Research Paper

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Outcomes of Pelvic Support Osteotomy by Ilizarov Technique in Various Hip Conditions.

Medical Science

KEYWORDS : hip joint, instability, pelvic support osteotomy.

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ABSTRACT

Hip disorders are quite common in orthopaedics practice. Hip disorders causing joint destruction, producing joint unstability, sequele of septic hip etc. in various age groups as well as congenital & developmental conditions giving rise to unsound hip joint function. This is manifested by pain in hip, limp, limb length discrepancy (LLD) & altered biomechnics of hip. In order to give painless, mobile & stable hip with address to LLD pelvic support osteotomy with ilizarov's modification is a very useful tool. It contains valgus & extension subtrochenteric osteotomy with distal femoral corticotomy which is distracted. This solves all problems of limp, reduced mobility, LLD & allows squatting, sitting cross legged which is unique to pso in comparison to replacement. We did pso with ilizarov's technique in 14 patients having different hip conditions. Over serial followup we got excellent results in form of absent trendelenberg gait, improved harris hip score, no LLD, ability to sit crossed leg & squat. The study was done to assess whether this technique can successfully treat various hip disorders in all age groups demanding surgical intervention & the results were encouraging

INTRODUCTION

The main complaints in patients with an unstable hip joint are pain, limp and limb length discrepancy (LLD). Limb length discrepancy (LLD) 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. An unstable hip, whether unilateral or bilateral, results in a marked Trendelenburg gait due to hip abduction weakness, which is energy inefficient as well as stressful to the spine and other joint. In this way biomechanics of hip gets disturbed. Patients with an untreated or unsuccessfully treated congenital dislocation of the hip, sequel of septic arthritis of the hip, osteonecrosis (due to any reason) of the femoral head with or without intervention usually have loss of bone from the proximal femur or shortening of the limb or both[1]. Numerous procedures have been proposed for the treatment of an unstable hip. The most popular treatment options for an unstable hip are total joint replacement and pelvic support osteotomy. Many authors claimed that a total hip arthroplasty affords significant clinical improvement and significantly reduces pain, limp and LLD. Others insist that joint replacement is exposed to high mechanical stresses and is exposes to a high risk of failure, especially in young patients. Also revision of a total hip arthroplasty in a patient with DDH is often more difficult than astandard revision operation.Schanz[2] pointed out that in DDH the pelvis tilts on weight- bearing until the femur on the affected 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 andimproved hip function [1, 3, 4]. The drawbacks of this approach are further leg shortening and disturbance of the mechanical axis of the leg[1].In 1991 Ilizarov developed another technique of pelvic support osteotomy using ring fixator 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[4]. Ilizarov hip reconstruction has been used by many authors over the years. The Ilizarov method, however, has the disadvantage of numerous complications, the commonest being pin-tract infections, difficulty in hygienic care, patient discomfort due to bulky frames, as well as decreased range of motion due to the muscle groups being impaled by the transosseous wires.The aim of this study was to report the outcome of pelvic support osteotomy by ilizarov method for a variety of etiologies.

PATIENTS AND METHODS

Our series included 14 patients with a unilateral unstable hip operated at SMS hospital & medical college between Jan-2010 to Dec-2015. The original pathology was either not treated or unsuccessfully treated: DDH (1 patient), sequele of septic arthritis of the hip (6 patients), osteonecrosis of the femoral head with or without intervention (2 patients) & sequele of tuberculosis of hip (5 patients). There were 7 females and 7 males with an average age of 19.5 years (range: 11 to 34). Patients were evaluated clinically for hip pain, range of motion, lumbar lordosis, hip flexion contracture, Trendelenburg sign, Harris hip score and limb length discrepancy.Pre-operatively, all of the patients had the Trendelenburg gait and pain associated with walking. All cases had limb length discrepancy, with the mean limb length discrepancy being 38 mm (21–76 mm). The preoperative planning and the determination of the site of osteotomy were done following Paley[5].Radiographic analysis included an antero posterior radiograph (AP) of the pelvis with both hips in neutral, an AP standing view of both lower extremities, AP standing view of pelvis while weight bearing on affected limb, frog leg lateral radiograph of each hip and an AP view of the pelvis with the affected hip held in maximum adduction. Limb length discrepancy was calculated from the AP standing view. The radiograph of the pelvis was used in the accurate analysis of the local pathology, while the radiograph in full adduction helped with pre-operative planning of the amount of valgus angulation to be given.

