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Valgus intertrochanteric osteotomy and fibular strut graft in the management of neglected femoral neck fracture

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ABSTRACT

Purpose: A prospective study of neglected femoral neck fractures in mostly young patients was conducted to evaluate whether our technique of valgus intertrochanteric osteotomy with fibular strut grafting and osteosynthesis with dynamic hip screw and double-angle side plate can facilitate union with consistent satisfactory clinical outcomes.
Methods: Forty-one consecutive patients (27 males, 14 females) of neglected femoral neck fractures treated between April 2002 and December 2009 were studied. The average age of patients was 45.41 years (±11.67, range 20–62 years). The average interval since injury was 14 weeks (±10.21, range 4–44 weeks). The cases were evaluated radiographically and clinically.
Results: The average follow-up period was 32.5 months (±8, range 24–54 months). Radiographically union was seen in 39 patients at the nonunion site. The average time to radiographic union was 16.82 weeks (±3 weeks, range 12–24 weeks). Average Harris Hip Score (HHS) was 19.9 (±7.9, range 10–35) preoperatively and 90.9 (±10.35, range 62–100) at the latest follow-up. At that time clinical outcomes were excellent in 31, good in four, fair in three and poor in three patients.
Conclusion: Our mechanobiological surgical technique is reproducible with radiographic union achieved in 95.12% cases (39 patients) at the nonunion site and consistent excellent or good functional outcome in 85% of patients over a 32-month average follow-up. We recommend this procedure for neglected femoral neck fractures.

Introduction

One month or older fractures of the neck of femur are considered as neglected.[1–3] Neglected femoral neck fractures pose additional problems such as osteopenia, resorption, difficulty in reduction and communition besides high frequency of failure associated with internal fixation alone.[1–4] Delay in surgery leads to variable degrees of neck absorption, proximal migration of the greater trochanter (GT) and disuse osteoporosis with the ensuing co-morbidities.[5] Existing treatment options include osteosynthesis without or with either free or vascularised bone graft,[6–9] valgus osteotomy[2,3] and hemiarthroplasty or total hip arthroplasty (THA).[10,11] In spite of recent advances in treatment and outcome, results are variable and there is no universally accepted standard method of treatment.[3,10,11]

Hip arthroplasty is an attractive option in the elderly.[10,12–15] However, because of financial constraints, patients' reluctance to undergo joint replacement and change a lifestyle that involves squatting and sitting cross-legged, we preferentially offer joint-preserving procedures to our patients. In younger patients, every effort is made to preserve the native hip.[10,12]

The purpose of this prospective study was to evaluate whether our technique of valgus intertrochanteric osteotomy with fibular strut grafting and osteosynthesis with dynamic hip screw (DHS) and double-angle side plate can facilitate union in neglected femoral neck fractures in young patients with consistent satisfactory clinical outcomes.

Materials and methods

This study was approved by the hospital ethical committee and informed consent was obtained from all patients prior to enrolment. Forty-two consecutive patients of neglected femoral neck fracture were treated between April 2002 and December 2009. All these patients had displaced intracapsular femoral neck fractures. One patient developed implant cut out in the immediate

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postoperative period and underwent a bipolar hemiarthroplasty and was excluded. The remaining 41 cases were considered for the present analysis. The average age was 45.41 years (±11.67, range 20–62 years). There were 27 male and 14 female patients. The average interval since injury was 14 weeks (±10.21, range 4–44 weeks). Four patients had hypertension and two patients had diabetes mellitus. Plain radiographs of the both hips were assessed for avascular necrosis (AVN),[16] neck resorption,[1] measurement of the Pauwels angle [17,18] and osteoporosis.[19] There were seven Pauwel's type II and 34 type III fractures in our series. No special investigations were performed to detect pre-collapse or AVN of femoral head due to limited resources. Preoperative magnetic resonance imaging (MRI) scan was available for four patients and AVN of the femoral head was not detected in any of them. Exclusion criteria were presence of more than two co-morbid factors, patients presenting less than 4 weeks since injury and age more than 65 years.

All patients were operated under spinal (37 patients) or general anaesthesia (four patients). Preoperative planning was done on the pelvis with both hips' antero-posterior (AP) radiographs. The fracture was reduced on a fracture table accurately by gentle traction in external rotation followed by internal rotation and abduction by about 20° and confirmed under an image intensifier in AP and lateral views. Only one patient needed open reduction of fracture.

Via a direct lateral approach, the vastus lateralis muscle was released in the 'L' shape and lifted subperiosteally. An angle guide was used to pass two guide wires at an angle of 110°, to provisionally hold the reduction. The inferior guide wire was passed from the base of GT to the lower quadrant of the femoral head in AP view and central or posterior in lateral view. The second guide wire was passed superiorly and a 6.5 cancellous screw was inserted over it to stabilise the fracture to prevent displacement during the subsequent manipulations. This guide wire was subsequently removed.

