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Clinical Outcome Comparison of Large Diameter Head and Conventional Diameter Head Total Hip Arthroplasty

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ABSTRACT

Background: Due to the important kinematics and load bearing function of hip and the high number of patients suffering from degenerative hip conditions, the first and the main efforts in artificial joint replacement were focussed on this point. **Objectives:** to study the clinical outcome comparison of large diameter head and conventional diameter head total hip arthroplasty.

Material and Methods: A total of 25 hips were operated upon for uncemented large diameter head in total hip arthroplasty in the Department of Orthopaedics, Pt. B.D.S. P.G.I.M.S. Rohtak.

Results: Limb length discrepancy was found in 11 hips (44%). Range of motion was good in 15 (60%) cases and mild restriction was seen in 10 cases (40%). none had inclination less than 35°, five hips (20%) had inclination of 36 - 45°, 19 hips (76%) had inclination of 46 - 55° and one hip (4%) had inclination of ≥ 56°. Harris hip score at final follow up was, 14 cases (56%) had excellent results, 10 cases (40%) had good results and one (4%) had fair result.

Conclusion: Lower dislocation rate and better range of motion in majority of the cases reinforces the advantage of large diameter head total hip arthroplasty.

Keywords: Limb length discrepancy, Range of motion, complication, infection, Harris hip score.

INTRODUCTION

The size of the femoral head, the ratio of head and neck diameters, and the shape of the neck of the femoral component have a substantial effect on the range of motion of the hip, the degree of impingement between the neck and rim of the socket, and the stability of the articulation. This impingement can lead to dislocation, accelerated polyethylene wear, acetabular component loosening, and liner dislodgment or fracture. The introduction of advanced bearing surfaces has allowed the use of larger head sizes than those traditionally used in the past.[1]

Polyethylene wear debris can however lead to osteolysis, bone loss, aseptic loosening and eventually failure of the implant, especially in high demand young patients. But, wear and osteolysis have become foremost concerns in primary THA in the recent decade.[2] Metal-on-metal (MM) THA is an alternative to overcome polyethylene wear induced prosthetic failure. The MM wear rate is reported to be 20 to 100 times lower than conventional wear rates.

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Metal-on-metal wear rate is also influenced by the size of articulation and its clearance (i.e. difference between radius of the head and the shell). Larger heads show lower wear rates provided they have a low clearance.[3] Other advantages of large diameter heads seem to be increased range of motion and reduced number of dislocations.

Because of its high density, implants have a surface finish smoother than metal implants. The hydrophilic nature or ability to absorb moisture, of ceramic promotes lubrication. Ceramic is harder than metal and more resistant to scratching from third-body wear particles. The linear wear rate of alumina-on-alumina has been shown to be 4000 times less than cobalt-chrome alloy–on–polyethylene. Impingement between the femoral neck and rim of the ceramic acetabular component creates problems unique to this type of articulation. Impact loading of the rim can produce chipping or complete fracture of the acetabular bearing. Repetitive contact at extremes of motion also can lead to notching of the metal femoral neck by the harder ceramic and initiate failure through this relatively thin portion of the implant.[4] Microseparation of the implants during the swing phase of gait is a recognized phenomenon. Edge loading at heel strike has been proposed as a cause of the stripe wear.[5]

The primary goal of operation is to relieve pain and restore mobility of patient, enabling him/her to return to active daily living. The implanted prosthesis undergoes wear as time progresses. Also the general condition of patient undergoes change over a period of time. This necessitates the need for continous follow up and monitoring of the patients, complications, data collected and its analysis.

This not only helps in assessing the outcome and performance of the reconstructive procedure, but also provides timely inputs regarding any complications, enabling remedial measures to be taken. This information also provides the background against which further research and development can be undertaken. The purpose of this study was to study the clinical outcome comparison of large diameter head and conventional diameter head total hip arthroplasty.

MATERIAL & METHODS

This study was conducted in the Department of Orthopaedics, Pt. B.D.S. P.G.I.M.S. Rohtak. Patients presenting to Outpatient Department and emergency Department of Pt. B.D.S. P.G.I.M.S. Rohtak between January 2010 to June 2020 were screened for avascular necrosis of hip, osteoarthritis of hip, fracture neck of femur and other disorders of hip. A total of 25 hips on 24 patients were operated upon for uncemented large diameter head in total hip arthroplasty.

Detailed history, clinical examination and radiological examination were carried out in all 24 patients.

