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Dr. Sabyasachi Bhowmik
Associate Professor, Department
of Orthopaedic, American
International Institute of
Medical Sciences, Bedwas,
Udaipur, Rajasthan, India

Dr. Mohammad Azmoddin
Professor, Department of
Orthopaedic, American
International Institute of
Medical Sciences, Bedwas,
Udaipur, Rajasthan, India

Radiological assessment of total hip arthroplasty in displaced neck of femur fracture: An observational study

Dr. Sabyasachi Bhowmik and Dr. Mohammad Azmoddin

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Abstract

Aim: Radiological assessment of Total Hip Arthroplasty in Displaced fracture Neck of femur.

Materials and Methods: This observational study was carried out in the Department of Orthopaedics, American International Institute of Medical Sciences, Udaipur, Rajasthan, India. Total 110 patients were treated with total hip replacement. Plain X-ray pelvis with both hip joints and proximal femur - pre and post-operative - AP view, preoperative X-ray of affected hip- lateral view, X-ray of the operated hip with proximal 2/3rd of femur- AP and lateral view were evaluated.

Results: Out of 110, 80 patients were male and 30 female. Most of the patients in this study were above 60 year, followed by 55-60 year. Patients scored 47.3% excellent, 27.3% good, 10.9% fair and 14.5% poor. The acetabular cup inclination 85 neutral, 15 vertical and 10 horizontal positions were seen. Femoral stem positions were central in 82 hips, valgus in 15 hips and varus in 13 hips. There were 2 subsidences and 1 migration. Class II heterotopic ossification was noted in 4 hips, i.e., 6% incidence that underwent THA. We had 2 cases of dislocation (1.8%).

Conclusion: The result of this study shows that Total Hip Arthroplasty gave good results in Displaced Intracapsular Neck of femur fractures with radiological assessment.

Keywords: Radiological, total hip arthroplasty, neck of femur fracture

Introduction

Total hip arthroplasty (THA) is a very common procedure in orthopaedic surgery [1]. Total hip arthroplasty is often indicated to relieve pain and increase range of motion in patients with arthritis and other collagen diseases [2]. Postoperative hip dislocation is one of the major complications and has been reported in 0.5 to 10.6 % of patient after primary THA [3, 4]. Surgical technique and approach as well as implant selection, implant positioning, patient education and patient-related factors have an impact on the incidence of dislocations. THA is one of the most successful and cost-effective interventions in orthopaedic surgical field [5]. Hip replacements have transformed the lives of hundreds of thousands of people regardless of the underlying etiology [6]. Total hip arthroplasty is an operation to restore motion and stability to a joint and function to the muscle, ligaments and other soft tissue structures that control the joint. Implanting an artificial head and socket to replace the degenerated head or fractured neck of femur, exerted a profound social impact and enjoyed such a dramatic early success. Various immediate and long term complications may compromise this procedure, but it still remains the greatest boon available to orthopaedic patients, and has proved to be the greatest advancement in the field of orthopaedic surgery in the 21st century [7].

The role of arthroplasty for an acute displaced femoral neck fracture is still a matter of debate [8]. There is ongoing controversy about the relative merits of different types of arthroplasty among specific groups of patients. There is a group of surgeons, which favour THR for an acute displaced femoral neck fractures but on the other hands, another group of surgeons do not favour this. Paucity of quality data provides an opportunity for extension of this debate.

