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Result of tensor fascia lata muscle pedicle bone graft in early-stage avascular necrosis of femoral head in adults

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ABSTRACT

Background: The avascular necrosis (AVN) of femoral head in young adults is a disabling condition. The core decompression along with Tensor fascia lata (TFL) Muscle pedicle bone graft (MPBG) fixed with screw at the base of the neck of the femur is a simple, effective, treatment method with excellent to good result in majority of the early cases of AVN.
Methods: In this retrospective study we operated on 32 hips with early or advanced AVN especially in young adults from May 2021 to April 2023, using core decompression along with TFL MPBG fixed with screw at the base of the neck of the femur. The final assessment was done on only those patients who were followed for at least 2 years post operatively using modified Harris hip score (mHHS).
Results: The mean age of the patients was 29.2 years. The mean duration of surgery was 129 minutes. The mHHS score was found to be excellent in 12, good in 15, Fair in 3 and poor in 2 patients. The correlation was found between AVN & mHHS. Those with early AVN had better mHHS compared to advanced one, whereas a few with advanced AVN had the tendency to progress to further advanced stage of AVN.
Conclusions: The core decompression along with TFL MPBG fixed with screw in the neck of the femur is a simple, effective and reproducible treatment modality with excellent to good results in early AVN in majority of young adults.

Keywords: Avascular necrosis, Neck of femur, Tensor fascia lata, Muscle pedicle bone graft, Modified Harris hip score

INTRODUCTION

Femoral head avascular necrosis in adults is a painful disabling situation. Primarily it is idiopathic, but may also be caused by long term use of corticosteroid, alcohols, hemoglobinopathies, coagulopathies, and trauma.[1]

In the post COVID-19 phase the incidence of avascular necrosis (AVN) femoral head has been shown to increase because of the long-term use of corticosteroids.[2] Most commonly it affects people in 3rd to 5th decade of life[3]. Often the presentation is late in most of the cases, but if diagnosed early, the femoral head can be conserved. Ficat grading is an X-ray based grading being most commonly used for management of AVN.[4] Though Core decompression surgery has been described, it decreases the femoral head pressure but doesn't increase its vascularity.[5]

Now, muscle pedicle bone graft surgery, which enhances the vascularity of the femoral head added with cord compression have shown good results even in some advanced stage AVN.[6] This study intends to find out the functional and radiological outcome of the tensor fascia lata (TFL) muscle pedical bone graft (MPBG) as the treatment modality in AVN of femoral head in young adults.

METHODS

After the institutional ethics committee (IEC) approval, in this retrospective study we studied the patients on whom Tensor fascia lata Muscle pedicle bone graft was done along with core decompression in early or advanced AVN, especially in young adults from May 2021 to April 2023 at Mata Gujri Medical College, Kishanganj, Bihar.

There was total 32 hips were this was done. In this study only the Idiopathic, Alcohol and Corticosteroid induced AVN in skeletally mature patient >18-50 years where included. Post traumatic and hemoglobinopathies induced AVN were excluded. The TFL MPBG was harvested and transfixed in the cortical window at the anterior aspect of base of femoral neck with the help of cortical screw.

Post operatively all the patients were allowed to do active range of movement exercise and non-weight bearing crutch walking was allowed as soon as the pain was tolerable. The partial weight bearing and full weight bearing was started at around 4 and 8 weeks respectively. All the patients were evaluated clinically, using modified Haris's hip score[78] and radiographically at 3, 6 and 12 months and 2 years respectively. All the data were analysed using SPSS software.

Surgical procedure

On the fracture table in supine position the core decompression was done using 4.5 drill bit under the image intensifier guidance, then hip was exposed using the anterior Smith Peterson approach (Figure 4a) taking care of the lateral cutaneous femoral nerve of thigh.[9] The central and superficial part of TFL MPBG was harvested from the ipsilateral iliac crest of size 2×2 cm with the help of oscillating saw (Figure 4b). About 3 cm thick TFL was dissected up to the level of lesser trochanter along with the iliac crest bone graft. Then the capsule over the anterior aspect at the base of the femoral neck was exposed and about 1.5 cm oval window was created with the help of K wire and Osteotome.

The TFL MPBG was then enrouted and turned inferiorly beneath the straight head of rectus femoris. The iliac Crest bone graft was tailored to fit over the window at the base of the neck. The graft position was secured using a 3.5 cortical screw using the lag principle as in the light bulb technique. The hip was closed in layers with suction drain kept in situ.