Special Investigation: Factor PFT HLA B27

Radiological Investigations

X – Ray Pelvis with both hips – AP
X – Ray both hips with thigh – AP & LAT
X – Ray chest – PA
X – Ray L S Spine – AP & LAT (in selected patients)
X – Ray B/L Sacro iliac joints – Oblique (in selected patients)

Patients were evaluated clinically and data recorded on the basis of modified Harris hip score

Category	Harris hip score
Excellent	91-100
Good	81-90
Fair	71-80
Poor	70 or less

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Preoperative Planning

This aspect is important in choosing appropriate implants and anticipating unusual needs during the surgery.

Preoperative Regime

Parts were shaved and cleaned 48 hours before surgery, nails were cut short. Intra-venous prophylactic antibiotic was given 12 hours prior to surgery and continued till 5 days postoperative.

Postoperative Regime: In the immediate postoperative period, the hip is positioned in 15° of abduction. Patient was assessed periodically for the amount of blood collected in suction drain, blood pressure, pulse, any soakage and any need for postoperative blood transfusion.

Check X –ray was done the next day to check the positioning of implant.

Postoperative (Day 1)

Initiation of bedside exercises, Review of hip precautions and weight-bearing status, Initiation of bed mobility and transfer training - Bed to/from chair.

Postoperative (Day 2)

- Initiation of gait training with the use of assistive devices, such as crutches and a walker.
- Continuation of functional transfer training.
- Drains were removed between 24 and 48 hours after surgery.

Postoperative (Days 3-5)

Progression of ROM and strengthening exercises to the patient's tolerance, Progression of ambulation on level surfaces the assistive device and Progression of ADL (activities of daily living) training.

Wound was inspected on fifth postoperative day and if healthy, intravenous antibiotics stopped and patient was started on oral antibiotics. If any discharge was seen on expressing the wound, it was sent for pus culture and sensitivity and injectable antibiotics continued until results were available. Sutures were removed after 12 – 14 days postoperatively and patient was discharged.

Postoperative (Day 7 to 4 Weeks)

Strengthening exercises - For example, seated leg extensions, knee bends, Stretching exercises to increase the flexibility of hip muscles, Progression of ambulation distance and Progression of independence with ADL.

Patient was reviewed at 6 weeks (at 3 months post-operative) and assessed for gait pattern. Patient was instructed to use cane in opposite hand from then onwards. If any abductor weakness was seen, patient was taught abductor exercise to strengthen abductors. Patient was again assessed after 6 months when cane could be discarded.

Hence patient was evaluated after 6 weeks, 3 months, 6 months and 1 year after surgery. Results were evaluated and compared with previous results both clinically and radio graphically.

The fit of the stem of the femoral component in the femoral canal was considered to be excellent if the anteroposterior radiograph showed the stem to be in contact with the cortical bone at some point on both medial and lateral surfaces and the lateral radiograph showed the stem to come within two millimeters of the cortex at two of the three possible contact points (proximal and anterior, distal and anterior, and posterior). The fit was considered to be good if the stem was seen to be within two millimeters of the cortex medially and laterally on the anteroposterior radiograph and it was seen to come within three millimeters of the cortex at two of the three possible contact points on the lateral radiograph. The fit was considered to be poor if there was more than two millimeters between the stem and the medial or lateral part of the cortex on the anteroposterior radiograph or if there was more than three millimeters between the stem and the cortex at two of the three contact points on the lateral radiograph.

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Loss of density proximally and rounding of the proximal aspect of the medial side of the femoral neck were determined by study of sequential radiographs and were evaluated for progression.

