TREATMENT OF THE NONUNION OF THE FEMORAL NECK BY VALGUS OSTEOTOMY

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Between 1980 and 1998, we performed 27 valgus osteotomies for nonunion of femoral neck fractures. Patients were aged 17 to 79, with an average of 45 years. Twenty-four patients had undergone previous surgery. Prior to osteotomy, the average neck-shaft angle was 105° (80 – 130°), with an average shortening of 2.5 cm (1.5 – 4.5 cm). After valgus osteotomy, 24 of the 27 fractures healed after 3 – 10 months (average, 5 months). One patient died 2 months after surgery (79 years old) and two had implant failures. Five patients had mild avascular necrosis at the time of study, which was not symptomatic. Pain and limitation of motion improved remarkably, so that the majority of the patients did not have to use crutches. Shortening was reduced to an average of 1 cm. We recommend valgus osteotomy of the proximal femur in the nonunion of femoral neck fractures.

Keywords: Femoral neck • nonunion • valgus osteotomy

Introduction

Nonunion of fractures of the femoral neck remain a major problem, especially in developing countries. Despite improvements in the techniques of surgery and internal fixation devices, nonunion is still reported in one-third of cases of femoral neck fracture with displacement.

Treatment options include: rigid internal fixation with or without bone grafting, muscle pedicle bone graft, valgus osteotomy of the proximal femur with or without bone graft, or hip arthroplasty.

Materials and Methods

Between 1980 and 1998, we treated 27 cases of nonunion femoral neck fracture. Seventeen patients were males and 10 were females, with an average age of 45 years (18 – 79 years). Twenty-four patients had undergone previous surgery; 6 in our hospitals and 18 elsewhere. Three patients had not had any previous surgery. All patients with a history of previous surgery had experienced failure of the implant. The cause of the fracture was trauma in 26 patients and osteomalacia in one patient.

All patients complained of pain and limitation of hip motion and were unable to walk without support. There was an average of 2.5 cm (1.5 – 4.5 cm) shortening of the extremity in these patients. In 5 cases, displacement of the greater trochanter was very high, and needed skeletal traction before surgery (7 – 10 days). The average neck-shaft angle before surgery was 105° (80 – 130°).

Five patients had mild avascular necrosis (AVN) of the femoral head. Subtrochanteric valgus osteotomy was performed in all patients at an average of 11 months (2 – 35 months) after the first operation. In one patient who had surgery 2 months after the first operation, there was implant failure and displacement of the fracture fragments.

Surgical technique

In some patients, surgery was performed on a fracture table with fluoroscopic control. In others, we used an ordinary operating table with the patient in a supine position.
Except for the 2 patients who needed bone grafts, the fracture site was not exposed. The failed implant was removed, the blade of an angle blade plate (AO) or (DHS) was inserted, subtrochanteric osteotomy was performed, the limb was abducted, and the plate fixed. A 150° DHS was used in 12 cases and double angle blade plate in 15 (Figures 1A, 1B, 2A, and 2B).

Results

In 24 patients, the fracture went on to satisfactory union after an average of 5.5 months (3 – 11 months). The average neck-shaft angle after surgery was 140° (130 – 150°). The average shortening of the extremity after surgery was 1.2 cm. One patient died 2 months after surgery. Two patients had implant failure, and their fractures did not heal.

Discussion

Accurate reduction and internal fixation have the greatest influence on union rate of femoral neck fractures. In an undisplaced fracture of the femoral neck, which is securely fixed, the rate of nonunion is relatively low. However, about one-third of displaced fractures of the femoral neck will not heal after internal fixation. If the fixation device does not migrate, the fracture usually heals, whereas in those patients where the fracture device fails, there is a high incidence of nonunion.

With improvement of internal fixation devices and better methods of surgery in recent years, the rate of nonunion has been reduced. In the majority of nonunions of femoral neck fractures, there has been either inadequate reduction, poor internal fixation, or vascular insufficiency.

Pauwels believes that the fracture line (Pauwels' angle) has an important role in the union of fractures. The presence of shearing stress in fractures with vertical inclination increases the risk of nonunion. In these patients, change of the fracture line from vertical to horizontal through osteotomy will usually result in healing.

Phemister suggested that the lack of periosteum in the femoral neck decreases the healing potential and creates a high risk of nonunion.

Barnes et al, Boyd and Calandruccio, and Phemister noted that since the healing of a fracture of the femoral neck is interosseous (endosteal), there is a marked incidence of nonunion of the femoral neck in patients with avascular necrosis. Banks noted that 60% of the

Figure 1 (A and B). Valgus intertrochanteric closed-wedge osteotomy is performed as treatment for nonunion of the femoral neck with a shear angle of 75°.
patients with nonunion of the femoral neck had comminution at the fracture site, especially in the posterior part of the neck. The patient’s age, poor general medical condition, and osteoporosis also increase the rate of nonunion of femoral neck fractures. 3, 6

The appropriate treatment for nonunion of a femoral neck fracture depends on the age of the patient, his or her medical status, the viability of the femoral head, the size of the remnant femoral neck, osteoporosis, the duration of the disease, and finally, the state of joint space. 3, 6, 13

Considering the fact that the majority of the patients with femoral neck fracture are over 60 years of age, have extreme osteoporosis, and are poor surgical candidates, it is better to replace the femoral neck with a femoral prosthesis or conduct a total joint replacement. 3, 14, 15 In the case of infection of the joint with nonunion of the femoral neck, when it is not possible to do total joint replacement, it is better to perform resection arthroplasty (Girdlestone procedure). There is no indication for arthrodesis of the hip joint in old patients. 14 – 16

In young patients who are in good general medical condition, with no osteoporosis and with a reasonable size of the femoral neck and normal joint space, it is better to save the femoral head. 12, 2, 17 Different techniques for saving the femoral head are: internal fixation, bone grafting (cancellous or fibular), pedicle graft, femoral osteotomy, or a combination of these methods. 4, 17 – 19 There are two different kinds of osteotomies for nonunion of the femoral neck:
1. Medial displacement osteotomy (Mc Murray) 20 at the level of the lesser trochanter.
2. Valgus osteotomy below the lesser trochanter.

We believe that valgus osteotomy, with or without bone graft is a good method of treating nonunion of the femoral neck. We treated nonunion with this method because it converts the shearing force of a vertical fracture line to a transverse line and the compression force will enhance healing.

The osteotomy is relatively easy to perform and is fairly stable. Disadvantages of this procedure are predisposing the hip to degenerative arthritis and possible avascular necrosis of femoral head.

Marti et al 8 reported 88% union in 50 patients treated by this method alone and Ballmore reported union in 12 out of 17 patients undergoing surgery for the first time. Three of the five remaining patients went on to union after a second operation. Our results from this osteotomy of proximal femur (by changing the fracture line from shearing to stress forces) was very good in the 27 patients with nonunion of the femoral neck. One patient died before the fracture healed, however, in two patients the fracture did not heal (possibly due to implant failure in these patients).

Figure 2 (A and B). Valgus intertrochanteric dome-shaped osteotomy is performed as treatment of nonunion of the femoral neck with a Pauwels angle of 55°.
References