RESULTS

In this study we have treated 29 patients out of whom 4 patients with unilateral involvement were lost to follow up and were excluded from the study. Mean age of patients were 29.2 years (range). 7 patients had bilateral, 18 had unilateral involvement, so a total of 32 hips were treated by this method. 20 patients were male and 5 were female. Out of 18 unilateral affections 10 had affection in right and 8 had affection in left hip (Table 1). The cause of AVN in 16 where due to long term corticosteroids especially during the COVID-19, alcohol induced were 9 and 7 had idiopathic AVN (Table 2). According to Ficat stage the 15-patient had stage IIa, 13 had stage IIb, and 4 had stage IIIAVN of the femoral head (Table 3). The average duration of surgery was 129 minutes (range 150-140 minute).

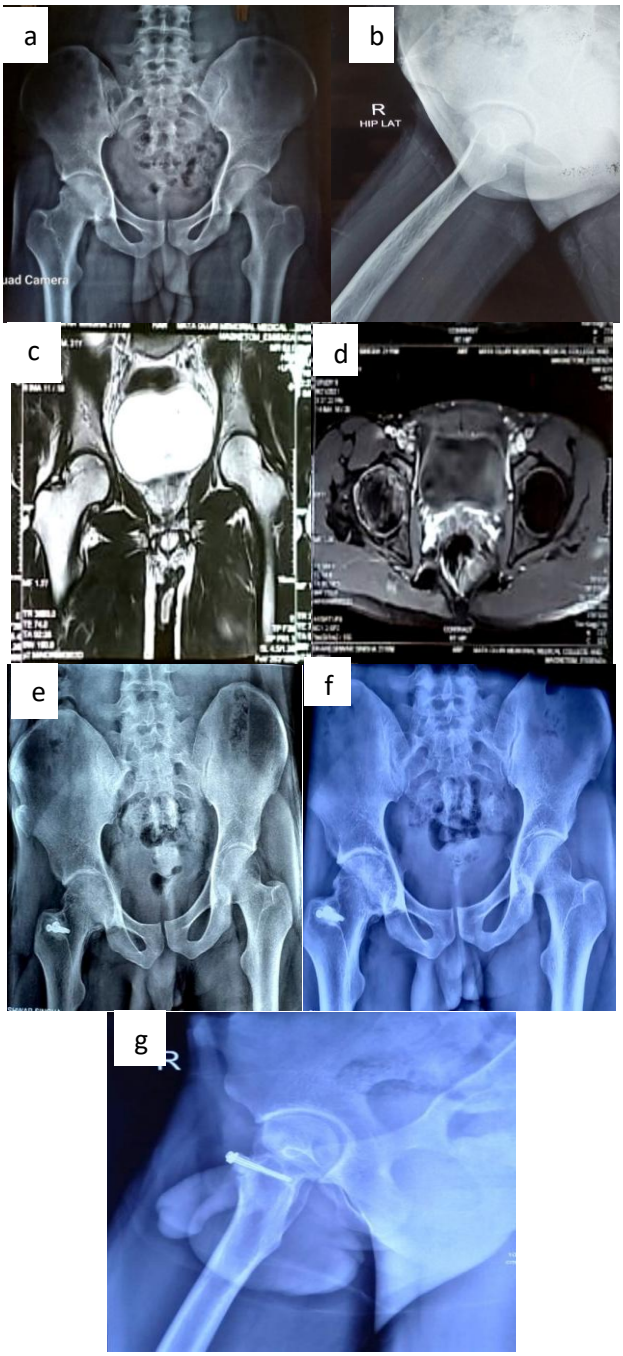

Figure 1: Case 1 (a) Pre-operative X-ray AP view, Ficat stage IIa; (b) pre-operative X-ray lateral view; (c) MRI coronal section; (d) MRI transverse section; (e) follow up X ray AP view at 1 year; (f) follow up X-ray AP view at 2 years and (g) follow up X-ray lateral view at 2 years.