Pre-operative planning

The indication for the pelvic support osteotomy was that the patient with unstable hips was willing to undergo therapy of a relatively prolonged duration. Contraindications for the surgery were that the patient was medically unfit for surgery, not willing to accept the long duration of external fixator application, acute infection or had a recent history of intramedullary infection. A relative contraindication for this procedure was a very low range of motion in the

patient, scanty muscle mass, pre-existing abduction contracture of the hip, as this would be aggravated after the surgery.Pre-operative planning was performed according to the method described by Catagni et al.[1] and later elucidated by Paley et al.[5]. It was decided that the level of osteotomy would be the point on the proximal femur which coincided with the ischial tuberosity with the limb in

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full adduction (figure 1).

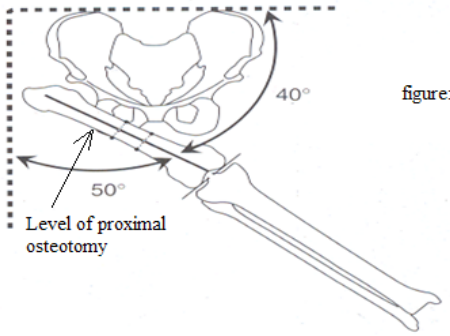
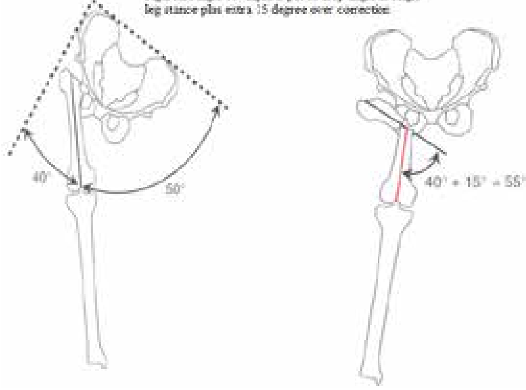


figure:1

The angle of the osteotomy was the angle of maximum hip adduction while standing on affected limb with an overcorrection of 15° (figure-2).

Figure:2 Angle of valgus is pelvic drop angle in single leg stance plus extra 15 degree over correction



The amount of extension to be given to the proximal osteotomy depended on the amount of existing flexion deformity, with a maximum of 20°of extension given. An excessive amount of extension was not planned in order to avoid decreasing the flexion arc postoperatively. The level of the distal osteotomy was calculated as the intersection point of the proximal and distal mechanical axis lines—the proximal mechanical axis line is a line perpendicular to the horizontal pelvic line, while the distal mechanical axis line is the line passing from the center of the ankle to the center of the knee, which was extrapolated proximally (Fig.3). The angle of the distal osteotomy was taken to be that which results in the correction of the mechanical axis of the limb, and the mechanical lateral distal femoral angle(mLDFA) was taken to be 87°. The desired lengthening at the distal osteotomy was planned according to the parallel beam teleradiograph, which determined the amount of limb length inequality present.

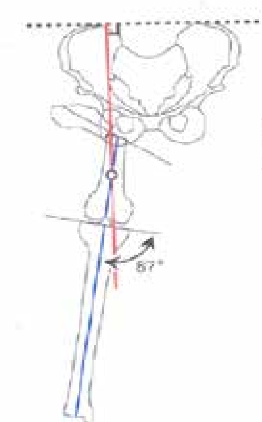


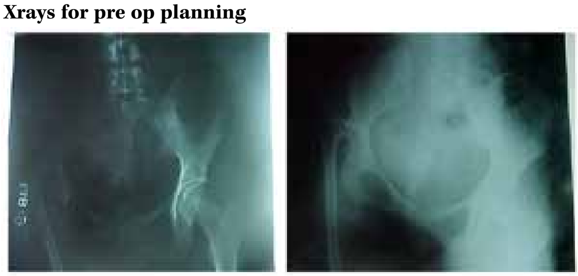
Fig-3 Schematic drawing showing the new hip center and new mechanical axis.

