

**REPAIR OF BONE DEFECT ON CALCAR FEMORALE WITH TENSOR FASCIA LATA
MUSCLE VASCULARIZED PEDICLE ILIAC BONE FLAP: A CASE BASED
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Article Received on 28/06/2018

Article Revised on 18/07/2018

Article Accepted on 08/09/2018

ABSTRACT

The reconstructive management of Bone defect of Calcar femorale is a challenging procedure for surgeons. Calcar femorale is the weight bearing area of femur neck. It provides the mechanical support and aid in load distribution within the proximal femur. Therefore, the bone defects in this region are very prone for pathological fractures of femur neck and it might lead to more complications such as avascular necrosis of head of femur. This would emphasize the importance for an excellent reconstructive management with sufficient blood supply. We present two related case reports highlighting the surgical technique.

KEYWORDS: Bone defect; iliac bone graft; vascularized graft; calcar femorale; femur neck.**INTRODUCTION**

Bone defects are really difficult to be managed, depending upon the size, shape and the region of defects. It can be due to trauma, bone cyst, pathological fractures, neoplasm, non-union of femur neck and so on. The main complication of ununited neglected femoral neck fracture in a young adult is avascular necrosis (AVN), with most reported incidences being 15 % (range 0–67 %).^[1] The variety of management techniques can be done for the treatment of bone defect and non-union, including osteosynthesis with bone graft^[2], grafting demineralized bone matrix, ceramics, and prosthetic implants.

The word 'calcar' means spur, an anatomical term used for years. The calcar is the most important structure of proximal femur. It is a prominent spur of compact bone running from the lesser trochanter towards the femoral head.^[7] This ridge of bone provides mechanical support and aids in load distribution within the proximal femur. The calcar femorale is a normal ridge of dense bone that originates from the postero-medial endosteal surface of the proximal femoral shaft, near the lesser trochanter. Average length of calcar measured on roentgenogram is 36.78 mm.^[8]

The golden standard in bone graft surgery is still the use of autologous bone graft.^[4] A large volume of bone graft can be harvested from iliac bone. Anterior region of iliac bone 20 mm distal from anterior superior iliac spine, can harvest a 5-mm thick tricortical graft with 35-mm height and 47-mm width at the thickest point of the iliac tubercle^[3] and from the posterior region also, can harvest

approximately 40–50 mm inferior to the iliac crest and 10mm anterior to the posterior superior iliac spine.^[5] So the larger area of defect also can be reconstructed by iliac bone.

The tensor fascia lata muscle has a good vascular supply from the ascending branch of lateral circumflex femoral artery (LCFA), and the distributary branches supplies the muscle within the 7.5 to 11.5 cm distal to anterior superior iliac spine. The LCFA trifurcates into three branches before entering the muscle.^[6]

The case report gives a view on the reconstructive management of bone defect with the help of iliac bone and vascularized pedicled tensor fascia lata muscle. The osteoconductivity of vascularized graft are high. In this paper we have two real cases; first case is unicameral or simple bone cyst of calcar femorale of femur neck that caused large bone defect and the second case is pathological fracture of femur neck with bone defect. Radiological investigation suggested a large size cyst formation which caused a major defect of calcar femorale of femur neck. Without reconstruction it's very susceptible to fracture. Our study highlights that the vascularized iliac bone flap helps in good results and increased success rate. The profuse volume of harvest of iliac bone helps in reconstruction of larger bone defects.

CASE 1

A case of Unicameral bone cyst of femur neck. Patient 29 years old male, complaints of pain on right side of hip and reduced mobility for past 15 days. On hospital

checkup, the movement of right leg caused tenderness. The patient was posted for clinical investigation, x-ray and computed tomography of pelvis (figure 5). The result suggested right proximal femur lesion. It was a lytic lesion with no fracture, but very prone to have pathological fracture. On physical examination, vitals were normal. The patient was posted for surgery, curettage of the bone cyst and the bone defect at region of curettage was reconstructed by iliac bone pedicle flap.

