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Treatment of avascular necrosis of femoral head with cemented total hip replacement a prospective study

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Abstract

Total hip arthroplasty is a remarkable surgical procedure that provides mobility stability as well as better quality of life in persons suffering from hip disorder. It is procedure in which surgical excision of femoral head and proximal neck is done and is replaced with metal ball; while the acetabulum is resurface with metal shell & plastic liner.

Total hip arthroplasty is a reconstructive procedure, that improve the management of those diseases of hip joint that respond poorly to conventional medical therapy and produce great problems in patient thus eliminate pain and restore function of hip. At present it is the most commonly performed re-constructive hip surgery in elderly.

This prospective study done in the Department of Orthopaedics, Rajendra Institute Of Medical Science, Ranchi during the period 2014 to 2016. Aim of study was to evaluate the clinical, functional and radiological outcome of total hip arthroplasty.

30 Patient with avascular necrosis of femur head admitted during above period was selected for study after proper clinical, radiological and laboratory evaluation.

The functional outcome was measured with Harris Hip Score.

On postoperative evaluation 3 cases i.e 10% patients had excellent result, 24 cases i.e 80% had good result, 2 cases i.e 6.66% patients had fair result and 1 cases i.e 3.33% patients had poor result.

Keywords: Treatment, avascular necrosis, hip replacement, prospective study

Introduction

Total hip arthroplasty is a remarkable surgical procedure that provides mobility stability as well as better quality of life in persons suffering from hip disorder. It is procedure in which surgical excision of femoral head and proximal neck is done and is replaced with metal ball; while the acetabulum is resurface with metal shell & plastic liner.

Total hip arthroplasty is a reconstructive procedure, that improve the management of those diseases of hip joint that respond poorly to conventional medical therapy and produce great problems in patient thus eliminate pain and restore function of hip. At present it is the most commonly performed re-constructive hip surgery in elderly.

The incidence of chronic disabling conditions of the hip such as osteoarthritis, inflammatory arthritis and osteonecrosis is on the rise. The most common condition for which total hip arthroplasty is done is severe osteoarthritis of the hip, accounting for nearly 70% of cases. The other indication for hip arthroplasty is ankylosing spondylitis, fracture neck of femur, pyogenic arthritis, and degenerative joint disease. The primary indication for this (THR) procedure is severe pain in the hip and the limitation in activities of daily living that it causes. To warrant doing total hip replacement, pain must be refractory to conservative measures such as oral non-steroidal anti-inflammatory medication, weight reduction, activity restriction, and the use of supports such as a cane. Conventional cemented total hip arthroplasty dramatically improves a patient's function and quality of life. With contemporary prostheses and modern cementing techniques, the rate of femoral loosening appears to be substantially reduced.

In Cemented Total hip arthroplasty fixation is achieved by mechanical interlocking of cement. In uncemented Total hip arthroplasty implant surface is textured with porous bead or titanium mesh to enhance bone fixation by osteointegration.

Recently bioactive surface coating hydroxyapatite is used on this surface. Over period of time bone grow in porous coating surface.

Avascular necrosis involves the bones of a joint; it often leads to destruction of the joint articular surfaces. Avascular necrosis most commonly affects ends (epiphysis) of long bones such as femur, humerus, knees, shoulders, ankles and jaw. The disease may affect just one bone, more than one bone at the same time, or more than one bone at different times. Avascular necrosis usually affects people between 30 and 50 years of age. Avascular necrosis is especially common in the hip joint. Different methods are now used to treat avascular necrosis; most common is Total Hip Replacement.

Therefore, aim of treatment is less discomfort, early and better restoration of function of hip and rapid mobilization by Total hip arthroplasty. Aseptic femoral and acetabular loosening which is a potential cause of pain and loss of function have emerged as the most serious complications of THR and the most common indication for revision. Periprosthetic fractures of femur can be a difficult problem to manage. Several factors contributing to these adverse effects, which may eventually result in failure of the total hip arthroplasty, include the selection of the patients and the materials and design of the implant. Many designs have been studied in an attempt to minimize these adverse effects and thus improve outcome. Total hip replacement (THR) relieves the pain and functional disability experienced by patients with moderate to severe arthritis of the hip thus improving their quality of life. It is a highly cost-effective procedure. The anatomically designed prosthesis can provide good results, with low prevalence of pain in the thigh and loosening of the component.