Surgical technique

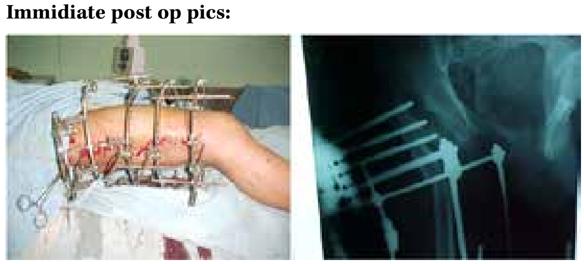
With the patient in the supine position, the assistant holds the extremity in maximum adduction, the position and site of osteotomy are checked with fluoroscopy. Three tapered pins with a diameter of 6 mm are inserted into the proximal femoral fragment between GT & LT in a direction parallel to the horizontal axis of the pelvis and obliquely to the femur in the sagittal plane. These pins are to be inserted in such a way that they make angle with each other. The Italian arch is fixed to the tapered pins in line with the horizontal axis of the pelvis and distally inclined in the both planes. Two tapered 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 in between these rings. The preoperatively calculated valgus correction is realised and the distal femur is medially displaced. The patella is pointed upward in neutral rotation. Then the italian arch is connected to a 5/8 ring with hinges mounted parallel to the valgus extension angle making the Italian arch horizontal. A wire of 1.8 mm diameter inserted parallel to the knee joint and one full ring is fixed by this wire and two tapered pins to the distal femur, below the level of the planned distal osteotomy. It connects to a 5/8 ring with 3 threaded roads with provision of distraction. 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. Care was taken to mobilize the skin around the pins by pulling the skin proximally and distally to prevent puckering and tethering of the skin during the manipulation of these pins. The proximal osteotomy was performed by the multiple drill hole method.

Case:1 Gajendra 25 year old man with sequel of septic hip

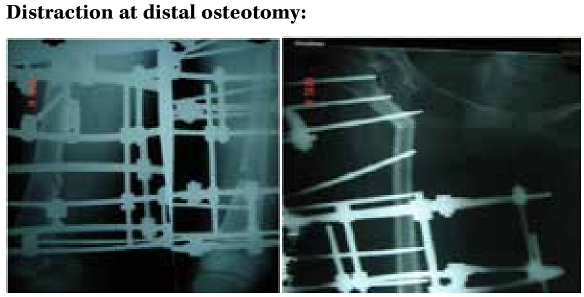
Xrays for pre op planning



Immidiate post op pics:



Distraction at distal osteotomy:



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Varusisation at distal osteotomy:

Final Xray with correction of Limb length discrepancy, improved abductor mechanism & realigned mechanical axis for better function

Case 2: Sitabai; sequel of tubercular hip

Post-operative management

Post-operatively, all patients underwent supervised daily physiotherapy, including active and passive range of motion of the knee and ankle, which was started two days after surgery by a trained physiotherapist. Distraction at the distal osteotomy site was started 2 week after surgery at a rate of 1 mm/day until the desired length was achieved. Length was increased 5 cm more then opposite limb then varusisation of distal osteotomy was done by modifying frame and replacing thraded rods by antero and postero medial open hinges and laterally based distracting rod. Radiographs were taken periodically to check the maintenance of correction and consolidation. Weight bearing with two crutches was started as soon as pain could be tolerated by the patient. Patients were taught about pin track care. Removal of the fixator was performed when three cortices out of four in regenerate were seen solidified and the patient could bear weight with no pain. The mean fixator time from application to removal was 19.5 weeks (range 16–38 weeks). The mean admission time for patients was 8 days (range 5–14 days). The patients were asked to follow-up monthly during the application of the fixator and 3 monthly thereafter. At every visit, they were analyzed clinically by the in terms of the ranges of motion of their hip and knee, limb length presence or absence of the Trendelenburg sign, gait,amount of pain, as well as functionally using the Harris hip score. Complications were looked for and treated appropriately. Radiographic analysis included an anteroposterior view of the pelvis with both hip joints, and an AP standing radiograph of both lower extremities.

