ORIGINAL PROF-1005

PAUWEL'S OSTEOTOMY AND OSEOSYNTHESIS;
ITS USE IN PATIENTS WITH NON UNION OF FEMORAL NECK FRACTURES

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ABSTRACT...masgharrana@hotmail.Com. Introduction:- Fracture neck of femur is one of serious injuries encountered in orthopaedic trauma management. It can result from trivial trauma in elderly but are usually the result of high-energy trauma in the younger age group. Objective- To evaluate the results of Pauwel's osteotomy and oseosynthesis in patients with non union of femoral neck fractures. Setting Orthopaedic Unit, Nishtar Hospital, Multan. Duration 1989-1998. Material and methods Sample size 30 patients. Results: 30 cases of neglected fracture neck of femur treated. 5 patients were treated first with traction where greater trochanter migrated a way up to bring it down to the proper level. Then osteotomy was done. In 25 cases Pauwels' osteotomy was primarily done and fixed with 120 degree osteotomy plate. Follow up period ranged from 7 months to 2 and half years. Patients were assessed for reduction of the fracture site in according to alignment index by Garden for union of the fracture and range of mobility and pain relief in follow up period. Conclusion:- This is a reliable method of dealing with nonunion of the fracture neck of the femur in young adults.

Key words:-Orthopaedic trauma, trivial trauma, neck of femur.

INTRODUCTION

Fracture neck of femur is one of serious injuries encountered in orthopaedic trauma management. It can result from trivial trauma in elderly but are usually the result of high-energy trauma in the younger age group.

Due to peculiar blood supply of the head of femur and to the fracture being intra capsular, the complications of non-union and avascular necrosis are common.

Rate of non-union is between 10% to 20%[1]. Non-union of femoral neck fracture is labeled when there

is no evidence of healing between six and twelve months after the fracture[2]. Non-union is a frequent complication following femoral neck fracture. While healing of the femoral neck fracture and preservation of a viable femoral head appear to offer the best outcome for managing femoral neck non-unions, the choice of treatment depends on patient age, congruityof the femoral head, quality of existing bone and expertise of he surgeon[3].

The causes of non-union of infra capsular fractures of the neck of femur have been studied for many years. It is noted that cause for non-union in the case of intra capsular fractures is to be fouod in our inability to maintain cooptation and immobilization of the fragments during the time required for union to take place.

Banks[4] added some other factors playing role in the non-union of femoral neck fractures namely the age of the patient, type of fracture, the surgical treatment, healing mechanism and the post operative care. The most significant pre-operative characteristic that predicts non-union was the age of the patient[2]. Three patients aged 27 to 74 years, in whom, after exclusion of other known factors, a femoro-acetabular impingement was identified at the cause for the nonunion of a femoral neck fracture[5].

Patients present with pain, shortening of limb and difficulty in walking. Hip movements are painful and restricted. X-rays shows that bone at fracture site is ground away and fragments fall apart. Hip joint X-ray was assessed whether head of femur is mobile within acetabulum or immured in it by fibrous tissue. Bone scan was done in cases where AVN suspected.

Improvement in the treatment technique in acute cases has drastically decreased the incidence of nonunion in these fractures. But Took MT reported that still with adequate treatment 10-20% non-union and 35% avascular necrosis occur[6]. The problem becomes many folds when the fractures are untreated (diagnosed late) in the younger patients. Femoral neck fracture non-union is a challenging complication for the orthopaedic surgeon. The etiology of non-union can be complicated and multifactorial. The diagnosis usually established clearly with clinical and radiographic examinations. There are no clear guidelines for treatment, although multiple factors must be taken into account[7].

Non-union is a frequent complication of displaced intra capsular fractures of the femoral neck and occurs in as many as 43% of patients. The incidence can be reduced by prompt anatomic reduction and stable fixation[8]. Intra capsular fractures of the femoral neck heal in the same way as other intra articular fractures by endosteal and not by periostium.

