International Journal of Research in Orthopaedics
Mundla MKR et al. Int J Res Orthop. 2018 Jan;4(1):15-21
http://www.ijoro.org

DOI: http://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20175108

Original Research Article

Treatment of osteonecrosis of femoral head in young patients by surface replacement of femoral head

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Received: 14 October 2017
Accepted: 04 November 2017

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ABSTRACT

Background: Osteonecrosis of hip is a pathological condition that affects usually young adults. Articular surface replacement (ASR) is considered to be a viable option in young patients. The study was done with the aim to analyse and to recommend the management of osteonecrosis of femoral head in young patients by surface replacement of femoral head as ideal procedure.
Methods: The present study was conducted in 30 patients with osteonecrosis of the femoral head who attended to OPD at Santhiram Medical College and General Hospital, Nandyal, A.P during the period of April 2016 to September 2017. Articular surface replacement of the femoral head was the surgical procedure done in all the patients. The success of the treatment was analysed by Harris hip scoring.
Results: Maximum number of patients (60%) was below 40 years of age. Male dominance (77%) was seen in the study. According to Ficat and Arlet classification 12 cases (40%) were under the category of stage II-B and 18 cases (60%) were of stage III. Postoperatively about 90% of patients had postoperative Harris hip score of >80 points. Surgery was succeeded in 10 hips of stage II-B and 15 hips in stage III. According to Harris hip scoring excellent results were obtained in 15 (50%), good in 12 (40%), fair in 2 (6.67%) and poor result 1 (3.3%) patient.
Conclusions: The study concludes that the surface replacement is an anatomical hip arthroplasty with preservations of more than 70% of bone stock of femoral head and the ability of the patients to sit cross-legged and squat, which is the desire of the Indian population.

Keywords: Osteonecrosis of femoral head, Articular surface replacement, Harris hip score

INTRODUCTION

Osteonecrosis of hip is a pathological condition occurs due to insufficient supply of blood to the bone and also known as avascular necrosis or aseptic necrosis.[1] It typically occurs in the second through fifth decades of life. The young age of such patients magnifies the effects of the disease in terms of lost income and productivity and especially in terms of the potentially excessive longevity required of the total hip replacement.[2,3]

In addition to total hip arthroplasty, the options for the treatment of osteonecrosis of the femoral head with collapse include core decompression, rotational osteotomy, vascularized and nonvascularized bone-grafting and surface replacement hemiarthroplasty.[4-10] The number and variety of procedures indicate both the lack of a clearly superior treatment and the undesirability of total hip arthroplasty for the treatment of osteonecrosis because of its high rate of failure.[11,12] Factors that contribute to the high rate of failure include the relatively

young age (mean, thirty-eight years) and long life expectancy of the patients as well as the poor quality of the femoral bone and the possible persistent defects in bone-mineral metabolism.[3,13] The ultimate goal of treating osteonecrosis of the hip is preservation of the femoral head. However, this is difficult since the condition is associated with a number of different diseases and neither the etiology nor the natural history has been definitively determined.

Articular surface replacement (ASR) hemiarthroplasty or limited femoral resurfacing or hemi-resurfacing arthroplasty is a viable option in young patients with osteonecrotic lesions of femoral head without acetabular involvement. This procedure offers several advantages: (1) the damaged cartilage on the femoral head is removed, (2) femoral head and neck bone stock is preserved, and (3) revision to a subsequent total hip arthroplasty is not complicated.[14]

The study was conducted with the main objective of to analyse the management of osteonecrosis of femoral head and to assess and determine whether the clinical results after articular surface replacement of femoral head are good enough to recommend it as a successful interim procedure to young patients who have osteonecrosis of femoral head.

METHODS

The present study was conducted in 30 patients who attended to OPD at Santhiram Medical College and General Hospital, Nandyal, A.P during the period of April 2016 to September 2017. All the subjects were the patients with osteonecrosis of the femoral head and they were informed about the study in all respects and informed written consent was obtained. The procedure carried out was articular surface replacement of the femoral head in all the patients.

Selection criteria

Inclusion criteria were patients of both sexes between the age group 20 to 50 years and with stage II-B and III according to Ficat and Arlet classification.[15]

Exclusion criteria were patients with advanced stage of disease with involvement of acetabulum (Ficat & Arlet stage IV), patients unfit for surgery and patients not consenting for surgery.

