Original Research Article

A study of management of intracapsular fracture neck femur using bipolar prosthesis

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Abstract

Introduction: Problems of the hip joint, whether due to trauma or arthritis need surgical skill and judgement often requiring multiple surgical procedures and prolonged rehabilitation.
Bipolar hip replacement offers a durable and versatile solution for many problems of the hip in which replacement of the head and neck of the femur in a hemiarthroplasty offers advantages of rapid return to function with a pain free hip. Replacements cannot last forever and this becomes a concern particularly in relatively younger individuals.
Aim of the study: To evaluate the efficacy of Biploar hip prosthesis, in management of intracapsular fracture neck femur in physiologically younger patients where replacement of the head and neck of the femur offers the advantage of rapid return of joint function.
Materials and Methods: This was a prospective study done in the department of Orthopedics, Government General Hospital, Kurnool, where 30 patients with intracapsular fracture neck femur underwent bipolar prosthesis procedure. Post-operative clinical and radiological follow up was done at 6 weeks, 3 months, 6 months and 1 year. The outcome was graded as poor, fair, good and excellent. Complications were looked for.
Results: Good to excellent results were seen in 96% of the patients. Infection was seen in 4% of cases. None of the cases had dislocation or loosening of prosthesis. No mortality or major complications, revision surgery or mortality were seen.

Conclusion: Bipolar Hip Prosthesis offers excellent, painless mobility and ease of rehabilitation and return to function and is especially useful in younger patients. The surgery is relatively easy to perform and it has low rate of complications.

Key words

Biploar hip prosthesis, Intracapsular fracture neck femur, Harris hip score.

Introduction

Problems of the hip joint, whether due to trauma or arthritis need considerable surgical skill and judgement. The patient also needs to go through multiple surgical procedures and prolonged rehabilitation in order to preserve his original joint.

Bipolar hip replacement offers a durable and versatile solution for many problems of the hip in which replacement of the head and neck of the femur in a hemiarthroplasty offers advantages of rapid return to function with a pain free hip.

In the face of the complications of Unipolar arthroplasties, the bipolar offers a reduction in those complications and also gives better joint function. In addition, it can be easily converted to total hip replacement without much surgical trauma which offers superior advantage over unipolar hemiarthroplasty. Hip arthroplasty is irreversible and however carefully the procedure is done and taken care of the replacement cannot last forever. This is particularly true for relatively younger individuals who still have a long time to live.

The bipolar hip prosthesis offers an additional advantage that of salvage of failed total hip and unipolar arthroplasties. In most instances of failure of these arthroplasties the alternative was previously an excision arthroplasty.

Aim of the study

The aim of this study was to evaluate the efficacy of Biploar hip prosthesis, in management of Intracapsular fracture neck femur where replacement of the head and neck of the femur offers the advantage of rapid return of joint function.

The emphasis was on using Biploar hip prosthesis in physiologically younger patients who would place considerable demands on the prosthesis and whose life expectancy is more and where osteoynthesis is of doubtful value in cases of neglected intracapsular fracture neck of the femur.

Materials and methods

This was a prospective study done over a period of two and half years. A total of 30 patients were selected from admissions in the Department of Orthopedics, Government General Hospital, Kurnool. The patients were counseled and consent was taken for participation in the study. They were informed of all the possible complications that can happen during or as a result of the surgery prior to giving consent. Upon admission all patients underwent routine blood investigations and radiological investigations.

Criteria for patient selection

Patients were selected for Bipolar arthroplasty using the following guidelines:

Pathology

- Displaced intracapsular fracture of the neck of the femur with adequate calcar.
- Neglected intracapsular fracture of the neck of femur more than 3-4 weeks old in patients less than 60 years of age.
- Non-union of intracapsular fractures of the neck of femur.
- Intracapsular fractures of the neck of femur with changes of early avascular necrosis.

Nonunion or avascular necrosis of head of femur following lagscrew fixation for intracapsular fractures of the neck of femur

Age

60 years or more in fresh intracapsular fractures of neck of femur; or if fracture is more than 3 to 4 weeks old or early changes of avascular necrosis or non- union are present in adults younger than 60 years.

Method

- Patients selected according to predetermined criteria.
- Surgical Technique: Internationally accepted procedure followed.
- Pre-operative work up: Standard protocol observed.
- Implants used were manufactured by INOR.
- Existing facilities at Government General Hospital, Kurnool were utilized.
- Laboratory support was from Government General Hospital, Kurnool.
- Patients were followed up according to standard protocol and results were analysed.

