The Incidence of Osteoarthritis of the Knees in Hemiplegic Patients

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ABSTRACT

The purpose of this study was to investigate the incidence of osteoarthritis (OA) of the knees in hemiplegic patients after one year from the stroke. Twenty male and female hemiplegic patients due to cerebrovascular accident (CVA) participated in this study. Their mean age was 49.8 years ±5.28 and their mean duration of illness was 17.84 months ±3.77. From the past history, all patients reported normal knee joints before the stroke. Plain A-P X-rays were done to calculate the differences between the affected and the non affected side, in relation to the joint spaces of the medial and lateral condyles, and the mechanical axises of both knees (the angle between the longitudinal axises of femur and tibia). The results of this study showed that there were a significant differences between the affected and the non affected side in relation to joint spaces with OA findings and a decrease in joint spaces on the non affected knee joints. Also there were a significant differences between the affected and the non affected mechanical axises of both sides with increase in the valgus angle of the affected side. This means that, the patient with hemiplegia may be suffering from OA of both knees after one year from the onset of stroke, so we have to plan a protective physical therapy program for that patient.

INTRODUCTION

Patient with stroke constitute a large portion of the adult population treated by physical therapy in rehabilitation centers. Impairment in the ability to walk is one of the main functional problems that physical therapists encounter in caring for neurologically impaired patients.

In this study we tried to show the incidence of osteoarthritis of the knees in hemiplegic patients after one year from the onset of stroke. Osteoarthritis is generally accepted to be mechanically mediated disease process that has well-defined biomechanical, metabolic, and histologic manifestations[3]. Osteoarthritis is a degenerative articular condition characterized by deterioration of the cartilaginous weight bearing surfaces of joints, presence of sclerotic changes in subchondral bone, and proliferation of new bone at the joint margins. The proliferation of new bone is manifested as osteophytes and spurs, which evident on radiographs. Osteoarthritis is a localized phenomenon affecting joints that are frequently subjected to excessive external forces and to musculoskeletal overuse, especially the knee[8].

A patient with OA presents with a condition of general joint pain, which may be exacerbated by knee motion; a reduction in the normal knee joint range of motion; Quadriceps

muscle weakness; and generally diminished functional capacity[8].

A most important guide to normal anatomy is the "leg alignment" radiograph. In the long AP picture, which shows the whole lower limb on one film, the centers of the femoral head, knee, and ankle should be in a straight line. This does not mean that the shafts of the femur and the tibia are themselves in line. The femoral neck makes an angle with the femoral shaft, this offset means that the femoral shaft joins the tibia at the knee at an average angle of 7°. Against all expectations, we have not been able to show that there is a significant difference between adult male and female subjects in this measurements, nor does the subject's height make any difference. This line is called the "mechanical axis" fig (1)[5]. Also, figure (2 a & b) is an X-ray for left and right knees of one of the patients with right hemiplegia illustrating the mechanical axis of both femur and tibia. The critical significance of these angles for the health of the knee is emphasized by the fact that if either the angle between the femoral and tibial shafts (i.e., 7°) or that between the tibial plateau and the tibial shaft (i.e., 90°) varies by as little as 4o the line of action of the body weight can be moved from its optimum position to the outer or inner thirds of the joint, whilst a variation of 10° can put the line of action of the body weight beyond the articular surface[4]. Such malalignments will cause significant increases in the compressive stresses encountered by the bones on the concave side of the joint and in the tensile stresses encountered by the ligaments on the convex side[6].

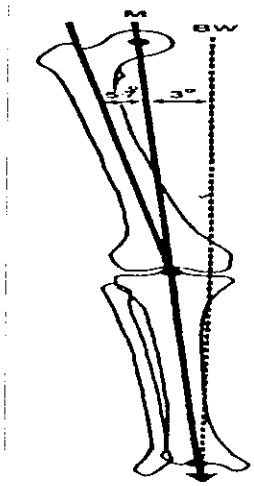

Fig. (1): A diagram to show the mechanical axis of femur and tibia (M), the plane of the knee, and the line of action of the body weight (BW) in one leg stance.