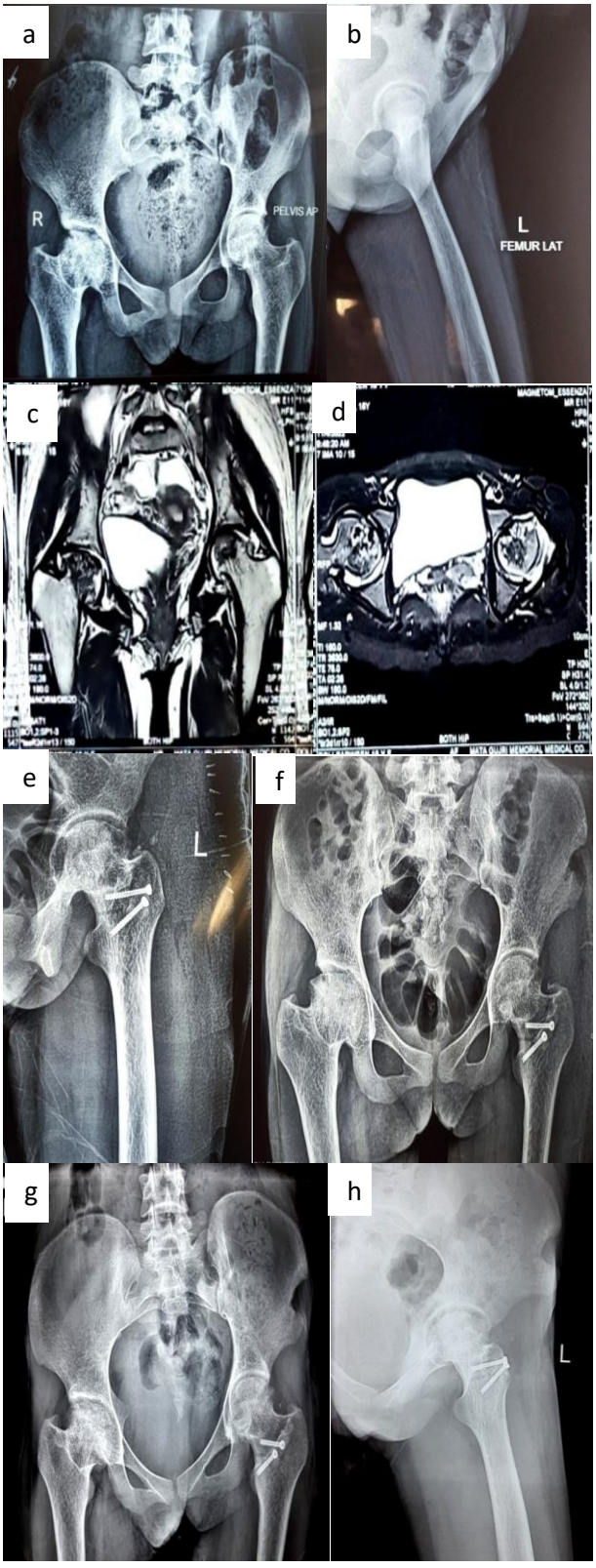

Figure 2: Case 2 radiological follow up images; (a) pre-operative X-ray AP view, Ficat stage III in left side; (b) pre-operative X-ray lateral view; (c) MRI coronal section; (d) MRI transverse section; (e) Follow up X-ray lateral view at 1 year; (f) Follow up X ray AP view at 1 year; (g) follow up X-ray AP view at 2 years; (h) follow up X ray lateral view at 2 years.

Figure 3: Clinical pictures of a case; (a) straight leg raises; (b) hip flexion. (c) hip extension; (d) hip external rotation; (e) squatting; (f) internal rotation.

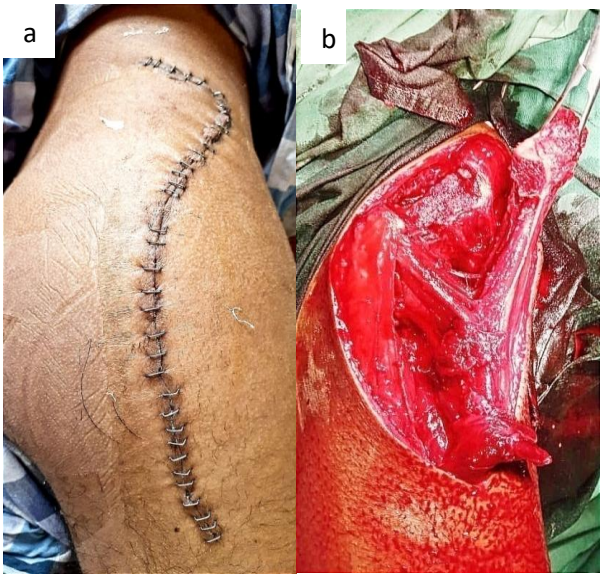

Figure 4: Intra-operative pictures of a case; (a) clinical picture showing suture marks; (b) Intra op image showing bone graft harvest.

The patients were followed up to 2 years both radiologically (Figure Case 1 (a-g) & Figure Case 2 (a-h)) and clinically at 3, 6, 12 months and finally at the end of 2 years (Figure 3 a-f). The modified Harris hip score was evaluated at each stage and score was found to be improving in the subsequent follow up as compared to the previous one. At the final follow up the modified Harris hip score was found to be excellent in 12 hips, good in 15 hips, fare in 3 hips and poor in 2 hips (Table 4). The Ficat stage was found to correlate with the modified Harris hip score, the patient the hip having excellent and good scores mainly belonged to stage IIa and IIb, whereas hips having fair and poor scores mainly belonged to stage III (Table 5).

The lateral cutaneous nerve of thigh was injured in 7 cases (6 transient and 1 permanent). In 3 cases wound healed a bit longer due to sub clinical superficial infection which responded to higher antibiotics. In 2 hips AVN progressed from stage 3 to stage 4. No cases had any per operative or post operative fracture neck of femur (Table 6).

