



Modified Valgus Osteotomy for Treatment of Femoral Neck Fracture Non-Union

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Abstract

Background: Non-union of the femoral neck fracture in young and middle-aged patients is a problem and can be very debilitating. If the femoral head is viable, the most appropriate treatment is valgus osteotomy that without refreshing of the fracture site, it only increases the femoral neck angle to change shearing force to compression force. In this study, after refreshing the non-union site and establishing normal relation between head and neck of the femur, valgus osteotomy was done.

Materials and methods: In this case-series study, of all patients who had femoral neck non-union and presented during a 2-year period to Sina Hospital and were less than 60 years of age with a viable femoral head, 22 patients (18 males and 4 females) with a mean age of 34 years (20-47 years) were studied. There were stabilizing screws in 10 patients. The patients were followed up to one year with radiography and were assessed regarding Harris hip score, union, and complications especially femoral head necrosis and the signs of joint destruction and arthrosis.

Results: Harris hip scores before and after surgery was 63 and 89, respectively. The angle between the femoral neck and shaft of the femur reached 150 degrees and union was occurred in all patients. Femoral head necrosis happened in 2 cases and in 3 cases following femoral neck collapse, implant tip was entered into the joint which was removed immediately. Mean time of union was 4.5 months.

Conclusion: Refreshing the non-union site before valgus osteotomy in femoral neck fracture non-union causes increase in union and less complications.

Keywords: Non-union; Femoral neck fracture; Valgus osteotomy

Introduction

Femoral neck fracture is one of the most important fractures and bears special problems and complications in any age [1]. Before puberty, injury to the upper growth plate of femur, malalignment and limb shortening; and in young and middle-aged patients, femoral head necrosis and non-union of the fracture site; and in the elderly, femoral head exchange and prosthesis implantation are major complications of this fracture [2]. This fracture is uncommon in childhood, though the complications can be really severe. On the other hand, with access to newer generations of prostheses for femoral head substitution and also with low activity and function of the elderly, the difficulties due to femoral neck fracture in this group may lead to less functional disorder. Most complications of this fracture are seen amongst young and middle-aged patients [3]. One of the most complications of this fracture in young and middle-aged patients is non-union. Important factors which are responsible for this complication are insufficient circulation of fracture site, inappropriate fixation, early weight bearing, and also anatomic position of the femoral neck and shearing forces at the fracture site [4]. If non-union happens, the treatment depends on the situation of the femoral head (viable or nonviable). If the femoral head is viable, the surgeon tries to preserve the femoral head and stimulate union at the fracture site. This purpose is achieved by performing valgus osteotomy in the sub trochanteric or inter trochanteric region [5]. Shearing force is changed to compression force which is a stimulant of fracture union. In classical method of this operation, the non-union site is not exposed by surgeon and only by passing fixation device through fracture site, the femoral neck angle is increased by valgus osteotomy [6,7]. Though there is less injury to circulation of the femoral head and less probability of necrosis, it has some problems. Sometimes, femoral neck fracture non-union is associated with fracture of implanted screws for primary fixation of the fracture. The retained screws inside the femoral head prevent implantation of a new fixation device, or at least prevent appropriate implantation of this device. Often non-union

occurs in varus position of femoral head [8] and causes cartilaginous part of the femoral head become adjacent to osseous part of the femoral neck and decreases the probability of union [9]. In this study, the site of non-union is exposed and if the fractured screws prevent appropriate fixation, they are removed and cancellous parts of head and neck are placed near each other and are fixed together.

Materials and Methods

In this case-series study, all patients who presented with non-union of the femoral neck fracture during a two-year period to Sina Hospital and were 20-60 years of age and had viable femoral head with no destruction, were studied. All the fractures were trans-cervical ones. Twenty-five patients met the criteria to enter into the study. Three patients did not present for further follow-ups and therefore 22 patients (18 males and 4 females) remained until the end of the study. Mean age of the subjects was 34 years (20-47 years). Age range of the cases was 20-47 years. The patients were informed regarding the method of the surgery and its advantages and disadvantages and written consent were gathered. Range of motion of hip and Harris hip score were measured and documented.