Early complications of hip arthroplasty include fracture, nerve injury, dislocation, deep vein thrombosis and pulmonary embolism. Late complications include infection, heterotrophic ossification and loosening.

Evaluation of long term outcomes of an operative procedure is important to determine the durability of the procedures like total hip replacement (THR). Patient outcome scales have become increasingly important to surgeons and clinical researchers for measuring improvement in function after surgery. It provides a means for comparison of the results of different clinical interventions which may lead to changes in operative technique and implant design over time. The Harris hip score is the most widely used scoring system for evaluating hip arthroplasty.

Choice of Total hip arthroplasty is based on surgeon performance and patient profile like-age, bone quality, life expectancy morbidity and economic condition.

Materials and Methods

This prospective study done in the Department of Orthopaedics, Rajendra Institute Of Medical Science, Ranchi during the period 2014 to 2016. Aim of study was to evaluate the clinical, functional and radiological outcome of total hip arthroplasty.

30 Patient with avascular necrosis of femur head admitted during above period was selected for study after proper clinical, radiological and laboratory evaluation. Patients of avascular necrosis of femur head with acute or chronic Hip pain with restriction of movement.

Methods

Patients with Avascular necrosis femur head between the age of 30 to 70 years were selected out of those admitted in

Orthopaedic department of Rajendra Institute Of Medical Science, Ranchi, thorough examination including X-ray both antero-posterior and lateral views of the affected hip joint.

AP view of the pelvis should be reviewed specifically to evaluate the structure integrity of acetabulum and femur, to determine the center of rotation of hip, the correct stem size, the diameter of medullary canal, femoral offset, to estimate the approximate size of implant required, condition of bone, amount of reaming required, level of osteotomy of neck of femur, and for any osteophyte.

Lateral view of the hip helps to plan the location of femoral opening, and assess the femoral bow and the AP canal diameter.

Third generation cephalosporin were given preoperatively in the operative room 15-30 min before the skin incision.

In this series moore's approach was used in all the 33cases. Anterior dislocation of hip is completely achieved by full adduction and external rotation of the hip. After dislocation of the head osteotomy of the femoral neck is performed and the femoral head is excised.

Acetabulum preparation

Acetabulum is exposed. Central and medial osteophyte removed and the transverse acetabular ligament preserved. Rim osteophyte was left intact. Reaming done with increased size of reamer sequentially. It is important to preserve the subchondral plate superiorly. Also care must be taken to leave the anterior and posterior wall intact. At this point, multiple 6 to 10 mm anchoring holes of approximately 10 mm depth are made in the roof using a drill. Inferior hole are not require. Pulsatile lavage was used to thoroughly and copiously irrigate the acetabular bone bed. It is essential to remove the blood, marrow element, and any residual soft tissue from the acetabular cavity. Furthermore, recommend that H₂O₂ sponge pack in the cavity prior to the final wash by sterile saline in order to further limit bleeding at the cancellous bone surface. After final wash, multiple dry sponges were placed in the cavity to completely dry the bony surface for better cementation. Most socket required 40 gram batch of bone cement. Once the cement has reached appropriate viscosity, a large ball of cement is formed and inserted into the acetabular cavity immediately after removing the packed sponges used for drying. The cement is then pressurized manually, after one minute mechanical pressurizer is placed until the cement has sufficiently penetrated and reaches high enough viscosity. Excess cement was removed. Cup size was 4 mm smaller in diameter than the largest reamer used in order to insure circumferential cement mantle of at least 2 mm. The acetabular component was held in place until the cement has sufficiently hardened.

Femur preparation

The femoral neck is cut at the pre-operatively template level. This resection was done 1.5 cm to 2 cm above the level of the proximal aspect of the junction of the lesser trochanter with the femoral neck. A higher neck cut at the 35⁰ to the femoral shaft axis can be beneficial as the preservation of the distal femoral neck increases rotational stability of the stem. Osteotomy is done by oscillatory saw.

