

CASE REPORT

PATHOLOGICAL INTRACAPSULAR FRACTURE OF NECK FEMUR IN A YOUNG PATIENT: REPORT OF AN INNOVATIVE METHOD OF FIXATION WITH REVIEW OF LITERATURE

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HOW TO CITE THIS ARTICLE:

Jishnu Pr. Baruah. "Pathological Intracapsular Fracture of Neck Femur in a Young Patient: Report of an Innovative Method of Fixation with Review of Literature". Journal of Evidence based Medicine and Healthcare; Volume 1, Issue 12, November 24, 2014; Page: 1503-1510.

ABSTRACT: When there is the need to salvage the head of femur in a young patient with pathological intracapsular fracture of neck femur, the options are limited and there are not too many references in contemporary literatures. Traditional fixation methods are found to have many disadvantages in this setting due to the weak bone and the lack of sufficient stability to support any structural grafts. Fixation devices with side plates that also provide sufficient axial stiffness should theoretically provide the optimum environment for the incorporation of the grafts and revascularization and union of the head. The proximal femoral locking compression plate would be one such device and it can also be used for fibular osteosynthesis in other such situations.

KEYWORDS: Pathological neck femur fracture – Fibular osteosynthesis – Locking plate fixation.

KEYMESSAGE: Shaft fixation with limited intraoperative fracture compression and restriction of excessive postoperative fracture site collapse may be the ideal method to stabilize a fibular osteosynthesis of fracture neck of the femur.

INTRODUCTION: Fixation of femoral neck fractures requiring fibular grafting have traditionally been done with one or two cancellous screws.^[1,2,3] This type of fixation appears less desirable in the setting of osteoporosis of the trochanteric cortex, like in pathological situations.^[4,5] There is very little in contemporary literature regarding use of other implants along with the fibula.^{[7][6]} We report our experience with an alternative method, a proximal femoral locking compression plate, which was used to fix such a pathological fracture, and present a review of literature to justify the decision.

CASE HISTORY: A 24 year old apparently healthy female with 2 months history of right hip injury following fall from standing height. She was initially able to walk with pain and gradually became incapacitated. Direct questioning revealed history of mild local pain preceding trauma of 1 month duration. X-ray revealed pathological intracapsular hip fracture. [Fig. 1] Differential diagnosis included Unicameral bone cyst, Aneurysmal bone cyst, Giant cell tumour, Nonossifying fibroma, Fibrous dysplasia, Metastasis, Chondrosarcoma. The lesion was reported as Unicameral bone cyst. Routine investigation was within normal limits. MRI suggested Unicameral bone cyst with a small erosion in the trochanteric region posteriorly. [Fig. 2] Vascularity of the head was assessed to be normal. Preoperative FNAC from the posterior aspect of the trochanteric region was inconclusive.

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Pathologic fractures of the femoral head and neck rarely heal, and the neoplastic process tends to progress.^[7] Accordingly, there is a high incidence of failure if traditional fracture fixation devices are used.^[8] If not complicated by the intracapsular fracture, the line of management would have been different. The apparent benign nature of the lesion, the patient's young age and the intracapsular fracture prompted us to decide on trying to salvage the normal hip and reserve any extensive surgery until later if indicated by the histopathology. The decision to salvage the joint is supported by literature.^[9,10,11,12] We opted for an urgent single step extended curettage of the lesion through a lateral window after closed reduction and temporary fixation with K-wires. After thorough curettage and irrigation with hydrogen peroxide solution, corticocancellous grafts and ipsilateral fibula was inserted into the cavity and the region was fixed with a PFLCP with two locking screws anterior and posterior to the fibula.[Fig.3,4] Tissue sent for histopathological examination to two separate labs revealed Unicameral bone cyst and Aneurysmal Bone cyst respectively.

After cautious follow-up and delayed mobilization, the patient was able to walk unaided after 4 months and her 2 and half years follow-up showed complete healing of the fracture and incorporation of the graft without any complications. [Fig. 6, 7, 8, 9]

DISCUSSION:

BIOMECHANICS OF NECK FEMUR FRACTURE: The forces transmitted across the head of femur, the fracture and the fixation device are of considerable magnitude. It seems that the load borne by the hip when standing is not less than two to two and a half times the body weight.

