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Manas Chandra
Safdarjung Hospital, New Delhi, India

Mayur Anand
Safdarjung Hospital, New Delhi, India

BP Sharma
Safdarjung Hospital, New Delhi, India

Correspondence
Manas Chandra
Safdarjung Hospital, New Delhi, India

Neglected intertrochanteric fractures treated with valgus osteotomy

Manas Chandra, Mayur Anand and BP Sharma

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Abstract
Introduction: Malunited intertrochanteric fractures may occur due to mechanical and biological factors. Malunion of intertrochanteric fractures is common in developing countries as many people rely on indigenous treatment and splint age for fractures. Varus malunion is more commonly seen as compared to valgus malunion. A popular surgical treatment aimed at improving the biomechanics-valgus intertrochanteric osteotomy-optimizes conditions for fracture healing by converting shear forces across the fracture site into compressive forces. The double-angled 120° plate is usually used for internal fixation of the osteotomy.
Material and methods: A total of 14 cases operated from May 2016 to December 2019. Outcomes analysed include radiological outcome in terms of improvement in neck-shaft angle and evidence of radiological union at the osteotomy site. Other outcomes analysed include, measurement of limb length discrepancy and functional outcome assessment with Oxford hip score. Results: There were significant improvements in the postoperative neck shaft angle and Oxford hip score. Limb length discrepancy improved to about 0.5 cms.
Conclusion: Subtrochanteric lateral closing wedge valgus osteotomy and internal fixation with dynamic hip for maluniting intertrochanteric fracture showed good results.

Keywords: Intertrochantric femur, valgus intertrochanteric osteotomy, malunion

Introduction
In India, neglected intertrochantric fracture is a common presentation as they rely on indigenous treatment and splintage for fractures. In these cases, malunion is common occurring in comparison to nonunion. Varus malunion is more common than valgus malunion in intertrochanter femur fractures [1]. Nonunion of intertrochanteric fractures is uncommon because there is excellent blood supply and good cancellous bone in the intertrochanteric region of the femur [5]. Due to this non-union is seen in patients with displaced comminuted fractures of intertrochanteric region in addition to the presence of comorbidities like uncontrolled diabetes mellitus, hemiparesis, malignancies, poor nutrition etc. Literature is sparse regarding primary intertrochanteric nonunions and malunion and its treatment [7]. In a malunited intertrochantric fracture, it is technically challenging to recreate the fracture and associated with more morbidity and blood loss. It is a wise decision to accept the malunion and correct the Coxa vara with a valgus subtrochanteric osteotomy. Intertrochanteric osteotomy was first introduced by Pauwels [2] in 1927. The osteotomy reorientates the fracture, converting shear forces at the fracture site into compressive forces, which enhances fracture healing [2-4]. This study aims to evaluate the results of internal fixation, valgization with 120° double angle dynamic hip screw (DHS) in 14 patients with primary malunion of intertrochanteric fractures.

Materials and Methods
We carried out a retrospective analysis of 14 patients with primary intertrochanteric malunion treated in our institution during 2017-2019. Most of the fractures occurred after a slip and fall during house hold activities. A few fractures occured following road traffic accidents. The average age was 54.5 {33-67 years} and 11 were males. The average duration between the index injury and surgery was 6 months {5 – 9 months}. 9 patients underwent native treatment with serial casts and 5 patients underwent no treatment. The right hip was affected in 10

patients and the left in 4. Clinical examination revealed a mean shortening of 1.8 cm {1.5 – 2.4 cm}. All patients filled up the oxford hip score questionnaire {adapted for the local language} to ascertain their level of function before surgery. The usual clinical findings were supratrochanteric shortening with broadening of trochanteric prominence and external rotation attitude of limb and ipsilateral abductor insufficiency. All had restricted abduction and internal rotation due to coxa-vara. Preoperative antero-posterior and lateral x-rays of the hip joint were taken. Preoperative neck shaft angle of bilateral proximal femur was calculated. The amount of correction needed was calculated and the angle of wedge to be resected was decided. All patients were treated by wedge-removing valgus intertrochanteric osteotomy. The fixation device was 120° double angle DHS in all patients.

Results

All patients were untreated cases of intertrochanteric fracture either due to negligent behaviour of patients belong to low socio-economic status or due to lack of nearby medical facility and subsequent treatment by quack. The average blood loss was 310{200 – 400 ml}. All fractures radiologically united at a mean time of 12 weeks {10 – 14 weeks}. The average pre-operative neck-shaft angle was 102.4 degrees {90 - 110 degrees} which was corrected to134.3 degrees (128-138 degree). The mean oxford hip score was 39.4 (38-42) at 6 month follow up. This was a significant improvement compared to pre op oxford score of 16.1(11-22). There were no screw cut outs or loss of correction. There were no incidences of deep infection. Mean pre-operative shortening was 1.8 centimetres which improved to a mean shortening of 0.65 centimetres post-operatively. All patient experienced improved gait except for 2 patients demonstrated mild trendelenberg lurch at 6 month follow up which required assistance of walking stick. All patients resumed their normal activities at an average of 12 weeks.