After the proper axis of femoral canal determination with canal finder, with a box osteotome; lateral portion of the femoral neck by removing a wedge of cancellous bone. 3-5 mm of cancellous bone was left medially along the calcar to enhance lateral cement Interdigitation. Now sequential broaching of the femur is done, with maintaining the lateral

and posterior pressure on the broach handle so that to preserved 3 mm of the medial and lateral cancellous bone. A stem size is 2 mm smaller than largest broach used so that a minimum 2 mm circumferential around the stem is needed for a cement mantle. Now cement restrictor was placed 1.5-2 cm distal to the tip of the femoral stem to allow for an appropriate cement mantle distally. Most socket required 80 gram batch of bone cement. Now cement is prepare, once the cement has reached appropriate viscosity, a large ball of cement is formed and inserted into the femoral canal immediately after removing the packed sponges used for drying. As the proximal femur is filled with cement the thumb is used to temporarily pressurise the cement by sealing the medial calcar area. Once cement is adequately pressurized the stem is slowly inserted using steady manual pressure. The entry point of stem was same as for the broach, posterior and lateral, in the line with the axis of the canal. Slight posterior pressure to direct the stem tip anteriorly will result in a central position of the stem.

Postoperative Protocol

The IV antibiotics are continued for 6-7days. In the immediate post-operative period the hip is positioned in approximately 15° of abduction by using a triangular pillow to prevent postoperative dislocation. Static quadriceps exercises were started from day one, isometric quadriceps exercises are continued and both knees kept apart maintaining abduction at the hip. The patient was made to sit by edge of bed and active assisted knee flexion-extension exercises started

Active assisted hip and knee flexion along with straight leg raising exercises were started. Walking started on 2nd post op week. Stitch removal was done between 12-14 days.

The follow-ups were done at regular intervals of 1, 3, 6, 12 and 18 months post-operatively and results were tabulated as per Harris Hip Score (1969).

Follow up included complete clinical and radiological evaluation. 1st follow up examination is 4 weeks after surgery with gradual increase in weight bearing in the subsequent 8 weeks. Between 3 to 6 months postoperatively nearly 50% of muscle strength is regained. Patients with sedentary occupation return to work after 6 to 8 weeks. At 3 months they can do limited lifting and bending. Routine X-rays are taken at 6 month intervals thereafter and compared with previous films for signs of loosening, migration, wear and implant failure.

Post-Operative Radiological Assessment

The femoral component is assessed by following parameters: Restoration of centre of rotation of hip compared to normal side, Neutral position of the tip of the stem without any varus or valgus angulation, Tip of greater trochanter corresponds to the centre of head, Optimum level of lesser trochanter on both sides for any limb length discrepancies, Correct seating of collar of stem on the calcar of the femoral neck, Restoration of offset (both medial or vertical as compared to normal side), Femoral Neck Orientation to vertical offset.

Acetabular component is assessed by the following parameters

Correct size and optimal seating of the cup without any polar gaps.

Correct inclination of the cup at 45° at the level of tear drop.

The average anteversion of the cup is $15^{\circ} \pm 10^{\circ}$.

Degree of polyethylene wear was measured by the linear distance of penetration of femoral head into polyethylene.

Functional Assessment

Post-operatively the results were evaluated as per Harris hip score

Modified Harris Hip Score Pre-Op Post –Op Pain

Totally disabled, Crippled, pain in bed, bedridden-0

Marked pain, serious limitation of activities -10

Moderate pain, tolerable but with some limitation of ordinary activity or work - 20

Mild pain, no effect on average activities, rarely

Moderate pain with unusual activity, may take aspirin -30

Slight, occasional, no compromise in activity- 40

None, or ignores it - 44

Limp Pre-op Post-op

Severe	0
Moderate	5
Slight	8
None	11

Support Pre-op Post-op

Two crutches/not able to walk	0
Two canes	2
One crutch	3
Cane Most of the time	5
Cane for long walks	7
None	11

Distance Walked Pre-op Post-op

Bed and chair	0
Indoor only	2
2 or 3 blocks (250 to 375 mts)	5
6 blocks walking (750 mts)	8
Unlimited	11

Stairs Pre-op Post-op

Unable to do stairs	0
In any manner	1
Normally using a railing	2
Normally without using a railing	4

Put on shoes or socks Pre-op Post-op

Unable	0
With difficulty	2
With ease	4

Sitting Pre-op Post-op

Unable to sit comfortably on any chair	0
On a high chair for 30 minutes	3
Comfortably, ordinary chair for one hour	5

