was 0.70. No association was found between the ASLR score and age, parity, duration of the postpartum period, height or weight.

Conclusion. The ASLR test is a suitable diagnostic instrument to discriminate between patients who are disabled by PPPP and healthy subjects; the test can be recommended as a disease severity scale in patients with PPPP. The test is easy to perform; reliability, sensitivity and specificity are high. It seems that the integrity of the function to transfer loads between the lumbosacral spine and legs is tested by the ASLR test.

Introduction

The use of diagnostic instruments in lumbopelvic pain is mainly to categorize patients in groups with different prognoses and to measure disease severity. The most popular measurements in lumbopelvic pain research are self-reported scales.[4,7] The value of physical examination and radiography in non-specific lumbopelvic pain is limited.[28,29] Many scales are based on decreased mobility of the spine and/or the strength of the trunk muscles. Although the reliability of those measurements is high, the relation with clinical parameters is questionable or weak.[11,14,15,19,20,24,27,29] A need exists for simple tests with high validity, sensitivity and specificity.[11]

Pregnancy is frequently complicated by the occurrence of lumbopelvic pain; the reported cumulative nine-month incidence ranges from 48-56%.[2,5,10,17] Posterior pelvic pain since pregnancy (PPPP) is often described as a distinct category.[8,17,18,25] But it remains questionable whether PPPP is a specific syndrome, or just non-specific lumbopelvic pain with an onset during pregnancy or delivery. Regardless of the answer, detailed study on the characteristics of PPPP could provide better understanding of lumbopelvic pain in general.

A step in the development of a diagnostic instrument is to investigate its ability to identify between patients and healthy subjects. To discriminate patients with PPPP from healthy subjects various instruments have been investigated. Mobility of the pelvic joints assessed by the Chamberlain method showed a range of motion between the pubic bones of 5.9 ± 3.3 mm in puerperal women with pelvic pain since pregnancy and 1.9 ± 2.2 mm in a group of puerperal women without pelvic pain.[1,3] As far as we know, the specificity of this method was never studied in PPPP with a disease duration exceeding 6 months. Kristiansson et al. assessed the discriminatory power of a large battery of pain provocation tests to identify pregnant women with and without pain in the lumbopelvic region.[8] The specificity of the various tests ranged from 0.89-1.00; the sensitivity from 0.05-0.69. In two studies in pregnant women the posterior pelvic pain provocation test (PPPP test) scored high both on sensitivity (0.69-0.81) and specificity (0.80-0.90).[8,18] A major disadvantage of pain provocation tests is the inability to assess decreased function in patients with little pain even when disability is high. 'Catching' of the leg (the phenomenon that a patient feels difficulty in moving one or both legs forward when walking) is described as a diagnostic sign in PPPP.[25] The specificity of this sign was similar to that of the PPPP test, but its sensitivity was much lower; the reliability of this sign has, as far as we know, never been investigated.

Our setting (see section 'subjects') provides the opportunity to examine a large group of patients with PPPP. It was noticed that, in most patients, active raising of one or both legs in supine position, was weak. Many patients report pain during this action, even though most also describe feeling as though they were paralyzed. As early as 1839 the Swedish gynecologist Cederschjöld gave a description of a condition which he called 'joint loosening' in pregnant and puerperal women.[6] One of the described

characteristics was the 'difficulty or almost impossibility of even moving the lower limbs.' He assessed '... an instantaneous relief in the pains and the ability to move the limbs when the hips are pressed hard together with the hands.' In a previous study a significant relationship was found between impaired Active Straight Leg Raising (ASLR) and radiographic measured mobility of the pelvic joints.[13]

The aim of the present study is to investigate the usefulness of this phenomenon as a diagnostic instrument in women with PPPP. More specifically, the reliability and the validity of the ASLR test to qualify and quantify PPPP were investigated.

Methods

Subjects

Patients were selected from the outpatient clinic of a rehabilitation center, specialized in treatment of lumbopelvic pain. Because peripartum pelvic pain is a main topic of our research, many patients come from all over the Netherlands (200,000 births per year) to consult us.

