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Pain relief with core decompression and autologous bone graft in osteonecrosis of femoral head in grade 2

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Abstract

Background: Osteonecrosis of femoral head means death of osteocytes with subsequent structural changes leading to femoral head collapse and secondary osteoarthritis of hip joint. Avascular term is reserved for osteonecrosis due to interruption of nutrient arteries as result of fracture of femoral neck and dislocation of hip joint. The most common presenting symptom in osteonecrosis is pain in hip joint. The aim of this study is to evaluate pain relief in early stage of osteonecrosis in patients operated with core decompression with bone grafting at different stage of follow up.

Material and Method: In prospective study, we included 50 hips of stage 2 based on Modified Ficat and Arlet classification. We did core decompression with 8mm diameter track and filled with cancellous bone graft taken from posterior superior iliac crest. Pain relief assessed based on visual analogue score at all stage of follow up.

Results and Conclusion: According to our study it is found that core de compression with bone grafting provide satisfactory outcome for pain relief if patient is selected carefully with early stage of osteonecrosis before collapse of femoral head. It is method of choice for young patient presented with early changes.

Keywords: Core decompression, visual analogue score, ficat and arlet classification, bone graft

Introduction

Osteonecrosis of femoral head means death of osteocytes with subsequent structural changes leading to femoral head collapse and secondary osteoarthritis of hip joint [1-3]. Femoral head is supplied by branches of profunda femoris artery (lateral branch of femoral artery). Avascular necrosis of femoral head is associated with many etiological factors and usually one or more risk factors are present but approximately two-thirds of this is related to alcohol abuse and corticosteroid intake. Rest are mainly idiopathic. The femoral head is more prone to developing osteonecrosis due to the lack of a collateral circulation and due to the fact that it has relatively avascular sinusoids and bone marrow.

Osteonecrosis, also known as avascular necrosis or AVN, is characterized by a stereotypical pattern of cell death and a complex repair process of bone resorption and formation. It is not the necrosis itself but rather the resorptive component of the repair process that results in loss of structural integrity and subchondral fracture. Most likely, a common pathophysiological pathway exists involving compromised subchondral microcirculation. Decreased femoral head blood flow can occur through three mechanisms: vascular interruption by fractures or dislocation, intravascular occlusion from thrombi or embolic fat, or intraosseous extravascular compression from lipocyte hypertrophy or Gaucher cells.

Stages of AVN

Stage 1: Loss of cell viability

Stage 2: Invasion of marrow vascular spaces of dead bone by proliferating capillary and cells

Stage 3: Invasion of marrow vascular spaces of dead bone by mesenchymal cells

Stage 4: Differentiation of mesenchymal cells to osteoblasts and synthesis of new bone; mesenchymal differentiation into fibroblast and synthesis of collagen and proteoglycan.

Stage 5: Internal remodeling of repaired cancellous bone. There may fracture at junction between repaired bone and unrepaired bone which is filled with dense fibrous tissue radiologically identified as crescent signs.

Stage 6: Resorption of subchondral bone and invasion of articular cartilage. There will increase in mass of coarse cancellous bone and a decrease in mass of compact subchondral bone.

There are number of modalities for treatment of avascular necrosis like

- Core decompression with bone grafting
- Multiple drilled hole
- Total hip replacement
- Fibular stud graft

Out of above modalities we opted for core decompression with cancellous bone graft to study the pain relief after the procedure.

The rationale for the use of core decompression is based on the concept that increased intra-medullary pressure is involved in the pathogenesis of avascular necrosis. Thus by core decompression, creeping substitution to the necrotic area occurs by bringing the blood supply through the drilled channels thereby decreasing the intra-medullary pressure. This may arrest or reverse the progress of avascular necrosis before the collapse occurs thereby avoiding articular collapse and its sequelae. Hence when acted, vigilantly at initial stages before collapse occurs, core decompression may preserve the normal femoral head. It is most commonly seen in a younger age group usually in the third or fourth decade of life. Osteonecrosis occurs in fatty marrow which has a sparse blood supply. The etiological factors are long term alcohol or steroid intake, collagen vascular disease, sickle cell disorders, trauma to neck femur and coagulopathies [4-7].

Materials and Method

Study was undertaken in our institute which included 50 skeletally mature hips with Ficat and Arlet stage 2 osteonecrosis of the femoral head willing for the procedure and follow up were included in our study while skeletally immature patients, Ficat and Arlet stage 1, 3 and 4 and patients not willing for follow up were excluded.

We used modified Ficat arlet staging system

Stage 1: Symptoms present, X-Ray normal, MRI finding present

Stage 2A: Subchondral cyst or sclerosis seen

Stage 2B: Crescent sign

Stage 3: Broken contour of femoral head, bone sequestrum, joint space normal

Stage 4: Decreased joint space, collapse of femoral head, Acetabular changes

For patients who presented to the outpatient department with history of groin pain radiating to the thigh with or without a limp, a thorough history was taken regarding alcohol consumption, steroid use, bleeding disorders, trauma and other causative factors. The patients were then evaluated radiologically with standard x-rays of the pelvis with both hips-anteroposterior and lateral views. If the x-rays were normal and there was a high degree of suspicion for the presence of avascular necrosis, MRI of the affected hip was done with screening of the opposite hip due to the high degree

of bilaterality seen in osteonecrosis. The MRI findings and the stage of the disease were noted and documented in the case records and the pre-operative and post operative Harris hip score was also documented. Pain was assessed by visual analogue score.