Procedure of the study

Detailed history of the patient was collected. Duration of symptoms, associated risk factors like steroid intake and excessive alcohol intake were noted. Patients were assessed clinically using Harris hip score and investigation findings were noted on a predesigned proforma.[16]

Radiographs of affected hip joint were taken in anteroposterior and lateral views. MRI of the affected hip was done in all the cases. Pre-operative records were studied and imaging records analyzed from which diagnosis of osteonecrosis was confirmed. The disease was staged according to Ficat and Arlet classification based on X-rays and MRI.

Surgical procedure

After spinal or epidural anaesthesia, patient was placed in the lateral cubitus position on the OT table. The operative site was thoroughly prepared by scrubbing with savlon and betascrub, mopped with spirit and painted with betadine solution and sprit. Limb was carefully draped with sterile sheets and Hip-U drape. In this study, posterior approach was preferred to enable an accurate assessment of the articular cartilage and precision fitting to the cartilage which is best preserved, whether it is central or around the periphery.

The patient is placed in the true lateral position, with the affected limb uppermost. The bony prominences of the legs and pelvis are protected with pads placed under the lateral malleolus and knee of the bottom leg and a pillow between the knees. The limb is draped free to leave room for movement during the procedure. A 5 cm to 8 cm linear incision centered on the posterior aspect of the greater trochanter is made. The fascia lata is incised on the lateral aspect of the femur to uncover the vastus lateralis. The fascial incision is lengthened superiorly in line with the skin incision, and the fibers of the gluteus maximus are split by blunt dissection. The fibers of the split gluteus maximus and the deep fascia of the thigh are retracted. The hip is internally rotated to put the short external rotator muscles on a stretch (making them more prominent) and to pull the operative field farther from the sciatic nerve. Stay sutures are inserted into the piriformis and obturator internus tendons just before they insert into the greater trochanter. The muscles are divided at 1cm from their femoral insertion so as to preserve the medial circumflex femoral artery. The rotators and the capsule are cut separately. This facilitates closure of these structures separately. The neck is not dissected free from capsule. Thus, preserving it's blood supply. Dislocation of the hip is achieved by internal rotation after capsulotomy. The articular surface of the femoral head is inspected and palpated with a probe and the extent of the necrosis is noted. The damaged or necrotic cartilage part is removed using nibblers and cutting saw. The femoral head and neck bone stock is preserved. The head surface is prepared till the bone surface actively bleeds indicating viability. Only less than 1 cm of bone is resected. Any presence of a cyst >0.5 cm at this stage becomes a contraindication to this procedure. The head size is measured using calipers and the appropriate size ASR implant is selected.

The AP and transverse diameters of the head and neck are measured with Vernier calipers and two lines are drawn

perpendicular to each other. The intersection point of these two lines is used for drilling a hole to about 5 cm depth to incorporate the peg of the prosthesis. Multiple drill holes using k-wire is made on the prepared surface of the head. Then cementing procedure has to be done. The cement is used in it's wet state to apply underneath the prosthesis and the prosthesis is fixed to the prepared femoral head. After the cement has set the excess cement is removed, thorough wash given and the femoral head is relocated back into the joint. Stability is checked by full ROM on the table. The capsule is sutured and the rotators are sutured back by tying the previously placed stay sutures. The wound is closed in layers and a drain is placed insitu. Skin is closed either by 2-0 Ethilon or staples and sterile dressing is done.