Bank reported regarding the histological evaluation of 100 specimens of the femoral head and neck with intra capsular fracture of hip4. He concluded that by three weeks from the time of injury this new bone formation is well developed. If the femoral head is viable, this repair response is present on both sides of the fracture. If the femoral head is not viable the response is seen only in the femoral neck side.

The repair from the neck side can migrate into the head and heal the fracture only if there are close apposition and rigid internal fixation of well-reduced fracture fragment. The appropriate treatment of nonunion of femoral neck fractures depends on many factors:

Age and physical status of patient. -Viability of femoral head. Resorption of femoral neck. Duration of injury

Patients with non-united fractures neck of femur admitted and treated during the period 1989 - 1997

were included in the study. All of these patients had first been treated by quacks. Recent neglected and unreduced fractures were considered to be pseudo-arthrosis as they barely had chance to unite. Various methods had been used to deal with these fractures but my study is focused to evaluate the results of Pauwel's osteotomy and oseosynthesis in patients with non-union of femoral neck fractures.

MATERIAL AND METHODS

Thirty patients were included in this study. Various methods have been used to deal with these fractures. Pauwel's abduction osteotomy was done in 30 patients. There were 27 male and three female patients. Five patients were treated first with traction where greater trochanter was migrated a way up to bring it down to the proper level. Then osteotomy was done. In 25 cases, Pauwel's osteotomy was primarily carried out and fixed with 120-degree osteotomy plate. In 18 cases, valgifying intertrochanteric osteotomy was done. In four cases, valgifying wedge prop osteotomy while in five cases valgifying Y-prop osteotomy was done.

RESULTS

30 cases of neglected fracture neck of femur treated in Nishtar Hospital Multan from 1989-1998. 5 patients were treated first with traction where greater trochanter migrated a way up to bring it down to the proper level. Then osteotomy was done. In 25 cases Pauwels' osteotomy was primarily done and fixed with 120 degree osteotomy plate.
Follow up period ranged from 7 months to 2 and half years. Patients were assessed for reduction of the fracture site in according to alignment index by Garden for union of the fracture and range of mobility and pain relief in follow up period.

ALIGNMENT INDEX

The patient's radiograph showed a broken Shenton's line in every case, even coxa vera and high replacement of the greater trochanter. The absorption of the femoral neck was more severe in patients with period of neglect more than 6 months and patients had been walking on it, 26 patients suffered from leg length discrepancy, the greatest of which was 5.5crn.

Table-l. Alignment index

No of cases	Alignment index
Good	25
Acceptable	3
Poor	1
Frank mal reduction	1

After surgery all case except 2 cases had restored anatomical contour of the femoral neck and shanton's line was also well restored

ALIGNMENT INDEX BY GARDEN

Reduction good: If neck shaft angle ranges from 1 GO-180 degree ,
Acceptable: With the range of 155-180 degree in both AP and Lateral view
Poor Less than 155 or grater than 180 in both view
Frankly mal reduction: Less than 150 or greater than 185 degree in AP view alone.

Table-ll. Union percentage

Union	No of cases	%Age
United	24	80%
Non united	6	20%

UNION OF FRACTURE AND OSTEOTOMY

Radiographs are assessed at each visit for union of fracture site. Union was regarded as complete

disappearance of the fracture site and replaced by osseous material.

23 patients had united in an average of 3.7 months, while osteotomies had all healed in 6-7 weeks. One case of non-union resulted due to a large bone spur of dorsal fracture which imponged on the acettabulum during full extension and external rotation acting as a lever to continuously dissociate to proximal fragment from the distal fragment. The bone spur was removed, improving leg extension and eliminating external rotation blockage. Subsequently the non-union healed within 3 months with increasing rate from 76.7% to 80%. One another case developed deep infection later ankylosed hip requires Girdle stone. One case of nonunion required bone grafting and refixation to heal. In two cases required revision osteosynthesis and implant exchange.