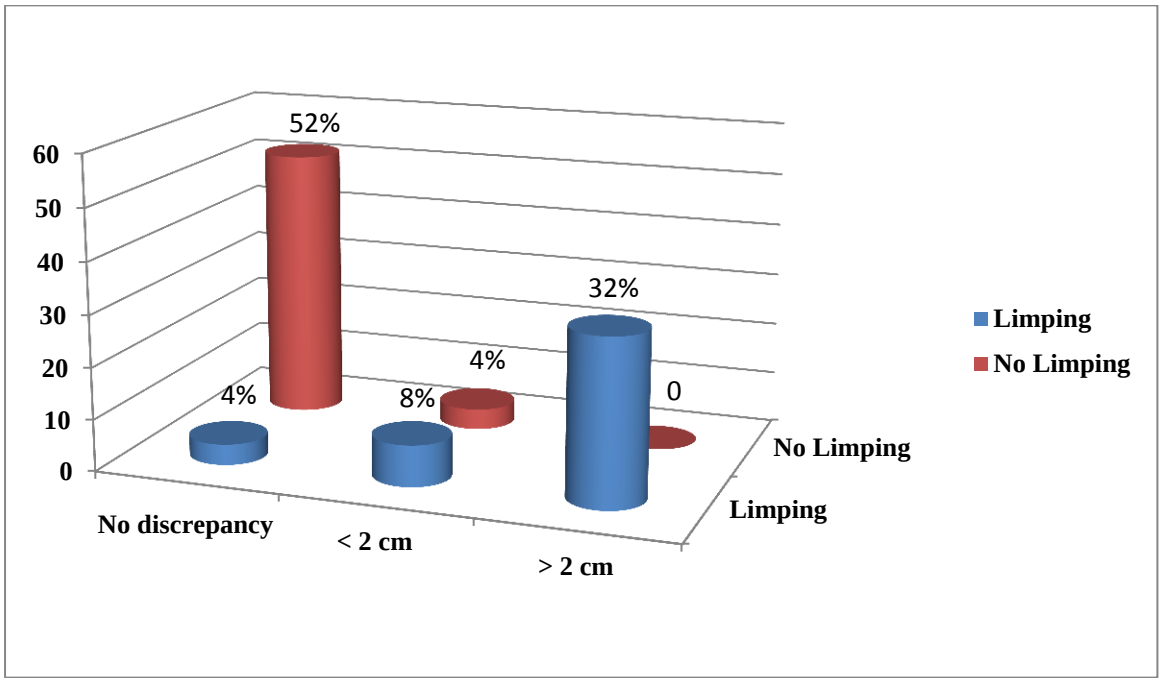
Vertical subsidence of the femoral component was measured by determination of change in the distance from the superomedial extent of the porous coating to the most proximal point on the lesser trochanter.

Vertical migration of the acetabular component was determined by measurement of the change in the vertical distance from a horizontal line drawn through the inferior aspect of both teardrops to a horizontal line drawn through the center of the spherical acetabular component, with the use of a template with a series of concentric circles. Horizontal migration of acetabular component was determined by measurement of change in the horizontal distance from a vertical line drawn through the center of teardrop to a vertical line drawn through the center of the acetabular component, again with the use of a template with a series of concentric circle.

RESULTS

Of total 25 hips, Metal-on-metal THR was done in 8 cases (32%), Metal-on-polyethylene THR was done in 17 cases (68%) and Ceramic-on-ceramic was done in none. Postoperative pain was absent in 15 patients (60%), mild pain was seen in 9 patients (36%) and moderate pain in one patient (4%).

Limb length discrepancy was found in 11 hips (44%). Of the 11 hips three hips (12%) had limb length discrepancy of less than 2 cm, of which two had limp. Eight hips (32%) had limb length discrepancy of more than 2 cm and of whom all the eight hips had limp. 14 hips (56%) had no limb length discrepancy, of whom one (4%) had limp Figure 1.



Range of motion was good in 15 (60%) cases and mild restriction was seen in 10 cases (40%)

Of total 25 hips, none had inclination less than 35°, five hips (20%) had inclination of 36 - 45°, 19 hips (76%) had inclination of 46 - 55° and one hip(4%) had inclination of ≥ 56°

