

Experience Using PRP Injection as an Adjuvant with Core Decompression & Fibula Strut Grafting for Grade 1 & 2 AVN Head of Femur

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Abstract: ***Introduction & purpose:** As a pathological process, AVN of the femoral head is characterized by the vascularity of the femoral head, cellular necrosis, microfracture, and the collapse of the articular surface. Treatment for early stage AVN head of femur is limited to core decompression. To improve the core decompression efficacy, regenerative techniques such as the use of platelet - rich plasma were proposed for early stage AVN head of femur. In this review, we present a comprehensive overview of the efficacy of PRP for early - stage AVN head of femur. **Material & Methods:** A study was carried out in orthopaedics department from the month of April 2018 to September 2019, 17 patients with AVN head of femur stage 1 & 2 have been included in this study and have been followed up till September 2021 and have been evaluated based on HHS and VAS score system. **Results:** Among 17 patients with AVN head of femur stage 1 & 2 (9 males and 8 females) their mean HHS and VAS scores showed improvement after getting treated with core decompression with Fibulastrut graft along with PRP as an adjuvant. **Conclusion:** PRP plays an important role in tissue repair, regeneration, and the differentiation of mesenchymal stem cells so as an adjunctive therapy for core decompression, PRP is recommended to improve the treatment of early - stage AVN head of femur patients, especially when combined with bone grafts, by inducing osteogenic activity and stimulating the differentiation of stem cells in necrotic lesions.*

Keywords: Platelet Rich Plasma (PRP), AVN head of femur, Fibula sturtgraft

1. Introduction

As a pathological process, AVN of the femoral head is characterized by a vascularity of the femoral head, cellular necrosis, micro fracture, and collapse of the articular surface [1–3]. Presently, the pathological mechanism underlying AVN has not been explained clearly, but the use of glucocorticoids and alcohol is recognized as the most common pathogenic factor [4, 5]. The prevalence of AVN head of femur worldwide is unknown. In China, the overall number of AVN cases has reached 7 million, and 100,000 to 200,000 new cases of AVN head of femur are diagnosed each year [6]. Meanwhile, it is estimated that 15,000–20,000 new cases of AVN head of femur are diagnosed in the US each year [7]. The incidence of AVN head of femur is increasing, and more patients with AVN head of femur are now diagnosed in the clinic [8, 9]. At present, total hip arthroplasty (THA) remains the most widespread procedure used to treat end – stage AVN head of femur [10]. However, arthroplasty is not a suitable option for patients who are young or with early - stage AVN head of femur because THA reduces the quality of life of patients by restricting the motion of the hip and resulting in some complications. Therefore, young patients who suffer early – stage AVN head of femur tend to choose conservative treatment to avoid or atleast delay THA. Currently, core decompression of the hip is the most common conservative treatment for early - stage AVN head of femur, but its cure rate is only 63.5%, and its efficacy remains controversial [11–13]. This is because core decompression is used to decompress the intraosseous pressure and remove necrotic tissue from the hip, but it does not have superior effects on facilitating osteoanagenesis in the necrotic area [14, 15]. For this reason, with the purpose of improving the results of core decompression, regenerative techniques such as the use of platelet - rich plasma (PRP) have been proposed to address

early - stage AVN head of femur [16]. As a specimen of autologous plasma containing platelets at concentrations above the baseline [17], PRP contains growth factors in addition to platelets, such as platelet – derived growth factor (PDGF), transforming growth factor - β (TGF - β), basic fibroblast growth factor (bFGF), endothelial growth factor (EGF), and vascular endothelial growth factor (VEGF), which have an important effect on tissue repair and the proliferation and differentiation of mesenchymal stem cells (MSCs) [16, 18]. The application of PRP in orthopaedics began earlier this decade and has been combined with bone grafts and in various other modalities [19]. Vander Jagt et al. reported that the use of PRP could relieve pain and halt the disease progression of patients with AVN head of femur [20]. Currently, increasing experimental and clinical evidence has shown that PRP may play an effective role in AVN [21, 22]. In this review, we present a comprehensive overview concerning the PRP as an adjuvant with core decompression with fibula strut grafting for AVN head of femur stage 1&2.