At first, using bone scan or MRI, the viability of femoral head was proved. Then, through antero-lateral approach (Watson-Jones)

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and capsulotomy of hip, non-union site was exposed. After removing fractured screws, precise reduction of the femoral neck fracture was done and the head and neck angle was corrected. Then, Chisel was used to implant angle blade plate (150 degrees) with 6 holes. Bone graft, either in the form of cancellous graft or pediculated graft, was not used. The patient started walking using walking aid with contact of the foot with ground and in 6 weeks, 3 months, 6 months, and one year intervals was examined. The required time to union was documented. After one year, Harris hip score was calculated and fracture union, reduction, femoral head necrosis, arthrosis, and femoral head destruction and limb shortening were considered. If infection or entrance of implant into the joint space occurred, it was documented as well.

Results

Mean limb shortening before surgery was 2 cm (1-3.5 cm) and at the end of the study was 0-1.5 cm (mean, 1 cm). In 10 patients (46%) the previous screws had been fractured and in 4 patients (18%) the fixation was not achieved. Mean union time of non-union site was 4.5 months (3.5-7 months). Mean Harris hip score was 63 (60-70) before surgery and 89 (82-98) at the last examination. The complications were entrance of implant point into joint space (3 cases) and avascular necrosis of the femoral head and its destruction (2 cases). There was no infection, implant fracture, and non-union of osteotomy site. In all of the cases (100%) union in nonunion site were happened. (Figure 1 and 2).

Discussion

One of the problems during surgery is the fracture of the previous fixation device. This may prevent placement of angle blade in appropriate site. This problem has not been reported in other studies. If it occurs, the surgeon has to expose the non-union site to remove the fractured screw. Also, if the initial reduction is inappropriate or is unsuccessful, the surgeon has to expose the non-union site. In former reports, there is no information about the cases in which non-union is exposed and the fracture edges are cleaned of fibrosis. In Marti et al. study, in 50 patients below 70 years-old 83% union happened. In Mathius study on 15 patients below 70 years-old, 80% union was reported. In another study in 2007 on 13 patients, 100% union was reported. In another study in 2007 on 10 non-union cases among children, 100% union was noted [10]. In the largest case-series on 66



Figure 1: Nonunion and implant fracture.



Figure 2: After modified valgus osteotomy.

non-union of the femoral neck with a mean age of 49.5 years (18-72 years), valgus osteotomy and fixation using angle blade was done and 88% (58 cases) showed union [8].

In another study, 18 cases of 20 cases with non-union who were below 60 years who were treated by angle blade and valgus osteotomy showed union [14]. There are some studies to study the effect of valgus osteotomy without manipulation of non-union site (cleaning the fibrosis) [12,13].

In the current study, the probability of union of non-union site was reported as 100% which is superior to the aforementioned studies. One of the complications of surgery with angle blade plate is the entrance of implant point into the joint space. Since in contrast to Dynamic Hip Screw (DHS), there is no chance of dynamic effect of fixation device (angle blade plate), with compression of nonunion site with partial weight bearing, the tip of angle blade may enter the joint space. Fortunately, in our study, this was occurred concomitantly with the union of the femoral neck and Implant was removed immediately before joint destruction.

Although in case of using DHS, the likelihood of implant point entering into joint space is less, due to evacuation of large amounts of cancellous bone from the femoral head, there is less possibility of firm grip of nail in head and this is one of the causes of failure. In most studies, fixation has been done using angle blade and in few studies other devices have been used. Hartford et al. treated 8 patients with DHS. One patient was dropped out due to death, in 7 patients with mean follow-up time of 24 months union was achieved and Harris hip score increased from 24 to 73 [13]. In another study, 4 patients with age range of 25 to 35 years underwent valgus osteotomy and fixation using sliding hip screw and union was achieved in all cases. Mean union time was 6 months (4-8 months) [14]. Improvement and significant increase in Harris hip score from 63 to 89 is a good sign indicating effectiveness of surgery and improved function and returning patient to previous normal life. In this study patients had some shortening of limb before intervention, it was better to use open wedge method for valgus osteotomy. However, for 2 reasons proximal femur osteotomy with close wedge method was preferred, although this method can

potentially shorten the limb. On one hand, with valgus of proximal femur, there is some lengthening of the femur (difference of final length of the limb was about 1 cm which is negligible) and because of compression in osteotomy site, the probability of union is increased and there is no need to use bone graft. So, there is no prolongation of operation time and less injury to the patient.

Conclusion

The results showed that opening of the hip capsule and cleaning the non-union site and removing fractured screws not only does not increase the probability of femoral head necrosis, but also causes better union rate and better reduction and higher contact between cancellous bone of the femoral head and neck. Improvement of Harris hip score has a positive effect on patient life.

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