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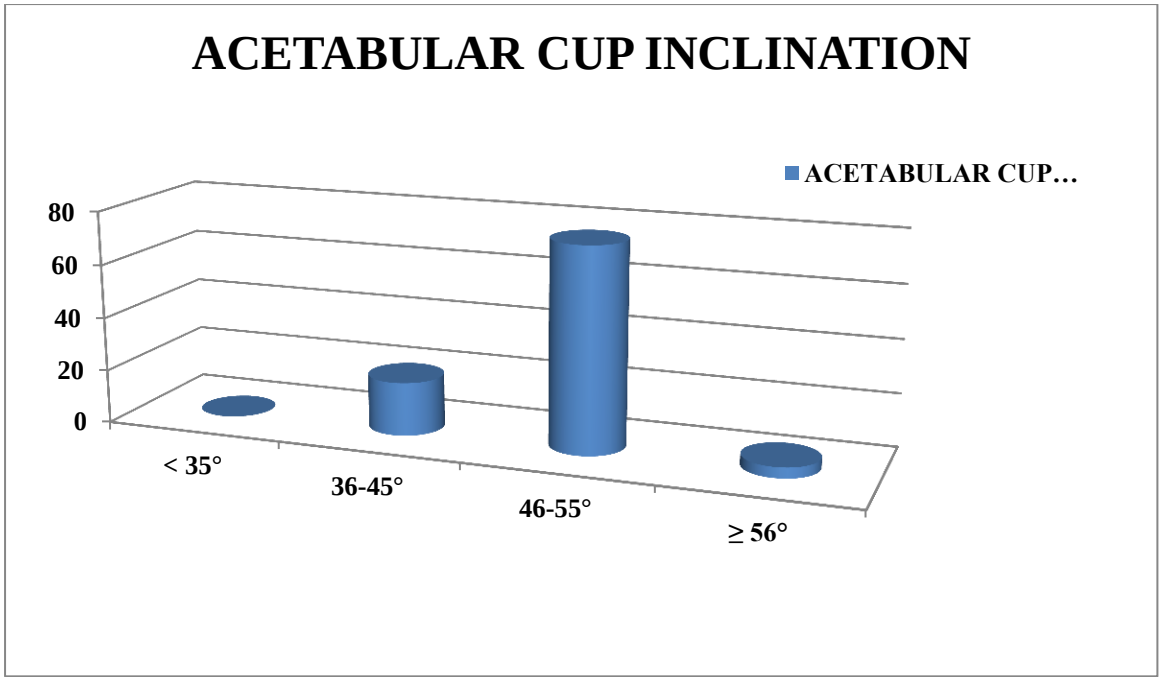
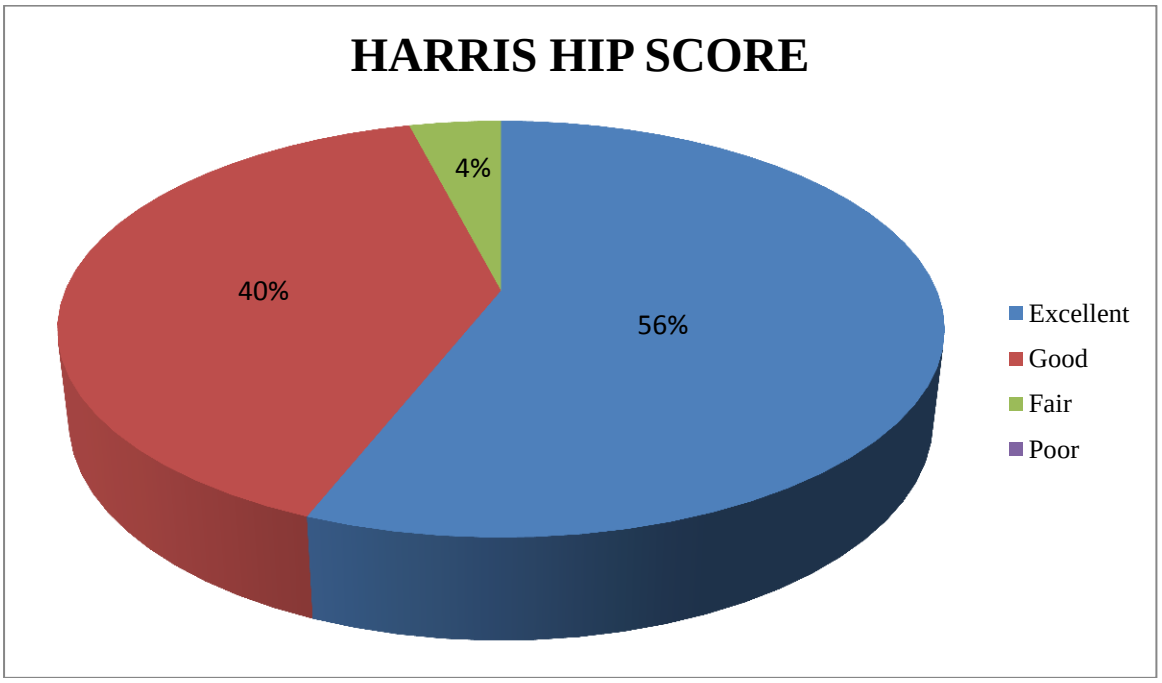


Harris hip score at final follow up was, 14 cases (56%) had excellent results, 10 cases (40%) had good results and one (4%) had fair result figure 3.



