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ORIGINAL STUDY

Outcome of pelvic support osteotomy with the Ilizarov method in the treatment of the unstable hip joint

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Instability of the hip joint in the young adult is a difficult problem. Patients with an unstable hip secondary to any aetiology usually have loss of bone from the proximal femur or shortening of the limb or both. In this study we report our results in the treatment of the unstable hip joint in young adults by pelvic support osteotomy using the Ilizarov method.
From 1997 to 2004, 25 patients (17 females and 8 males) with an unstable hip joint were treated in the Orthopaedic department of Mansoura University Hospital, Egypt. Their mean age was 22.4 years (range : 19 to 35). The main complaints were pain, leg length discrepancy, limping, and limited abduction of the hip.
All patients underwent valgus extension osteotomy in the proximal femur and distal femoral osteotomy for lengthening.
The average follow-up ranged from 2 to 7 years. All hips were pain free at follow-up. The Trendelenburg sign became negative in 20 patients. There was no limb length discrepancy and alignments of the extremity were re-established. Five patients had a lurch gait.
Valgus extension osteotomy has provided stability of the hip joint and maintained some motion of the hip joint. By using the Ilizarov technique, we could prevent the valgus effects created by the valgus extension osteotomy while achieving lengthening of the femur through the distal osteotomy in the femur.

Key words : hip joint ; instability ; pelvic support osteotomy.

INTRODUCTION

The two main complaints in patients with an unstable hip joint are pain and leg length inequality. Leg length inequality associated with a unilateral unstable hip usually results in shorter step length, lower pelvis, a lateral shift of the ground reaction force, decreased maximum adduction moments of the hip and knee on the affected side, and increased maximum adduction moments of the hip and knee on the unaffected side *(13)*. Patients with an untreated or unsuccessfully treated congenital dislocation of the hip, septic arthritis of the hip, avascular necrosis of the femoral head with or without hardware and paralytic dislocation or subluxation of the hip joint due to poliomyelitis usually have loss of bone from the proximal femur or shortening of the limb or both *(3)*.

Numerous salvage procedures have been proposed for the treatment of an unstable hip. The two popular treatment options for an unstable hip are total joint replacement and pelvic support osteotomy *(11)*.

Many authors claimed that a total hip arthroplasty affords significant clinical improvement, and significantly reduces pain and leg length inequality *(10, 12)*. Others insist that joint replacement is exposed to high mechanical stresses and is exposed

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to a high risk of failure, especially in young patients *(6, 7, 15, 17)*. Also revision of a total hip arthroplasty in a patient with congenital hip dysplasia or dislocation is often more difficult than a standard revision operation *(4)*.

Schanz *(21)* pointed out that in congenital dislocation of the hip the pelvis tilts on weight- bearing until the femur on the dislocated side impinges on the lower border of the pelvis. If the femur is angled to align the upper fragment with the side wall of the pelvis and the lower fragment parallel with the axis of weight-bearing, the lurching gait will be diminished because the stable position is reached earlier. The depression of the trochanter also improves the leverage of the glutei. The lower femoral fragment should also be extended backwards at the osteotomy site to decrease the pelvic tilt and diminish the lumbar lordosis.

Many authors described a proximal femoral valgus osteotomy for treatment of an unstable hip joint. This method provided hip stability and improved hip function *(1, 3, 8, 16)*. The drawbacks of this approach are further leg shortening and disturbance of the mechanical axis of the leg *(3)*.

Ilizarov developed the technique of pelvic support osteotomy using his apparatus and biologic principles. He described a double osteotomy : a proximal femoral valgus extension osteotomy for correction of stability and a distal femoral osteotomy for lengthening and correction of the mechanical axis of the leg *(8)*.

PATIENTS AND METHODS

Our series included 25 hips in twenty five patients with a unilateral unstable hip. The original pathology was either not treated or unsuccessfully treated : congenital dislocation of the hip (12 patients), septic arthritis of the hip (4 patients), avascular necrosis of the femoral head with or without hardware (5 patients) and paralytic dislocation or subluxation of the hip joint due to poliomyelitis (4 patients). There were 17 females and 8 males with an average age of 22.4 years (range : 19 to 35). Patients were evaluated clinically for hip pain, range of motion, lumbar lordosis, hip flexion contracture, Trendelenburg sign, Harris hip score and leg length discrepancy.

Preoperative imaging included CT scan for measuring the mechanical axis of the leg and amount of shortening, and plain radiographs for preoperative planning and assessment of the mechanical axis.

The preoperative planning and the determination of the site of osteotomy were done following Paley *(18)*.

