A Systematic Review of the Passive Straight Leg Raising Test as a Diagnostic Aid for Low Back Pain (1989 to 2000)

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Study Design. A systematic review.

Objectives. This systematic review sought papers (January 1989–January 2000) on the passive straight leg raising test (PSLR) as a diagnostic component for low back pain (LBP) to identify, summarize, and assess developments in the test procedure, the factors influencing PSLR outcome, and the clinical significance of that outcome.

Summary of Background Data. Previous studies suggested that the PSLR tractioned the sciatic nerve and that diminished leg elevation with reproduced pain indicated low lumbar intervertebral disc pathology.

Methods. Searches on six computerized bibliographic databases identified publications written about the PSLR. Papers were excluded if they were published before January 1989, were non-English language papers, or employed either an active SLR or a PSLR for purposes other than LBP diagnosis. The references of qualifying papers (and the references of references) were searched. Contact with primary authors, and others known to be active in this field, was attempted.

Results. The PSLR procedure remains unchanged. The influence of hip rotation during the PSLR was discussed without consensus. Biomechanical devices improved intra- and interobserver reliability and so increased test reproducibility. Hamstrings were found to have a defensive role in protecting nerve roots by limiting PSLR range in cases of nerve root inflammation. A small diurnal variation in the PSLR may imply a poorer prognosis. A positive PSLR at 4 months after lumbar intervertebral disc surgery predicted poor reoperative outcome, and a negative 4-month PSLR predicted excellent outcome. The influence of psychosocial factors was not discussed, neither was the diagnostic significance of a negative PSLR outcome.

Conclusions. There remains no standard PSLR procedure, no consensus on interpretation of results, and little recognition that a negative PSLR test outcome may be of greater diagnostic value than a positive one. The causal link between LBP pathology and hamstring action remains unclear. There is a need for research into the clinical use of the PSLR: its intra- and interobserver reliability; the influences of age, gender, diurnal variation, and psychosocial factors; and its predictive value in lumbar intervertebral disc surgery.

[Key words: sciatica, diagnosis, passive straight leg raising test] Spine 2002;27:E388-E395

Low back pain, (LBP) is a widespread, disabling, and poorly understood condition[39,78] that, in general, is not successfully treated.[14] The cost of LBP to the UK National Health Service rose from 156 million pounds sterling[58] in 1987 to 500 million by 1996.[55] The passive straight leg raising test (PSLR) is commonly used as an aid to the diagnosis of LBP.[55,46] Forst[25] was the first to describe the PSLR in his Paris medical thesis of 1881. Rang[70] quoting from Forst,[25] described how the supine patient’s heel is supported with one hand while the other is placed over the same limb’s patella:

“...We have just seen that the patient experiences acute pain when the thigh is flexed on the pelvis while the leg is held in extension. If we now flex the leg at the knee, we are able to flex the thigh at the hip without causing the patient any painful feeling” Forst (1881)[13,23]

Forst[25] thought that the limiting mechanism was hamstring tension, whereas contemporaries, Lazarevic et al[51] in 1880 and de Beurmann[4] in 1884, favored sciatic nerve stretch. Since Mixter and Barr[62] in 1934, it has been thought that a causal link exists between intervertebral disc protrusion (herniation of the anulus and protrusion of the pulposus) and “sciatic pain” (defined by O’Connell[64] in 1943 as pain along the course and in the distribution of the sciatic nerve, as distinct from LBP).

This received support from in vitro studies that showed movement of the nerve root with accompanying pressure contact between nerve root and protrusion.[13,16,77]

Although the PSLR is considered an important clinical test for lumbar intervertebral disc herniation (LDH)[45,46,79] there is variation of opinion in how it should be carried out, the mechanism of its limitation, and its clinical significance.[82]

Such a widely used diagnostic test should be subject to periodic review, especially when the logic of the model can be called into question by evidence that approximately 25% to 30% of asymptomatic individuals have LDH[83,84] and by suggestions that neither the origin of radicular pain nor its precise spinal level can be determined by neurophysiologic testing.[2] This systematic review sought papers, published between January 1989 and January 2000, written primarily about the PSLR as a diagnostic component in the assessment of LBP to identify, summarize, and assess developments in the test procedure, the factors that influence its outcome, and the clinical significance of that outcome.