Reliability

Test-retest reliability was performed in a group of 50 women with lumbopelvic pain of various etiology and various degrees of severity. The test was scored two times with a one-week period in between.

Intertester reliability of a selfassessment scale is not possible. To be sure that the test-retest reliability of the two scores one week apart were not largely based on good memory of the patient, the scores of the patient were compared with the scores of a blinded assessor. The assessor was an experienced examiner (IR) and scored the impairment to raise the leg by observing the velocity of leg raising, the appearance of any tremor in the leg, the amount of rotation of the trunk, and verbal and non-verbal expressions of the patient. The patients and the assessor were blinded for each others' scores and for the scores from the previous week. Moreover, the assessor was blinded for the results of all other measurements and the patients' medical history.

Sensitivity

Patients were selected from those who visited the rehabilitation center for the first time. Two hundred consecutive patients who fulfilled the criteria were included. Patients generally have two main reasons to consult the center: for treatment of (relatively severe) complaints, or because they have (relatively minor) complaints and need information about the risks in case of a new pregnancy. In order to investigate the diagnostic properties of the ASLR test in patients with minor as well as severe disease intensity, patients were selected from the entire population. The sensitivity of the 50% of the patients with the highest disability and with the 50% with the lowest disability were both computed. Disability was measured on the Québec Back Pain Disability Scale

(QBPDS). This scale was developed to measure the grade of disability in non-specific low back pain;[7,21] in a pilot study the scale appeared also suitable in patients with PPPP (unpublished data).

Inclusion criteria:

1. Pain in the lumbopelvic region. Defined as pain experienced between the upper level of the iliac crests and the gluteal fold.
2. Pain beginning during pregnancy or within 3 weeks after delivery.
3. The patient was not pregnant and the last delivery was 6 months to 5 years previously.
4. Aged 20-40 years.

Exclusion criteria:

1. A history of fracture, neoplasm or previous surgery of the lumbar spine, the pelvic girdle, the hip joint or the femur.
2. Signs indicating radiculopathy: asymmetric Achilles tendon reflex and/or (passive) Straight Leg Raising restricted by pain in the lower leg.
3. A systemic disease of the locomotor system.
4. Insufficient knowledge of the Dutch language to fill in forms, or any restriction to be tested.

Specificity

Control subjects were 50 non-pregnant women who consulted a primary care unit because of local problems of the locomotor system, e.g. tennis elbow, trigger finger, frozen shoulder. Only those women were included who had at some time been pregnant and were without previous medical consultations or time lost from work due to lumbopelvic pain, and scored zero on the QBPDS at the moment of examination. The period post partum and the age were not restricted.

Measurements

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 on a six-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 0-10.

Comparison with the PPPP test

Because the PPPP test is a well-documented, reliable, sensitive and specific diagnostic instrument to assess PPPP,[8,17,18] the ASLR test was compared with this test. The PPPP test was performed on both sides.[18] The test was scored positive if pain was provoked on

at least one side. To score the PPPP test and the ASLR test as independently as possible from each other, the ASLR test was performed after the PPPP test and the score on the ASLR test was given by the patient without any help from the examiner.

Validity as instrument to measure severity
The criterion-based assessment of validity of disease severity measurement is hampered by the lack of a "gold standard". To test external validity the associations between the scores of the ASLR test and three types of variables were investigated:
1) medical history variables, 2) self-reported scales on disability, pain and fatigue, 3) pain provocation tests.

The following medical history variables were expected to correlate with disease severity: radiation of pain into one or both legs, use of pain medication during the previous week, previous consultation of a medical specialist, sleep disturbance because of PPPP, absence of work because of PPPP at the moment of examination.[7,23]

Disability was measured by the interval of time (in minutes, ranging from 0-60) without increase of pain when standing, walking, bicycling, sitting and lying down. Pain and fatigue were measured on visual analogue scales.