Table-Ill. Relief of pain

Grade	No of cases	%age
Grade 1	25	83.3%
Grade II	3	10%
Grade III	1	3.3%
Grade IV	1	3.3%

PAIN AND RANGE OF MOBILITY

23 patients with excellent results were pain free, had no limp and allowed hip flexion of over 90 degree. The patient with former osseous impingement at 3 months had still moderate but decreasing load dependent pain and good function. One patient developed infection later ankylosis of the hip Joint. Grading of pain and mobility done by Sikoski and Barrington pain & mobility scale.

SIKORSKI AND BARRINGTON PAIN SCALE[10]

Grade-I No pain at all
Grade-II Mild, occasional pain, not requiring analgesics
Grade-III Pain either constant or occasional requiring analgesics Grade-IV Pain constant and severerequiring regular analgesics

SIKORSKI AND BARRINGTON MOBILITY SCALE

Grade	Mobility
I	Independent, walks without aid, does own shopping, capable of using public transport
II	As above but using walking aid
III	Limited to house unless accompanied, walking aids not used indoor
IV	Requiring walking aids indoor
V	Chair bound
VI	Bed bound

Table-IV. Range of mobility

Grade	No of cases	%age
Grade I	23	77%
Grade II	4	13.3%
Grade III	2	6.5%
Grade IV	1	3.2%

HIP ARTHRITIS AND AVASCULAR NECROSIS

Patients were assessed before and per-operatively for hot head of femur. Even bone scan was advised in suspected cases. No case with Inove and Ono stage III and IV osteonecrosis included in the study.

In no case avascular necrosis developed and a single case not has hip arthritis until 2 and half years follow up.

Inove and Ono Scalen

Stage I	Normal X-ray (abnormal scintigram) Irregular density, Slight flattening
Stage II	Irregular density and segmental collapse
Stage III	Severe deformity, osteoarthritis

DISCUSSION

Femoral neck fractures are uncommon, yet serious injuries in young patients. They should be treated as early as possible after the injury[12]. Swiontkowski et al reported 27 cases; all treated as vascular emergencies by early anatomic reduction and internal fixation with capsulotomy[13]. In that prospective study, with many patients treated within eight hours of admission, they achieved a 100% rate of union. Dedrich et al however reviewed 32 cases of femoral neck fractures in young adults and found 20% non-union and 36% avascular necrosis[12]. They concluded that high rates of non-union and a vascular necrosis were seen after all types of femoral neck fractures in young adults, but were more often associated with subcapital fracture. These complications of hip fracture seemed to be independent of health status, method of treatment or severity of injury.

Non-union was defined as displacement of the fracture requiring revision surgery or the persistence of a complete fracture line at [1] year from injury4. The most significant pre-operative characteristic of the patients that predicted non-union was the age of the patient with an increased incidence of non-union with increasing age[2].

The most significant radiographic indicators of fracture non-union were those based on displacement of the fracture. The Garden grade is one of the most widely used classifications but suffers from a high degree of infra observer variation9 and makes no allowance for displacement on the lateral X-ray. These complications of hip fracture seemed to be independent of health status, method of treatment or severity of injury. The dynamic hip screw, which is routinely used for inter-trochanteric hip fractures, also provides a technically simple means of fixation of intertrochanteric valgus ostomoties in the treatment of femoral neck[14].

Non-union was defined as displacement of the fracture requiring revision surgery or the persistence of a complete fracture line at 1 year from injury[4]. The most significant pre-operative characteristic of the patients that predicted non-union was the age of the patient with an increased incidence of non-union with increasing age.

Meyers et al reported communition in 90 percent of fractures where the fracture line is exposed at the time of surgery[15]. Frangakis reported increased non-union with communition[16].

Non-union is inevitable if the hip fracture is neglected[15]. All of these patients were first treated conservatively with this method; patients may have ambulated when hip pain increased. Thus motion at the fracture site caused the resorption of the femoral neck. In addition, the greater trochanter displaced upwardly, which made the affected limb shorter. Although non-union of the femoral neck fracture without arthrosis can be solved by osteotomy with or without bone grafting, the ideal treatment of this neglected hip fractures should be anatomic reduction with rigid fixation[17].