Methods

A worldwide review of published work on the PSLR test was conducted. Studies were selected for the systematic review if
they were published between January 1989 and January 2000, written in English, and focused on the PSLR as a test for LDH. A number of search strategies were considered, including computerized bibliographic databases, hand searching, and the examination of reference lists. Searches of electronic bibliographic databases, namely, MEDLINE, Embase, BIDS (index to conference proceedings and Science Citation index), Proquest, CINAHL, and Cochrane were carried out. The use of key words “straight leg raising” or “Lasègue” (in the title) in all languages, from January 1989 to January 2000, balanced the search between comprehensiveness and precision. Variations exist in the spelling of “Lasègue,” necessitating the use of wild cards for the center characters from “Lasègue.” All papers meeting the criteria for selection, including reviews and conference proceedings, were obtained. All reference lists in the selected papers were examined for new references, which were also obtained. Any new publications that met the inclusion criteria were acquired and examined for new references, which were also obtained.

Hand searching was considered impractical, firstly because reference to the PSLR is common in the low back literature but is rarely the subject of the study. Consequently, the chance of finding appropriate papers was small, and secondly the use of the test crosses expertise boundaries, for example between biomechanics, general practice, radiography, surgery, and physiotherapy, so the number of journals to be hand searched would be large. Similarly, the estimation of search effectiveness by capture-recapture technique was subject to the same impracticalities and was rejected for the same reasons. Studies excluded were those published before January 1, 1989, non-English language papers, those using either an active SLR or a PSLR for purposes other than as a diagnostic aid for LBP, and Lasègue papers that focused on diet rather than on the PSLR. Twenty-six authors were contacted, as were others known to be active in the field, including authors of papers published in languages other than English. The contact consisted of requests for details of any data becoming available since publication and for any research known to be in progress. Eleven authors responded, of whom two provided further information.

Study aims, settings, sample sizes, inclusion criteria, test procedures, and basic definitions of terms varied to such a degree that neither a formal scoring system nor meta-analysis was applied.

■ Results

In this systematic review of PSLR literature from January 1989 to January 2000, 34 papers and letters were identified, of which 20 fulfilled the inclusion criteria.

Excluded Papers

Fourteen publications were excluded (Table 1). Reasons included the SLR used as an active test, as a rehabilitation exercise, as a measure of the effectiveness of soft tissue treatment, as a test for the quality of the load transfer system between the spine and leg, and as a way of selecting patients with LDH for a study examining chemical markers in their cerebrospinal fluid levels. Other papers were unobtainable or were letters, and one was a brief unsystematic review.

Included Papers: Settings, Samples, Numbers of Observers

The publication rate of included papers from January 1989 to January 2000 was broadly even, with no particular geographic concentrations and from a range of environments, including schools, universities, general medical practices, hospitals, and outpatient clinics. The included papers are listed in Table 2. Studies included both genders and a wide range of age groups. Samples varied in size from Goeken and Hof (n = 1) to Idota and Yoshida (n = 5899) (range = 1–5898; SD = 1208).

Table 1. Excluded Papers: Listed by Main Reason for Exclusion


SLR = straight leg raising; PSLR = passive straight leg raising.
Table 2. Papers Reviewed, in Chronologic Order


Some papers reported on more than one study; for example, Idota and Yoshida reported on three studies, and Hall et al. on two studies. At least one extended study, Goeken and Hof was the subject of more than one paper. Every study had different sample inclusion criteria.

Of the 20 included studies, five used two observers, seven used a single observer, and eight used an unknown number of observers. A range of terms was used for conditions such as “herniated disc” throughout these studies, with papers generally not defining basic terms such as “low back pain,” making comparisons between them less certain.