Surgical technique of Case 1

General anesthesia was administered and the patient was turned to the supine position. The anatomical markings were done (figure 1) and the technique performed was anterolateral approach of the femur neck along the course of tensor fascia lata muscle (TFL). On a straight line connecting the anterior superior iliac spine and the outer margin of the patella, an incision, 2 cm above and lateral to the anterior superior iliac spine towards the distal end is made and it was approximately 15 cm in length and 'S' shaped. After dissecting the skin and the subcutaneous tissue, the TFL muscle is exposed. A blunt incision of the muscle towards anterior superior iliac

spine (ASIS) is made. Using an osteotome, the iliac bone graft is harvested 2 cm away from ASIS for protecting lateral femoral cutaneous nerve (LFCN) (figure 2). The iliac bone harvested was approximately 4.5 cm in length and 2 cm in width (figure 3). A part of attachment of TFL muscle is taken as pedicled graft due to its sufficient blood supply of ascending branch of lateral femoral cutaneous artery (AB-LFCA).

The curettage of unicameral bone (UCB) or osteomyelitis of femur neck is done by retracting rectus femoris muscle and tensor fascia lata muscle, when the femur neck is exposed. The cyst is drilled and curettage is done by medically used concentrated spirit. The curettage of cyst makes bone defect in posterior medial portion of femur neck (calcar femorale). The Pedicled iliac bone flap is twisted with the muscle towards the femur neck and inserted to the bone defect (figure 4). A large compression plate bended according to the shape and lock screw is used to fix the graft in exact position (figure 6).

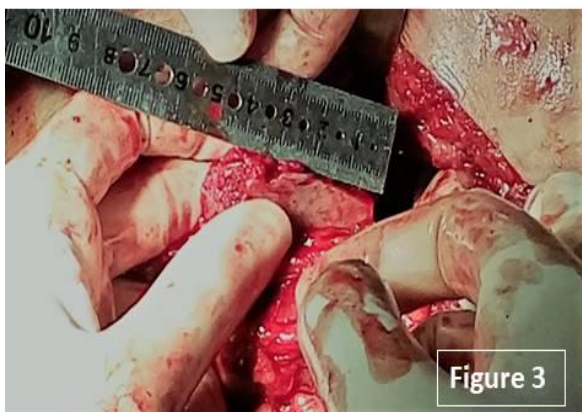


Figure 1: the anatomical markings preoperative, Figure 2: harvest of iliac bone pedicled bone graft, Figure 3: 4.5 cm measured graft, Figure 4: femur neck is exposed and iliac bone is grafted by twisting down the TFL muscle.

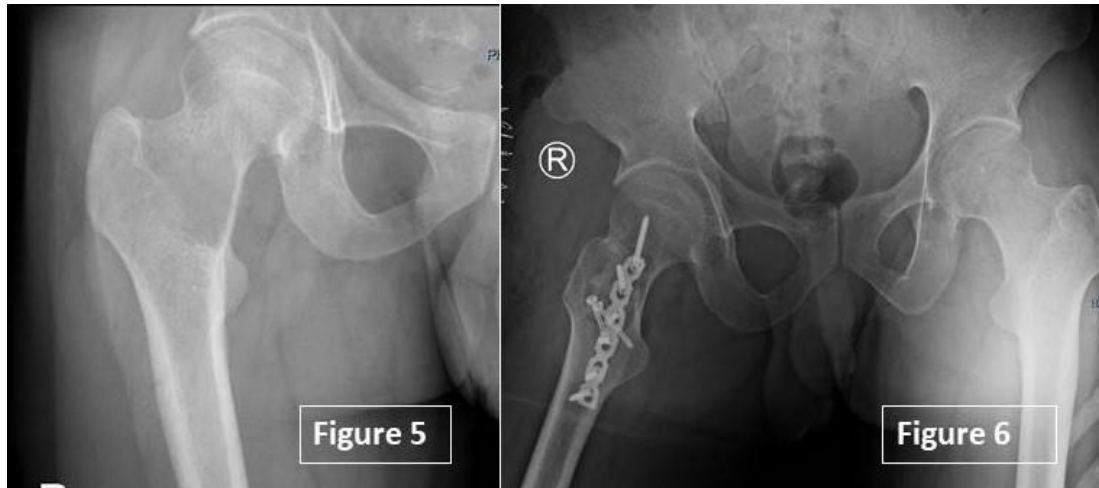


Figure 5: X-ray shows a right side femur neck lesion 4*3.cm size, Figure 2: postoperative X- ray show a perfect fixation.