Table 1: Demography.

	Male	Female	Unilateral	Bilateral
Cases	20	5	Right side 10, left side 8	7
Subtotal			18 Hips	14 Hips
Total	25 Patients		32 Hips	

Table 2: Cases according to cause.

Cause of AVN	No. of cases
Corticosteroid	16
Alcohol	9
Idiopathic	7

Table 3: Cases according to Ficat's staging.

Ficat Stage	No of cases
IIa	15
IIb	13
III	4

Table 4: Evaluation of Harris hip score.

MHHS	Result	Cases
90-100	Excellent	12
80-89	Good	15
70-79	Fair	3
<70	Poor	2

Table 5: Correlation of Ficat's stage with Harris hip score.

Ficat stage	Excellent hips		Fair hips	Poor hips
IIa	9	4	2	0
IIb	3	10	0	0
III	0	1	1	2

Table 6: Complications frequency distribution.

Complications	Cases
Injury lateral cutaneous nerve of thigh	6 Transient 1 permanent
Delayed wound healing	3, all respond to iv antibiotics
Progression to advanced stage	2 (from III→IV)
Peri/post-surgery fracture Neck of femur	None

DISCUSSION

AVN of femoral head he is a painful disabling situation in young adults.[10] Though the presentation is often late but if diagnosed early the progression can be reversed with the specific operative intervention aiming to increase the vascularity of the femoral head. Once the sphericity of the femoral head is lost then the secondary osteoarthritis is almost inevitable.

Through the joint space is well maintained even in the late stage, gives us the opportunity to intervene and decrease the frequency of total hip arthroplasty, especially in young adults. Earlier the intervention the better is the result, but with the muscle pedicle bone graft technique, now we can delay the progression of AVN or need of total hip arthroplasty and even reverse the early stage AVN of the femoral head. In some studies, the early stage AVN (stage I) has been shown to respond to bisphosphonates and core decompression, whereas in advanced stages, total hip arthroplasty is the only satisfactory option.[11,12] Young patient with stage IIAVN is the one who require either hip preservation or delay in the primary total hip arthroplasty. Though the primary AVN is the most common cause of

AVN but during the COVID, the abuse of corticosteroid has leads to increase in the steroid induced AVN in young adults. In this study steroid induced AVN was found to be 50%, Alcohol induced being 28%, while idiopathic being 22%.[13] The post traumatic AVN was excluded in this study as it requires a different approach of management. Hemoglobinopathies induced AVN are known for poor respondent to muscle pedicle bone graft hence where excluded.[14]

The X-ray based Ficat classification is most commonly use classification for the treatment of AVN. This is a simple 4 stage classification and can be evaluated very easily. Hungerford described that the core decompression is a good method in early AVN but it does not increase vascularity in advance stage.[15]

Koo-Kim et-al described core decompression does not halt the progression of AVN[16].There have been studies showing good results with core decompression with cortico-cancellous autograft in at early-stage AVN.[17] Urbanikhave shown good results with free vascularized fibula graft.[18] But vascularized bone graft is a technically demanding procedure.

The MPBG is relatively simple method which can be reproduced easily especially in the early stages. There are various MPBG technique has described most popular being Meyer's procedure (Quarter Femoris), Bakshi's procedure (TFL) and Zohu et al, described Sartorius MPBG.[19-21] Rosenwasser et al, described light bulb technique where core decompression was done through a cortical window in neck. Vaisya et al, Describe Sartorius muscle pedicle bone graft technique where bone graft was fixed with cannulated cortical screw with good results in stage IIb and Stage III.[22,23]

In this study Bakshi's procedure was performed with the addition of cortical screw fixation of the MPBG preventing its dislodgement, with good results in stage IIa, IIb & III. Recently some studies have shown promising results in with autologous bone marrow, PRP therapy and cell therapy in early stages but poor results in advanced stages.[24,25]

In advance stage THA is the only excellent treatment modality but due to its cost& need to revise after a period of time, in young patients, the need of MPBG technique provides the cheap effective reproducible result to such an extent either the need of THA is significantly decreased or it can postpone the need of such procedure in younger patients for longer duration.

Limitation of the current study is that it does not involve post traumatic and hemoglobinopathies induced AVN of femoral head. As the sample size is very small in our study, the results can't be generalized to all the AVN of femoral head. Thus, the need of this study on larger group is required to find out is wider acceptability and reproducibility.

CONCLUSION

The high clinical suspicion of AVN in non-traumatic hip pain, in you patients along with MRI can help in early diagnosis & intervention in the early AVN. MPBG technique with core decompression is a simple cheap reproducible technique with good results can prevent or delay the need of THA. Though sample size is very small in our study, the study on larger group is required to reach a definitive conclusion.

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