Based on Andrew Whaley and Daniel *et al.* criteria [9], radiological assessment of acetabular components in uncemented acetabulum is done and defined loosening when Migration of > 2mm in horizontal /vertical direction, Rotation of implant, Screw breakage or more than 1mm radiolucent line in all zones. Loosening in cemented acetabular components is assessed in 3

Corresponding Author:
Dr. Mohammad Azmoddin
Professor, Department of
Orthopaedic, American
International Institute of
Medical Sciences, Bedwas,
Udaipur, Rajasthan, India

zones defined by De Lee and Charnley criteria ^[10] which manifest as radiolucent line between cement-bone and cement-cup interface, distribution, thickness and progression of these lines, tilting and bulk migration of the socket in relation to the bone in X-rays. Acetabular cup inclination ^[11] was measured by AP radiograph by 2 lines, one is transischial line and other line parallel to opening of acetabular component, and grouped in to Normal (30-40o), Vertical (>45o) and Horizontal cup(<30o) alignment. Femoral stem position is determined as Varus, Valgus or Centre based on angle made by the lines drawn from mid points of transverse diameter of shaft of femur and the stem of the femoral component at 1cm, 3cm and 5cm from the tip of femoral stem. Heterotopic ossification was graded according to the Brooker *et al* ^[12]. Classification in to Grade I-IV, with Grade IV being Ankylosis. Observations and measurements were evaluated using the X-ray AP view of the pelvis with both hip joints and X-ray AP/lateral view of the operated hip and proximal 2/3rd of femur during post op, 4 weeks and then once in 5-6 months of follow up.

Material and Methods

This observational study was carried out in the department of Orthopaedics, American International Institute of Medical Sciences, Udaipur, Rajasthan, India. After taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient. Total 110 patients were treated with total hip replacement.

Inclusion criteria

- Displaced Intracapsular Neck of Femur Fracture
- Non-union Neck of Femur

Exclusion criteria

- Young patients
- Pathological femur fractures.
- Patients with neuromuscular disorders
- Infections
- Failed cancellous screw fixation
- Intertrochantric fractures and associated acetabulum fractures

Methodology

In the present study, Posterior approach in all the cases of THA was used and the second generation cementing techniques for cemented THA were utilized. Radiographic evaluation includes Loosening of the acetabular and femoral components, Inclination of Acetabular cup, Stem position of femoral component, Vertical subsidence, Migration of the Acetabular cup and Heterotopic Ossification. Modified Harris hip score was used for clinical and functional evaluation of patients.¹³ Plain X-ray pelvis with both hip joints and proximal femur - pre and post-operative - AP view, preoperative X-ray of affected hip- lateral view, X-ray of the operated hip with proximal 2/3rd of femur- AP and lateral view, were taken for radiological evaluation.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages and means.

Results

Table 1: Demographic profile of the study population

Variables	Number (N = 110)	Percentage (%)
Gender		
Male	80	72.7
Female	30	27.3
Age		
<50	Nil	Nil
50-55 years	10	9.1
55-60	20	18.2
Above 60	80	72.7
Cemented/Uncemented		
Cemented	65	59.1
Un-cemented	45	40.9
Laterality		
Right	67	60.9
Left	43	39.1

Table 2: Clinical and functional evaluation of study subjects using Harris hip score

Harris hip score	Number (N = 110)	Percentage (%)
Excellent (90-100)	52	47.3
Good (80-89)	30	27.3
Fair (70-79)	12	10.9
Poor (<70)	16	14.5

Table 3: Radiographic evaluation of the study population

Radiographic evaluation	Number (N = 110)	Percentage (%)
Acetabular cup inclination		
Normal (30-45 degrees)	85	77.3
Vertical (> 45 degrees)	15	13.6
Horizontal cup (<30 degrees)	10	9.1
Femoral stem position		
Central	82	74.5
Valgus	15	13.6
Varus	13	11.8
Subsidence & Migration		
Subsidence	2	1.8
Migration of Acetabular cup	1	0.9
Heterotopic ossification		
Dislocation	4	3.6
	2	1.8