CASE 2

It is a case of unicameral bone cyst with bone defect and cause pathological fracture of femur neck. A 24 year old male was admitted in hospital due to sudden onset of heavy pain and immobility in right side hip region. He reported two weeks of intermittent pain over the same region of right pelvis without any past history of trauma, fever and weight loss. On examination, the right limb was externally rotated and shortened and had severe pain on movement. The radiological investigations, X-ray (figure 8) and computed tomography (figure 9) revealed right-sided intracapsular fracture of femur (Garden type 3 fracture classification) with bone defect due to bone cyst in calcar femorale of femur neck. The vitals were normal and the patient was posted for surgery. Due to young age and the bone defect in calcar region, iliac bone vascularized flap and internal fixation with cannulated cancellous screw was suggested.

Surgical technique of Case 2

Under general anesthesia, the patient was positioned supine on the fracture table. The ipsilateral arm was

elevated on a sling and the contralateral uninjured leg was placed on a leg holder. C-arm image intensifier is used during surgery. Anatomical markings were done after aseptic technique (figure 7), 15 cm long incision was made, and anterolateral approach (Watson Jones approach) of the femur neck along the course of tensor fascia lata muscle (TFL) was the technique performed. On a straight line connecting the anterior superior iliac spine and the outer margin of the patella, an incision 2 cm above and lateral to the anterior superior iliac spine towards the distal end was made. The incision was approximately 15 cm in length. After dissecting the skin and the subcutaneous tissue, the TFL muscle is exposed. A blunt incision of the muscle towards anterior superior iliac spine (ASIS) was made. Using an osteotome, the iliac bone graft was harvested. The pedicled iliac graft was rotated to the region of bone defect and placed precisely (figure 10). The fracture was reduced and guide-wire was inserted. Finally, drilling over the guide-wire was done with 3.6 mm cannulated drill bit and fixed with 7.0 mm cannulated cancellous screws (figure 11).