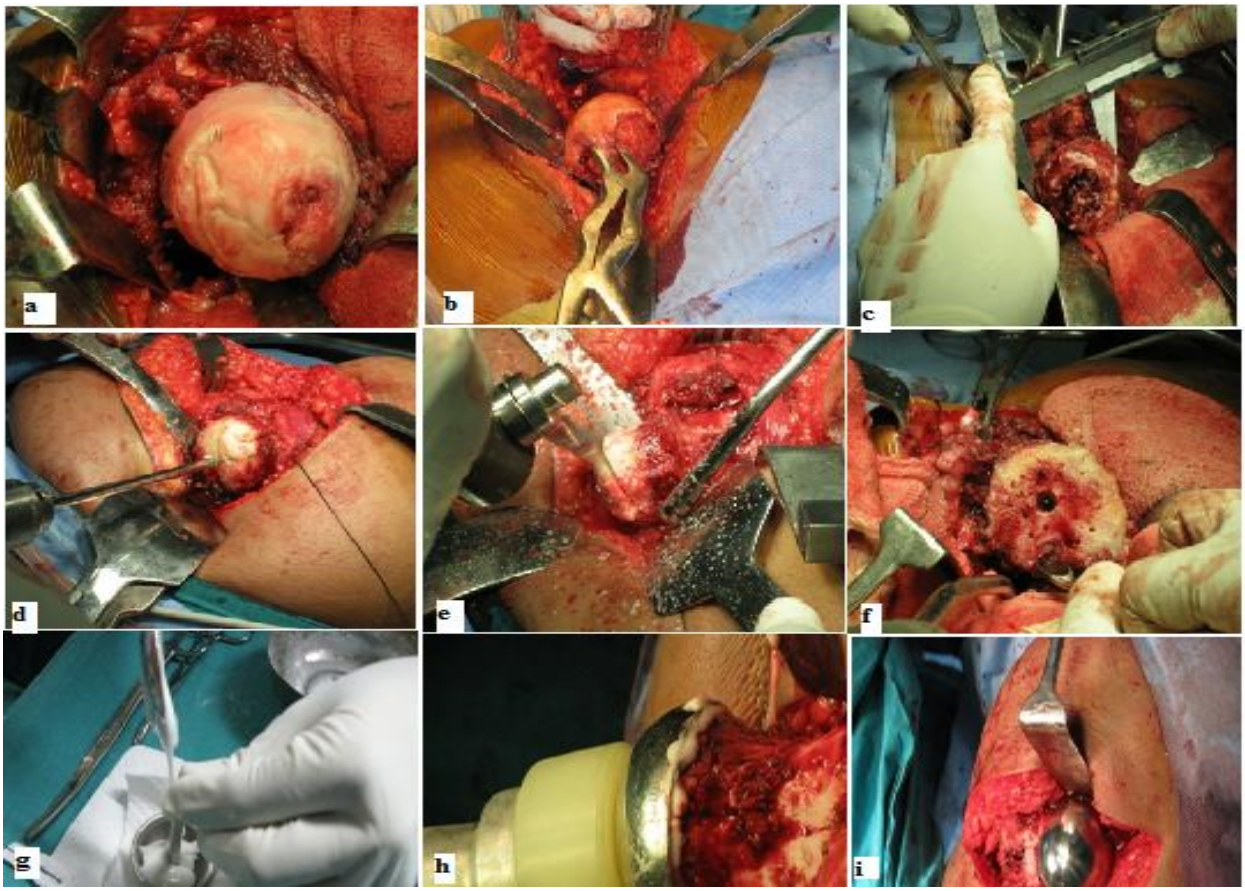

Figure 1: Surgical procedure. a) Damaged (osteonecrotic) articular cartilage of the femoral head, b) Damaged articular cartilage is removed using nibblers, c) Sizing of the head using vernier calipers, d) A hole is drilled in the center for the stem, e) Avascular bone is removed (not more than 1cm) using saw blade, f) The femoral head is prepared, g) Wet cement is applied to the ASR cup prosthesis, h) The prosthesis is fitted onto the prepared femoral head, i) : Precise fitting of the cup prosthesis onto the femoral head.

Postoperative management

The operated limb was kept in abducted position for two days to prevent adduction contracture. Intravenous antibiotics were continued for 3 days and later switched over to oral antibiotics for 7 days. Anti- inflammatory analgesics and other supportive drugs are given. Regular post-op dressings done and sutures/staples removed on post-op day twelve.

Physiotherapy program was started from 2nd day postoperatively and continued for 8 days. Patients were discharged on 12th post-op day after sutures/staples removal and are advised to continue hip exercises and non-weight bearing ambulation with walker.

Follow up was done after 4, 6 and 10 weeks respectively. Clinical and radiological assessments were carried out on every follow up. All the patients were assessed using Harris hip scoring system. When there was no progression of the disease then the result was claimed as total success.

RESULTS

In this study, analysis of demographic and radiographic factors was done to determine the prognostic effect on clinical and radiographic outcome. The demographic factors included age, gender, steroid use, alcohol. Radiographic factors related to outcome included stage of lesion.