2. Classification (Ficat staging)

1) Stage 0

- Preclinical and pre radiographic
- Diagnosis is suspected in one hip when the other has a definite disease - this is the stage of the truly “silent hip”

2) Stage I

- Earliest clinical manifestation of the syndrome which is pain in almost 50% of patients
- Limited movement of hip joint in all direction on physical examination
- Radiographs are normal or, at most, show only minor

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changes such as subtle loss of clarity with poor definition or blurring of the trabecular pattern, patchy osteoporosis in comparison with the opposite side, but the changes are not really significant

3) Stage II

- Extends over several months or even much longer
- Clinical signs persist, or worsen
- Radiographs show changes in the trabecular pattern of the femoral head: sclerosis: may be diffuse, localized, or in a linear arc which is concave superiorly lucency: may also be generalized or small cysts in the head, usually at some distance from the joints space mixed form: including both sclerosis and cysts is sometimes seen

4) Stage III

- Pathognomonic imaging features Crescent line: due to a subchondral fracture
- Out of round appearance: segmental flattening of the femoral head Paradoxically and because of the limited size of the sequestrum the joint space preserved or even increased.

5) Stage IV

- Terminal phase of the necrotic process
- Hip movement is progressively diminished until only a small range of flexion remains
- The radiographic picture is of osteoarthritis super imposed on a deformed femoral head which is characterized by progressive loss of articular cartilage and the development of acetabular osteophytes

3. Objectives

To evaluate Efficacy following platelet rich plasma (PRP) injection as an adjuvant along with core decompression with fibula strut grafting in AVN head of femur stage 1 & 2 using HHS & VAS score in our centre.

4. Material and Methods

A hospital based Retrospective study was conducted among 17 cases who presented with AVN head of femur grade 1 & 2 were admitted and got treatment in department of orthopaedics at GSL medical college, Rajahmundry from month of April 2018 to September 2019 and have been followed up till September 2021.

Inclusion Criteria

- AVN head of femur with Grade 1&2
- AVN head of femur with traumatic, alcohol & steroids abuse patients with inclusion criteria grade.
- Patients of either sex
- Age between 20 years to 50 years

Exclusion Criteria

- AVN head of femur with grade 3 & 4.
- Occurrence of AVN due to infections, hemoglobinopathy & storage disorders of any grade and age groups.
- Age <20 years & >50 years.

- Refusal of consent.

Ethical clearance from Institutional Ethical Committee of GSL Medical College, was obtained before initiating the study. Prior to the commencement of the study, the procedure was explained to the patient and informed consent was taken from the study participants after explaining the purpose of the study in vernacular language in an understandable manner.

5. Data Collection

All the patients who presented to the orthopaedics OPD and satisfied the inclusion criteria were considered for the study. A total of 20 cases of AVN head of femur came to Orthopaedics OPD during the study period, among which 3 of them did not give consent for treatment with injection PRP along with core decompression and fibula strut grafting. Hence, data for study was collected from 17 patients.

Initial Assessment

Patients were assessed clinically; a thorough history and clinical examination was carried out. The subjective symptoms and objective signs were recorded in a pre - designed proforma. This was followed by investigations as well as an X - ray & MRI of Pelvis with both hips were taken to consider AVN head of femur with grade 1 & 2. Once the diagnosis was established, PRP injection as an adjuvant for core decompression and fibula strut grafting was given to the patient. Then the patients were followed up at 3, 6 & 12 month. Assessment of functional outcome was done using Visual Analogue Scale (VAS) scores and Harris Hip Score (HHS) scores recorded before treatment and follow up at 3rd, 6th & 12th month based on following criteria.