Surgical technique

With the patient in the supine position, the assistant holds the extremity in maximum adduction, the position and site of osteotomy are checked with fluoroscopy. Three Shanz pins with a diameter of 6mm are inserted into the proximal femoral fragment in a direction parallel to the horizontal axis of the pelvis and obliquely to the femur in the sagittal plane. The pelvic arch is fixed to the Shanz pins in line with the horizontal axis of the pelvis and distally inclined in the sagittal plane. Three Shanz pins are inserted in the mid-femoral shaft in a direction perpendicular to the femoral axis and held by 5/8 ring. The proximal osteotomy is done at the level of the ischial tuberosity. The preoperatively calculated

Table I. — Comparison between the preoperative and postoperative data

	Hip flexion contracture (degrees)		Range of abduction (degrees)		Range of flexion (degrees)		Harris hip score	
	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
Range	5-20	0-7	0-15	10-50	40-120	100-140	40-78	65-90
Mean	12.8	2	8	30	90	127	55	81
St deviation	+/- 5.1	+/- 2.7	+/-5.5	+/-11.4	+/-15.5	+/-13.1	+/-10	+/-8.03
Kurt	-0.971	-1.323	-1.253	-0.653	3.623	-0.623	-1.167	-1.089
p value	SS		SS		SS		SS	

SS = statistically significant.

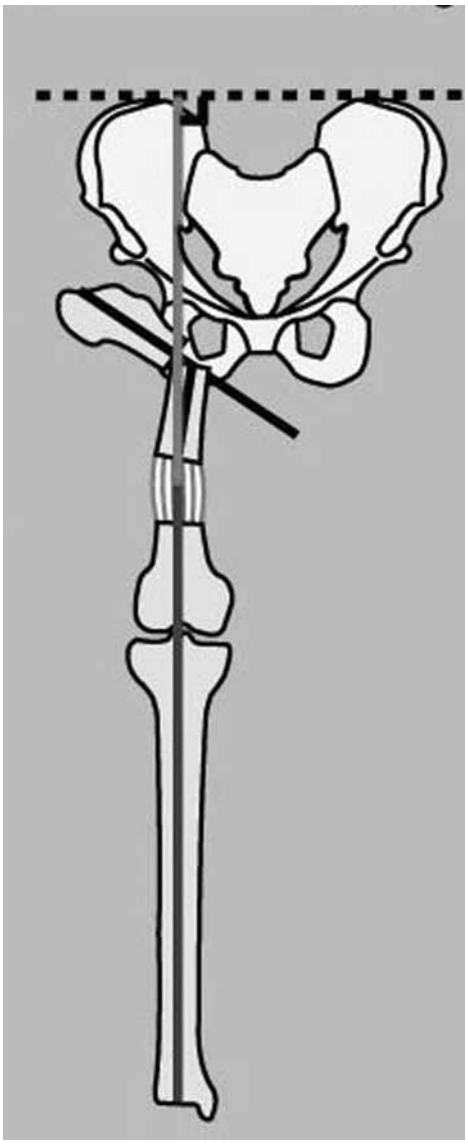

Fig. 1. — Schematic drawing showing the new hip center and new mechanical axis.

valgus correction is realised and the distal femur is medially displaced. The patella is pointed upward in neutral rotation. Then the pelvic arch is connected to a 5/8 ring. One full ring is fixed by 3 Shanz pins to the midshaft of the femur, above the level of the planned distal osteotomy. It connects to a 5/8 ring with 3 threaded roads. A K-wire of 1.8 mm diameter inserted parallel to the knee joint and 2 Shanz pins of 6 mm diameter fix the distal femur to the distal full ring. The distal ring is connected to the above ring by one threaded rod laterally and two rods with universal joints, one anteromedially and other posteromedially. The distal osteotomy is done with a Gigli saw. Intra-operative radiographs check the mechanical orientation of the frame.

At final follow-up the clinical evaluation was compared with the preoperative one. The mechanical axis deviation (MAD) and the lateral distal femoral angle (LDFA) were measured on the final postoperative radiograph. The new hip center is regarded as the point between one third to one half the distance lateral to the medial edge on the supporting end of the proximal femoral segment (fig. 1). Two tailed Student's test was used for data analysis.

RESULTS

The mean period of follow-up was 4.5 years, ranging from 2 to 7 years. The mean duration in the Ilizarov frame was 7 months (range : 5 to 15). Limb lengthening was achieved in all patients, with a mean gain of 5 cm (range : 3 to 8). Hip flexion contracture, range of abduction and range of flexion were significantly improved postoperatively (table I). Pain during distance walking disappeared in all patients to a varying degree. The Trendelenburg sign was positive in all patients preoperatively. It became negative in 20 patients. Four out of 5 patients with a persisting positive Trendelenburg sign had poliomyelitis. The mean Harris hip score was 55 (range : 40 to 78) preoperatively, and 81 (range 65 to 90) at follow-up. This improvement is significant (table I). The mean MAD was 0.4 mm while the mean lateral distal femoral angle (LDFA) was 87.9°. The main complication was pin tract infection, treated by oral antibiotics and local pin site care. All patients were satisfied with the treatment, mostly since they were pain free and limb length was equalised (fig 2).

