LEG LENGTH INEQUALITY AND THE SIDE OF LOW BACK PAIN

A Pilot Study

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Abstract:
OBJECTIVE The objective of this paper is to investigate if there is a relationship between the side of leg length inequality (LLI) and the side of low back pain (LBP).

DESIGN Carefully standardised radiographic technique as described by Giles (1,2) and reviewed by Rock (3) was utilised to evaluate LLI in individuals who presented for assessment of LBP. Age, sex and the side of LBP were extracted from patient records. The side of LBP was determined by marking a pain diagram, taking the form of a body outline, included in the patient questionnaires. These findings were examined to reveal any relationship between the side of LLI and the side of LBP.

SETTING The study was conducted in a private chiropractic practice.

PARTICIPANTS From January 1993 to September 1993 all patients presenting for chiropractic assessment of LBP where included. Patients whose history revealed relevant trauma, surgery or whose radiographic examination showed anomaly or pathology, likely to confound results, were excluded from the study.

RESULTS AND CONCLUSION A relationship has been demonstrated between the LLI side and the side of LBP. The broad age range of subjects may well have been a confounding factor in this study. Re-analysis of the sample of patients aged 34 years or less demonstrated that the LBP side is most commonly opposite the side of LLI.

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INTRODUCTION AND LITERATURE REVIEW

Before data collection clinical observation had demonstrated a relationship in which the side of low back pain (LBP) would more commonly be opposite the side leg length inequality (LLI).

LBP is a common complaint that affects 88% of people and is our most expensive disease (4-6), but frequently the cause remains unknown. Controversy continues as to which pathologic or radiological abnormalities may be of significance in LBP. Using radiological criteria (5,7-11), etiologic groupings of conditions thought to cause LBP do not mention whether LLI was taken into account when evaluating LBP. This oversight appears to ignore an important external factor which may affect the lumbar spine and pelvis by influencing biomechanical function.

LLI has fascinated many researchers and has been the subject of much investigation. The vast majority of patients with LLI have no known etiology for this inequality. There has been a wealth of material published on the topic and the implications of LLI remain controversial at the very least. Much of the controversy has revolved around accurate determination of LLI. In reviewing these papers it became apparent that the most accurate and reproducible measurements were those obtained using erect radiographic techniques (1,2,3,12,13).

A study by Giles (14) using these techniques showed greater prevalence of LLI in LBP patients compared with controls. Studies by Rush (15) Stoddard (16) and Giles (17) reported a relationship between LLI, scoliosis and LBP. Nichols (18) found that 22% of airmen with LBP had LLI versus 7% in the control group. Clarke (19) suggests that the portion of life during which an individual has had symptoms of back pain increases with LLI. These studies suggest strong evidence of the importance of LLI as an etiologic factor in LBP. A preliminary study by Lawrence (20) side with up to 6mm LLI, and to the long leg side with over 6mm LLI. Giles (1) described structural changes in the lumbar spine of low back pain patients with LLI (without correlation to symptoms) demonstrating that asymmetrical loading could be a causative factor in the pathology of LBP.

There are studies that show no correlation between LLI and LBP. Hult (21) found no association with LLI up to 3.72cm. Papaioannou (22) found that 6 of 23 subjects with LLI had a structural scoliosis; none complained of LBP or had radiographic evidence of degenerative joint disease. In a study of LLI in marathon runners, Gross (23) drew the conclusion that less than 2.5cm 'did not appear to have a deleterious effect on function in marathon runners, nor was a lift effective for them'. This conclusion may not have considered that a running gait does not include a phase were both feet are on the ground. It should also be noted that these studies relied on measurement in a static supine position, none used reliable erect radiographic techniques (2,3,13) for determination of LLI.

MATERIALS AND METHODS

Antero-posterior (AP) and lateral (Lat) erect posture radiographs (in bare feet) were taken of patients presenting for chiropractic assessment of LBP.

The radiographic technique used for assessment of LLI was based on the method described by Giles and Taylor (16) and modified by Rock (3) using a footplate fixed horizontally to the floor in front of the bucky. A pair of parallel lines were drawn on the footplate perpendicular to the bucky, 14cm apart, and equidistant from the centre line of the bucky. The patient's feet were placed just outside these lines so that each heel was approximately below the ipsilateral femoral head. In this position the shape of a parallelogram is most closely approximated by the position of the patient's heels and acetubulae.

A radio-opaque fluid level in the form of a mercury manometer is attached to the front of the bucky to produce a horizontal reference point on the exposed radiograph. The bucky is positioned vertically so that its inferior edge is below the ischial tuberosities (located by palpation). The central ray is directed horizontally, at a Focal to Film Distance (FFD) of 200cm, to the centre of the bucky. This places the horizontal central ray approximately 9cm above the femoral head height.

The patient is positioned with the feet parallel, just outside the line on the footplate, with straight knees, ensuring weight bearing through the heels and lightly revealed a shift of axial weight bearing to the short leg leaning against the bucky. A compression binder is used to stabilise the patient and is tightened bilaterally.

On the radiographs, lines are drawn using a parallel ruler, from the horizontal reference point to the top of each femoral head. The vertical difference between these two lines is measured and recorded as the LLI.

The patient's age, sex and side of pain were tabulated from patient records (table 1). The side of pain was derived from a pain drawing, completed by the patient, on a body outline included in the new patient questionnaire (appendix 1). This was confirmed by asking the patient to indicate with their hand the site of pain, and reconfirmed by asking whether the pain they were indicating was more on the left, more on the right or both sides evenly (central).