Definitions. Distinctions were drawn between the PSLR, the Lasègue test, and the Lasègue sign. The original PSLR published by Forst was in two parts: the affected straight leg was raised extended at the knee, the symptoms reproduced, and the test was then repeated, this time elevating the affected leg flexed at the knee. The symptoms were again reproduced but only when the leg was extended at the knee; this second part of the procedure became known as the Lasègue test. The Lasègue sign was described as the reproduction of pain distal to the knee in the affected leg during the Lasègue test. One group assumed the PSLR and the Lasègue test were synonymous, with the difference being that one term referred to the procedure and the other to its inventor. Although no standardized definitions seem to exist (so all of these could be regarded as equally valid), this confusion served to further confound comparisons between studies.

Carrying out the Passive Straight Leg Raising Test

A Standardized Procedure for the Passive Straight Leg Raising Test? Previous to the review period, a clinical procedure had been developed for the PSLR, which might be summarized in the following sequence from Breig and Troup:

- A firm, level couch with a supine, relaxed patient, neck in neutral position
- Patient’s trunk and hips without lateral flexion or rotation, hips neither adducted nor abducted
- Practitioner, ensuring that patient’s knee remains extended, with the foot in a vertical plane, supports affected leg at the heel and gently elevates the limb. Angle of leg elevation at pain onset and site of that pain recorded.
- If the PSLR is unilaterally limited, induces unilateral symptoms, or is bilaterally limited to less than 50°, then, for each leg, raise to onset of pain, lower a few degrees (to reduce pain), then successively dorsiflex ankle, medially rotate the hip, and flex the neck. Symptom reproduction by one of these tests would be interpreted as a positive PSLR outcome, suggesting increased root tension, with the site of the pain suggesting the cause.

No mention is made in the literature of the significance, if any, of the speed or acceleration of the leg elevation (beyond it being slow and steady) or the influence of patient clothing, room temperature, or bed firmness. It is assumed that Breig and Troup expected each of the qualifying tests to be completed and returned to a neutral position before the next stage, although this was not stated explicitly. They also suggested making a record of pain induced during the PSLR, its location, whether unilateral or bilateral, and whether exacerbated by ankle dorsiflexion, medial hip rotation (MHR), or cervical flexion. No consensus on a standard PSLR procedure was apparent from the reviewed papers.
Identifying a Positive Passive Straight Leg Raising Test Outcome: Implications for Test Reliability. There was no agreement in the reviewed papers on the criteria for a positive test outcome. Many of the studies used onset of patient pain to indicate a positive test result, but maximum pain tolerance was used by some, and the start of symptom onset by others. The nature of the recorded pain varied from study to study, although maximum pain tolerance was used by some, and the start of symptom onset by others. The location of pain varied from leg pain distal to the knee, general leg pain resembling sciatic pain, and a combination of back and leg pain. These inconsistencies in identifying a positive test outcome would have diminished interobserver reliability.

Intra- and Interobserver Reliability. Both intra- and interobserver reliability of the PSLR were considered inadequate by Porter and Trailesca but good by Chow et al, Boland, and Lee and Yang, and they were found by van den Hoogen et al to improve in a hospital setting when compared with general practice. Considerable improvements could be gained by using biomechanical devices, which standardized procedures, thus reducing the influence of differing settings, individual observers, and patients; this notwithstanding, it seems unlikely that these devices were designed for use, or are practical, in the routine clinical context.

Little emphasis was placed in the reviewed papers on either intra- or interobserver reliability of the PSLR in the ordinary clinical setting. This was a notable lack because it failed to establish whether the test was reliable, a matter that has to be documented before the test’s clinical validity becomes meaningful.

Test validity in terms of specificity or sensitivity was not explored in the reviewed papers. Deyo et al and Andersson and Deyo had quoted a sensitivity for the PSLR of 0.818 (72–97%) (sensitivity meaning a negative result rules out the disorder) and a specificity of 0.418 (11–66%) (specificity meaning a positive result rules in the disorder). This suggested that a negative PSLR result was diagnostically more important than a positive one, a matter not considered in the papers reviewed.