DISCUSSION

The aim of the treatment of an unstable hip in a young adult is to reduce pain, improve range of hip motion and equalise limb length. Total hip arthroplasty is now the first choice in the treatment of an unstable hip in a young adult, with the current surgical techniques and prosthesis designs *(11)*. Theo-

Fig. 2. — ***(a)*** A 35-year-old lady had neglected hip dislocation (AP radiograph).

(b) Postoperative radiograph showing the proximal femoral osteotomy.

(c) Radiograph after 6 years follow-up showing the correction.

(d) Clinical view of the patient after 6 years follow-up with complete flexion of the hip and knee.

retically it should significantly improve these patients' ability to walk efficiently and greatly reduce pain *(12)*. Lai *et al (12)* claimed that the leg length equalisation obtained with total hip arthroplasty in patients with unilateral congenital dislocation of the hip significantly improves gait symmetry and efficiency. They studied 22 women with unilateral congenital dislocation of the hip following successful cementless THA. They found that the leg length discrepancy was equalised within 2 cm in all patients. Kim *et al (10)* reported on 118 hips in young adults treated with a second generation cementless total hip prosthesis after an average follow-up of 9.8 years : 12 % of the patients had osteolysis in the calcar region of the femur and 9 % had acetabular osteolysis. However, many authors claimed that total joint replacement in patients suffering from an unstable hip due to congenital dislocation and severe developmental dysplasia of the hip has specific technical difficulties such as irreducibility, over-shortening, nerve palsy and displaced femoral shaft fractures *(5, 14, 19)*.

The pelvic support osteotomy constitutes an alternative treatment method for a young adult with an unstable hip. The principles of the pelvic support osteotomy are to perform an abduction and extension effect in the femur at the level of the ischium to increase the range of abduction, support the femur on the pelvis, reduce lumbar lordosis and increase the distance from the pelvis to the greater trochanter, which tightens the gluteus medius and prevents Trendelenburg's limp *(2)*. Many authors claim that pelvic support osteotomy gives the best results in patients over 15 years of age *(9, 11, 20)*. In 1983 Ilizarov *(8)* reported that in patients aged 9 to 17 years, loss of correction varied between 3° and 13°. In our study the mean age was 22.4 years (range : 19 to 35). We had good results without loss of correction in all patients.

Akosy *et al (1)* reported that 35 patients with unilateral or bilateral neglected congenital dislocation of the hip were treated by subtrochanteric valgus extension osteotomy alone. The mean age was 22 years, the mean follow-up was 7 years. Alleviation of the pain was the most significant functional outcome of the treatment. It was also noted that limping could be improved. In 1993 Bombelli *(2)* demonstrated that an apparent lengthening may occur by over abduction of the distal femoral fragment. This excessive abduction causes genu valgum, increases the shearing stresses on the knee joint, and may cause knee pain and low back pain. Catagni *et al (3)* claimed that unilateral subtrochanteric valgus extension osteotomy causes considerable leg length discrepancy and secondary genu valgum induced by excessive valgus.

In our study, the mean preoperative limb length discrepancy was 5.3 cm (range : 3 to 8). At last follow-up, limb length equalisation was achieved in all patients and the mean mechanical axis deviation was 0.4 mm (range : 0.0 to 2.0). Thus there was no secondary genu valgum as, with Ilizarov pelvic support osteotomy, the distal osteotomy allows the simultaneous lengthening and correction of the mechanical axis of the leg. In our series of 14 patients with unilateral neglected high dislocation of the hip treated with the Ilizarov pelvic support osteotomy, at a mean age of 20 years and an average follow-up was 68 months, the outcome was satisfactory. Pain subsided in all patients, the Trendelenburg sign became negative in all, no patients had limb length discrepancy and alignment of the extremity was re-established. There were three patients still complaining of a lurch gait *(11)*. In our study 5 patients still had a positive Trendelenburg sign, of which four had a paralytic dislocation or subluxation of the hip joint due to poliomyelitis. We agree with Cocaoglu *et al (11)* that we need long term follow-up studies to know whether this osteotomy can prevent degenerative changes at the pelvic support point or not. In our study, no patient currently needs subsequent conversion to a total hip.

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