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Radiological assessment of outcome and complications of total hip arthroplasty

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Abstract
Introduction: Proximal femoral fractures fixation demonstrates overall failure rates in the range of 3%-12%, with non-union in 2% to 5%, device penetration in 2% to 12%, and varus collapse in 5%-11%. The primary indication for secondary surgery is relief of pain resulting from the aforementioned complications
Methodology: The deformity, range of movements (ROM) and limb length discrepancy were measured for all the patients in the standard proforma made for each patient. All the patients were assessed using Harris hip score
Results: Post-operative radiological complications were very few. Calcar resorption was noticed in 1 case postoperatively, and dislocation occurred in one case which was reduced by closed reduction with immobilization for 6 weeks and later followed by gait training with no evidence of further dislocations. None of the post-operative cases got infected till the last follow-up indicating satisfactory radiological outcome in total hip arthroplasty
Conclusion: The complications like aseptic loosening and particle wear requiring re-revision have not been found in our study

Keywords: Total hip arthroplasty, radiology, outcome

1. Introduction
During normal ambulation, the human hip undergoes cyclic loading that can place forces three to five times those of body weight on the prosthetic components. During more strenuous activity, such as running or climbing, the joint is exposed to much greater forces as much as 12 times those of body weight.
To describe the forces acting on the hip joint, the body weight may be depicted as a load applied to a lever-arm extending from body's Centre of gravity to the center of the femoral head. The abductor musculature, acting on a lever arm extending from the lateral aspect of the greater trochanter to the centre of the femoral head, must exert an equal moment to hold the pelvis level during a one-legged stance, and a greater moment to tilt the pelvis to the same side while walking or running [1].
Arthroplasty had its inception in the mid 19th century when surgeons attempted to produce extra articular pseudoarthrosis by "simple resection arthroplasty" of ankylosed joints. In 1831 James syme performed excision of diseased joints, and in 1852 Bigelow did hip resection arthroplasty and in 1947 Girdle stone excision arthroplasty.
Next was "interpositional arthroplasty" where various substances were interposed between resected joint surfaces to prevent the recurrence of fibrous or bony ankylosis. Tissues used were muscle, fat, fascia etc. And were unsuccessful until smith peterson developed vitallium mold interpositional arthroplasty. In 1885, Ollier used adipose tissue and John Benjamin Murphy used fascia lata in 1902 and in 1940 Smith Peterson developed Vitallium mold interpositional arthroplasty [2, 3].
Artificial replacement of the femoral head with acrylic cement was introduced by Judet in 1937. This was the opening to the novel idea of replacing the hip joint in part or whole. This also withstood only a short period of time. The Austin Moore's prosthesis (1940) and the Thompson's prosthesis immediately afterwards, provided promising results in early follow-ups. However, the problem of acetabular erosion surfaced, with the recurrence of pain in the

hip becoming inevitable. Sir John Charnley (1962) from wrightington engineered a low friction total hip arthroplasty using bone cement to fix both the acetabular and femoral Components [4, 5].

2. Methodology

Detailed history and proper clinical examination was done to find out – duration of illness, focus of infection in the body, sensory and motor examination, vascularity of the limb, ambulatory status of the patient, and deformities of the hip, Range of Movements (ROM) of the hip, limb length discrepancy and status of the other joints.

The deformity, range of movements (ROM) and limb length discrepancy were measured for all the patients in the standard proforma made for each patient. All the patients were assessed using Harris hip score

2.1 Radiological assessment

Radiographs of the pelvis with both hips with proximal half of shaft of femora – AP View and lateral view of the involved side was taken for all patients. The radiograph was evaluated for –

- Non union of fracture
- Aseptic Loosening and backing of the implant
- Osteonecrosis of femoral head
- Post traumatic and post implantation osteoarthritis of hip
- Calcar resorption
- Fracture collapse with Implant failure
- Cut through of screws from femoral head
- Osteoporosis/osteopenia of proximal femur
- Deformity of proximal bone
- Proximal bone loss
- Varus collapse of femoral head
- Acetabular index
- Bone stock of the acetabulum
- Need for bone grafting
- Size of the femoral canal.

Pre-operative decision regarding the choice of implant was made depending upon the presence or absence of calcar, proximal bone loss, absorption of greater trochanter, extent of osteolysis of proximal femur, cortical screw holes if any, limb length discrepancy and the degree of acetabular erosions. Cementless acetabular component was used in all hips.