Patient Position, Cervical Flexion, Ankle Dorsiflexion, Medial Hip Rotation, Pelvic Rotation. Among the 20 included studies, 17 placed the patient in a supine position, two side lying, and one in vitro side lying. Of the 17 studies based on the supine position, 12 stipulated that both cervical flexion and ankle dorsiflexion should be neutral, two varied both cervical flexion and ankle dorsiflexion, one varied ankle dorsiflexion, and two expressed no preference. Of the two studies based on the in vitro side-lying position, one did not stipulate neck or ankle position, and one positioned both neutrally. In total, regardless of patient position, 13 studies placed the neck and ankle in a neutral position.

The addition of ankle dorsiflexion decreased the range of the PSLR but the addition of cervical flexion had little further effect. This was previously reported by Troup, who found, however, that cervical flexion caused pain in the back or leg when used in the seated position.

Slater was the only reviewed author to mention either plantar flexion with inversion (PFI) or MHR. He suggested that PFI added to the PSLR stressed the common peroneal nerve, potentially aiding differential diagnosis of common peroneal nerve problems. He also briefly commented on MHR, stating that it may “selectively increase tension.” Breig and Troup had supported this view, but Grieve had differed, suggesting that MHR was of negligible additional clinical value.

Pelvic rotation during the PSLR was mentioned in several studies, usually assuming hip position to be neutral at the starting point with rotation occurring after some degrees of elevation. Porter and Trailesca and Cameron et al disagreed and insisted that pelvic rotation should be avoided during the PSLR. Bohannon, in his letter responding to Porter and Trailesca, commented on pelvic rotation during PSLR:

“The fact is that pelvic rotation has been shown to begin within 10° of the start of hip flexion, regardless of the manner of stabilization, whether the knee is flexed or extended and whether the motion is performed actively or passively.”

Bohannon (1990)

It may be that this phenomenon is partly age dependent; Idota and Yoshida observed that in asymptomatic youths, hip rotation during the PSLR began almost immediately on leg elevation. There is scope for further investigation in the role played by hip rotation in the PSLR and allied tests such as the Lasègue test.

Mechanisms of Passive Straight Leg Raising Test Limitation. As 16 of the 20 included studies suggested that a positive PSLR was signaled by patient pain, the mechanisms responsible for this pain are important in understanding the diagnostic significance of the test. Most earlier authors had suggested that compression of the nerve root was the most likely cause of pain during the PSLR. The sciatic nerve root, they had suggested, being relatively fixed between the dura and the intervertebral foramen, was unable to move away from a disc protrusion, and the ensuing compression and PSLR induced traction-generated pain. Only one paper during the review period, an in vitro study examined nerve root motion near the intervertebral disc between the axilla of the dura and the dorsal root ganglion. The results from this agreed with earlier findings. The direction of nerve root movement was reported as caudal but also lateral toward the pedicle, and so toward any posterolateral LDH. It was also noted that the dura moved less than the intrathecal nerve root at the pedicle and experienced more
strain, implying that the dura may be a contributor to the reproduced pain.

The effect of the PSLR on the sciatic nerve had previously been observed under *in vitro* conditions at the nerve’s exit from the pelvis after only 1 or 2 inches of leg raise and was noticeable at the intervertebral foramen after 20° to 30° of elevation. The motion was greatest at L5–S2 at 60° to 80° of the PSLR, but it was rarely seen at L3 or above.26,43 The greatest movement, 4 to 5 mm, was reported at the S1 nerve root, with 3 mm at the L5 nerve root,23,43 but decreasing with age, possibly because of increased adherions between the sciatic nerve and surrounding tissues.26

