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Iatrogenic leg length inequality may cause low back pain due to scoliosis

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Abstract

The aim of this manuscript is to discuss iatrogenic leg length inequality as an aetiologic factor of degenerative scoliosis and low back pain. Iatrogenic type leg length inequality prevalence is getting higher recently, because of increasing number of hip and knee surgery parallel to the increasing number of elder people in population. We presented four cases, who had low back pain due to degenerative scoliosis caused by leg length inequality. Case 1, 2 and 3 were elder people who had previous knee or hip surgery. Case 4 was a young lady who had low back pain due to degenerative scoliosis and leg length inequality and she had no previous surgery. In Case 1, 2 and 3, leg length inequality was iatrogenic type which was caused by hip or knee surgery. This iatrogenic leg length inequality caused degenerative scoliosis same as in case 4, who had anatomical leg length inequality. Iatrogenic leg length inequality may cause degenerative scoliosis, thus low back pain. Scoliosis caused by leg length inequality cannot be compensated by elder people or even young people whose abdominal muscles week.

Keywords: leg length inequality, leg length discrepancy, iatrogenic, degenerative scoliosis, low back pain

1. Introduction

Low back pain is one of the most important medical condition that causes disability. Up to 84% of population suffer from it during their life time (1). Its financial dimension is also big problem for governments (2-5). The causes of low back pain are mainly degenerative diseases of spine, musculoskeletal disorders, lower extremity joint diseases (hip-knee).

Several authors have suggested that leg length inequality also may cause low back pain and it may occur after hip or knee surgery (6-9). This iatrogenic type of leg length inequality prevalence is getting higher recently, because of increasing number of hip and knee surgery parallel to the increasing number of elder people in population.

Recently we also realized that more people, who had previous hip or knee surgery, have been admitting to our clinic with the complaint of low back pain. This was our starting point for this manuscript.

2. Material and Methods

We selected to present four cases among patients who had low back pain and had previous hip or knee surgery.

2.1. Case 1

Seventy-three years old female patient admitted to our department with the complaint of low back pain and weakness on her lower extremity. She had been suffering from low back pain for 15 years, but ten days ago it became unbearable, and her lower extremities lost their strength. In her neurological examination there was 80% loss on distal parts and 60% loss on proximal parts of lower extremity bilaterally. Laseque sign was negative. We noticed that her left leg was 4 cm shorter than the right leg probably due to right knee arthroplasty which was performed one year ago. In her radiological investigation there were severe degenerative changes and scoliosis concave to the right side (Fig. 1). We thought that it was a rigid deformity, so we performed only L3 and L4 laminectomy and foraminotomies. Her pain complaint resolved but weakness on her lower extremities did not improve so much.

2.2. Case 2

Sixty-four years old female patient who had left knee arthroplasty 17 years ago and right knee arthroplasty 5 years ago, admitted to our department with the complaint of low back pain and neurological claudication. Her low back pain was increasing while she was standing. She feels more comfortable while she was sitting or bending. In her examination there was no motor deficit or laseque sign, but her left leg was 2 cm shorter than the other. In her radiological examination there were severe degeneration and scoliosis concave to the right side (Fig. 2). We performed left L2, L4 hemilaminotomy, bilateral L3 hemilaminotomy and foraminotomies. We corrected her leg length inequality with a shoe insert. She had no more low back pain and claudication after surgery.

2.3. Case 3

Sixty-two years old female patient who had surgery two times for lumbar discectomy admitted to our department with the complaint of severe low back pain. She had no leg pain. She

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had also right knee arthroplasty. In her neurological examination there was no motor deficit. In her radiological examination there were L3 total laminectomy, L4 partial laminectomy from upper part and, scoliosis concave to the right side (Fig. 3). We noticed that her left leg was shorter than the right side probably due to previous knee arthroplasty. We corrected it with shoe insert. But her pain persisted. We performed L2, L3, L4 transpedicular fixation and decompression. After the surgery there was no low back pain and neurological defisit. She continued to use shoe insert after surgery.