RESULTS

The mean period of follow-up was 1.3 years, ranging from 1 to 2.5 years. The mean operating time (calculated from the time from incision to closure excluding induction) was 95 min (range 80–123 min). The mean valgus given to the proximal osteotomy was 44.5°(range 32–74°), and the mean extension given was 9°, with the proximal osteotomy being an average of 6 cm distal to the lesser trochanter (range 4–8 cm). The distal osteotomy was a mean 11.5 cm proximal to the knee joint (range 6–14 cm). The mean varus angle of the distal osteotomy site was 18°. The average time to full union of the proximal osteotomy was 15 weeks (range 14–21 weeks). The mean duration in the Ilizarov frame was 19.7 weeks months (range: 16 to 38 weeks). Delayed consolidation was defined arbitrarily as an inability to show adequate signs of osteotomy healing by12 weeks after surgery. There was delayed consolidation of the regenerate in 5 patients (1 at the proximal site and four at the distal site), which was treated by delayed removal of the fixator. Limb lengthening was achieved in all patients, with a mean gain of 4.5 cm (range: 3.5 to 7.2 cm). Hip flexion contracture, range of abduction and range of flexion were significantly improved postoperatively. The hip range of motion improved significantly, with the arc of flexion improving from a pre-operative mean of 75°(±20) to a post-operative mean of 105°(±10) and abduction from a pre-operative mean of 20°(±10) to a post-operative mean of 35.52 (±10).The hip flexion contracture improved from 10°(±5) pre-operatively to 1°(±5) post-operatively. Improvements in all of these parameters were statistically significant based on Student's t test, with P \0.0001. The mean pre-operative knee range of motion was 110°(±10), and the post operative knee range of motion at the time of last follow-up was 105°(±5).The difference was not statistically significant, with P=0.7198. The Trendelenburg sign was positive in all patients preoperatively. It became negative in 12 patients. The mean Harris hip score was 53 (range: 39 to 75) preoperatively, and 80 (range 63 to 87) at follow-up. This improvement is significant. The mean lateral distal femoral angle (LDFA) was 85.9°. The main complication was pin tract infection, treated by oral antibiotics and local pin site care. All the patients showed significant improvements in their levels of pain, except for two patients who already had developed severe involvement of the spine and the other joints. Six patients developed knee stiffness during fixator application, which improved after fixator removal with good physiotherapy. This stiffness was more towards the end of the distraction phase, and all six patients had developed pin tract infections of the distal pins, which caused pain and made physiotherapy difficult. The range of motion of the knee improved progressively in the consolidation phase and once the pin tract infections came under control. The improvement continued after the removal of the fixator, and all patients had regained their pre-operative knee function by the last follow-up. All patients were satisfied with the treatment, mostly since they were pain free and limb length was equalised .

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[9]. Theoretically it should significantly improve these patients' ability to walk efficiently and greatly reduce pain[8]. Lai et al [8] claimed that the limb 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 uncemented THA. They found that the leg length discrepancy was equalised within 2 cm in all patients. Kim et al[9] 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[10,11,12]. 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[13]. Many authors claim that pelvic support osteotomy gives the best results in patients over 15 years of age [7, 14, 15]. In 1983 Ilizarov[4] reported that in patients aged 9 to17 years, loss of correction varied between 3° and 13°. In our study the mean age was 19.5 years (range: 11 to 34). We had good results without loss of correction in all patients. Akosy et al[3] 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[13] 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 [1] 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 4.5 cm (range: 3 to 8). At last follow-up, limb length equalisation was achieved in all patients and the mean mechanical axis deviation was 0.5 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. 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 [7].In our study 2 patients still had a positive Trendelenburg sign. We agree with Cocaoglu et al[7] 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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