Enter public transportation Pre-op Post-op

Yes	1
No	0

Flexion contracture – degrees

Limb Length discrepancies – (in cms)

Absence of deformities – (All yes- 4, less than 4-0)

Less than 30 degrees Fixed flexion deformity- Y/N

Less than 10 degrees Fixed Adduction - Y/N

Less than 10 degrees Fixed internal rotation in Extension-Y/N

Limb length discrepancy less than 3.2 cms - Y/N

Range of Motion

Total degree measurements, then check range to obtain score

Flexion	- 1400
Abduction	- 400
Adduction	- 400
External rotation	- 400
Internal rotation	- 400

Total Score

Range of motion scale

0-30 degree	0
31 to 60 degrees	1
61 to 100 degrees	2
101 to 160 degrees	3
161 to 210 degrees	4
211 to 300 degrees	5

Range of motion score

Total Harris Hip Score

Final results were graded as follows

Score < 70	- Poor
70-79	- Fair
80-89	- Good
90-100	- Excellent

Observations

Table 1: Age distribution

Age	No. of Patients	Percentage
30-40	5	16.6%
41-50	9	30%
51-60	14	46.6%
61-70	2	6.66%
	30	100

Table 2: Gender distribution

Gender	No. of cases	Percentage
Male	18	60%
Female	12	40%
Total	30	100%

Table 3: Side involvement

Side	No. of cases	Percentage
Left	14	46.6%
Right	16	53.3%
Total	30	100

Table 4: Cause of avascular necrosis of femur head

Indication	No. of cases	Percentage
Fracture NOF	13	43.3%
Neglected hip dislocation	4	13.3%
Steroid induced	5	16.6%
Idiopathic	8	26.6%

Table 5: post-operative acetabular cup angle

Angle (in degree)	No. of cases	Percentage
40	6	20%
42	8	26.6%
44	8	26.6%
46	4	13.3%
48	2	6.66%
50	1	3.33%
52	1	3.33%

Table 6: Femoral stem alignment

Alignment	No. of patients	Percentage
Neutral	27	90%
Valgus	2	6.66%
Varus	1	3.33%
Total	30	100%

Table 7: Post-operative Complication

Complication	No. of cases	Percentage
Infection	1	3.33%
Aseptic loosening	1	3.33%
Limb Length discrepancy	1	3.33%
DVT	0	0%
Pulmonary embolism	0	0%
Heterotopic ossification	0	0%
Total	3	10%

Table 8: Harris Hip Score

Harris Hip Score	Preoperative HHS No. of patient (%)	Postoperative HHS No. of patients (%)
Poor <60	27 (90%)	1 (3.33%)
Fair 61-80	3 (10%)	2 (6.66%)
Good 80-90	0 (0%)	24 (80%)
Excellent 90-100	0 (0%)	3 (10%)

Preoperatively 90% patients had poor Harris hip score. Postoperatively result showed a significant improvement, where in 10% an excellent score had and 80% had good result while 6.66% patients had fair and 3.33% had poor Harris hip score.

Conclusion

In our study we prospectively studied clinical and functional outcome of total hip replacement in avascular necrosis of femur head. In our series of 30 patients of avascular necrosis of femoral head, they were treated with cemented total hip replacement, group comprising of 18 male and 12 female case. The age group included in study was ranging from 30-70 years.

Cases were followed on regular interval with clinical, functional and radiological assessment. They were followed up regularly at an interval of 1month, 3-month, 6 months and at 20 months.

The most common cause for avascular necrosis of femur head in our study was fracture neck of femur.

The functional outcome was measured with Harris Hip Score. On postoperative evaluation 3 cases i.e 10% patients had excellent result, 24 cases i.e 80% had good result, 2 cases i.e 6.66% patients had fair result and 1 cases i.e 3.33% patients had poor result.

There were 1 cases i.e 3.33% patient had their stem in varus position and two case i.e 6.66% had their stem in valgus.

Postoperative superficial infection was seen in 1(3.33%) case which was controlled after extending iv antibiotic therapy.

Limb length discrepancy seen in 1 (3.33%) case which was shortening of greater than 1cm.

Aseptic loosening was seen in 1 i.e 3.33% of cases.

Cemented total hip replacement is a good option in patient of painful avascular necrosis of femur head.

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