Fig. 1. Severe degenerative changes and scoliosis concave to the right side

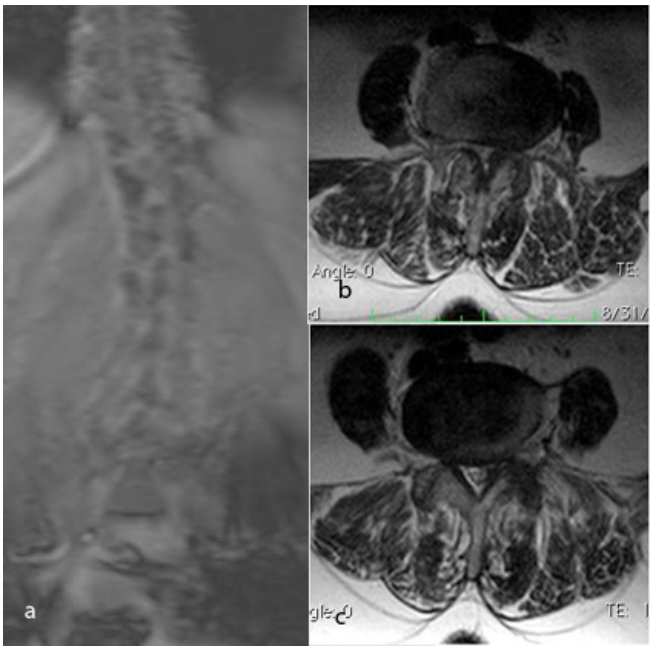

Fig. 2. a- Scoliosis, b- and c- lumbar stenosis

Fig. 3. a- Scoliosis, b- laminectomy defects due to previous surgery

Fig. 4. Scoliosis concave to the right side

2.4. Case 4

Twenty-eight years old female patient had low back and left leg pain. Her complaint increased after her second birth. There was no motor deficit or root sign in her neurological examination. Her left leg was 6 cm shorter than right side. There was pain on her left hip with movement. In her radiological examination there was scoliosis concave to the right side (figure 4). We corrected her leg inequality with shoe insert and, we recommended her lumbar isometric exercises. After five months of exercise, she said her complaints remain same. We recommended her surgery and corrected her scoliosis with T12-L5 transpedicular instrumentation. After surgery there was no complaint of low back or leg pain and she continued to use shoe insert.

3. Discussion

Changes in lumbar lordosis and sacral inclination have been described in patients with mechanical low back pain, degenerative lumbar disc disease, scoliosis and lumbar surgery. Low back pain has close relationship with mechanical factors. It has been very well known that changes in lumbar lordosis and sacral inclination may cause low back pain (10). Increase in lumbar lordosis makes sacral inclination angle wider. It has been shown that lumbar lordosis and sacral inclination were also related to the hip extension. This is described as hip-spine syndrome by Offiersky et al. (11). In this situation if hip has flexion deformity, this will end up with loss of lumbar lordosis.

Similarly degenerative changes in knee often cause limitation of extension. Murata et al showed that there was a positive correlation between the knee angle and lumbar lordosis. Limitation of knee extension led to loss of lumbar lordosis. Murata et al called it "knee-spine syndrome" (12).

Skeletal system has to be in good balance. It always try to maintain the line of the center of gravity within the base of support. If the balance impairs in one part, it has to be compensated by another part. If the problem becomes chronic then the compensation mechanisms cause degeneration. Knee-spine syndrome or hip spine syndrome are the results of this rule in sagittal plane.

Either in hip-spine syndrome or in knee-spine syndrome intradiscal pressure is increased due to loss of lumbar lordosis. Increased intradiscal pressure may cause low back pain.

Leg length inequality also effects biomechanical characteristics of spine and pelvis in coronal plane. Leg length inequality or anisomelia is a bilateral asymmetry in lower limb lengths. There are two types of leg length inequality: anatomical and functional (13, 14).

In anatomical short leg, bony components of the lower limb are actually different in length. In this type of leg length inequality anterior and posterior iliac spines are lower on the side of the short leg (15). In functional short leg, main cause is pelvic rotation caused by scoliosis or joint contractures. In this type, posterior iliac spine higher on short leg side while anterior iliac spine is higher on the long leg side. Some writers describe a third type; environmental leg length inequality (16). This type mainly caused by drainage slopes built into roads and effect road runners.

Relationship between leg length inequality and low back pain is controversial. According to the some publications there are no relationship between low back pain and presence of leg length inequality (17, 18), while some others advocate that low back pain prevalence is higher among individuals who have leg length inequality (6, 7).

According to the advocators of leg length inequality-low back pain relationship, leg length inequality may cause scoliosis. Scoliosis is the lateral bending of spinal column. It can be classified as functional and structural (19). Functional scoliosis is a transient phenomenon which is related to the biomechanical changes in spinal column, pelvis and lower extremities. Pelvic tilt is the first step for leg length inequality induced scoliosis. Body try to maintain the line of the center of gravity within the base of support by pelvic tilting and related functional scoliosis. The degree of scoliosis depends on the magnitude of the leg length inequality (20). In a scoliotic patient, spinal column is concave to the longer leg side. This concavity causes a compression on the annulus of the intervertebral disc, thus patients suffer from low back pain and sciatica on concave side. Latz et al found alterations of glycosaminoglycan content in intervertebral discs of patients with leg length discrepancy (21). Balik et al suggest that abnormal loading due to leg length inequality may cause to lumbar disc herniation, so low back pain (22).