3. Results

Average age of patients in our study is 58.66 yrs, youngest being 36 years and the oldest 80 years. Majority of the patients are in the middle age group with high functional demands.

The Acetabular Inclination Angle in our study is between 40-55 degrees in 18 cases (85.71%), two case with less than 40 degrees and one case with above 55 degrees. Acetabular inclination angles < 30 degrees and >60 degrees predisposes the chances of dislocation, but in our study dislocation was not noticed in any of these cases.

Table 1: Age distribution

Age group	No. of cases	Percentage
30 - 39	1	4.76
40 – 49	9	42.85
50 – 59	6	28.57
60 – 69	3	14.28
70 - 79	2	9.52

Table 2: Pre-operative radiological findings

Pre-op finding	No. of cases	Percentage
Fracture non union	12	57.14
Screw cut through from femoral head	10	47.61
Avascular necrosis of femoral head	6	28.57
Fracture collapse with implant failure	4	19.04
Screws back out	9	42.85
Infection	NIL	-
Proximal migration of greater trochanter	2	9.52
Calcar resorption	nil	-
Heterotopic ossification	nil	-

Table 3: Acetabular inclination angle

Acetabular angle	No. of cases	Percentage
35-40	2	9.52
40-45	2	9.52
45-50	9	42.85
50-55	7	33.33
55-60	1	4.76
Total	21	100

Table 4: Post-operative radiological findings

Post-op radiological findings	No. of patients	Percentage
Calcar resorption	1	4.76
Loosening	Nil	-
Dislocation	1	4.76
Infection	Nil	-
Cortical hypertrophy	Nil	-
Peri-prosthetic fracture	Nil	-
Sunken prosthesis	Nil	-
Polyethylene wear	Nil	-
Heterotopic ossification	1	4.76
Peri femoral osteolysis	2	9.52
Peri Acetabular osteolysis	2	9.52

In majority of the cases (85.71%) in our study the post-operative acetabular cup angle lies between 40-55 degrees with normal femoral stem placement in 80.95% cases, and normal offset in 90.47% patients.

Post-operative radiological complications were very few. Calcar resorption was noticed in 1 cases postoperatively, and dislocation occurred in one case which was reduced by closed reduction with immobilisation for 6 weeks and later followed by gait training with no evidence of further dislocations. None of the post-operative cases got infected till the last follow-up indicating satisfactory radiological outcome in total hip arthroplasty.

Peri acetabular osteolysis was found in 2 cases (9.52%) and peri femoral osteolysis was seen in 2 cases (9.52%) post-operatively represented as thin lucent zones of > 2mm at the bone-prosthesis interface.

Table 5: Complications encountered post- operatively

Complication	No. of cases	Percentage
Deep vein thrombosis	Nil	0
Dislocation	1	4.76
Infection	Nil	0
Hoof stress fracture	Nil	0
Periprosthetic fracture	Nil	0
Loosening	Nil	0
Pain in the operated hip	2	9.52
Limb length discrepancy (> 2cms)	6	28.57
Nerve injury	1	4.76
Anterior thigh pain	2	6.25
Heterotopic ossification	1	4.76

About 20% of the cases presented with pain postoperatively till the last follow-up, of which 2 cases reported mild pain with no effect on average activities and 2 case reported with moderate pain with some limitation of ordinary activity or work. Two cases presented with anterior thigh pain and one case with foot drop which was recovered by their last follow-up.

4. Discussion

In our study excellent results were obtained in 38.09% of the cases, good in 28.57%, fair in 23.80% and poor in 9.52%. 17/21 (80.95%) patients could walk unlimited distance, 16(75%) patients walked without support, 18(85.71%) patients could use public transport. 80% of the patients who were employed prior to the surgery returned to work. 17 patients were completely pain free and 2 patients complained of mild pain and 2 patients with moderate pain.

Carmelo D`Arrigo and his colleagues reported results of 21 pateints with 19 total hip arthroplasty. 4/21 (23.8%) cases the postoperative HHS was between 90 and 100, in 10/21 (47.6%) between 80 and 89, and in 6/21 (28.6%) between 70 and 79. In one case the HHS was poor. comparable to our study [2].

Akram Hammad, Ahmed Abdel-AAL [6] and his associates, reported among 27 arthroplasties at the end of follow-up, they had 21 hips (77.7%) with good or excellent results, four hips (14.8%) with fair results and two hips with poor results. The majority had good pain relief and marked functional improvement. Twenty-two patients had either no or mild pain and 24 patients were able to walk freely with or without support.