Procedure

Patients, under Spinal anaesthesia, were placed supine on a fracture table. An 8 cm incision given above lateral malleoli to ipsilateral leg a 7 cm fibula graft was harvested and graft was prepared. Now, 10cm incision was made through the skin and the fascia, distal to the greater trochanter following the vastus lateralis. A threaded pin was introduced through the greater trochanter. Its position was adjusted so it was pointing toward the necrotic area under guidance of C - arm fluoroscope using antero posterior and lateral views. The tip was placed at a distance of 2-3mm from the articular cartilage. A cannulated drill was inserted through the guide pin and we rammed the core tract to 9 to 10mm diameter, under fluoroscopic control. At the end, the canal was filled with Ipsilateral fibula strut graft which was prepared before, at the moment PRP which was obtained prior to surgery from 40ml of peripheral autologous blood.

The blood was centrifuged twice, at a speed & time of 1500rpm for 15min & 3500rpm for 7min, to obtain a platelet concentration of approximately around 5 to 7ml were obtained, this concentrate of platelets were added as adjuvant to the procedure by making another core in the femoral head region. Finally wound was closed in layers and sterile dressing applied.



PRP preparation, Fibular strut graft harvesting, injecting PRP & Intraoperative C – arm pictures of the procedure

6. Statistical Analysis

Data extraction and analysis was done using Microsoft Excel 2007 and SPSS version 2.0. Results were expressed as percentages for categorical variables. Continuous variables were expressed as mean and standard deviation. Paired 't' test was applied to compare the mean scores at every follow-up. A 'P' value of <math><0.05</math> is considered as statistically significant.

7. Results and Discussion

A total of 17 patients of stage 1 & 2 AVN were evaluated. About 3 belonged to 20 to 30 years age group, 8 belonged to 30–40 years age group, 6 belonged

To 40–50 years age group. Males constituted majority 9 (53%) while Females were 8 (47%). Mean age of the study subjects in this study was 38.11 years \pm 7.03. Right side was predominantly involved with 10 cases (59%) of subjects and 7 cases (41%) on left side.

The mean VAS from the baseline values have been mentioned in Table 1. As we can see mean pain score has dropped from 6.5 before treatment to 1.4 at twelve months post operative follow up. In detail, all comparisons of VAS indifferent time periods for pre and post operative with core decompression with Fibula strut graft along with PRP as an adjuvant were statistically significant by t test with and p value obtained was <math><0.00001</math>.

The mean HHS from the baseline values have been mentioned in Table 2. As we can see mean score has improved from 58.8 before treatment to 93.8 at twelve months post operative follow up. In detail, all comparisons of HHS in different time periods for pre and post operative with core decompression with Fibula strut graft along with PRP as an adjuvant were statistically significant by t test with and p value obtained was <math><0.00001</math>.

Results of the present trial indicated that core decompression with Fibula strut graft along with PRP as an adjuvant is effective and shown that therapy can significantly decrease pain, and improve functional limitations with AVN Grade 1&2.

