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Indian Journal of Orthopaedics Surgery

Journal homepage: <https://www.ijos.co.in/>

Original Research Article

Outcome analysis of bilateral total hip replacement in patients of avascular necrosis of femoral head

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ARTICLE INFO

Article history:

Received 20-05-2021

Accepted 30-06-2021

Available online 20-09-2022

Keywords:

Avascular necrosis

Femoral head

Ficat and Arlet classification

Harris hip score

Oxford hip score

Total hip replacement

ABSTRACT

Introduction: Avascular necrosis (AVN) of the femoral head is one of the common causes of painful hip in a young adult. Bilateral presentation is frequently seen and males are more commonly affected. Total hip replacement (THR) is one of the most successful surgical procedures for AVN. THR is a time tested surgery giving good outcome in terms of relieving pain, restoring function & improving quality of life in patients of AVN.

Aims: The purpose of the study was to analyse the outcome of bilateral THR & comparing the outcome of one stage THR with Two stage THR.

Material and Methods: In this study, 40 patients with AVN of bilateral femoral head who were presented in the Department of Orthopaedics, Hamidia Hospital, Bhopal from April 2016 to April 2020 who fulfilled the inclusion criteria were included in the study. THR of all the patients was done on elective basis by senior surgeons of the department. All patients were followed up clinically and radiologically for a period of 6 months after the surgery. Any complications if present were also noted.

Conclusion: This study concludes that in patients of AVN of bilateral femoral head, THR gives excellent functional outcome with early walking & early return to work. As compared to Two stage bilateral THR, One stage bilateral THR has advantage of less blood loss, less need of parenteral analgesics & antibiotics & less hospital stay. However, there is no significant advantage in terms of functional outcome, walking capability & return to work.

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1. Introduction

Hip joint is one of the major weight bearing joints of the body. It is subjected to various stresses during daily activities of an individual. Avascular necrosis (AVN) of the femoral head is one of the common causes of painful hip in a young adult. Bilateral presentation is frequently seen and males are more commonly affected. Contralateral hip may be affected in about 55% of the patients within 2 years.¹

Total hip replacement (THR) is one of the most successful surgical procedures and has been identified as

the “operation of the century”.² Most common condition for which THR is done in India is AVN of femoral head. THR is a now a time tested surgery giving good outcome in terms of relieving pain, restoring function & improving quality of life in patients of AVN. With the newer implants, better understanding of hip biomechanics and reduced risk of anaesthesia and peri-operative complications, patient satisfaction rates are increasing.

Studies have demonstrated that patients who undergo unilateral THR may require a contralateral procedure within 10 years. Some studies report that a bilateral procedure is required in approximately 15% to 25% of patients.³ Staging of bilateral THR has been under debate over a

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period of time. Charnley et al first reported performing one-stage bilateral THR in 1971. Ritter and Randolph in 1976 performed the first detailed study of the functional outcome of one-stage bilateral THR.⁴ Since then there has been ongoing debate over advantages & disadvantages of One stage over Two stage surgery. Although many studies favour One stage bilateral THR & have reported their advantages, limited literature is available on comparison study between One stage & Two stage surgery.

Despite the increased interest in evaluating outcome following surgery, challenges remain in ensuring that such assessments of outcome are accurate, reliable and relevant. Therefore the purpose of the study was to analyse the outcome of bilateral THR & comparing the outcome of One stage THR with two stage THR.

2. Materials and Methods

This study is a Prospective & Retrospective observational study carried out in the Department of Orthopaedics, Gandhi Medical College & Hamidia Hospital, Bhopal during the period from March 2017 to October 2020.

2.1. Inclusion criteria

1. Patients with stage 3 & 4 (Ficat & Arlet classification) AVN of bilateral femoral head.
2. Patients of age >20 years & <70 years of either sex.
3. Patients willing & motivated for surgery & life style changes required post-operatively.

2.2. Exclusion criteria

1. Patients of age <20 years & >70 years.
2. Patients unwilling to give consent for the study.
3. Patients medically unfit for the surgery.
4. Patients with clinically detectable focus of active infection.