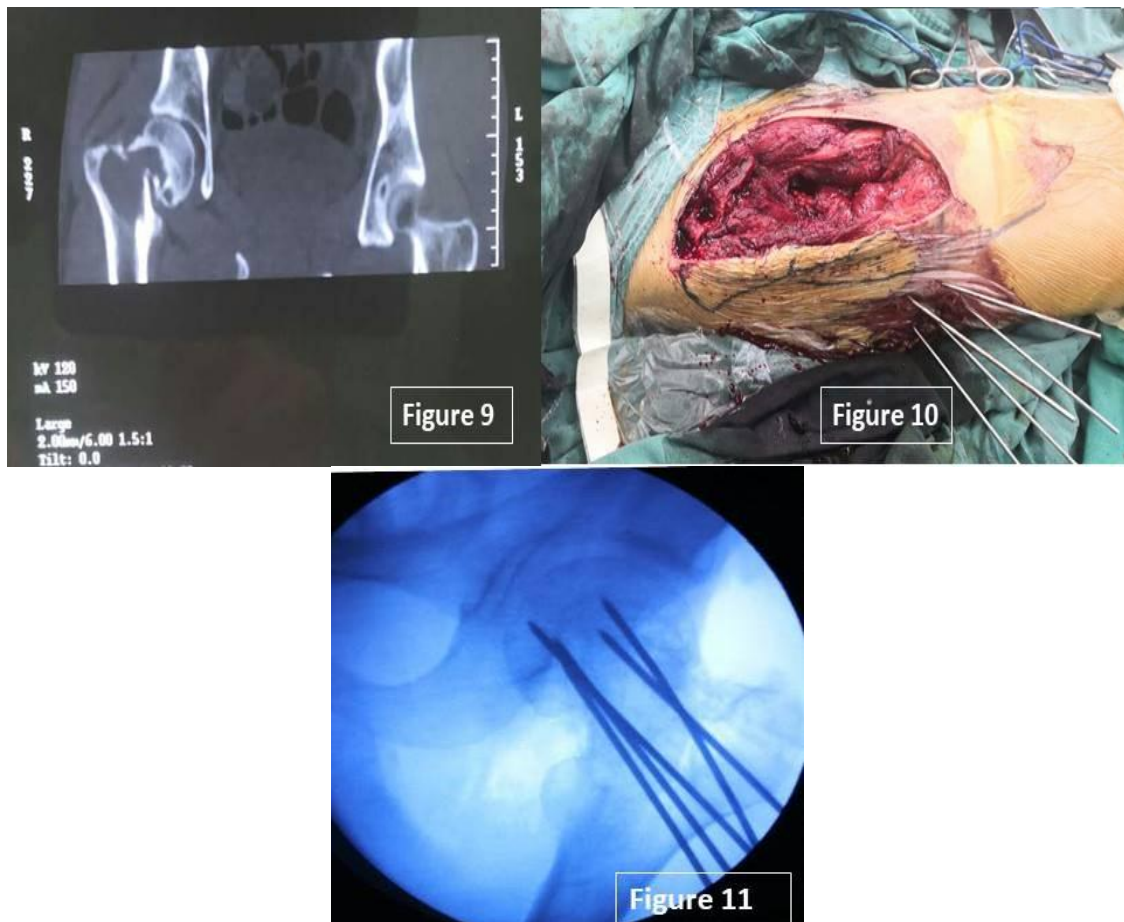


Figure 7: anatomical markings, denotes femoral nerve artery and vein, **Figure 8 and 9:** pre-operative X-ray and CT shows the fracture caused by bone defect, **Figure 10 and 11:** the iliac bone graft is harvested and fixed using guide k-wire.

DISCUSSION

We present two similar cases that show bone defect of calcar femorale of femur neck. It is the weight bearing region of the femur. In this, we are focused on the surgical management of bone defect with vascularized pedicle bone flap. The management of bone defect is controversial. Amputation was the early procedure. In 1960, no reconstructive methods were done for the survival. Neer in 1966 reported curettage and grafting for unicameral bone cyst. Autogenous cancellous bone graft, allograft, prosthesis and vascularized pedicled bone graft techniques increased the survival rate of bone defect from amputation. Simple curettage of the cyst and periosteal conservation facilitates reconstruction. If the tumor leaves a continuous bony wall, curettage and filling by graft, cement or bone substitute also provides good results, but with a 10% to 30% risk of local recurrence.^[7] Vascularized bone grafts have been used and reports shows that the mean success rate of bone defects treated by vascularized bone graft is 69% and that 15% of the cases required secondary surgical treatment.^[10]

Mostly unicameral bone cysts are asymptomatic. Pathological fracture and pain are the factors that leads patient for checkup. The differential causes of bone

defect are rheumatoid disease, giant cell tumor, unicameral bone cyst, aneurysmal bone cyst and all types of tumors. The X-ray, computed tomography and magnetic resonance imaging investigation guide to the diagnosis and for the confirmation, biopsy of the culture material is to be done.

In 1962, Fahey and O'Brien suggested the technique for unicameral bone cyst treatment that they referred to as subtotal resection and grafting.^[11] It was wide excision of adjacent normal bone tissue and curettage of the cyst. Cortical iliac and tibial bone harvested to graft the bone defect. Around 4 years' follow-up, Fahey and O'Brien reported a 95% (19/20) success rate with their technique (using the absence of a cyst as their criterion).^[11] Those times his procedure became a choice of treatment for primary cyst and for patients with the recurrence by conventional method of surgery. In 1997, Pogrel conducted the study between the comparison of vascularized and non-vascularized bone graft for mandible.^[12] According to that study, out of 39 vascularized bone graft patient, 95 % was the success and out of 29 non vascularized bone graft, only 76% was success. He also noted that length of the graft is a depending factor of success. More than 5-6 cm of non-vascularized graft is prone for failure and for a vascularized bone graft, more than 9-10 cm not a factor

of failure.^[12] Eisenschenk et al. studies showed that 80 patient underwent iliac crest vascularized graft for femur head necrosis. Harris Hip Score was about 86.8% and no prognosis of the disease over more than half of follow up patient.^[13]