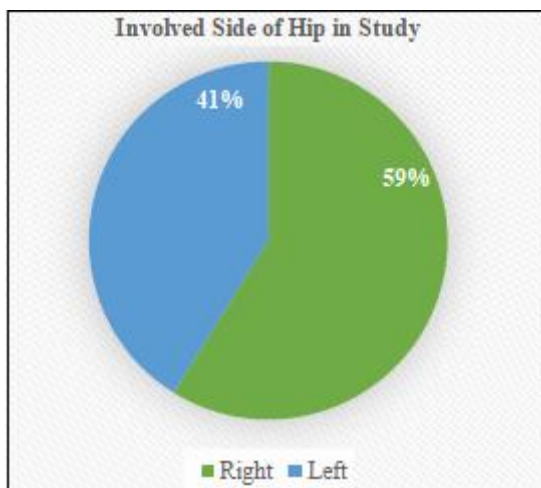
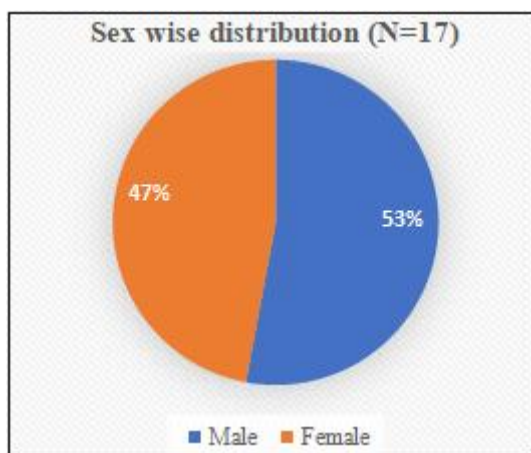
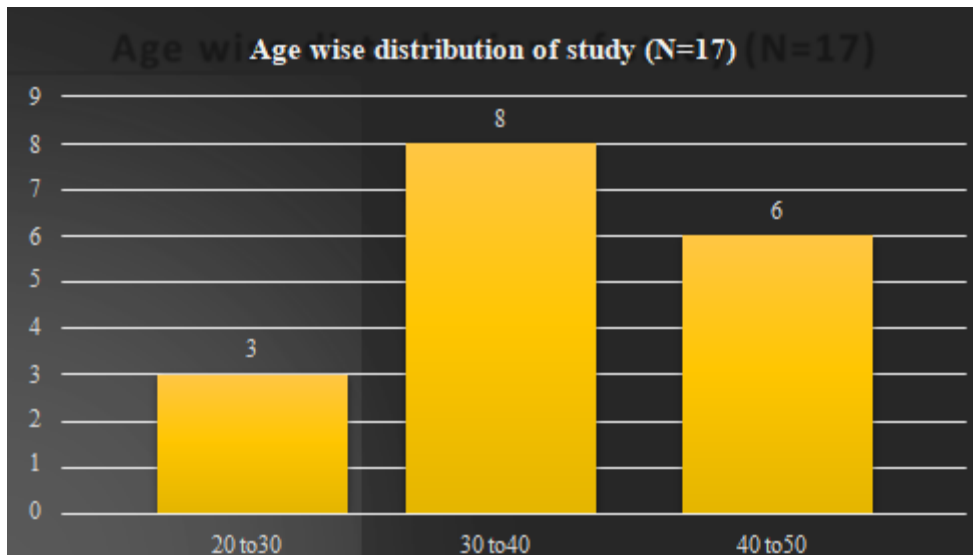


Table 1: showing cumulative data of VAS score of Mean, Standard Deviation, P score

S: Num:	VAS (Preop)	VAS (3months)	VAS (6months)	VAS (12months)
Mean	6.5	5.3	3.4	1.4
Standard deviation	1.17	1.11	0.51	0.51
P Value	-	0.00217	0.00001	0.0001

Table 2: Showing cumulative data of HHS score of Mean, standard deviation, P score

S: Num:	HHS (Preop)	HHS (3months)	HHS (6months)	HHS (12months)
Mean	58.8	75.7	86.4	93.8
Standard deviation	8.0	4.9	4.8	2.49
P Value	-	0.00001	0.0001	0.00001

8. Conclusions

PRP works mainly through three mechanisms: inducing angiogenesis and osteogenesis to accelerate bone healing, inhibiting inflammatory reactions in necrotic lesions, and preventing a popptos is induced by glucocorticoids. However, for the treatment of AVN head of femur, PRP alone will not work very well, Because AVN head of femuris characterized by osteocyteapoptosis as a consequence of the interruption of the blood supply, the most important steps for treating AVN are facilitating osteogenesis and angiogenesis and restoring bone formation to reconstruct the support at the joint surface. PRP must be administered in association with core decompression and other treatments to play its role.

To summarize, PRP could not reverse the pathophysiological course of AVN head of femur; however, PRP is recommended as an adjunctive therapy for core decompression combined with auto logous bone grafts to induce osteogenic activity and stimulate the differentiation of stem cells in grade I and II patients.

The findings of this study show that PRP is recommended as an adjunctive therapy for core decompression combined with autologous bone grafts is an effective mode of treatment for patients with stage 1 & 2 AVN head of femur. Though many modalities of treatment are available response of patients was found to be good with highly significant results & no significant side effects were observed

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