For this study 40 patients with AVN of bilateral femoral head who were presented in the Department of Orthopaedics, Hamidia Hospital, Bhopal from April 2016 to April 2020 who fulfilled the inclusion criteria were included in the study. Data for retrospective study was obtained from the clinical records available in the hospital.

2.3. Pre-operative protocol

All patients were subjected to detailed clinical history, thorough systemic clinical & local examination. Harris Hip score & Oxford Hip score were calculated. Investigation like CBC, RFT, LFT, Blood Sugar, Blood Culture sensitivity, urine routine and microscopy and culture sensitivity, ECG, Chest X-ray, X-ray pelvis with both hips, MRI of bilateral hip were done for all patients.

All the patients were operated on elective basis by senior consultants of the department. Whether surgery has to be

done in one or two stage was decided by the chief operating surgeon. There was no protocol for staging of the surgery & surgical approach used. Surgeries were carried out in the operation theatre having laminar air flow under spinal or epidural anaesthesia.

2.4. Post-operative follow-up

All patients were followed up for a period of 6 months after the surgery. Clinical & radiological evaluation was done using Harris hip score, Oxford hip score, limb length discrepancy, pelvis with both hips- AP view x-ray. Number of days/months after which patients started walking with support & returned to their work was documented. Any complications if present were also noted.

2.5. Statistical analysis

The data obtained was compiled systematically and subjected to statistical analysis. Statistical analysis was done using Statistical Package of Social Science (SPSS Version 20: Chicago Inc., USA). Data comparison was done by applying specific statistical tests to find out the statistical significance of the comparisons. Quantitative variables were compared using mean values & qualitative variables using proportions.

Significance level was fixed at $p < 0.05$.

3. Results

The present study included 40 patients. Male patients comprised of 87.5% (Figure 1). Male:Female ratio in our study group was 7:1. Mean age of the patients was 39.25yr with range from 22 to 68 yrs. Age range 31-40 yr had highest proportion of the patients i.e. 30% whereas age range >50yr were lowest i.e. 6%. History of alcohol intake was present in 47.5% patients. None of the patients had the history of trauma to hip joint.(Figure 2)

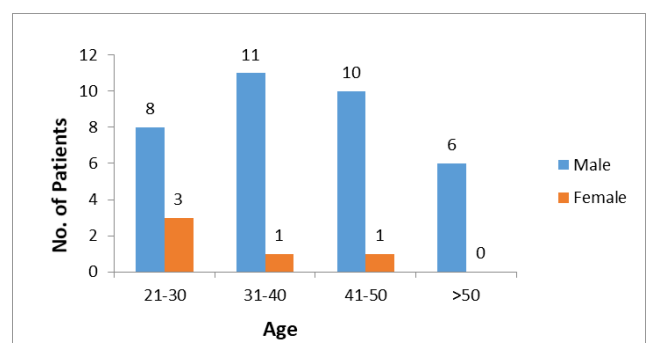


Fig. 1: Age and sex distribution of the patients

Mean preoperative Harris Hip score in our study was 41.7 (range 17-63) (Figure 3). Mean Harris Hip Score on 1st follow up i.e. after 6 weeks of surgery was 82.81 (range