Although there is a relationship between the degree of scoliosis and leg length inequality, it has been reported that there is no close relation between the degree of the scoliosis and severity of the back pain (14). There are some interesting publications in the literature. For example, Nourbakhsh et al evaluated the relationship between low back pain and 17 different mechanical factor in 600 patient at the age of 43 ± 15 (23). According to their publication endurance of the back extensor muscles had the highest association with low back pain. Length of the back extensor muscles, and the strength of the hip flexor, hip adductor, and abdominal muscles also had a significant association with low back pain. They couldn't find any correlation with low back pain and degree of pelvic tilt and lumbar lordosis, leg length inequality, length of hamstrings, iliopsoas and abdominal muscles. There is a dilemma here. For low back pain, are these structural changes predictive factors or consequences?

This knowledge makes us think an alternative hypothesis. According to this hypothesis extremity inequality which has begun from the early time of life may not be the cause or the result of low back pain. Body can compensate these structural faults. But if structural changes occur at the elderly, it may cause low back pain. Studies have shown that fat mass increases and muscle mass decreases with age (24). Abdominal muscles are weaker in elder people. Because of this, they cannot compensate new structural changes.

When we look at the case 1-3 from this point of view, these elder people have not any complaint of low back pain until certain age. They have all knee or hip surgery and have leg length inequality. They have complaints related to the scoliosis. It is difficult to discriminate whether the scoliosis is structural or functional related to leg length inequality. How much does leg length inequality contribute on scoliosis formation? If they hadn't leg length inequality, would they have such a severe scoliosis or degeneration?

We can find our answers partly on case 4. She is a young person who have severe degenerative scoliosis. In a young

person, such a severe degeneration can only occur if there is a balance problem on spinal column. There is only leg length inequality in our hands for the explanation of scoliosis. This young woman couldn't compensate the scoliosis formation probably because of her abdominal muscle weakness due to two childbirth.

Another point for patients who have scoliosis is that leg length measurement must be routine in their physical examination. Sometimes a simple shoe insertion may be enough to relieve pain without surgery.

We can explain scoliosis formation on cases 1-3 with the leg length inequality due to knee or hip surgery. This means iatrogenic leg length inequality may cause degenerative scoliosis. Balik et al suggested the relation between leg length inequality and lumbar disc herniation. They did not give any information about the causes of leg length inequality of their patients (22). According to our knowledge there is no publication about degenerative scoliosis related to iatrogenic leg length inequality.

Iatrogenic leg length inequality may occur after hip or knee surgery. There are several publications which mention this problem (9, 25-30). As the expected lifetime gets higher in population, more people need hip or knee surgery and people who have leg length inequality due to hip or spine surgery have increased. This iatrogenic type of leg length inequality can be classified separately instead of inside the anatomical group.

Leg length inequality is also common problem among people who uses prosthesis due to lower limb amputation. According to Friberg's study only 15% of 113 Finnish war-disabled amputees have acceptable prosthesis and these people have chronic pain symptoms of low back, hip and knee correlated significantly with the lateral asymmetry caused by incorrect length of the prosthesis (31). Unilateral sciatica or chronic hip pain occurred mainly on the long leg side independently of the side of amputation. In these patients, leg length inequality causes pelvic tilt and functional scoliosis. According to Friberg these compensation mechanisms have predisposing role in the etiology of chronic low back and hip pain symptoms. If these veteran soldiers who must have had strong muscles cannot compensate scoliosis due to leg length inequality, this means it is more difficult for elder people whose muscles are weaker.

Another point is that leg length inequality can be seen in normal population too. According to the Gofton et al 7% of the asymptomatic adult population has a leg length inequality greater than 12 mm (32). If the difference is greater than 11 mm, symptoms usually begin (33). Some publications suggested that modified shoes or shoe inserts are useful in treatment of mild leg length inequality (34, 35). Sometimes attractive view of the scoliosis may mislead our attention to the spinal column in a patient who have scoliosis and leg length inequality at the same time. Such a misdiagnosis may lead doctor and patient easily to an unnecessary surgery instead of simple solution like prescribing a shoe insert. Measuring leg length must be routine in neurosurgical examination for the patients with low back pain.

Leg length inequality is one of the causes of low back pain and degenerative scoliosis. Iatrogenic leg length inequality due to hip or knee surgery also may cause low back pain and degenerative scoliosis or worsen existing complaints. According to best of our knowledge there is no publication in English literature suggesting relation between iatrogenic leg length inequality and degenerative scoliosis related low back pain. Young people can compensate it but elder people and women whose abdominal muscles are weak due to high number of births cannot compensate such an impairment because of muscle weakness. Evaluation of leg length must be a part of neurosurgical examination especially for patients who have scoliosis. Leg length inequality which become more prominent after scoliosis surgery can be corrected by using shoe inserts.

Conflict of interest

The authors declare that there is no conflict of interest.

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None to declare.

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