The displacement of the fragments that must be prevented by an appliance capable of resisting this load are: 1) Lateral rotation of the distal fragment, especially in the setting of comminution of the posterior cortex, 2) Varus displacement of the capital fragment, especially in the setting of inferior cortex comminution and 3) Axial rotation of the head on the neck.

An effective appliance must withstand all the elements of displacement and retain its grip on the bone which may be weakened by osteoporosis.

FIXATION TECHNIQUES: Systematic reviews still do not come to any clear conclusions on the choice of implant for internal fixation of intracapsular fractures from the available evidence within randomized trials.^[13] Parallel screw fixation seems to be the most commonly used technique^[1,2,3] but attention has to be put in their correct placement and even then, they are found wanting in situation of gross osteoporosis and comminution of the cortex of the neck.^[5] Crossed nails or screws provide better fixation than parallel nails or screws.

They give excellent control of axial rotation of the head and good control of lateral rotation of the distal fragment. The main criticism of this technique is that stability against varus displacement is often dependent on the integrity of the shell of cortical bone in the trochanter and subtrochanteric region; once this crumbles, the fixation is lost. Attempts were made to prevent this by the method of triangular pinning of Smyth, Ellis, Manifold and Dewey (1964) in which the two screws are joined by a bracket which lies against the lateral cortex of the upper

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part of the shaft of the femur.^[4] Recent efforts with the Dynamic Hip Screw and de rotation screw also echoes these principles.^[14,15]

However, Blair et al. found that a de rotational screw located superior to the sliding hip screw does not enhance fixation.^[16] The collapse at the fracture site may not be desirable in all situations like gross osteoporosis or with fibular osteosynthesis. In fact, compression at fixation time may not be required at all, as shown by Frandsen et al- In a prospective study of 220 displaced intracapsular fractures treated with a dynamic hip screw, with or without application of compression, union occurred in 67% of fractures with compression and 82% of fractures without compression.^[17] There was also a consistent finding of one serious complication (avascular necrosis) with the sliding hip screw in comparison with five different types of cancellous screws.^[13] Besides DHS occupies too much of space to be put together with a fibula. The Blade plate is more appropriate.^[6,18]

The Gottfried Percutaneous Compression Plate is another recent attempt using shaft fixation along with controlled collapse.^[19] Another innovative method to address this problem in recent times is the F- technique using biplane double-supported screw fixation using 3 screws in crossed fashion suggesting that controlled collapse may actually not be as important as fracture stability in improving healing.^[20]

The PFLCP provides the necessary axial stability of the crossed screw configuration and also has the advantage of the lateral shaft fixation to control the varus and the external rotation tendencies. Besides it gives enough space for fibular osteosynthesis and the necessary rigidity to protect the fibula till its incorporation. In a comparative study, Aminian et al.^[14] examined the biomechanical stability for fixation of Pauwels Type-III femoral neck fractures in cadaver femora and found that the strongest construct was the proximal femoral locking plate, followed by the dynamic condylar screw, the dynamic hip screw, and lastly the three-cannulated-screw model.

However, proper anatomic reduction and compression of the fracture are necessary prior to fixation, as this plate does not allow fracture compression. The reported clinical experience with the proximal femoral locking plate is insufficient to allow a recommendation for its routine use at this time.^[21] We have found that the configuration of the locking cancellous screws-uniplanar towards the base and diverging in the axial plane towards the head conforms optimally with the biogeometry of the femoral neck^[22] and allows a fibula to be placed in the space of one of the screws. Static compression can be applied during the insertion of the first screw by using a washer to prevent locking, followed by locking with the other screws and finally even locking the first screw after removing the washer.