Pain was also assessed by provocation tests. If the test was performed at both sides, the test was scored as positive when pain was evoked at least on one of the two sides. The selection of the pain provocation tests was based on good intertester reliability, specificity and selectivity.[8,9,16,18] The following tests were performed: posterior pelvic pain provocation test, pelvic torsion, tenderness of the long dorsal sacro-iliac ligament, sacral thrust and lumbar pressure.

Comparison with the QBPDS test
To investigate the surplus value of the ASLR test above existing severity scales an extensive comparison of the ASLR test with the QBPDS test was carried out.

Possible confounders
To assess the existence of variables having an influence on the ASLR score (confounders), the influence of the most obvious variables was analyzed in both the patient group and the control group: the length of the postpartum period, age, parity, height and weight corrected for degree of disability, measured with the QBPDS.

Statistical analysis
SPSS statistical software was used for data analysis. Test-retest reliability and comparison of the score of the patient with the score of the assessor were determined by calculating Pearson's correlation coefficient and intraclass correlation coefficient (ICC). The estimates of variance for the ICC were obtained from a one-way random effect model. Sensitivity and specificity were calculated for different levels of the ASLR score. A Chi square test and Pearson's correlation coefficient were used to investigate the correlation

between the ASLR test and the PPPP test. Associations between the score on the ASLR test and severity scales were determined by calculating Pearson's correlation coefficient. For dichotomous variables the significance of the difference of the means of the scores in both groups were compared using the independent samples t-test. A multiple linear regression model was used to examine the existence of confounders. A p-value < 0.05 was considered significant.

Results

It took 15 months to include the 200 patients. Mean age of the patients was 32.7 ± 3.5 years. Parity ranged from 1-6 with a median of 2. Postpartum period ranged from 0.5 - 4.8 years with a median of 1.7 years.

Mean age of the 50 control subjects was 47.7 ± 8.1 years. Parity ranged from 1-9 with a median of 2. Postpartum period ranged from 0.27 - 40.4 years with a median of 18.5 years. Age, parity and duration of the postpartum period of the control group were higher than those of the patient group (independent samples t-test $p < 0.001$).

Reliability

In this group of 50 patients the score at the first examination ranged from 0-10 with a mean value of 4.6 ± 2.4. The test-retest reliability measured with Pearson's correlation coefficient between the two ASLR scores one week apart was 0.87; the ICC was 0.83.

The test-retest reliability for the scores of the assessor measured with Pearson's correlation coefficient between the two ASLR scores one week apart was 0.82; the ICC was also 0.82. When the scores of the patient were compared with the scores of the assessor, Pearson's correlation coefficient was 0.78 and the ICC was 0.77.

Sensitivity and specificity

Table 1 shows the ASLR scores of patients and controls; Table 2 shows the sensitivity and specificity for various scores of the ASLR test. The sum of specificity and sensitivity was highest when a cut-off was made between ASLR score 0 and 1. Based on these figures it is proposed to indicate scores 1-10 as positive and zero as negative. Because the test scored 1-10 in 86.5% of the patients, sensitivity was 0.87; because 47 (94%) of the control subjects had a score 0, specificity was 0.94. QBPDS score in the patient group ranged from 1-85. Mean score was 43.8 ± 18.7. ASLR score of the 100 patients with QBPDS score 45 or higher was positive in all patients (sensitivity 1.00); the ASLR score of the 100 patients with a QBPDS score below 45 was positive in 73 patients (sensitivity 0.73).

Table 1. ASLR scores of 200 patients with posterior pelvic pain since pregnancy (PPPP) and 50 healthy controls.

ASLR score	No. of Patients (%)	No. of Controls (%)
0	27 (13.5)	47 (94.0)
1	13 (6.5)	1 (2.0)
2	29 (14.5)	2 (4.0)
3	32 (16.0)	0
4	34 (17.0)	0
5	21 (10.5)	0
6	12 (6.0)	0
7	13 (6.5)	0
8	7 (3.5)	0
9	3 (1.5)	0
10	9 (4.5)	0

Table 2. Sensitivity of the ASLR test in 200 patients with PPPP and specificity in 50 healthy controls.

