Is Leg Length Discrepancy Associated With the Side of Radiating Pain in Patients With a Lumbar Herniated Disc?

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Study Design. The association between leg length discrepancy and the side of the radiating pain in lumbar disc herniation was investigated in a case series.

Objectives. To investigate whether pain tends to radiate into the longer or shorter leg in patients with a lumbar herniated disc.

Summary of Background Data. No previous studies have investigated the association between leg length discrepancy and side of radiating pain in patients with a herniated disc. Results of studies of low back pain with radiation and leg length discrepancy are inconsistent concerning this association.

Methods. Of 132 consecutive patients admitted to a district hospital for surgical management of a lumbar herniated disc, leg length discrepancy was assessed using the indirect method as described by Calliet.

Results. Seventy-three patients (55%) were men, and 59 (45%) were women. The mean age was 40 years, and 99% of all herniated discs appeared at L4-L5 ($n = 60$) or L5-S1 ($n = 71$). In 64 (62%) of the 104 patients with a leg length discrepancy of 1 mm or more, the pain radiated in the shorter leg ($P = 0.02$). In subgroups of patients with larger leg length discrepancies, similar results were found but because of smaller sample sizes, these findings did not reach statistical significance. In 32 of the 57 men (56.1%), the pain radiated to the shorter leg ($P = 0.43$); this was observed in 33 of the 47 women (70.2%; $P = 0.01$).

Conclusion. The results of this study showed a statistically significant association between leg length discrepancy and the side of radiating pain in a case series of patients with lumbar herniated discs. The relation was more pronounced and statistically significant in women only. [Key words: leg length discrepancy, lumbar herniated disc, radiation of pain] *Spine* 1999;24:684-686

To date, no studies have investigated the association between leg length discrepancy and the side of radiating pain in patients with lumbar herniated discs. In this case series of patients from the departments of neurosurgery and physical therapy who had a herniated disc requiring surgical management, the association between leg length discrepancy and the side of the radiating pain was investigated.

Patients and Methods

Leg length discrepancy was assessed according to the indirect method as described by Calliet.⁴ All measurements were performed by an experienced physiotherapist (ten Brinke). Before measuring the iliac crests for levelness, a 15-cm (square) wooden block was placed between the ankles to align each heel approximately below each hip.¹¹ If the iliac crests were determined to not be level, multiple boards 2- or 3-mm-thick were placed under the short leg until they were level. The patient had to bear weight equally through both legs with knees fully extended. In a pilot study of 27 healthy individuals, the intraobserver reliability was tested. The mean difference between test and retest was 1.9 ± 2.9 mm, and the intraclass correlation coefficient was 0.86, indicating acceptable agreement.

Patients included in the study were admitted consecutively over a 4-month period to the authors' hospital (Medisch Spectrum Twente, Enschede, the Netherlands) for neurosurgical management of herniated lumbar disc. All measurements were done before discharge from the hospital, but within 2 to 7 days after lumbar disc surgery, because pain, protective scoliosis, or protective flexion can disturb the assessment. Excluded from the study were patients unable to bear weight through both legs symmetrically, which was necessary for accurate measurement of leg length discrepancy. Typically these were patients with severe pain or profound weakness in their lower limbs.

Leg length discrepancies were expressed as mean difference in mm $\pm$ SD. Binomial tests were used to determine whether there was an association between the side of the pain and leg length discrepancy. The binomial test procedure compares the observed frequencies of the pain radiating into the shorter leg and the longer leg, respectively, with the frequencies expected under a binomial distribution with a probability parameter for both groups of 0.5. To assess whether there was a relation between age and the side of the radiating pain, age was recoded into two categories: 18-39 years of age (young) and 39-77 years of age (old).

Results

Of the 132 patients included in this study, 73 (55%) were men and 99% of the herniated discs were present at L4-L5 ($n = 60$) or L5-S1 ($n = 71$). The mean age was

The association between leg length discrepancy and low back pain or sciatic pain has been a controversial subject for more than 50 years.¹² Although some authors found a significant association,^{9,12} others found a questionable one.^{13,18} Confounding factors such as different populations (age, gender, etc.), different measurement methods, and different statistical analyses might explain why this controversy still exists.