Other pain-producing mechanisms have been suggested; for example, Inman and Saunders43 considered damage to related ligamentous structures and collateral creation of an inflammatory focus over the dural cuff of the nerve as possible causes of PSLR pain-generating mechanisms. Other earlier studies examined nerve root edema,23,40,68 nerve root irritation,21,26 and intervertebral foraminal venous obstruction.41,50

Because LDH was itself responsible for the adverse effects on the nearby nerve root, investigators had explored whether protrusion size, shape, and history may influence PSLR outcome. Generally the location of a protrusion was considered significant: a central prolapse produced LBP;23 a posterolateral protrusion, both LBP and leg pain; and a lateral protrusion, leg pain alone.20 In this review period, there was the broad assumption that LDH would produce LBP and sciatica,45,75 but the relevance of the characteristics of the protrusions were rarely discussed. Thelander et al79 found no correlation between protrusion size, shape, or location and PSLR restriction, instead ascribing the reproduced pain to inflammatory reaction in the dural sheath and nerve root. They also noted that any decrease in protrusion size that might have occurred over time was not accompanied by improvement in PSLR response.

**Prediction of Surgical Outcomes.** Most lumbar disc surgery has involved L4–L5, L5–S1 segments, a preoperative positive PSLR result at under 30°, an expectation that most of the postoperative improvement will take place in the first 4 months, (slowing toward 12 months), and an outcome adversely influenced by compensation claims and psychosocial factors.17,46,48 Jonsson and Strömquist46 noted that a positive preoperative PSLR correlated to neurologic deficit but not to postoperative recovery. They, however, reported a strong correlation between a positive PSLR at 4 month after surgery and re-operation with a poor prognosis, being poorer for females than males.45,47 A negative PSLR at the 4-month postoperative point predicted an excellent prognosis.

**Hamstrings.** The effect of hamstrings on PSLR outcome was rarely discussed in the pre-1989 literature, with the exception of Scandinavian writers from 1920 to 1947 who attributed reproduced pain during the PSLR to a “pathologically altered muscle.”73 A number of authors suggested that PSLR restriction was the outcome of a defensive hamstring muscle reaction.26,28,35,36,44 Goeken and Hof27,28 also observed that the PSLR was unable to differentiate between limited extensibility of hamstrings (in an asymptomatic control group) and limited extensibility produced by a defense reaction to avoid nerve stretch. They noted that the symptomatic group showed electromyographic activity at lower PSLR leg elevation angles, allowing differential diagnosis if appropriate equipment was available. Hall et al35,36 supported these conclusions, reporting that radiculopathy patients showed hamstring muscle response before reporting onset of pain. Hall et al36 felt that such a hamstring defensive reaction in protecting inflamed nerve roots reflected a heightened mechanosensitivity of the nervous system.

The theory, promoting a protective role for the hamstrings should predict that any lumbar pathology characterized by irritated sciatic nerve roots would result in PSLR limitation. Lee and Yang52 reported that out of 60 patients with spondylolisthesis, 48 also had sciatica. Although the authors did not distinguish between ischemic and degenerative spondylolisthesis, the context suggested that ischemic spondylolisthesis was being discussed. Of those, only nine produced a positive PSLR, and six of these were found to have LDH. It might be suggested that low lumbar spondylolisthesis with its abnormal anatomic relationships would produce nerve root irritation, and most of the patients did indeed have sciatica. Yet relatively few of those patients demonstrated a positive PSLR. The Lee and Yang52 study would imply that sciatic nerve root irritation on its own would not be enough to trigger the protective hamstring reaction and that additional factors are required.

Diurnal variation in PSLR outcome also called into question the protective role of the hamstrings. According to Porter and Trailescu,49,69 a less-damaged disc anulus may be capable of greater rehydration during extended recumbency than one greatly damaged. The resulting diurnal variation in disc hydration had a corresponding PSLR diurnal variation. This has differential diagnosis implications, because a smaller variation would imply greater disc damage and a worse prognosis.69 It also suggested a direct link between disc pathology and PSLR limitation.