Cut-off between ASLR Score	Sensitivity	Specificity
0-1	173/200 = 86.5%	47/50 = 94%
1-2	160/200 = 80%	48/50 = 96%
2-3	131/200 = 65.5%	50/50 =100%
3-4	99/200 = 49.5%	50/50 =100%
4-5	65/200 = 32.5%	50/50 =100%
5-6	44/200 = 22%	50/50 =100%
6-7	32/200 = 16%	50/50 =100%
7-8	19/200 = 9.5%	50/50 =100%
8-9	12/200 = 6 %	50/50 =100%
9-10	9/200 = 4.5%	50/50 =100%

Comparison with the PPPP test

In 62 patients (31%) the PPPP test was negative on both sides (Table 3). Thus the sensitivity of the PPPP test in this group was 0.69. Pearson's correlation coefficient between both tests was 0.27 ($p < 0.001$); Pearson's Chi square $p < 0.001$). In only 17 of the 200 patients (8.5%) were both tests negative.

Validity as instrument to measure severity

The score of the ASLR test correlated as expected with all severity scales (Tables 4-6). Scores were significantly higher when pain radiated into one or both legs, when medication to treat pain was used, when a medical specialist was consulted before the visit to the rehabilitation clinic, when sleep was disturbed by pain, when work was

interrupted because of pain at the moment of examination, or when pain provocation tests were positive.

Table 3. Relation between PPPP test and ASLR test in patients with PPPP.

	PPPP test Negative	PPPP test Positive	Total
ASLR test Negative	17	10	27
ASLR test Positive	45	128	173
Total	62	138	200

Pearson's correlation coefficient 0.27 ($p < 0.001$). Pearson's Chi square $p < 0.001$
Data are numbers of patients.

Table 4. Mean scores on the Active Straight Leg Raising test (ASLR) test and the Québec Back Pain Disability Scale (QBPDS) according to medical history of the study population.

variable	levels	n	mean score ASLR test (SD)	95% confidence interval of the difference of the means
Radiation of pain	No	52	2.10 (2.08)	1.41 - 2.85[a]
	Yes	137	4.23 (2.62)	
Use of pain medication	No	125	3.01 (2.34)	1.27 - 2.74[a]
	Yes	69	5.01 (2.74)	
Previous consultation of specialist	No	68	2.65 (2.06)	0.96 - 2.32[a]
	Yes	131	4.29 (2.73)	
Sleep disturbed because of pelvic pain	No	104	2.65 (2.28)	1.66 - 2.99[a]
	Yes	93	4.98 (2.48)	
Work absence at the moment of examination	No	50	2.32 (2.06)	1.46 - 3.11[a]
	Yes	99	4.60 (2.56)	

variable	levels	n	mean score QBPDS (SD)	95% confidence interval of the difference of the means
Radiation of pain	No	52	30.5 (19.4)	12.2 - 23.1[a]
	Yes	137	48.1 (16.0)	
Use of pain medication	No	125	37.7 (18.5)	11.6 - 20.9[a]
	Yes	69	54.0 (14.0)	
Previous consultation of specialist	No	68	36.2 (18.5)	6.4 - 17.0[a]
	Yes	131	47.9 (17.6)	
Sleep disturbed because of pelvic pain	No	104	34.8 (17.6)	15.2 - 24.1[a]
	Yes	93	54.4 (14.0)	
Work absence at the moment of examination	No	50	33.3 (17.2)	12.4 - 23.8[a]
	Yes	99	51.4 (16.3)	

n = number of patients
SD = Standard Deviation
[a] significant at the 0.001 level (2-tailed)

Comparison with the QBPDS test

The ASLR score was highly correlated with the QBPDS test score: 0.70 (Table 5 and Figure 1). This means that 49% (R^2) of the variance in the QBPDS score was explained by the score on the ASLR test. Correlations between the ASLR score and severity scales revealed roughly the same pattern as correlations between the QBPDS and the severity scales (Tables 4-6). The score on the ASLR test correlated slightly better than the score on the QBPDS test with results of the pain provocation tests. The correlation coefficients of the QBPDS score with self-administered scales of severity were slightly higher than the correlation coefficients of the ASLR score with severity scales in 6 of the 7 scales.