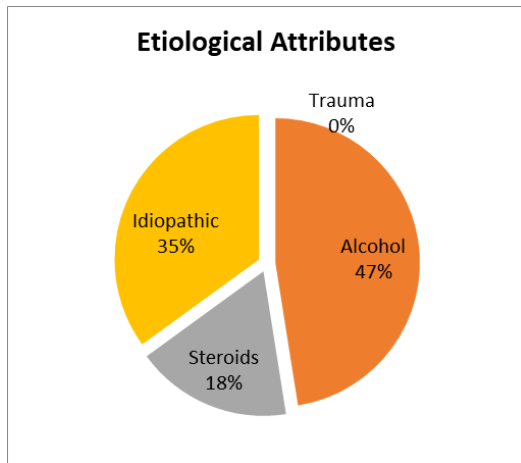


Fig. 2: Patient distribution on the basis of etiology

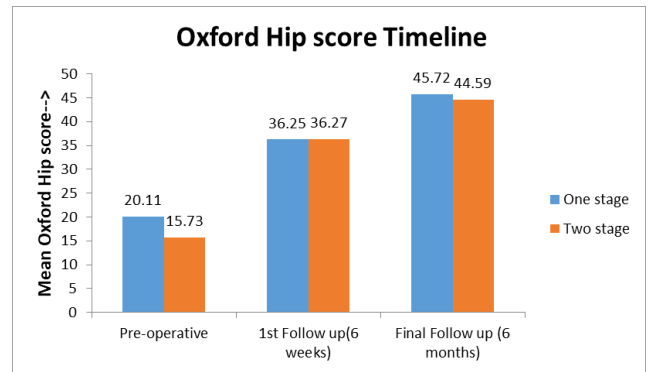


Fig. 4: Mean Oxford Hip Score of both groups at various time period

67-92). Mean Harris Hip score on final follow up i.e. after 6 months was 94.5 (range 86-99).

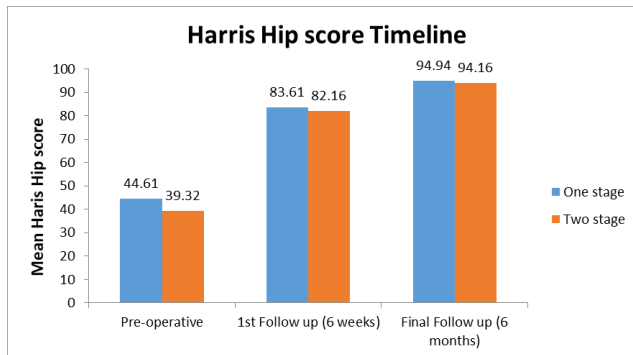


Fig. 3: Mean Harris Hip Score of both groups at various time period

Mean preoperative Oxford Hip score in our study was 17.7 (range 6-29) (Figure 4). Mean Oxford Hip Score on 1st follow up i.e. after 6 weeks of surgery was 36.26 (range 32-43). Mean Oxford Hip score on Final follow up i.e. after 6 months was 45.1 (range 38-48).

The outcome of hip replacement surgeries was graded on the basis of Harris Hip Score measured on final follow up i.e. after 6 months of surgery (Table 1). 90% of the surgeries were graded as Excellent & 10% were graded as Good. Among One stage group, 94% surgeries were graded as excellent whereas among Two stage group, 86% were graded as Excellent.

4. Discussion

In our study, we analysed the results of THR in patients with bilateral AVN of femoral head. In 1972, Lindberg & Sjostrand⁵ estimated that around 1/3rd of patients with primary osteoarthritis of hip would require bilateral surgery.

This emphasise the importance of comparison of one stage versus two stage bilateral THR.

In our study of 40 patients with Male: Female ratio of 7:1, the mean age of patients was 39.25 years with range from 22 to 68 years which was similar to the study conducted by Reddy et al⁶ where mean age was 37.63 years. It was 35.3 in the study conducted by Kumar et al⁷ & 47.5 years in the study by Gupta et al.⁸ Most of the patients in our study belong to the age group of 31-40 years which was similar to the study conducted by Kakaria et al⁹ as we included all Avascular necrosis patients & it is a disease of younger age groups & additional risk factors like alcohol & trauma occurs more frequently in this age group. Dhaon et al¹⁰ in his study concluded AVN as the most common (66.6%) indication for THR in Indian population while OA only in 4.76% cases.

In present study, 47.5% patients gave a positive history of alcohol intake which was similar to the study done by Jacob et al.¹¹ In the study conducted by Kakaria et al,⁹ 35% patients gave history of alcohol intake. The exact mechanism of how alcohol leads to AVN is not known however several studies have concluded that excessive fatty substances are produced & get deposited in small blood vessels of bone. This blockage leads to decreased blood flow to femoral head causing bone death. Jacob et al¹¹ concluded that alcoholism-induced bone necrosis is caused by fat embolism linked to co-existent hyperlipidemia. Thus, alcohol intake can be considered as high risk factor for development of AVN & subsequent requirement of THR.

In our study, history of steroid intake was present in 17.5% patients. In the study conducted by Reddy et al,⁶ 6.67% patients had history of steroid use. Wu et al¹² in his study concluded fat hypertrophy, intravascular coagulation & fat emboli as important risk factors of steroid-induced ischemic bone necrosis which may develop during initial 1 year of steroid intake.