It was notable that lumbar disc surgery was found to have a direct influence on PSLR outcome. In particular, the test was of value after surgery in assessing the eventual outcome of re-operation.

**Age.** The elderly have been underrepresented in the LBP literature8 and not mentioned at all in the period of the review. Miller et al61 reported that by age 50, 97% of lumbar discs showed signs of degeneration and that this degeneration was already manifest in the age range of 11 to 19 years for males, and a decade later for females, implying that age may be an important limiting factor for the PSLR.

It seems the traditional view that the incidence of LBP
and LDH is low in the young may be open to dispute.\textsuperscript{81} Grantham\textsuperscript{30} and Fairbank et al\textsuperscript{22} had reported the prevalence of LBP in teenagers to be 26\% and 11.5\%, respectively. Paajanen et al\textsuperscript{65} identified lumbar degenerated discs in more than 50\% of 20-year-old LBP patients, Parkkola et al\textsuperscript{66} reported premature disc degeneration in teenagers, and Balagué et al\textsuperscript{3} noted a 51\% lifetime prevalence of LBP in the 12- to 17-year age group. In contrast, Turner et al\textsuperscript{81} recording their data in a pediatric orthopedic practice, found only 1\% of adolescents with nonspecific LBP. It may be that these studies are not comparable. The Turner et al\textsuperscript{81} figures had been the product, presumably, of a multistage referral process, (e.g., parents, nonspecialist medical practitioners), whereas in the other studies the data had been gathered directly, for example in educational establishments.

Mierau et al\textsuperscript{60} had noted that the 14- to 18-year age group generally had longer histories of LBP and more-restricted PSLR compared with the 6- to 13-year age group, but interestingly only male adolescents showed a correlation between LBP history and PSLR restriction. This was supported by Idota and Yoshida,\textsuperscript{42} who reported increased tension in the pelvic and leg muscles resulting from rapid skeletal growth, which was thought to reduce PSLR range. These studies are not directly comparable because Mierau et al\textsuperscript{60} did not distinguish between PSLR limitation caused by nerve root irritation and that caused by hamstring tightness. It would appear, however, that age may be a limiting factor in PSLR restriction.

**Psychosocial Factors.** The influence of psychosocial factors on PSLR outcome was not investigated in the reviewed papers.

### Discussion

This systematic review of the PSLR as a diagnostic aid for LBP (January 1989 to January 2000) reassessed the PSLR procedure, re-examined factors influencing PSLR limitation, and reconsidered implications for clinical practice. There were notable shortcomings and omissions in the reviewed studies. Of the 20 included papers, 15 used only one observer or did not stipulate the number, thus calling into question the reliability of their observations. Terms were often undefined, in particular there was confusion over differences between the PSLR, the Lasègue test, and the Lasègue sign. This made comparisons between studies less certain. The influence of psychological factors was not mentioned, even though most authors considered that the PSLR procedure depended on patient response to pain onset and that different patients responded very differently to similar physical problems.\textsuperscript{84} The probable diagnostic importance of a negative PSLR result was also ignored, a serious omission given that a negative test is diagnostically more informative than a positive one.

These matters notwithstanding, it was possible to identify trends from the reviewed papers. The basic PSLR developed little over the period, although it was apparent that ankle dorsiflexion had become the additional neural sensitizing test of choice and was considered far more effective than cervical flexion. Medial hip rotation was largely ignored, and PFI was used with the PSLR to assist in the differential diagnosis of common peroneal nerve problems. There was no consensus over either intra- or interobserver test reliability, with both being considered inadequate by some authors\textsuperscript{69} but acceptable by others.\textsuperscript{6,15,52} Although biomechanical devices were shown to improve reliability by reducing human input,\textsuperscript{27-29,34} these were not designed for routine clinical use.

The lack of reliability of the PSLR was particularly illustrated by the lack of consensus in the reviewed papers on the criteria of a positive PSLR outcome. It would seem that at a positive PSLR meant something different to nearly all the reviewed authors.