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Table 1. Frequency of Pain Radiating in the Shorter Leg for Different Levels of Leg Length Discrepancy in Lumbar Herniated Disc Patients, and P Values (Binomial Tests)

Leg Length Discrepancy (mm)	No. (%) of Patients	No. (%) of Patients With Pain Radiating in the Shorter Leg (%)	P Value
0	28 (21.2)	—	—
≥1	104 (78.8)	64 (61.5)	0.02
≥5	64 (48.5)	38 (59.4)	0.17
≥10	21 (15.9)	12 (57.1)	0.66
≥15	8 (6.1)	5 (62.5)	0.73

40 ± 11 years (range, 18–77). Because of the predefined exclusion criteria, three patients were not enrolled in the study.

In this study population, a mean leg length discrepancy of 5.4 ± 5.2 mm (range, 0–26) was found, and 104 patients (79%) had a leg length discrepancy of 1 mm or more, whereas in 28 patients both legs were of equal size. In 64 (62%) of the 104 patients with a leg length discrepancy of 1 mm or more, the pain radiated in the shorter leg ($P = 0.02$, binomial test). In subgroups of patients with larger leg length discrepancies, similar results were found, but, because of smaller sample sizes, these findings did not reach statistical significance (Table 1). In 32 of the 57 men (56.1%), the pain radiated in the shorter leg ($P = 0.43$); this was observed in 33 of the 47 women (70.2%; $P = 0.01$). However, the difference between men and women did not reach statistical significance ($P = 0.14$). No relation was found between the side of the radiating pain and age, defined as young or old ($P = 0.61$). Furthermore, no statistical interaction between gender and age categories was observed.

Discussion

In approximately 60% of all patients with a herniated disc, the pain radiated in the shorter leg, irrespective of the magnitude of the leg length discrepancy. Only in patients with a leg length discrepancy of 1 mm or more was this association statistically significant. Because of smaller numbers of patients in subgroups with larger discrepancies, similar results were not significant (Table 1). The association between the shorter leg and side of radiating pain was more pronounced and statistically significant in women only.

The finding of an association between leg length discrepancy and side of radiating pain is important, because leg length discrepancy is very common. The association between the shorter leg and the side of the radiating pain can be explained by the functional biomechanics of the lumbar disc. During bending (flexion, extension, and lateral bending), one side of the anulus is compressed while the other side is put under tensile load. On the side of the longer leg, the pelvis will be slightly elevated, resulting in lateral bending and a smaller disc interspace, whereas on the side of the shorter leg, the disc interspace will be increased. Given time, this might cause pathologic problems (protrusion) on the side of the shorter leg.

The validity of the clinical measurement of leg length discrepancy is important when studying these associations. In several studies, the authors consider the indirect clinical measurement superior to the direct clinical measurement (tape) of leg length.^{5,7–11} The authors of some studies state that the indirect clinical measurement does not significantly differ from the radiographic method,^{1,7,19} whereas others regard this indirect measurement as inaccurate and highly imprecise.^{5,8,10,16} Although the authors of the current report demonstrated in the pilot study that the intraobserver reliability of the indirect measurement was acceptable, others have found poor intra- or interobserver reliability,^{5,8,17} and sometimes data were not available or reliability was not tested at all. Furthermore, it is reported that as leg length discrepancy increases, the validity of the measurement also increases.^{2–4,6} In most populations, however, only 20–30% of all subjects have a leg length discrepancy of 10 mm or more,^{12,13} which can be detected validly.^{4,14,15} For the practitioner, a difference of 10 mm or greater is clinically important, because this might be related to the patient's musculoskeletal symptoms (the mean leg length discrepancy of a healthy population is 5.5 ± 4.1 mm¹³).

Friberg¹⁰ regards the measurement as highly imprecise when the observer has to express the discrepancy in mm, but when the observer only has to decide which leg is longer or shorter, he found that 87% of all observations were valid. This strengthens the findings of the current study, because in this study the aim was only to determine which was the longer or shorter leg.

Conclusion

This study showed a statistically significant association between leg length discrepancy and the side of radiating pain in a case series of patients with lumbar herniated discs. The association was more pronounced and statistically significant in women only.

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