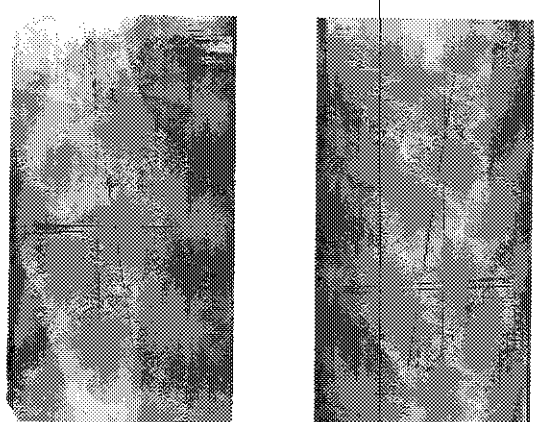

Fig. (2 a,b): (A) Mechanical axis of left lower limb. (B) Mechanical axis of right lower limb. Both A & B for right hemiplegic patient.

MATERIAL AND METHODS

Subjects:

Twenty male and female hemiplegic patients due to cerebrovascular accident (CVA) participated in this study. Their age ranged from 40 to 57 years old. Their duration of illness ranged from one to two years. From the past history, all the patients reported normal knee joints before the stroke.

Instrumentation:

- Plain X-ray apparatus: All X- rays were evaluated by the same designated investigator.
- Ruler: Used to measure joint's spaces.
- Angle rule: Used to measure the angle between the longitudinal axises of femur and tibia.

Procedures:

All the patients were subjected to A-P plain X-rays of both knees from standing erect position with feet together and their arms at their sides. For all hemiplegic patients joint's spaces, which represents the vertical distance (in millimeters) from the central points in the medial and lateral condyles of the tibia and femur were measured for both the affected and the non affected knees. Also for all patients the angle between the longitudinal axises of femur and tibia were measured for both the affected and the non-affected sides.

Statistical analysis:

Student s t-test was done to determine the significant difference between the affected and non affected knees at the level of P 0.01.

RESULTS

The results of this study showed the following. Table (1) presents the vital data of the hemiplegic patients. Table (2) and fig (3) showed the mean and SD of the valgus angle, the joint spaces of the medial and lateral condyles, and the significance of the results. The mean valgus angle of the affected lower limb was 8.2°±1.7°, while the mean valgus angle of the non affected lower limb was 6.05°±1.05°. There was a significant differences between the affected and non affected sides 2.15°, with low probability of error. The mean joint space of the medial condyle of the affected lower limb was 3.4±0.82 mm, while the mean joint space of the medial condyle of the non affected lower limb was 1.95±1.23 mm. There was a significant differences between the affected and non affected sides 1.45 mm, with low probability of error. The mean joint space of the lateral condyle of the affected lower limb was 5.05±0.83 mm, while the mean joint space of the lateral condyle of the non affected lower limb was 3.85±0.99 mm. There was a significant differences between the affected and non affected sides 1.2 mm, with low probability of error.

Table (1): Vital data of hemiplegic patients.

Parameters	Min.	Max.	Mean	SD
Age (years)	40	57	49.35	5.59
Weight (Kgs)	66	90	75.15	6.69
Height (cms)	165	174	169.05	2.78
Duration of illness (months)	12	24	18.3	3.63

Table (2): Comparison between the affected and the non-affected sides in relation to valgus angles, and joint spaces in hemiplegic patients and the significance of the results.

Parameters	Affected		Non-Affected		Difference	Significancy	
	X	SD	X	SD	X	T	P
Valgus Angle	8.2	±1.7	6.05	±1.05	2.15	4.80	< 0.0001
Joint Space (mm) medial condyle	3.4	±0.82	1.95	±1.23	1.45	4.38	< 0.0001
Joint Space (mm)	5.05	±0.83	3.85	±0.99	1.2	4.17	<0.0002

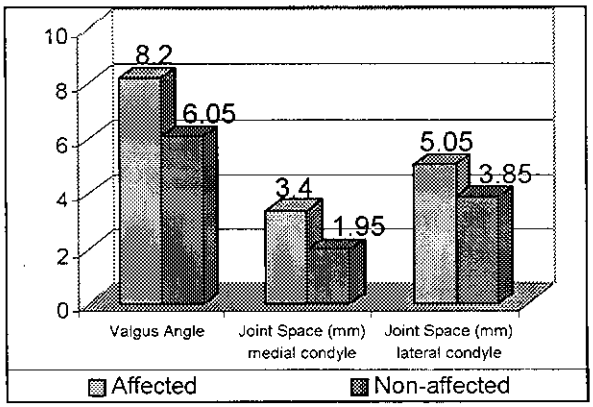

Fig. (3): Changes in the valgus angle and joint spaces.