Mobility evaluation: Using the Harris hip score

Investigations

Blood (Hemoglobin, TC, DC, ESR), Urine analysis, Blood Group, Chest X-ray, ECG, Renal Profile (Urea, Creatinine) and others (2D Echo)

Radiological evaluation

X-Ray Pelvis with both hips – AP view

X-Ray of affected hip with proximal femur in internal rotation

Clinical evaluation: Fever, pain, wound drainage and healing

Bacteriological evaluation: Swabs prior to and after incision and time of closure

Radiological

A. Position of the Stem

B. Position of the Cup

Evaluation at the discharge

1. Harris Hip Score, fever, wound healing, antibiotics, analgesics, blood transfusions, days in hospital, post-operative complications

Follow-up

Clinical and radiological follow up was done at 6 weeks, 3 months, 6 months and 1 year. Clinically, pain, operative wound site, Harris Hip Score and gait were assessed. Radiological evaluation was done by Charnley Gruen Score. The outcome was graded as poor, fair, good excellent.

Outcome

Poor ⇒ Harris Hip Score below 70

Fair ⇒ Harris Hip Score between 70 & 80

Good ⇒ Harris Hip Score between 80 & 90

Excellent ⇒ Harris Hip Score 90 above

Complications

Femoral Facture, Dissociation of Prosthesis, Heterotopic Ossification, Metallosis, Thigh Pain, Protrusio Acetabuli, Dislocation of Prosthesis, Polyethylene synovitis, Infection were looked for.

The implant: Talwalkar's Bipolar Hip Prosthesis

Talwalkar's Bipolar Prosthesis is a device that meets the most demanding requirements in the management of femoral neck fractures. It may be used for cemented or cementless arthroplasty. The large contact surface area and the two planes of rotation reduce the wear at acetabular surface and preserve the native acetabulum/acetabular cartilage. The device is easy and safe to use.

Self-centering action: The positive eccentricity of the centers of rotation corrects alignment.

Self-locking action: The fenestrations in the prosthesis permit in-growth of bone over time, which enhances fixation.

Biomechanical fixation: The biological component is the self-locking action while the mechanical component is represented by 3 point fixation in the femoral shaft.

Preservation of the acetabulum: Since the main articulation is between the head and the cup.

Fully congruous PE insert: Firmly fixed in the metal shell, to prevent micromotion and PE wear debris production.

Easy insertion: Means short surgical times.

Highly polished metal surface: To minimize friction between the implant and the acetabulum for use in combination with ceramic heads and metal heads.

The range comprises:

Sizes (dia.39-53mm, in 2mm increments).
Outer shell made of stainless steel 3.16L.
Insert made of UHMWPE.
To accept metal or ceramic femoral heads
Sterilized by Gamma irradiation

Metallurgy of Talwalkar's bipolar Hip endoprosthesis:

The Bipolar is made up of 2 parts:

A).Stem

Material: Stainless Steel Based ASTM F-745

Specifications: C% 0.06 max, Si% 1.00 max, Mn% 2.00 max, Cr% 17.00 – 19.00, Ni% 11.00 – 14.00, Mo% 2.00 – 3.00, P% 0.045 max, S% 0.03 max, Fe% Balance

B).Hard Top Cup – made up of

1) Stainless Steel: Conforms to ASTM F-745
Specifications: Same as in A

2) UHMWPE: Specification based on ISO 5834 (Part 1 & 2)

Surgical procedure: All surgeries were performed in the elective theatre using standard aseptic precautions.

Approaches for bipolar prosthesis: Moore's approach, which has been facetiously labeled "The Southern Exposure". In some patients a modification of the postero-lateral approach of Gibson was used.

Moore's approach / Southern approach

Patient Position: Straight lateral position with patient lying on the unaffected side.

Incision:

From a point 10 cm distal to Posterior Superior Iliac Spine and extended distally and laterally parallel to the fibres of Gluteus maximus to the posterior margin of the greater trochanter and then directed about 10 cm parallel to the femoral shaft. Deep fascia was exposed and divided in line with the skin incision as also was the fascia over Gluteus maximus, which was then split in the direction of its fibres using blunt dissection. By retracting the proximal fibres of the muscle proximally, the greater trochanter is exposed. Distal fibres are retracted distally and partly divided at their insertion into the linea aspera in line with the distal part of the incision. The Sciatic nerve was usually not exposed, and if it was, was gently retracted out of the way. The Gemelli and Obturator internus and the Piriformis tendon were divided at their insertions after tagging them for easier identification and reattachment.