The cases we illustrated here gives a view on the surgical management of bone defect of calcar femorale and highlights the reconstructive management of bone defect with vascularized pedicled iliac bone flap with regard to anatomical aspect. Follow up showed a good recovery around six month duration. Although studies.^{[11], [12], [13]} suggested the amount of graft that can be used as vascularized and non-vascularized. Average length of calcar femorale measured on roentgenogram was 36.78 mm.^[8] Our area of bone defect after curettage in both cases was around less than 5 cm length and 2.5 cm height. We had excellent results for the graft reconstruction. We suggest that our surgical technique using tensor fascia lata muscle with vascularized pedicled iliac bone flap is a best choice of reconstructive management of bone defect over calcar femorale of femur neck.

CONCLUSION

The bone defect in the region calcar femorale of femur neck is very prone for pathological fractures and they may lead to more complications such as avascular necrosis of head of femur. Thus, the bone defect in this region makes a great importance for an excellent reconstructive management with sufficient blood supply. Young people less than 30 years old has increased chances of unicameral bone cyst of proximal femur with bone defect. It should seriously consider the reconstructive management of bone defect before causing more complications and should give more privilege for maintaining the normal anatomical function.

REFERENCE

1. Roshan A, Ram S. The neglected femoral neck fracture in young adults: review of a challenging problem. *Clin Med Res*, 2008; 6: 33–39.
2. Helfet DL, Jupiter JB, Gasser S. Indirect reduction and tension-band plating of tibial non-union with deformity. *J Bone Joint Surg Am*, 1992; 74: 1286–1297.
3. Ropars, M., et al., How can we optimize anterior iliac crest bone harvesting? An anatomical and radiological study. *Eur Spine J*, 2014; 23(5): 1150-5.
4. Sen, M. K, & Miclau, T. Autologous iliac crest bone graft: should it still be the gold standard for treating nonunions? *Injury*, 2007; 1: S75-S80.
5. Boucree, T., et al., Posterior Iliac Crest Bone Graft: How Much Is Enough? *J Craniofac Surg*, 2017; 28(8): 2162-2164.
6. FAYSAL A. SAADEH., et al., Blood Supply of the Tensor Fasciae Latae Muscle. *Clinical Anatomy*, 1998; 11: 236–238.
7. Mascarid, E., A. Gomez-Brouchet, and K. Lambot, Bone cysts: unicameral and aneurysmal bone cyst. *Orthop Traumatol Surg Res*, 2015; 101(1): S119-27.
8. Merkel, F. R.: Betrachtungen uber das Os femoris. *Virchows Arch. f. Pathol. Anat*, 1873; 59: 237.
9. Christian E. P., Bosse M. J., Robb C. G. Reconstruction of large diaphyseal defects, without free fibular transfer in type 3b tibial fractures *J. Bone Joint Surg*, 1989; 71-A: 994-1003.
10. Prokuski L. J., Marsh L. Segmental bone deficiency after acute trauma. *Orthop. Clin. North Am*, 1994; 25: 753-765.
11. Fahey JJ, O'Brien ET. Subtotal resection and grafting in selected cases of solitary unicameral bone cyst. *J Bone Joint Surg Am*, 1973 Jan; 55(1): 59-68.
12. M.A Progreel, Scott Podlesh. Comparison of Vascularized and Nonvascularized Bone Grafts for Reconstruction of Mandibular Continuity Defects, 1997; 55: 1200-1206.
13. Eisenschenk A, Lautenbach M, Schwetlick G, Weber U. Treatment of femoral head necrosis with vascularized iliac crest transplants. *Clin Orthop Relat Res*, 2001; 386: 100–5.