Totally 30 cases were included in the study. Maximum number of patients (60%) was below 40 years of age. The average age was 35.8 years (range, 23 yrs to 48 yrs). Males (77%) outnumbered the females (23%). Out of 30 patients, 14 patients (46.7%) had involvement of the right hip and 16 patients (53.3%) of the left hip. According to Ficat & Arlet classification based on X-ray and MRI findings, 12 cases (40%) were classified as stage II-B and 18 cases (60%) as stage III (Table 1).

Postoperatively patient's satisfaction was analysed by Harris hip score. Before surgery all the patients had a poor score (<70). After surgery about 90% of patients had postoperative Harris hip score of >80 points as given in Table 2.

All the patients were assessed, preoperatively and postoperatively, based on the gradations of pain as used in Harris hip score. Preoperatively upon assessing 30 patients for pain, we found 4 patients (13.33%) with moderate pain, 14 patients (46.67%) with marked pain and 12 patients (40%) with disabling pain. Post-operatively when the patients were assessed for pain, out of 30 patients, 10 patients (33.33%) had no pain or ignorable pain; 5 patients (16.67) had slight occasional pain, but no compromise with activities; 12 patients (40%) had mild pain with moderate activities, rarely moderate pain with unusual activities; 2 patients (6.67%) complained of moderate pain, which was tolerable but caused limitation of usual activities and 1 patient (3.33%) had marked pain resulting in serious limitation of activities (Table 3).

Table 1: Demographic characteristics of the study participants.

Characteristics	Number of cases (n=30)	Percentage (%)
Age in years		
21-30	7	23.3
31-40	11	36.7
41- 50	12	40
Sex		
Male	23	77
Female	7	23
Side of involvement		
Right	14	46.67
Left	16	53.33
Ficat and Arlet stage classification		
II-B	12	40
III	18	60

Table 2: Postoperative Harris hip score analysis.

Harris hip score interval	Rating	No. of patients	Percentage (%)
90-100	Excellent	15	50
80-89	Good	12	40
70-79	Fair	2	6.7
<70	Poor	1	3.3

Table 3: Pre and postoperative pain analysis.

Amount of pain	Preoperatively		Postoperatively	
	No. of patients	Percentage (%)	No. of patients	Percentage (%)
None	0	0	10	33.33
Slight	0	0	5	16.67
Mild	0	0	12	40
Moderate	4	13.33	2	6.67
Marked	14	46.67	1	3.33
Disabled	12	40	0	0

On analysis of the patients with risk factors, 3 (60%) of 5 hips with excessive alcohol intake and 2 (50%) of 4 hips with the use of corticosteroid were failures in regard to postoperative radiographic progression of the disease (Table 4).

Table 4: Risk factors analysis.

Risk Factors	No. of patients	Failure	Percentage (%)
Alcohol	5	3	60
Steroid	4	2	50

Table 5: Complications.

Complications	No. of cases	Percentage (%)
Superficial wound infection	2	6.7
Deep vein thrombosis (DVT)	1	3.3

Table 6: Success of the surgery and final assessment.

Result	Ficat and Arlet stages				Total	
	II-B	Percentage (%)	III	Percentage (%)	No. of cases	Percentage (%)
Excellent	8	66.67	7	38.89	15	50
Good	3	25	9	50	12	40
Fair	1	8.33	1	5.56	2	6.67
Poor	0	0	1	5.56	1	3.33
Total	12	100	18	100	30	100

Table 5 presents the complications observed in the patients postoperatively. 2 patients (6.7%) developed superficial wound infection, which healed with short course of antibiotic therapy. 1 patient (3.3%) developed DVT, which resolved with heparin therapy for 5 weeks.

In our study, success of the surgery and final assessment was done based on Harris hip score and Ficat & Arlet classification respectively as shown in Table 6. Excellent results were obtained in 15 (50%) patients. Good results were obtained in 12 (40%) patients. Fair results were obtained in 2 patients (6.67%). Poor results were seen in 1 (3.3%) patient. There were 12 hips in stage II-B of which 10 (83.33%) were total success and 18 hips in stage III of which 15 (83.33%) were total success.

DISCUSSION

Osteonecrosis of femoral head is a disparaging disease that affects usually younger adults with destructive effects on hip joint and with many functional demands. There is no gold standard management for this disease and involves multiple approaches.[17] The main goal of the present study was to analyse and to recommend the management of osteonecrosis of femoral head in young patients by surface replacement of femoral head as ideal procedure.