VASCULARITY: The insult to the vascularity during injury is beyond the Surgeon's control. Surgeon can however create an optimal mechanical environment for revascularization of the femoral head by early optimal reduction and by stable fixation. It has been found that further damage is unlikely with internal fixation. However posterior & superior quadrant should be avoided.^[23] Therefore in this case, closed reduction, lateral approach and the primary fixation at the time of biopsy and extended curettage as a single step surgery was preferred to avoid further insult to the head which was still vascular according to the pre-operative MRI. This decision was thought prudent in the setting of the benign nature of the lesion in pre-operative radiographs and

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MRI. Also, the cortico cancellous grafts were taken avoiding the origins of the Sartorius and anterior portion of the Tensor fascia lata as they may have to be used at a later date.

SELECTION OF MODE OF TREATMENT: The associated pathology already suggested that this condition needed to be treated proactively as a femoral neck fracture non-union rather than a fresh fracture. In elderly patients with fracture neck femur non-union, total/ hemi joint replacement is an attractive treatment option with demonstrably good results.^[24] In younger patients who present with a femoral neck fracture without avascular necrosis, however, every effort should be made to preserve the native hip. In this particular case the apparent benign nature of the lesion further dictated that head deserved at least one chance. If unsalvageable, the Unipolar Articular Surface Replacement is a viable option.^[25] Regarding internal fixation versus arthroplasty, there is still a need for studies to define which patient groups are better served by the different treatment methods.^[26]

Schanz abduction angulation osteotomy and the Pawels valgus intertrochanteric osteotomy, were not considered because of the pathology extending to the trochanteric region with attendant risk of nonunion at the osteotomy site. Considering the long-term problems of osteotomy, Roshan et al. suggested that bone grafting with internal fixation is still the reliable method of fixation in femur neck nonunion.^[27]

That left us with the option of using osteosynthesis with bone grafting which incidentally was also needed for the treatment of the lytic lesion.

CHOICE OF BONE GRAFT: Many methods of osteosynthesis using vascularized cortico-cancellous graft i.e. muscle pedicle or fibular grafting have been advocated. Muscle pedicle grafting, as a primary procedure, needs open approach which further jeopardizes vascularity of the femoral head and is associated with high incidence of avascular necrosis and hence has lost its popularity.^[28]

Henderson treated non-union of the femoral neck fracture by open reduction and free fibular grafting with POP hip spica for 3 months. Nagi et al reviewed young patients treated by ORIF with one cancellous screw with free fibular graft and reported encouraging results.^[1] These have been reproduced by other researchers recently.^[2,3,28]

RATIONALE OF IMPLANT SELECTION: A PFLCP added the benefit of shaft fixation and a rigid support to the bone grafts to prevent unwanted shear and collapse. The use of side plate devices and application of crossed screw configuration is supported by many researchers both old and recent.^[4,6,14,20]

The rigid fixation thus achieved does not necessitate any external immobilization and the limited lateral approach and closed reduction doesn't disturb the retinacular vessels and the important blood supply so vital in fracture healing. PFLCP may provide the optimum environment in similar cases of fibular osteosynthesis of fracture neck femur.

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Fig. 1: Pre-operative x- ray

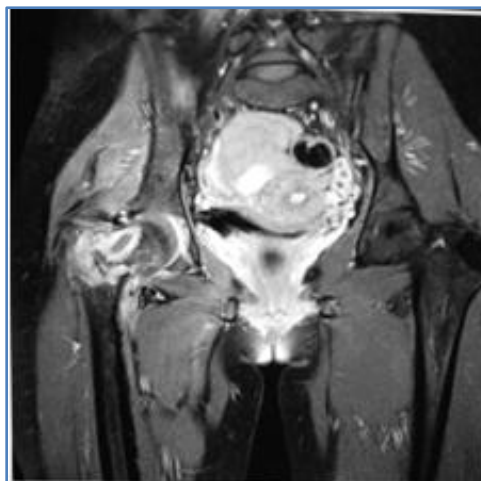


Fig. 2: Pre-operative MRI

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Fig. 3: Post-Operative AP



Fig. 4: Post operative Lat



Fig. 5: Two and half years follow-up AP view



Fig. 6: Two and half years follow-up lateral view



Fig. 7: Two and half years follow up full weight bearing



Fig. 8: Two and half years follow up squatting

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Date of Submission: 29/10/2014.
Date of Peer Review: 30/10/2014.
Date of Acceptance: 12/11/2014.
Date of Publishing: 20/11/2014.