Discussion

Total hip arthroplasty, or surgical replacement of the hip joint with an artificial prosthesis, is a reconstructive procedure that has improved the management of those diseases of the hip joint that have responded poorly to conventional medical therapy. Current evidence suggests that traditional total hip replacements last more than 10 years in more than 90% of patients. More than 90% of patients report having either no pain or pain that is manageable with use of occasional over-the-counter medications. The large majority of hip replacement patients are able to walk unassisted (i.e. without use of a cane) without any limp for reasonably long distances ^[8]. Like any major surgical procedure total hip replacement is associated with certain medical and surgical risks. Although major complications are uncommon, they may occur. John C and W.H. Harris ^[14] (JBJS 1999) presented a series of 188 Harris-Galante porous coated acetabular components that were followed for an average of 122 months. The hips were evaluated with Judet radiographs as well as anteroposterior and true lateral radiographs. 4% (8hips) had osteolytic lesions of the pelvis and less than 1% (1hip) had an osteolytic lesion that necessitated bone grafting.

Engh C.A. Jr *et al* [15]. (JBJS 1997) reported in his series, 174 hips were followed for a minimum of 10 years. A total of 7 acetabular components, i.e., 4.02% of the 174 hips were radiographically loose. 4 patients of the 174 hips had symptomatic loosening of the acetabular cup, and the cup was revised eight, nine, ten and 12 years after index arthroplasty. The other 3 hips were not revised because they were not causing any symptoms. The average duration between the index operation and the diagnosis of loosening was 7.8 years. In our study there were no Loosening of the acetabulum and femoral components.

Primary endoprosthetic replacement has been advocated to improve survival by eliminating fracture fixation and healing problems and by allowing early mobilization. Conventional treatment for fracture neck of femur, grade 1 and 2, is open reduction and internal fixation, whereas, that for grade 3 and 4 is still controversial. Regarding functional outcome, our study showed that hip replacement for patient with displaced fracture neck of femur had good outcome as indicated by Harris hip score.

This procedure is riddled with a large number of long-term complications ranging from dislocations including recurrent dislocations. Another study observed increased rate of dislocation following posterior approach. His study shows dislocation rate of 2.8% following posterior approach.¹⁶ Philips studied incidence rates of dislocation along with other parameters after elective total hip replacement and observed dislocation rate of 3.9% [17]. The incidence of dislocation was highest during the immediate post-operative period but remain elevated throughout the first three post-operative months. We had 2 cases of dislocation (1.8%). One dislocation of hip occurred after 8 days of surgery. This dislocation was managed by closed reduction and abduction pillow. Another dislocation occurred during the 2nd month of the surgery at home. This patient was treated by open reduction and change of modular head of femoral prosthesis to gain neck length of operated limb.

The normal acetabular cup inclination is 30° to 45°. In our study 85 neutral, 15 vertical and 10 horizontal positions were seen. The ideal position of stem of femoral component is central. In this study we had 82 central, 15 each in valgus and 13 varus position. Varus position of the stem may lead to complications such as anterior thigh pain and periprosthetic fractures. Till the most recent review the femoral stem position has not changed in any patients.

Subsidence is seen on x-rays only 3 weeks post operatively, following THA and well defined in 6 months [18-20]. In this study there were 2 subsidences and 1 migration. The incidence of heterotrophic ossification ranges from 5% to 90% in various literatures [21]. The bone marrow and debris escape when uncemented femoral implant is used however there is less chance for this when cemented implant is used. In a study by William J. Maloney and William H. Harris, (1991 JBJS) the incidence of heterotopic ossification in an uncemented group and a hybrid group were compared. 65 uncemented and 70 hybrid (uncemented acetabular component and cemented femoral component) total hip replacements with minimum follow up of 1 year were reviewed. In the group who had uncemented hip replacement, there was a statistically significant increase in the incidence of heterotopic ossification. In our study, 4 patients with class II heterotrophic ossification is seen with uncemented hip replacement. As with any other study, our study is also associated with some drawbacks. Sample size is small and follow up period is short. Long term follow up with adequate

sample size is required in future.

Conclusion

The results of the present study concluded that on radiological examination the total hip arthroplasty gave better results in displaced intracapsular Neck of femur fracture and further long term review is essential to with larger sample to generalize the findings. This study opens new vistas for future research.

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