DISCUSSION

During the stance portion of the walking cycle, the hemiplegic patient typically demonstrated relatively limited weight transfer to the paretic limb11. The limb loading asymmetry and difficulties with actively redistributing weight support while standing have been considered major contributors to disordered hemiplegic gait[10]. The elimination of weight bearing and / or restriction of joint movement results in cartilage degeneration or atrophy[7]. Measurements of cartilage thickness confirmed that unweighting without immobilization resulted in a decrease in the thickness of the uncalcified cartilage layer of the knee joint of male rats while unweighting with cast immobilization did not[9].

The knee is affected by osteoarthritis more often than any other joint. It is caused by wear and tear, but nearly always some factor is present that has caused the joint to wear out sooner than usual. While overweight is the commonest factor, but there are some reasons seems to impose a harmful stress upon the knee, whereas it does not adversely affect the hip or ankle. There are other important predisposing factors, one of them is malalignment of the femur on the tibia[1].

When arthritic subjects were compared with healthy subjects, the arthritic subjects had lower rates and range of knee motion. These differences are believed to be a result of both the reduced gait velocity and pathological processes involved with the knee[2]. Therapeutic exercise programs, delivered by physiotherapist to hemiplegic patients, should stress balance reeducation, including shifting weight through the affected leg in standing, as a means to improve the gait pattern[12].

In this study, the patients with hemiplegia may be suffering from OA of both knees after one year from the onset of stroke, due to increases the compressive stresses encountered by the bones on the concave side of the joint, and in the tensile stresses encountered by the ligaments on the convex side of the affected leg. In addition to that the tendency of hemiplegic patients to put too much weight on the non affected side, which consider one of the commonest factor, to impose a harmful stress upon the knee joint. Also this study showed that hemiplegic patients may be suffering from osteoarthritis of both knees due to mal-alignment of the joint axis and improper weight distribution between the affected and the non affected knees.

CONCLUSION

These results may give us attention to prevent theses complication of osteoarthritis of the knees in hemiplegic patients. Also a better understanding of how articular cartilage health is influenced by changes in movement and joint loading which underlies the development of effective treatment interventions (such as exercise and joint mobilization) that are intended maximize joint function.

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الملخص العربي

مدى حدوث التهابات مفصل الركبة في مرضى الشلل النصفي الطولي

كان الهدف من هذه الدراسة هو التحقق من مدى حدوث التهابات بمفصلي الركبة لمريض الشلل النصفي الطولي بعد سنة من الإصابة بالجلطة. لذا تم اختيار عشرون مريضا من الجنسين لإجراء هذه الدراسة، كان متوسط أعمارهم ٤٩,٨ سنه، وكذلك متوسط فترة مرضهم كانت ١٧,٨٤ شهرا، قبل المرض كان المرضى يتمتعون بمفصلي ركبة طبيعيين. تم عمل أشعة عادية (منظر أمامي خلفي) لمفصلي الركبة المصابة وغير المصابة لجميع المرضى، حتى يمكن حساب مساحة كل مفصل عند كل من اللقمة الخارجية والداخلية للمفصل وكذلك المحور الميكانيكي لكلا الركبتين (الزاوية بين المحور الطولي لكل من عظمتي الفخذ والساق) ، ثم حساب الفرق بين الركبتين المصابة وغير المصابة بخصوص مساحة الفصل، المحور الميكانيكي للركبتين. أظهرت نتائج هذه الدراسة وجود فرق جوهري في : مساحة مفصل الركبة حيث وجد نقص في مساحة مفصل الركبة غير المصابة عن المصابة، وكذلك وجد زيادة في زاوية تقوس الساقين الخاصة بالركبة المصابة عن غير المصابة، وهذا يعنى أن مريض الشلل النصفي الطولي يمكن أن يعانى من التهابات بمفصلي الركبة بعد سنه من الإصابة ، لذا يجب وضع برنامج علاج طبيعي وقائي لهذا المريض.