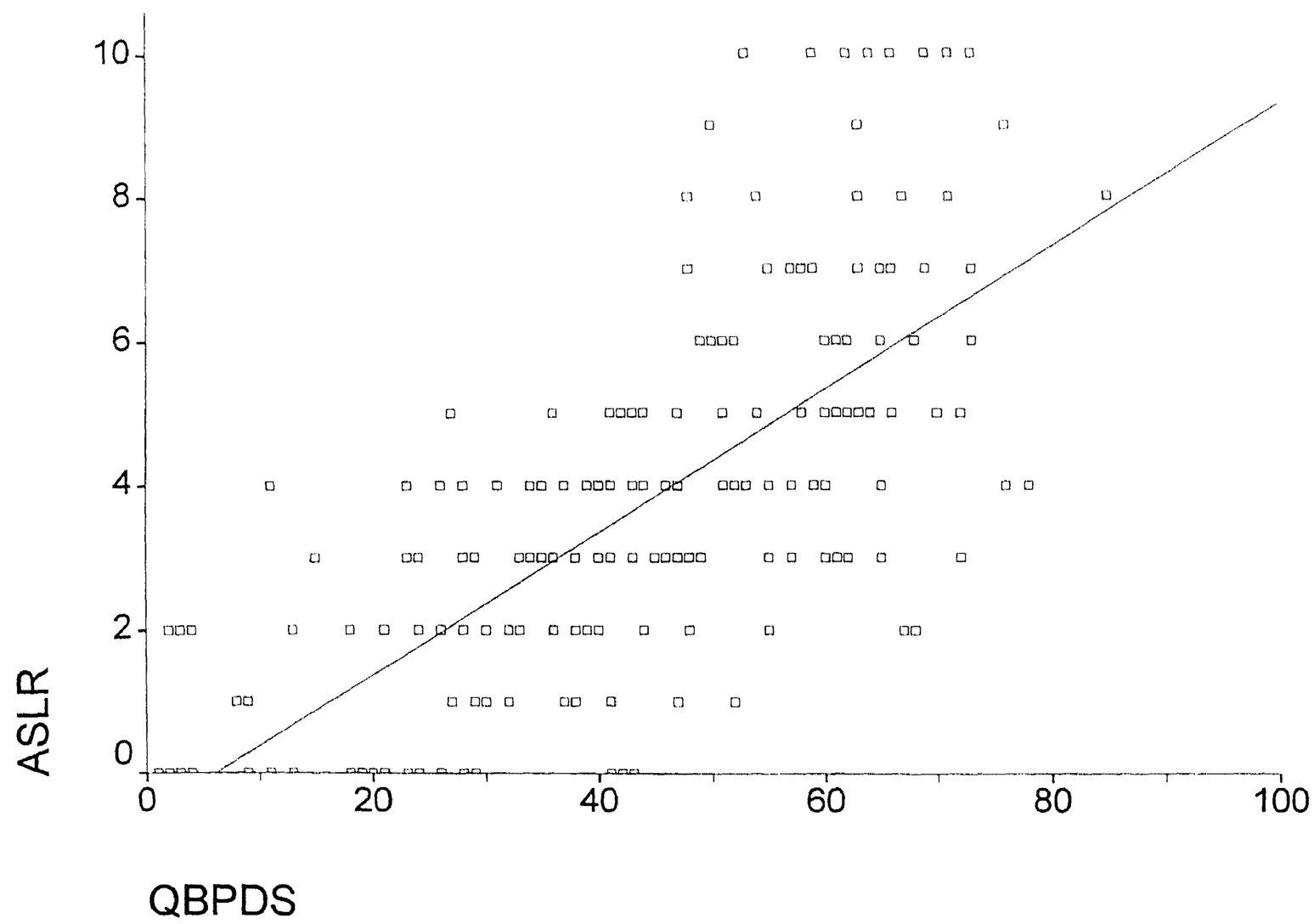

Figure 1. Relation between ASLR and QBPDS scores in 200 patients with PPPP. R = 0.70.