Operative Procedure: Under spinal anesthesia, patient was placed on standard operating table in lateral position. Posterior superior iliac crest was palpated and incision over iliac crest towards spine was put and making window over iliac crest cancellous bone graft was taken. We made lateral longitudinal incision starting from greater trochanter to 3-5 cm distally. One guide wires were placed targeting the most necrosed and depressed part of femoral head under c-arm control. Necrosed bone was removed out with help of 8mm drill tap and small curette. The track was packed with cancellous bone graft. Wound was closed in layers and antiseptic dressing applied.

Biological Augmentation: Biological augmentation had done in the form of autologous cancellous bone grafting. Required amount of autologous cancellous bone graft was taken from posterior superior iliac crest. Both core tracks were tightly packed with autologous cancellous bone graft. Hernigou P. et al. reported that core decompression with autologous bone grafting yielded better results as compared to core decompression alone [7]. Cancellous bone grafts become incorporated more quickly and completely than cortical bone grafts.

Postoperative Protocol: On 1st postoperative day static quadriceps and ankle pump exercises were started. From 2nd postoperative day high sitting, knee flexion and extension were started. Post operative 2 and 5 dressing done and on 12 sutures were removed. Patient was kept non weight bearing, however knee flexion and extension were allowed. Partial weight bearing was started at 12th postoperative week and full weight bearing in consecutive follow up. Follow up visits were done at regular interval of 6th week, 12th week, 18th week, 24th week. Pain was assessed by visual analogue score on 2nd day, 5th day, 6th week, 12th week, 18th week, 24th week.

Results and Analysis

1. **Age:** Out of 50 patients 32(64%) of patients from 31 – 40 years age group. Mean age of presentation was 37.2 years.

Table 1: Age

Age	Number of Patients	Percentage (%)
21 – 30	8	16
31 – 40	32	64
41 – 50	10	20

2. **Sex:** All patients included in our study were male.

3. **Etiology:** According to our study most common cause of osteonecrosis of femoral head is chronic alcohol intake.

Table 2: Etiology

Risk Factor	Number of Patients	Percentage (%)
Alcohol	27	54
Idiopathic	11	22
Steroid	8	16
Sickle Cell Disease	4	8

4. **Grade:** Grading was done according to X-Ray and MRI findings.

Table 3: Grade

Grade	Number of Patients	Percentage
2A	35	70%
2B	15	30%

5. **Duration of pain:** Patients diagnosed with osteonecrosis presented to us with different stage of and different duration of pain. Most common time of presentation was between 3 months and 6 months of pain.

Table 4: Duration of pain

Duration	Number of Patients	Percentage (%)
1 Month	7	14
3 Months	13	26
6 Months	26	52
9 Months	4	8

6. **Assessment of pain:** Patient presented to us were assessed on based of visual analogue score. Post operative assessment was done in similar manner. At time of presentation 90% patients had moderate to severe pain and immediate post operatively 90% patients had complete pain relief.

Table 15: Assessment of pain

Visual Analogue Score	At Time of Presentation	Immediate Post Op	1 Month Follow Up	3 Months Follow Up	6 Months Follow Up
No Pain	0	45	47	47	44
Mild	5	5	3	3	5
Moderate	24	0	0	0	1
Severe	21	0	0	0	0

7. Pain relief associated with grading – 3 Patients with stage 2A and 2 patients with stage 2B had persistent pain. At

final follow up 4 patients from stage 2A and 2 patients from 2B had pain.

Table 6: Pain relief

Grade	Immediate Pain Relief			At Final Follow up Pain Relief		
	Yes	No	Total	Yes	No	Total
2A	32	3	35	31	4	35
2B	13	2	15	13	2	15

Discussion

- Core decompression is the procedure of choice in the management of osteonecrosis of the femoral head of stage 2 before the onset of mechanical collapse. It does not have a role at a later stage when the sphericity of the femoral head is not maintained and other procedures such as rotational osteotomy or replacement arthroplasty needs to be done according to the stage of the disease and the extent of involvement of the head [9, 10].
- The advantages of core decompression are that it's a simple procedure, easy to perform, does not require prolonged stay in the hospital and the surgical field for subsequent arthroplasty if necessary, is not altered [11].
- In our study, 80% patients were between age of 20 – 40. This suggest that it is more common in younger age group [12-14].
- In our study, 54% had alcohol as the cause of osteonecrosis. 52% patients had pain since 6 months.
- In our study, we made patients immobilize for 12 weeks. This is because once core decompression is done, femoral head would require adequate time for regeneration. Hence if weight bearing is started before adequate bone formation, it might lead to collapse of the femoral head under stress. Adequate immobilization (at least 3 month post-operatively) for AVN patients treated with core decompression for incorporation of the graft and new bone formation is therefore suggested.
- In our study, at time of presentation almost all the patients had moderate to severe pain. Among them 45 (90%) patients had immediate post operative pain relief and from rest of 5 patients 2 patients had pain relief at 1 month of follow up. But during further follow up 3 patients developed pain at 6 months of follow up, all 3 patients are known case of sickle cell disease.

- In our study, 44 (88%) patients had complete pain relief at 6 months follow up and they are walking.

Conclusion

Core decompression is a promising procedure for pain relief for AVN grade 2(Ficat Arlet). However long term follow up is required and more studies with larger sample size will be required.

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