After due consideration of the tip–apex distance, a DHS of appropriate length was passed over the inferior guide wire.[20] A 110°/130° custom-made double-angle side plate was inserted over the screw leaving the side plate at an angle of approximately 20° from the lateral aspect of the femoral shaft. Now at the level of the elbow of the plate (which is usually at or just proximal to the level of the lesser trochanter (LT)) a femoral osteotomy was performed by creating space for the oscillating saw. A pre-determined wedge usually of 20° was removed and the shaft of the femur abducted and fixed to the plate by cortical screws.

The length of the fibular graft required was assessed by the length of the superior screw. The outer part of the fibula of adequate length was removed by an oscillating saw from the middle third of the ipsilateral leg with the interosseous border kept intact. The cannulated cancellous screw was then removed. The fibular graft was inserted in the tunnel of the cancellous screw, by impaction up to the subchondral part of the femoral head under an image intensifier. The wound was closed in layers over a negative suction drain. No postoperative immobilisation was given.

Isometric quadriceps exercises and knee bending were started on the second postoperative day. Non-weight-bearing ambulation on crutches was encouraged as soon as the pain subsided. Weight bearing was allowed after 6 weeks as pain permitted.

Patients were assessed postoperatively at monthly intervals until radiographic union and at 3 months, 6 months and 1 year since surgery and yearly after that. Clinical assessment included evaluation for Harris Hip Score (HHS).[21] Radiographs were assessed for signs of union and appearance of signs of AVN.[16] Radiographic union was determined by the presence of bridging trabeculae across the fracture and the osteotomy site in both AP and lateral views. Unsupported weight bearing was allowed after radiographic union of the fracture.

Results

The average follow-up period was 32.5 months (±8, range 24–54 months). The average HHS was 19.9 (±7.9, range 10–35) preoperatively, 88.4 (±9.45, range 63–97) at the end of first year and 90.9 (±10.35, range 62–100) at the latest followup. At the end of the first year, clinical outcomes were excellent in 24, good in 11, fair in three and poor in three patients. At the latest follow-up, clinical outcomes were excellent in 31, good in four, fair in three and poor in three patients. Owing to only 20° correction, we removed smaller wedges, and the leg length discrepancy (LLD) in all patients was less than 2 cm. LLD was reported as per HHS.[21] At the end of the first year, 17 patients had no limp and the rest had either slight (19) or moderate limp (5) on walking. At the latest follow-up, 28 patients had no limp and the rest had either slight (10) or moderate limp (3).

Preoperatively, femoral head collapse was not observed in any radiographs. Postoperatively, seven patients developed radiographic signs of AVN and two out of these progressed to collapse of the femoral head during follow-up.[16] One patient of AVN, with progressive collapse, underwent a bipolar hemiarthroplasty for pain. The remaining six patients had fair outcome on HHS evaluation at the latest follow-up. Even though terminal range of flexion was restricted in these patients, activities of daily living were not affected.

Preoperatively, varying degree of neck resorption was observed in all patients. Thirty-three patients had type 3 and eight patients had type 2 Pauwels' fracture pattern. Eight patients had grade 5 osteoporosis, seven patients had grade 4, 24 patients had grade 3 and one patient had grade 2.[19] Radiographic union was seen in 39 patients at the nonunion site. The average time to radiographic union was 16.82 weeks (±3 weeks, range 12–24 weeks). Radiographic union at osteotomy sites was seen in all patients.

Nonunion was seen in two patients and underwent bipolar hemiarthroplasty. Superficial infection in two cases was controlled with regular dressings and change of antibiotics. There was no residual disability at the donor site, except transient lateral popliteal nerve involvement in one case.

Discussion

In developing countries, femoral neck fractures usually present late owing to factors such as neglect, mismanagement by bone-setters and delayed referral.[1,22,23] In spite of hip arthroplasty being an attractive treatment option especially in the elderly,[10,12–15] we preferentially offer joint preserving procedures to our patients. In younger patients, every effort is made to preserve the hip and joint replacement is used as a salvage procedure.[10,12,24,25]

There is no consensus as to the best treatment option and many methods of treatment such as osteosynthesis with cancellous screws, osteotomy with either displacement or angulation, osteosynthesis with cortico-cancellous graft with vascular pedicle[3,6,7,10,11] and osteosynthesis with either vascularised or non-vascularised fibular grafts are reported.[2,8,9,23] Valgus intertrochanteric osteotomy has the longest and most proven track record,[26] and excellent results are reported in young[27] and old.[17]

Femoral neck fracture nonunion is a mechanobiological problem[18]; hence, just a mechanical (fixation) or biological (grafting) solution is not enough, and a combination of the two must be used. Even though successful use of blade plate is reported,[17,22,25] it is technically difficult.[12] Greater risk of complications such as cutting out on insertion, displacement, fracture and less than satisfactory angular correction[28] with angle blade plate fixation is reported as compared to DHS.

In our series, intra-operative compression at the nonunion site was achieved[10] in all cases, which was not possible with an angle blade plate alone. Lack of rotational control of the proximal