In present study, average blood transfusion was 2.3 units (Table 2). In patients of Two stage surgery, requirement of blood transfusion was significantly higher (p<0.01) which



Fig. 5: Clinical and radiological images of 32yr male patient **A-C:** Pre-operative, **D-F:** Post-operative

Table 1: Outcome of hip replacement surgeries graded on the basis of Harris Hip Score

Final Follow-up HHS	One Stage	Two Stage	Total
Excellent (91-100)	95.38±0.34 (34)	95.29±0.35 (38)	95.33±0.24 (72)
Good (81-90)	87.5±0.5 (2)	87.0±0.37 (6)	87.13±0.30 (8)
Fair (71-80)	0	0	0
Poor (<70)	0	0	0

Table 2: Requirement of blood transfusion in both groups

Blood Transfusion	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
PRBC Required (Units)	1.83±0.16	2.55±0.19	2.23±0.14

p<0.01

can be co-related to the higher intra-operative blood loss. Our results were supported by the study conducted by Agarwal et al.¹³ In their study, intraoperative blood loss was 280 ml for One stage group & 440 ml for Two stage group. Average blood transfusion was 1.6 units for One stage group & 2.2 units for Two stage group.

In our study, (Table 3) One stage surgery patients spent average 10.8 days in hospital after surgery whereas Two stage surgery patients spent significantly ($p < 0.0001$) higher number of days in hospital which was 17.2 days in our study. Our results were supported by the study done by Agarwal et al,¹³ Parvizi et al¹⁴ & Bhan et al.³ Our institution followed the policy of discharging the patients after suture removal which was generally done 12 days after surgery. Similarly, the average requirement of parenteral antibiotics (Table 4) & analgesia (Table 5) were significantly higher in Two stage group. Agarwal et al¹³ in his study concluded that the total cost ratio between One stage & Two stage group was 1:1.4 i.e. 40% more. The patients & the family members took more number of days off from work & home. Thus, the family members were more comfortable with single stage surgery.

Table 3: Duration of post operative hospital stay in both groups

Hospital Stay	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
Mean Post Operative Hospital Stay (Days)	10.8±0.39	17.2±1.53	14.32±1.02
Mean±SEM (Number of Procedures)			

Table 4: Requirement of parenteral analgesia in both groups

Analgesia Requirement	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
Days	4.8±1.03	7.2±1.24	6.1±1.12

Table 5: Comparison of parenteral antibiotics in both groups

Antibiotic Requirement	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
Days	7.4±0.49	13.5±1.16	10.76±0.86

The Harris Hip Score is the most widely used scoring system for functional evaluation of hip.¹⁵ We also used Harris Hip Score for functional outcome of the surgery in our study. (Table 6) The mean preoperative HHS of our study was 41.7 which was improved to 94.51 at final follow up of 6 months. We found similar results in the study done by Kakaria et al & Shah et al. In study done by Kakaria et al,⁹ preop HHS was 43 & postop HHS was 89. In study done by Shah et al,¹⁶ preop HHS was 45 & postop HHS was 91.28. We also compared the post op HHS among the patients of One Stage surgery & Two stage surgery. There

was no significant ($p > 0.05$) difference among the score of both the groups. Our results were also supported by the study done by Agarwal et al & Bhan et al. Agarwal et al¹³ concluded long term results to be similar in the both the groups with comparable Harris Hip score.

In addition to the Harris Hip Score, we also used Oxford Hip Score to analyse the functional outcome of the surgery. The mean pre operative OHS in our study was 17.7 which improved to 45.1 postoperatively at final follow up (Table 7). In the study by Kumar et al,⁷ pre operative OHS was 6.7 which improved to 41.14 post operatively. We did not find any significant ($p > 0.05$) difference between the post operative OHS of patients of One stage & Two stage surgery.

In our study we used HHS of final follow up to grade the outcome of surgery & found that all of the patients had results as Excellent or Good i.e. all patients' post op HHS was between 81 to 100 (Table 8). 90% patients had Excellent results & 10% had good results. Results were similar to the study done by Kakaria et al⁹ where all 20 patients had Good to Excellent results. Similarly, in the study done by Reddy et al,⁶ all 30 patients had results Good to Excellent.