Table 5. Relation between the ASLR test and the QBPDS versus self-reported scales on disability, pain and fatigue in the study population. Pearson's correlation coefficients.

	ASLR	QBPDS
QBPDS	0.70[a]	1
Standing time	-0.45[a]	-0.64[a]
Walking time	-0.47[a]	-0.63[a]
Bicycling time	-0.46[a]	-0.60[a]
Sitting time	-0.50[a]	-0.60[a]
Lying down time	-0.36[a]	-0.33[a]
Pain (Visual Analogue Scale)	0.53[a]	0.67[a]
Fatigue (Visual Analogue Scale)	0.45[a]	0.51[a]

[a] significant at the 0.001 level (2-tailed)

Table 6. Mean scores on the ASLR test and the QBPDS according to pain provocation tests in the study population.

variable	levels	n	mean score ASLR test (SD)	95% confidence interval of the difference of the means
Posterior pelvic pain provocation test	Negative	62	2.55 (2.29)	0.94 - 2.46[a]
	Positive	138	4.25 (2.61)	
Pelvic torsion	Negative	17	2.70 (1.53)	1.09 - 2.86[a]
	Positive	129	4.68 (2.57)	
Tenderness long dorsal ligament	Negative	33	2.76 (1.89)	1.25 - 3.11[a]
	Positive	111	4.94 (2.51)	
Sacral thrust	Negative	52	3.40 (2.30)	0.82 - 2.48[a]
	Positive	93	5.05 (2.50)	
Lumbar pressure	Negative	30	3.07 (2.02)	0.88 - 2.64[b]
	Positive	115	4.83 (2.56)	

variable	levels	n	mean score QBPDS	95% confidence interval of the difference of the means
Posterior pelvic pain provocation test	Negative	62	32.6 (19.0)	11.0 - 21.4[a]
	Positive	138	48.9 (16.3)	
Pelvic torsion	Negative	17	44.5 (14.6)	0.7 - 14.9[c]
	Positive	129	52.3 (13.9)	
Tenderness long dorsal ligament	Negative	33	41.9 (15.8)	7.1 - 17.4[a]
	Positive	111	54.2 (12.3)	
Sacral thrust	Negative	52	42.9 (13.6)	9.1 - 17.7[a]
	Positive	93	56.3 (12.1)	
Lumbar pressure	Negative	30	44.6 (14.6)	3.1 - 14.3[b]
	Positive	115	53.3 (13.5)	

n = number of patients
SD = Standard Deviation
[a] significant at the 0.001 level (2-tailed)
[b] significant at the 0.01 level (2-tailed)
[c] significant at the 0.05 level (2-tailed)

Possible confounders

In a multiple linear regression analysis the multiple correlation coefficient of the combination age, parity, duration of the postpartum period, height, weight and QBPDS score with the ASLR score in the patient group was R = 0.712 (Table 7). This means that 50.7% (R^2) of the variance in the scores was explained by this combination. The uppermost part of the variance was provided by the QBPDS score. The contribution of the other variables was negligible. Data analyses on possible confounders in the control group revealed similar figures (Table 8). QBPDS in the control group was deleted because the score on this scale was by definition zero for all subjects.

Table 7. Results of multiple linear regression with scores on ASLR as dependent variable in patients with PPPP.