The posterior part of the capsule thus exposed was incised from distal to proximal along the line of Neck of Femur and at right angle to it, thus making a 'T' shaped opening. The distal part of the capsule was detached from the femur. The thigh and knee were flexed to 90^0 and the thigh was rotated internally to expose the neck of the femur or dislocate the hip posteriorly.

The head of the femur was levered out of the acetabulum and size measured using templates. The femoral shaft was rasped using a Broach (rasp) and prepared for the insertion of the prosthesis.

The Bipolar prosthesis was then inserted into the femoral shaft in about $5\text{-}10^0$ of ante-version and impacted into the femur. The reduction of the prosthesis was then done using traction of the thigh. After suturing the capsule and reattaching the external rotators to the greater trochanter, the wound was closed in layers over a suction drain, which was removed at the first change of dressing after 48 hours.

One unit of compatible blood was transfused where necessary either intra or postoperatively. Where adductors were found to be tight, closed adductor tenotomy was done.

Postoperative care

Mobilization:

From the first postoperative day, the patient was allowed to weight bear depending on his / her pain tolerance and encouraged to walk thereafter. Sitting cross-legged and squatting were not allowed. Suture removal was done on the 9th to the 11th postoperative days and the patients were discharged later. Antibiotics were given intravenously, starting at induction of anesthesia and for 48 hours thereafter.

Patient follow up: Was done as given as above

Harris hip score as per **Table – 1** [1].

Table – 1: Harris hip score.

FUNCTION PAIN (P) 0 "Totally disabled, crippled, pain in bed, bed ridden" 10 "Marked pain, serious limitation of activity" 20 "Moderate pain, tolerable but makes some concessions to pain" 30 "Mild pain, no effect on average activities" 40 "Slight, occasional, no compromise in activity" 44 "None, or ignores it"	FUNCTION GAIT – LIMP (GL) 0 Severe or unable to walk 5 Moderate 8 Slight 11 None
FUNCTION GAIT – SUPORT (GS) 0 Two crutches or not able to walk 2 Two canes 3 One crutch 5 Cane most of the time 7 Cane for long walks 11 None	FUNCTION GAIT – DISTANCE WALKED (GD) 0 Bed and chair only 5 Two or three blocks 8 Six blocks 11 Unlimited
FUNCTION ACTIVITIES – STAIRS (AS) 0 Unable to do stairs 1 In any number 2 "Normally, with use of banister" 4 "Normally, without banister"	FUNCTION ACTIVITIES – SHOES / SOCKS (SS) 0 Unable to fit or tie 2 With difficulty 4 With ease
FUNCTION ACTIVITIES–SITTING (GS) 0 Unable to sit comfortably on any chair for 30 minutes 3 On a high chair for 30 minutes 5 "Comfortably, ordinary chair for one hour"	FUNCTION TRANSPORATION (T) 0 Unable to use transportation (bus) 1 Able to use transportation (bus)
FUNCTIONAL TOTAL ROM (RM) 0 "Flex + Abduct + Adduct + Ext Rot + Int Rot = 0 to 29 degrees" 1 "Same Total ROM = 30 to 59 2 "Same Total ROM = 60 to 99 degrees" 3 "Same Total ROM=100 to 159 degrees" 4 "Same Total ROM=160 to 209 degrees" 5 "Same Total ROM = 210 to 300 ^{0}"	FUNCTION DEFORMITY 1 (D1) 0 Flexion contracture 30 degrees or more 1 Flexion contracture less than 30^{0}
FUNCTION DEFORMITY 2 (D2) 0 Fixed adduction 10 degrees or more 1 Fixed adduction less than 10 degrees	FUNCTION DEFORMITY 3 (D3) 0 Fixed internal rotation (in extension) 10 degrees or more 1 Fixed internal rotation (in extension) less than 10 degrees
FUNCTION DEFORMITY 3 (D4)	X-RAY GRUEN (G)

0 Leg length discrepancy greater than 1.25 inches (3.2 cm) 1 Leg length discrepancy less than 1.25 inches (3.2cm)	1 ">5mm" 2 "2 – 5 mm" 3 "0 – 2mm ' 4 x 5 None
X-RAY CHARNLEY (C) 1 ">5mm" 2 "2 – 5mm" 3 "0 – 2mm" 4 x 5 None	TOTAL SCORE out of 100

Results

In our study there were a total of 30 patients. The patient age ranged from 18- 50 years and 20 males and 10 females were enrolled in study the male to female ratio was 2:1.