In our study, walking with support of walker was started after average 4.06 days after surgery in One stage surgery patients & 10.3 days after Two stage surgery (Table 9). There was significant ($p < 0.01$) difference between the results of One stage & Two stage group. Agarwal et al¹³ in his study concluded that early functional recovery is seen in single stage group as they started walking early without support & regained comparative ROM earlier. Two stage group patients were bed ridden for more time. They were also not able to stand & walk properly immediately after the first surgery as other side was usually painful & deformed. Wykman & Olsson¹⁷ stated that in bilateral hip disease, optimal function is not entirely regained until both hips have been replaced. Optimal function can be achieved more quickly with One stage surgery.

In our study, walking without support was started after an average 44.4 days after One stage surgery & 48.27 days after Two stage surgery (Table 10). There was no significant ($p > 0.05$) difference between the results of both groups. Results were similar to the study conducted by Agarwal et al¹³ where It was 42 days for One stage group & 50 days for Two stage group.

In our study, the average time for return to work was 2.47 months (Table 11). There was no significant ($p > 0.05$) difference between the results of both groups. It was 2.39 months for One stage group & 2.64 months for Two stage group.

Our study has few limitations like small sample size, short follow up period & inclusion of retrospective cases limiting randomization. A further study with more patients with longer duration of follow up will be needed to come to a firm conclusion.

Table 6: Harris hip score timeline of both groups

HHS Timeline	One Stage	Two Stage	Total
Pre-operative	44.61±1.25 (36)	39.32±1.72 (44)	41.7±1.13 (80)
1st Follow up (6 weeks)	83.61±0.71 (36)	82.16±0.92 (44)	82.81±0.61 (80)
Final Follow up (6 months)	94.94±0.44 (36)	94.16±0.53 (44)	94.51±0.35 (80)

Mean±SEM (Number of Procedures)

Table 7: Oxford hip score timeline of both groups

OHS Timeline	One Stage	Two Stage	Total
Pre-operative	20.11±0.78 (36)	15.73±0.88 (44)	17.7±0.64 (80)
1st Follow up (6 weeks)	36.25±0.50 (36)	36.27±0.40 (44)	36.26±0.31 (80)
Final Follow up (6 months)	45.72±0.22 (36)	44.59±0.35 (44)	45.1±0.23 (80)

Mean±SEM (Number of Procedures)

Table 8: Outcome of hip replacement surgeries graded on the basis of Harris Hip score

Final Follow-up HHS	One Stage	Two Stage	Total
Excellent (91-100)	95.38±0.34 (34)	95.29±0.35 (38)	95.33±0.24 (72)
Good (81-90)	87.5±0.5 (2)	87.0±0.37 (6)	87.13±0.30 (8)
Fair (71-80)	0	0	0
Poor (<70)	0	0	0

N= No. of hips, Mean±SEM (Number of Procedures)

Table 9: Comparison of post op walking with support in both groups

Walking with Support	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
Days	4.06±0.33	10.3±0.72	7.49±0.55

p=0.002

Table 10: Comparison of post op walking without support in both groups

Walking without Support	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
Days	44.44±3.77	48.27±4.21	46.55±4.01

Table 11: Comparison of return to work in both groups

Return to Work	One Stage (n=18)	Two Stage (n=22)	Total (n=40)
Months	2.39±0.25	2.64±0.54	2.53±0.33

5. Conclusion

Based on the findings this study concludes that in patients of AVN of bilateral femoral head, THR gives excellent functional outcome with early walking & early return to work. As compared to Two stage bilateral THR, One stage bilateral THR has advantage of less blood loss, less need of parenteral analgesics & antibiotics & less hospital stay. However there is no significant advantage in terms of functional outcome, walking capability & return to work.

6. Source of Funding

None

7. Conflict of Interest

The authors declare that there is no conflict of interest.

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Cite this article: Dubepuria A, Gohiya A, Sonkar D, Choudhary J. Outcome analysis of bilateral total hip replacement in patients of avascular necrosis of femoral head. *Indian J Orthop Surg* 2022;8(3):176-182.