Predictor Variable	Higher Score Category	Standardized Beta Coefficient	T-test	P-Value
Age	Older	0.037	0.671	0.503
Parity	Higher	0.084	1.599	0.111
Duration	Shorter	0.006	0.108	0.914
Height	Smaller	0.022	0.384	0.702
Weight	Heavier	0.080	1.352	0.178
QBPDS	Higher	0.684	12.581	0.000

Multiple correlation coefficient R = 0.712. R^2 = 0.507. Adjusted R Square = 0.491.

Table 8. Results of multiple linear regression with scores on the ASLR test as dependent variable in control subjects.

Predictor Variable	Higher Score Category	Standardized Beta Coefficient	T-test	P-Value
Age	Older	0.553	1.689	0.099
Parity	Lower	0.122	0.759	0.452
Duration	Shorter	0.613	1.919	0.062
Height	Taller	0.160	1.079	0.286
Weight	Lighter	0.051	0.344	0.732

Multiple correlation coefficient R = 0.313. R^2 = 0.098. Adjusted R Square = 0.007.

Discussion

In the present study the validity of the ASLR test was assessed to decide whether this instrument can be used to diagnose and measure disease severity in PPPP.

Reliability

The results show that the test-retest reliability is high. The scores from the patient and from the experienced assessor showed a high correlation; this substantiates the reliability of the test. In case an objective verdict is needed the score of an experienced examiner would be preferred. In case the assessor is not experienced, or in situations where blinding is needed (for example clinical trials) the score of the patient might be preferable. It would be interesting to investigate the cause of an occasional large discrepancy between the score of an individual patient and that of a skilled assessor. The discrepancy might give the investigator more insight into how the patient is facing her disability, especially in case of a large discrepancy between the severity measured with the self-assessment scales and assessed with the physical examination.

Sensitivity and specificity

The best balance between specificity and sensitivity was found when score 0 is negative and 1-10 are designated as positive. It is possible that in some clinical situations a higher cut-off point may be preferable. For example between ASLR score 2 and 3; at that point the sensitivity is 0.66, not very high, but specificity is 100%. In daily practice it was noticed that 'Not difficult at all = score zero' and 'Minimally difficult = score 1' (in the Dutch translation) were for some subjects two different ways of expressing the same feeling. Thus it was possible that a subject indicated 'Minimally difficult = score 1' to inform us that active raising of her legs was normal.

The sensitivity of a test is always dependent on the examined population; especially the degree of disability appears to influence the ASLR score. The results of this study show that sensitivity is 1.00 when the score on the QBPDS was 45 or higher. The sensitivity of 0.73, in cases with minor complaints, is still acceptable.

Comparison with the PPPP test

Sensitivity of the ASLR test is higher than the sensitivity of the PPPP test: 0.87 and 0.69, respectively. The correlation coefficient between both (0.27) is rather low. It seems that both tests measure different aspects of PPPP. Advantage of the ASLR test is that, when the score is given by the patient, it is not necessary to be skilled in examination of the locomotor system to measure the score.

Validity as instrument to measure severity

The results demonstrate that the ASLR test effectively measures disease severity in patients with PPPP. Among the self-reported scales, time lying down without increase of pain showed the weakest association with the ASLR score. This is explained by the lack of variance in the lying down time (when measured on a scale ranging from 0-60 minutes), because most patients had no problem to lay down for 60 minutes without increase of pain.

Comparison with the QBPDS test

The ASLR test and the QBPDS test seem to have equal qualities in measuring disease severity in patients with PPPP. Advantage of the ASLR test is the simplicity of score measurement. A more important advantage is that, when scored by the examiner, the test is partly objective. Waddell et al. investigated the usefulness of 27 tests on their reliability to be used as objective measure of physical impairment.[29] Nine of these 27 tests were objective, as well as being well associated with the degree of disability. However, with this latter test battery only 25% of the variance of the self-reported disability could be explained.

Possible confounders

Since age, parity, duration of the postpartum period, height and weight had no significant association with the ASLR score, it is not necessary to make a correction for these factors. It shows that the differences between the healthy subjects and the patients with respect to age, parity and duration of the postpartum period did not influence the results. However, it should be kept in mind that in the patient group the age limit was 20-40 years, nulliparae were not included, and the duration of the postpartum period was restricted to 0.5-5.0 years.