Good to excellent results were seen in 96% of our patients. The Harris hip score was 90.36. No deterioration of the Bipolar hemiarthroplasties was seen in the follow up period in our study. No incidence of protrusion was observed in any of the cases over the period of this study. In our study, there was only one case of persistent anterior thigh pain and none of the cases showed any evidence of loosening of prosthesis or dislocation of prosthesis. One (4%) case of superficial infection was encountered among the complications.

No other complications like fracture, sepsis etc. were noted. There was not a single mortality in our study. Also though the period of study was less, no case required any revision surgery within the study period.

Discussion

In our study of Bipolar hemiarthroplasty of the hip, we evaluated 30 cases that underwent Bipolar Prosthesis at our hospital. The concept of dual bearing surfaces offers considerable advantages as it results in sharing of motion at the two surfaces and hence reduction of net wear at either surface, thus reducing erosion at the acetabular – joint interface. In addition, the total range of movement at the joint is increased.

As quoted by Nottage, et al. [2] the mean Harris hip Score as given in Bateman study using bipolar prosthesis was 85 and in our series was 90.36. For Unipolar arthroplasties it was reported as 77 [2].

We have used the uncemented technique in our Bipolar hemiarthoplasties. Some studies show better clinical ratings with un-cemented Bipolars than cemented Bipolars [3].

This is probably because of absence of stress shielding of the proximal femur and near – physiologic transfer of stress to the medial femoral cortex.

That there was no deterioration of results of the Bipolar hemiarthroplasties overtime in the short term was prove in a study by Bochner and Pellicci et al. [4].

In our series also there was no deterioration of results over the period of this study.

According to Merlo, et al. [5] although protrusion was present on radiology, there was no clinically significant correlation. In our patients, we have found no incidence of protrusion over the period of this study.

According to Lausten, et al. [6] acetabular protrusion and erosion have been reduced in Bipolar arthroplasties, which is hence the good alternative to the Unipolar prosthesis fracture of the Neck of the femur in the elderly and physiologically younger patients.

The proportion of good to excellent results of 96% in our study is testimony to the efficacy of Bipolar Hemiarthroplasty.

The survival of the Bipolar implant and the acetabular cartilage was proved by Dr. James Ennis Bateman, the orginator of the Bipolar prosthesis. In a study of 1213 unipolar hip replacements that they had done including 760 osteoarthritic hips they reported healthy acetabular bone preservation for as long as 15 years after surgery [7].

In addition, clinical results after even after15 years compare favorably with conventional 2-piece total hip replacement techniques [7]. A Japanese study by Yamamuro et al showed Good clinical out come as long as 5 years after replacement in osteoarthrtic hips with reaming of the acetabulum [8].

According to McConville, et al. [9] anterior thigh pain, attributed to femoral component loosening would be decreased by use of proportionately sized femoral components and use of cement when indicated.

In our series, we found one case of persistent anterior thigh pain, and no evidence of loosening of the prosthesis.

In our study we used the Bipolar Prosthesis in physiologically younger patients with neglected intracapsular fractures in whom internal fixation was thought to yield an ambiguous result.

Polyethylene wear debris and Metallosis causing failure of the Bipolar hemiarthroplasty were reported as isolated instances by Kim, et al. [10] and Kobayashi, et al. [11] respectively.

Dislocation/ dissociation of the Bipolar prosthesis is a rare phenomenon. It has been reported in literature as ranging from 1% by Vazquez, et al. [12] to 2.3% by Wada, et al. [3] and 2.63% by Maricevic, et al. [13]. However, in our series, no dislocation occurred.

Infection rate in Nottage, et al. [2] series was 2.63% to 3.9% (deep infection). We had one case (4%) of superficial infection.

Peri-Operative mortality was 1.31% as observed by Maricevic, et al. [13] to 4.6% by Nottage, et al. [2]. There was no mortality in our series.
Other complications like fracture of endoprosthetic stem, fracture of the polyethylene cup which were observed by Maricevic, et al. [13] have not occurred in our series.

Revision rate in fractures of neck femur treated with Bipolar prostheses was 6.5% according to Maricevic, et al. [13] and 10% according to La Belle, et al. [14] over 7 years and 5 months. We therefore expect no more revisions in our series, than reported by other workers over the long term.

Conclusion

This study concludes that Bipolar Hip Prosthesis offers a long term solution in patients with Intracapsular fractures of the neck of the femur. It offers excellent, painless mobility and ease of rehabilitation and return to function. The durability of the implant and potential for preservation of acetabular cartilage allow this prosthesis to be used in the elderly and physiologically younger patients. The surgery is relatively easy to perform, takes less operating time has less blood loss and hence safer. The low rate of complications when compared to unipolar prosthesis indicates the superiority of the implant.

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