The best end result after a femoral neck fracture is the patient's own healed femoral neck and head. Pauwels osteotomy follows this principle representing a logical concept in the treatment of delayed unions and nonunions. There are many

reports claiming good early results with Pauwels abduction osteotomy[191318'19]. Our early results are comparable with the above series. In our series, we achieved consolidation by one osteotomy along in 23 of 30 cases. Three cases (two technical errors) needed revision before union was successful increasing the overall consolidation rate to 88%.
The largest series was published by Marti et al1, who reported on 50 cases of intertrochanteric osteotomy (Pauwels Osteotomy) and had a consolidation rate of 86%. In the study by Ballmer, overall consolidation rate achieved was 88%[19].

In two French publications reported 98 non-unions treated essentially with combined intertrochanteric valgus and medialization osteotomies, a consolidation rate of 74% was mentioned20'21. Non-union in 63 patients treated with subtrochangeric osteotomies consolidated in 52%. Compared to the literature, our rate of consolidation is in agreement with the success.

Collapse of the articular surface is the sign of avascular necrosis of the femoral head that is a common complication in femoral neck fracture. It is however reported that aseptic necrosis is rare when treatment is neglected because patient instinctively assume the position of greatest joint capacity (flexed and internally rotated)[22]. Thus in cases of extended negligence, the femoral head is not necessarily necrotic. Frangakis[16] found 45% avascular necrosis in a clinical study of 76 femoral neck fractures, with the highest percentage in un-united fractures and in the Garden stages 3 and 4. Calandruccio and Anderson considered that the vascular damage at the time of the fracture decides whether or not necrosis will develop[23.] Stromquist et al using tetracycline staining and isotope uptake studies showed that the vascular damage may be increased during the operative fixation of a fracture24. It is also recognized that over connection to more than 20 degree to 30 degree valgus, or mal-rotation will affect the remaining vessels in the ligamentum teres and the joint capsule, and increase the chance of developing[14'18"25].

Revascularization has been shown historically[26'27] and by scintigraphy although it is a restricted process[19.] If the artery of the ligamentum teres is intact, partial revascularization of the foneal area of the head is possible. The uniting fracture is limited but has been clearly recognized[26'27].

From these studies, it appears that the primary treatment of a femoral neck fracture may influence the chance of developing avascular necrosis. It is difficult to decide whether a secondary procedure such as an osteotomy for non- union can do the same. In the cases we studied, at a minimum of two and an average of nine months after fracture, avascular necrosis may already have been presented, without showing on the radiograph (Stage I of Inove and Ono)[11]. Revascularization on the other hand may also be in progress, although no contribution from a uniting fracture can be present. It is possible that any intact retinacular and ligamentum teres vessels have increased in size and number, if this is so, then valgus osteotomy is unlikely to further jeopardize the nutrition of the femoral head and the uniting fracture will help to support revascularization.

Two patients had developed radiographic sign of avascular necrosis during, follow up. It seems reasonable to assume that, at the time of osteotomy, these hips had stage-l necrosis, not visible on standard radiograph. Scintigraphy might have detected this but is not routinely performed by us, since it would not change our indication for osteotomy. These patients showed some progression of necrosis and collapse of femoral head, one needed prosthetic replacement but two had few or no complaints. This underlines the observation that even severe necrosis may be compatible with a satisfactory clinical results.

Although there was one non union of the osteotomy in the study by Ballmer19 but there was no non-union in our study, yet the risk of this complication is low in both our patients and in the literature.

CONCLUSION

Pseudarthrosis of neck of femur is a bio-mechanical problem. If the biomechanics are set in order, it will heal even without any biological support in the form of autologous or homologous bone graft. Pauwels intertrochanteric abduction osteotomy as modified by Muller et al is a reliable method of dealing with non union of the fracture neck of the femur in young adults. If there is concomitant avascular necrosis, the involved area should be small, not Invo type III and IV.

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