Possible explanation for the phenomenon

In previous studies it was hypothesized that symptoms in PPPP are caused by overloading of the ligaments of the pelvic ring and/or lumbopelvic junction during activities in which loads have to be transferred between legs and trunk.[12,13,22] The ASLR test could be seen as a check for this system. X-rays taken during the ASLR test suggest that during active raising of the leg the pelvic bone at the tested side is forced to an anterior rotation about a horizontal axis near the sacroiliac joint. Secondary mobility of the lumbar spine and the contralateral sacroiliac joint are involved.[13] The hypothesis that joint laxity plays a role in PPPP and in the ASLR test is also supported by our experience that in the majority of patients with PPPP fastening of a pelvic belt and, in severe cases, fusion of the three joints of the pelvic ring is beneficial in the majority of cases. In daily practice it became evident that the influence of a pelvic belt on the ASLR test predicts the usefulness of a pelvic belt during activities of daily living in individual patients. With this procedure the best position of the belt and the required tension are determined in a simple instant manner.

The suggested anterior rotation of the pelvic bone at the tested side during the ASLR test is probably the same as accomplished during the PPPP test. However, the rather low correlation between both tests suggests that the tests measure different aspects of this phenomenon. We hypothesize that the ASLR test measures the decreased function to transfer loads from legs to trunk and that the PPPP test shows whether the system has been overloaded or not during the preceding days or weeks. Thus it seems useful to use both tests to measure both aspects.

Besides joint laxity as explanation it is suggested that problems in lumbopelvic pain are caused by a disturbed proprioception and decreased function of muscles due to pain and fatigue.[25,26] Enlarged joint mobility as well as decreased muscle function may play a role. Especially patients with joint laxity may be vulnerable being trapped in a vicious circle with pain and fatigue, decreased proprioception, decreased muscle function, decreased muscular stability, decreased load transfer between spine and legs, pain and fatigue, etc. It seems that the ASLR test measures, in particular, the mechanical part of this vicious circle even in the absence of pain.

The 'catching of the leg' phenomenon (whereby the patient feels difficulty in moving one or both legs forward when walking) seems to be based on the same mechanism as weakness during the ASLR test.[25] Both phenomena are based on impaired ability to perform active hip flexion. Because of the difference of the lever arm it is obvious that moving the leg in flexion from a horizontal position is more difficult than from a vertical position. This could explain the difference in the sensitivity of both signs.

Waddell et al. described weakness of active raising of both legs together in supine position (bilateral active straight leg raising).[29] The test was positive when the patient was not able to raise both legs six inches off the couch during 5 seconds. The test had a sensitivity of 0.40 in patients with chronic non-specific low back pain and a specificity of 1.00. It seems that this sign is related to the ASLR test. The test was judged as a reliable and valid diagnostic sign and seems to support the validity of the ASLR test.

The use of the ASLR test to discriminate between PPPP and healthy subjects is substantiated in the present study. Further studies are needed to evaluate the usefulness of the test to discriminate PPPP from other syndromes with pain in the lumbopelvic region. It would be interesting to score the ASLR test in a population of patients with lumbopelvic pain of various etiology and to analyze if the patients with a positive test are different with respect to other diagnostic tests, etiology and prognosis. It might be that the effects of mechanical influences (for example pelvic belt, improvement of muscle function, surgical joint fusion) are more marked in patients with lumbopelvic pain with a positive ASLR test than in those with a negative test. Moreover, further studies are needed to evaluate responsiveness of the ASLR test.

Conclusion

The ASLR test is a suitable diagnostic instrument to discriminate between patients who are disabled by PPPP and healthy subjects and can be recommended as a disease scale to measure severity in patients with PPPP. The test is easy to perform; reliability, sensitivity and specificity are high. It seems that the integrity of the function to transfer loads between the lumbosacral spine and legs is tested by the ASLR test.

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