Study done by Haidukewych GJ, Berry DJ and his colleagues, reported 39/44 (89%) had no or mild pain and 5 had moderate or severe pain; in all these patients pain was in region of the greater trochanter. 40/44(91%) patients were able to walk pain free and 26 (59%) were able to walk with one arm support or less. 20 patients (45%) were able to walk about community [7].

In our study the time interval from original internal fixation to conversion to hip arthroplasty averaged 22 months (range 3 months to 36 months) comparable to study done by SKS Marya and his colleagues which is averaged 22 months [5]. Also Akram Hammad, Ahmed Abdel-AAL and his associates reported that the mean time from primary surgery to the salvage arthroplasty was 15 months (range, 4 to 32 months) [6].

In our study majority of the pre-op cases presented with restriction of flexion (60%) and internal rotation (90%) and post-operatively satisfactory improvement in the flexion range of movement was achieved with poor outcome of internal rotation movement.

Limb length discrepancy of > 2cms was noticed in 6 cases (28.57%) post-operatively of which 2 cases (9.5%) presented with shortening and 4 cases (19.04%) with lengthening of the operated limb.

One patient in our study presented with dislocation (4.76%) post-operatively where closed reduction was done with immobilization for 6 weeks and later mobilized with walker with no further recurrent dislocation at the last follow-up. This dislocation occurred when the patient voluntarily squatted on the floor inspite of strict instruction to avoid squatting. Mabry and his associates showed a dislocation rate of 9% for secondary total hip arthroplasty [8]. Johnsson R and his colleagues reported a high dislocation rate (6% for total hip replacement and 12% for hemiarthroplasty) has been demonstrated in other series in which Total hip arthroplasty was performed for the treatment of nonunion at the site of a femoral neck fracture [9].

The incidence of infection has dramatically decreased from a high of 11% in the 1960s to 0.5% to 2% in the more recent literature. Friedrich Bottner and Thomas P. Sulco [10] reported based on medicare population of 236, 140 patients undergoing total hip replacement between 1986 and 1989, the incidence of infection was estimated to be approximately 2.3%. In our study none of the case reported with infection post-operatively.

In our study one patient (3.12%) presented with foot drop indicating neuropraxia of sciatic nerve probably caused by retraction during surgery and was recovered till the last follow-up. Sciatic nerve injury following total hip arthroplasty remains one of the most devastating complications for both patient and surgeon. The widely accepted incidence of postoperative neuropathies about the hip ranges from 0.6% to 2.9% for primary total hip arthroplasty and from 1.8%to 7.6% for revision total hip arthroplasty [11], which is comparable to our study. The sciatic nerve, specifically the peroneal distribution of the sciatic nerve is involved in nearly 80% of the cases

Bone loss distal to the usual neck-resection level for hip arthroplasty is common, and calcar-replacement implants are frequently needed to make up for bone deficiency and to restore limb length however, such implants were used in this series. In our patients to bypass cortical defects left at the site of failed fixation devices. Long stem implants were used. Proximal bone loss, bone deformity, and compromised proximal bone quality limit implant fixation options and can contribute to intraoperative femoral fractures during canal preparation In our series we had two femoral fracture during preparation of the femoral canal which was successfully treated by circlage wiring comparable to study done by Carmelo D`Arrigo and his colleagues [2].

In 5 patients of our study (23.80%), modular series of uncemented total hip replacement system was used. The modular design makes it possible to achieve independent sizing in the distal canal and proximal metaphysis. Its modularity poses minimal risk and allows for a staggering number of combinations to handle a wide variety of femoral defects. The design provides both proximal and distal stability along with intimate bone apposition, helping to ensure bone ingrowth while minimizing the incidence of stress shielding. In only one case constrained liner was placed.

The patients in our study were followed up for an average period of 9 months (minimum of 2 months and maximum of 16 months). In the period that we followed the patients we did not encounter any sign of loosening, peri-prosthetic fracture and infection. Limb length discrepancy > 2cms was present in 6 cases (28.57%) post operatively which was compensated by increasing the height of the sole on the same side in cases of shortening and in the opposite limb in cases of lengthening

5. Conclusion

In cases with protrusio acetabulum, acetabulum was reconstructed with cortico cancellous bonegraft harvested from the head of femur provided excellent support for the seating of the uncemented cup

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