Clinical tests that have sought to identify the probable presence of LDH have generally assumed a causal link between symptomatic LDH, irritation of sciatic nerve roots, and PSLR limitation.\textsuperscript{9,10,57} It has often been assumed that the (perhaps chemically) irritated sciatic nerve root is tractioned by the flexion of the affected straight leg on the hip.\textsuperscript{23,43} This resulted in pain, in turn necessitating a limitation in leg elevation. A direct relationship between the elevation angle and the nature of the low back pathology was assumed in the diagnostic interpretation of the test outcome.\textsuperscript{9} There has also been a debate on whether the degree or location of the LDH predicted the nature of resulting pain,\textsuperscript{79} and the indications were that a central prolapse was likely to result in LBP\textsuperscript{27} and a lateral protrusion that would present primarily as sciatic pain.\textsuperscript{10}

Alternative explanations for the pathophysiology of reproduced pain during the PSLR do exist. For example, the relative influences on PSLR outcome of factors such as nerve root edema,\textsuperscript{23,34,66} intervertebral venous obstruction,\textsuperscript{43,50} and inflammatory reaction in the dural sheath are uncertain.\textsuperscript{43} It has been suggested that PSLR limitation may be the outcome of a defense reaction by the hamstrings of the affected leg acting to limit straight leg elevation to minimize further irritation of inflamed lumbar tissues.\textsuperscript{26,28,35,36,44} The precise mechanism of this link remains unknown.

Other studies noted that PSLR range decreased during periods of rapid growth in the young, irrespective of LDH.\textsuperscript{40} This was attributed more generally to increased muscular tension in pelvic and leg muscles. It may also be that gender was a further limiting factor, because adolescent males demonstrated a lower mean PSLR than adolescent females.\textsuperscript{60} Further research into patient age as a PSLR limiting factor may also be indicated, given that disc pathology in the young may be more common than previously thought\textsuperscript{1,22,30,65,66} and that little is known about LBP in the elderly.\textsuperscript{8}
One extended study reported that PSLR results at 4 months after LDH surgery was of significant assistance in predicting subsequent re-operation results. Again, this implied a direct disc-to-PSLR limitation connection, but again, the relative levels of inflammation were unknown, i.e., were the nerve roots 4 months after surgery in a similar state of inflammation before surgery? In addition, the study only reported 2-year postoperative results, and it has been suggested that one-third of recurrences requiring surgery may take place after a 4-year period. Finally, if hamstrings act to protect the damaged disc by limiting leg elevation during the PSLR, and if the test is a useful predictor of re-operation outcome, then it follows that soft tissue treatment of the hamstrings should be encouraged after lumbar disc surgery, because this predictive quality may be compromised.

The pathophysiology of sciatic pain, which provides the mechanism of the PSLR, remains unclear. Although the available evidence points to a causal link between LDH and PSLR limitation, the diagnostic value of the test in detecting the presence of LDH may, however, lie primarily in ruling out its presence, because the sensitivity of the test (0.8) is far greater than its specificity (0.4). The validity of a negative PSLR outcome was not discussed by the reviewed papers.

The PSLR is apparently simple to carry out and interpret. It is regarded as one of the diagnostic standards and is widely used. Until there is a standard procedure for carrying out and interpreting the PSLR, with known reliability and validity, researchers and clinicians should treat the test with caution. There is also a need to establish the PSLR mode-of-action, and the predictive qualities of patient age, gender, psychosocial factors, and diurnal variation.

Key Points
- There remains no standard PSLR procedure, with no consensus on interpretation of results.
- The causal link between LBP pathology and hamstring action remains unclear.
- The PSLR is effective after lumbar disc surgery in predicting re-operation outcome.
- A negative PSLR outcome may be of greater diagnostic value than a positive one.
- More research needed into the clinical use of the PSLR; its intra- and interobserver reliability; the influences of age, gender, diurnal variation, and psychosocial factors; and its predictive value in lumbar intervertebral disc surgery.

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