In our study, 18 patients (60%) out of 30 patients were below 40 yrs of age. In a study done by Hungerford et al, 17 patients (51.5%) out of 33 patients were below 40 yrs of age.[18] Our data correlates with this study emphasizing that the osteonecrosis of femoral head is more common in younger population. Male preponderance (77%) was observed in the present study which is in accordance with the findings of Koo et al (M:F=7:3).[19] These data indicate male are more affected for this disease. In our study involvement of the left hips (53.3%) was slightly more than the right hips (46.7%).

In our study, out of 30 cases there were 12 cases of stage II-B and 18 cases of stage III according to Ficat & Arlet classification. Similar observations were also made by Jameson et al in which 8 cases are of stage II-B, 34 cases of stage III and 17 cases of stage IV out of 59 cases.[20] In another study by Krackow et al, there were 19 cases of stage III out of 19 cases.[21] These data indicate that articular surface replacement hemiarthroplasty has been used as the choice of treatment by many authors for the treatment of stages II-B and III osteonecrosis of femoral head.

In the present study, majority of the patients were satisfied with the outcome of the procedure as evident from the relief of pain after the procedure. 27 patients (90%) out of 30 patients had mild to none pain postoperatively. Jameson et al in their series reported high satisfaction outcome, with regard to relief of pain, in 54 patients (92%) out of 59 hips.[20]

In our study, major risk factors identified was excessive alcohol intake (3 hips (60%) of 5 hips) and use of corticosteroids (2 hips (50%) of 4 hips) in regard to postoperative radiographic progression of the disease. Similar observations were also made by Hungerford et al.[18]

Jameson et al, in their series of 59 cases, reported superficial wound infection in 4 cases (6.8%), which was treated with antibiotics.[20] Deep wound infection in 1 case (1.7%), who was on long-term treatment with warfarin

for a mechanical cardiac valve, was treated by surgical debridement and antibiotic therapy for six weeks. DVT (deep vein thrombosis) in 1 case (1.7%), which was treated with warfarin for six weeks.

Figure 2: a) Preoperative X-ray of pelvis both hips (PBH) AP view showing avascular necrosis (AVN) in left hip, b) MRI of the same patient showing AVN of Left hip (stage II-B), c) Immediate postoperative X-ray, d) Post-op X-ray PBH AP view of left hip after 6 weeks, e) Post-op X-ray PBH AP view after 10 weeks, f) Bedside knee bending started on post-op day 4, g) Flexion upto 70 degrees at 6 weeks postoperative, h) SLR upto 70 degrees at 6 weeks postoperative, i) Sitting on a stool at 8 weeks postoperative.

Table 7: Comparison of outcome with other studies.

Series	Mean follow-up	Total no. of hips	No. of hips with good to excellent result (HHS >80)	Percentage (%)
Amstutz et al.[22]	11.2 yrs	10	5	50
Hungerford et al.[18]	10.5 yrs	33	20	61
Meulemeester et al.[23]	8 yrs	40	28	70
Sedel et al. [24]	7 yrs	38	31	82
Krackow et al.[21]	3 yrs	19	16	84
Jameson et al.[20]	43 months	59	52	88
Our study series	18 months	30	27	90

In our study, post operatively 2 cases (6.7%) out of 30 cases developed superficial wound infection, which healed with short course of antibiotic therapy and 1 case (3.3%) developed DVT, which resolved with heparin therapy for five weeks.

The Harris hip score is used for the grading of the results of the articular surface replacement hemiarthroplasty procedure in our study. Good to excellent result was noticed in about 27 cases out of 30. This was a good outcome compared to the results of previous studies as given in Table 7.

CONCLUSION

The results of the present study conclude that articular surface replacement hemiarthroplasty is appealing, in young patients with Ficat and Arlet II-B and III stages. It provides a more normal transfer of stress to the proximal femur and may be expected to prevent proximal bone loss

as a result of stress shielding and patients do better if this procedure is performed prior to the development of substantial degeneration of the acetabular cartilage.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Mundla MKR, Buchupalli SR, Reddy SG, Reddy KS. Treatment of osteonecrosis of femoral head in young patients by surface replacement of femoral head. Int J Res Orthop 2018;4:15-21.