Discussion

In Indian subcontinent, a large number of patient are treated by local bone setters since ages. This is because of lack of knowledge and medical facilities in rural India. These patients presents late with malunion and non-union. Nonunion of intertrochanteric fractures is uncommon as these fractures tend to occur through well vascularized cancellous bone. Malunited Intertrochantric fracture is a more common presentation in such neglected cases 6. While union in intracapsular fractures is complicated by biological and mechanical factors, the problem with extra capsular fractures is mainly mechanical.

There are many technique of treatment of malunited intertrochantric fracture. Our technique was valgus angulation osteotomy for the treatment of these factures. Lateral closed wedge osteotomy is the most commonly performed procedure. The applicability of valgus osteotomy in both intra and extra capsular fractures is based on similar principles.

It requires simple preoperative planning regarding amount of wedge to be respected. Removing wedges may hinder limb length restoration and requires careful planning and templating to avoid the same. Subtrochanteric osteotomy was chosen to avoid compromising the lateral wall fragment with a proximal osteotomy especially in extra capsular fractures. A very low subtrochanteric osteotomy should be avoided as it will be through the cortical bone where union rates are less predictable and nonunion at the osteotomy site have been reported due to higher stresses acting at the site [12]. Valgus osteotomy has a high success rate and good reproducibility. In Indian scenario, valgus osteotomy is an effective alternative to hip replacement surgery due to the high cost of the procedure. Muller [13] has insisted on reducing the fracture angle to less than 25 degrees to achieve consistent results though other authors have reported otherwise.

Valgus osteotomies using blade plates have been described by several authors [8-11]. Blade plates have excellent rotational control but are technically difficult to use. The dynamic hip screw is an excellent implant in this situation. It allows application of static compression during surgery with the coupling screw and also allows controlled dynamic collapse at the fracture site maintaining the neck shaft angle. The only drawback is the suboptimal rotational stability and rotational stress which may occur during reaming. Both these problems were addressed in our series to an extent by using an anti rotation screw along with the DHS in intracapsular fractures.

Recent articles on valgus osteotomies at the intertrochanteric level with DHS fixation has been described by Hartford *et al*., 2005 [14] and Schoenfeld *et al*., 2006 [15]. Both techniques in the own words of the authors required extensive pre-operative sketching and templating to achieve the desired result. While Schoenfeld *et al*. removed a partial thickness wedge to minimise limb length discrepancy Hartford *et al*. used a full thickness laterally based wedge.

Schoenfeld *et al*. also noted that the partial thickness wedge osteotomy may decrease the surface area of contact and may increase the chances of implant failure. Though the post-operative Pauwel's angle was much lesser in their series, the final clinical, radiological and functional results were much similar to the current series. While Shoenfeld achieved a good limb length restoration with his technique, the mean post-operative mean limb length discrepancy in the series by Hartford *et al*. was 1 cm probably because of the full thickness wedge technique they had used. Surgical time and blood loss were significantly lesser in our series compared to techniques described by these two authors. An osteotomy not only helps by improving the biomechanics but it also improves the hemodynamics at the nonunion site. A more horizontal fracture angle was achieved in all patients and they progressed to successful union. The limb shortening was brought to less than 1 cm in all patients.

All the patients were able to perform routine household activities when questioned at the end of 6 months which included sitting cross legged and squatting requiring support while getting up. Outdoor activities like walking on roadside and uneven surfaces was carried out with little difficulty and use of walking aid – a tripod walking stick. The results were comparable to studies by Jan Bartonicel *et al*., [16] who had published good results of valgus osteotomy in Intertrochanteric non-union and malunion. Most of the published data of valgus osteotomy are for femoral neck non-union. Our surgical technique for osteotomy was similar to that of James M Hartford *et al*., who used full thickness lateral based wedge resection for achieving valgus.

To conclude, valgus osteotomy with DHS fixation is a useful technique for varus proximal femur malunion in younger patients. Improving the biomechanics at the malunion site coupled with a stable fixation yields good consistent results regarding union. The sliding osteotomy technique is simple, saves surgical time, minimises blood loss and helps in limb length restoration. No elaborate planning and wedge removal are required to achieve the desired results.

Table 1:

Patient	Age/Sex	Pre – Op Neck Shaft Angle	Post Op Neck Shaft Angle	Pre – Op Limb Length	Post Op Limb Length	Pre – Op Oxford Hip Score	Post Op Oxford Hip Score
1	44/M	102	138	1.5 CM	0.5	14	38
2	56/M	105	136	1.5	0.5	11	39
3	55/F	110	132	1.8	0.6	16	40
4	48/M	105	130	2	0.8	20	42
5	52/F	108	138	2.2	1	22	38
6	33/M	95	134	2.4	0.8	16	38
7	65/M	100	130	1.8	0.5	14	40
8	58/M	105	132	1.7	0.6	12	42
9	58/M	108	138	1.5	0.5	16	38
10	67/M	95	132	1.8	0.5	20	39
11	61/F	102	136	2	0.8	22	39
12	50/M	105	138	1.7	0.5	14	38
13	67/M	90	128	1.6	0.5	16	40
14	49/M	104	138	2.2	1	12	41

Preoperative Xray

Immediate Post-Operative Xray

6 Month Postoperative

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