RELIABILITY OF METHOD

A procedural reliability trial was not deemed necessary. Patient positioning was identical to, and radiograph measuring techniques were similar to those used by Rock (3) who reported a reliability mean error of 0.63mm with a standard deviation 0.48mm.

RESULTS

The patient age, gender and side of pain are shown in Table 7.

The number of subjects totalled 53 and comprised 29 males and 24 females. Their ages ranged from 16 to 62 years, with a mean of 35.68 years and standard deviation of 12.25 years.

LLI ranged from 1 to 14.5mm with a mean of 5.53mm and standard deviation of 3.24mm. LLI of 5-9mm was found in 20 (37.7%) of the patients, and there was a difference of greater than 9mm in 7 (13.2%) of the patients. This compares favourably with Rock (3) whose sample showed 5-9mm LLI in 38.5% and greater than 9mm LLI in 10.9%.

TABLE 1 Sex, side of LLI

	LEFT	RIGHT	TOTALS
Male	20	9	29
Female	14	10	24
TOTALS	34	19	53

TABLE 2 Sex, side of pain

	LEFT	CENTRE	RIGHT	TOTALS
Male	7	9	13	29
Female	8	8	8	24
TOTALS	15	17	21	53

TABLE 3 LLI side, side of pain

	LEFT	CENTRE	RIGHT	TOTALS
Male	7	11	16	34
Female	8	6	5	19
TOTALS	15	17	21	53

TABLE 4 Summary Table for LLI side, side of pain

Chi Square	3.32
Chi Square P-Value	0.19
G-Squared	3.31
G-Squared P-Value	0.19

TABLE 5 LLI side, side of pain (0-34yrs)

	LEFT	CENTRE	RIGHT	TOTALS
LEFT	2	5	11	8
RIGHT	6	3	2	11
TOTALS	8	8	13	29

TABLE 6 Summary for LLI side, side of pain (0-34yrs)

Chi Square	7.48
Chi Square P-Value	0.02
G-Squared	7.75
G-Squared P-Value	0.02

DISCUSSION AND CONCLUSION

Contingency tables were drawn for observed frequencies of sex/side of LLI (table 1), sex/side of pain (table 2) and LLI side/side of pain (table 3). Table 1 shows a bias for left LLI with table 2 showing a bias for right side of pain. The data in table 3 are numerically too close to show statistical significance.

The mixture of quantitative (LLI) and ordinal (side of pain) parameters necessitated the use of the Kruskal Wallis one way analysis of variance. Table 4 reveals a Chi Squared P-Value of 0.19. To be statistically relevant this value should be under 0.05. In the sample taken there was no statistically relevant association between side of LLI and side of low back pain.

After studying the raw data age seems to be a confounding factor. Bearing this in mind and at the risk of 'data dredging', a Contingency table (table 5) for LLI side, and side of pain was again prepared, this time after excluding the results of all subjects 35 years of age or over. The association between LLI and side of pain was much stronger in this younger group than the full sample. Kruskal Wallis analysis giving a P-Value of 0.02 (Table 6).

CASE	AGE	SEX	SIDE	LLI	SIDE of PAIN
1	31	M	R	5.5	R
2	47	M	L	5.5	R
3	57	M	L	4	C
4	49	F	R	1	L
5	28	M	R	4	L
6	47	M	L	9	L
9	25	M	L	3	R
8	42	M	L	14.5	C
9	45	M	L	3	L
10	32	F	R	1.5	L
11	19	F	L	11	R
12	58	F	L	11	R
13	44	M	L	2	R
14	27	M	R	9	L
15	22	M	R	8	C
16	55	M	R	3	C
17	53	M	R	5	L
18	45	M	L	7.4	C
19	41	F	R	1	R
20	57	M	R	4.5	R
21	17	F	L	2.5	C
22	32	M	L	10	R
23	31	M	R	8	L
24	25	M	L	11.5	R
25	62	F	L	7	R
26	48	F	L	8	R
27	23	F	R	1	L
28	46	M	R	3.5	R
29	42	M	L	3	L
30	38	M	L	5	C
31	21	F	L	2	R
32	22	F	R	8	C
33	41	F	R	5	C
34	27	F	L	5.5	R
35	22	F	R	4	L
36	52	F	L	3.5	L
37	33	F	L	5	C
38	19	F	R	3.5	C
39	25	F	L	4	L
40	39	F	L	7.5	C
41	38	F	R	1	C
42	22	M	L	2	C
43	32	M	L	8.5	C
44	18	M	R	5	R
45	33	F	L	5.5	C
46	25	M	L	4	R
47	29	M	L	4.5	R
48	34	M	L	10	R
49	35	F	L	4	L
50	32	F	R	4.5	L
51	39	M	L	12.5	C
52	29	F	L	3	R
53	16	M	L	8	R

TABLE 7 Results as recorded

LLI has long been considered to be a factor in LBP, but without conclusive proof. Age, or rather the effect of ageing has also been considered to be a factor in LBP, again without conclusive proof. In the design of this pilot study the effect of ageing was overlooked. A further study of a larger sample whose subjects are restricted to a younger age group (whose possible range could be 1-34 years) may well demonstrate a stronger relationship between LLI side and side of LBP. Further investigation of lumbo-pelvic biomechanics and LBP may then be carried out armed with the knowledge that LLI is a factor in LBP.

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