DISCUSSION

The mean follow up in our series was 16.31 months, ranging from 7 – 24 months. Mean follow up for other studies were, 6.02 years for Siwach et al.[6], 5 years for Beksac et al[7] , 5.25 years for Bolland et al.[8] , and 3 years for Meding et al.[9] . It is evident that the studies quoted were of much longer follow up compared to present series.

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Name of Study	Mean follow up
Siwach et al.[6] (2007)	6.02 yrs
Beksac et al.[7] (2009)	5 yrs
Bolland et al.[8] (2011)	5.25 yrs
Meding et al.[9] (2012)	3 yrs
Present series	16.31 months

In our series the mean preoperative harris hip score was 38.94 and the mean harris hip score at final follow up was 90.50, of which 56% were graded as excellent, 40% were good and 4% were fair. While the mean harris hip score for other studies were,

Name of study	Harris hip score	
	Preoperative	At final follow up
Siwach et al.[6] (2007)	44	83.5
Mertl et al.[10] (2010)	49.3	91.6
Meding et al.[9] (2012)	51	93
Present series	38.94	90.50

Of the 25 cases who were operated upon, 15 hips (60%) had good range of motion and 10 hips (40%) had mild restriction of range of motion. This was correlated to pain at hip, which could have been the reason for mild restriction of motion in 10 hips. Though patients did not have limitation of their ADL (activities of daily living).

Prosthesis placement has an important role in the outcome of the procedure. It has 2 components;

a) Acetabular cup inclination
b) Femoral stem placement

Acetabular Cup Inclination

In the present series the mean angle of inclination of acetabular cup was 48.21°. Of these none were placed at < 35°, in five hips (20%) cup was placed at 36-45°, in 19 cases (76%) cup had an inclination of 46-55° and one hip had cup inclination >56°. The high inclination in one case was correlated to the disturbed anatomy of hip joint and altered bony land marks for proper placement of cup peropaeratively, as it was revision hip surgery. While mean cup inclination of other studies were, 49.2°, 40.1° and 48.6° by Berton et al.[11] , Bolland et al.[8] and Mertl et al.[10] respectively. No periacetabular osteolysis was seen. This was attributed to shorter duration of follow up.

Chemoprophylaxis was routinely carried out in all patients. No patient developed deep infection in present series. One case of superficial infection was observed. Superficial infection in one case was attributed to, failure to control high blood sugar as it was a case Diabetes mellitus and was resolved by intravenous antibiotics and hypoglycemic medications. All surgeries were performed in conventional operating theater. Wilson et al.[11]82 reported significant fall from, 11% to 1% in the infection rates when prophylactic antibiotics were used. Berton et al.[11] reported 2% of deep infection and Meding et al.[9]reported no deep infection in their series. No case of deep infection in the present series signifies the importance of proper operating room discipline along with prophylactic antibiotics, which can reduce infection rates to significant low level.

In our series one case of dislocation (4%) was observed in postoperative period on the day of surgery. The dislocation was attributed mainly to high inclination of acetabular cup and also due to lack of soft tissue tension, as it was an operated case of fracture dislocation hip three years prior to THR. It was treated with revision of isolated acetabular component on next

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day. No dislocations were reported by Berton et al.[11] and Cuckler et al.[12] . Mertl et al.[10] reported 1.8% of dislocations, Lombardi et al.[13] reported 0.05% of dislocations and Meding et al.[9] reported 0.14% of dislocations, in their studies.

The first two factors are controlled by the operating surgeon, while the third factor (patient noncompliance) can only partially be addressed by careful patient selection for prosthetic hip arthroplasty. Numerous patient factors may contribute to increased dislocation risk: aging, female gender, lower muscular disorders, cognitive dysfunction, dysplasia, previous femoral neck fracture, and rheumatoid arthritis.[7] The correlation between higher surgeon and hospital volume and lower dislocation rates has also been established.[14] The lower dislocation rate in present series could be the result of younger age group of patients and most of them were male patients, apart from main contributions of large diameter head itself.

CONCLUSION

Large diameter head total hip arthroplasty is a better option in young and active individuals, where in complications like dislocation and decreased range of motion, could be disabling for such patients. Uncemented hip arthroplasty with bone ingrowth/ ongrowth as a means of fixation of prosthesis to bone has favorable early results.

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