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EVALUATION OF FUNCTIONAL OUTCOME BASED ON ACETABULAR COMPONENT PLACEMENT IN TOTAL HIP REPLACEMENT

Orthopaedics

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ABSTRACT

BACKGROUND; Total hip arthroplasty (THA) is one of contemporary medicine's true successes (1,2). People with crippling hip diseases could only look forward to living out their years in excruciating pain for generations. For most patients who were unfortunate enough to be afflicted, the unrelenting advancement of hip illness resulted in a downward spiral of limited function. Although early attempts at inter-positional arthroplasty and resurfacing operations frequently failed, the development of contemporary THA has provided surgeons and patients with a safe and effective treatment for hip arthritis. Based on a pelvic radiograph and a CT scan, the purpose of this study is to evaluate the acetabular component version and inclination, as well as the functional outcome of total hip replacement..

METHODS:

Study design: Hospital Based Retrospective study.

Study period: September 2019 to August 2021.

Sample size: 30

RESULTS There were 16 males and 14 females among the 30 patients. In 18 cases, the right side was damaged, while in 12 patients, the left side was affected. Avascular necrosis is the most common reason for total hip replacement in 14 patients, followed by rheumatoid arthritis in three, non-union neck of femur in three, ignored fracture of neck of femur in two, secondary osteoarthritis in six, and ankylosing spondylitis in two. In our research, the average acetabular cup variant performed well. In axial CT, we employed a modified Murray's technique to measure acetabular version. This was the most widely used strategy in numerous investigations. This approach has a very high accuracy rating of around 95%. In all of the cases, the acetabular cup was anteverted. 90 percent of patients in our study had an excellent functional outcome, 6.3 percent had a good functional outcome, and 3.7 percent had a fair functional outcome. 86.66 percent of acetabular cup placements in our investigation were within acceptable limits. Excessive anteversion was found in just 13.33 percent of acetabular cups.

CONCLUSION In our study, 90% of the cases had an excellent Harris hip score, whereas 10% had a good or fair Harris hip score. Excessive anteversion was not linked to joint dislocation, however it did result in limited internal rotation.

KEYWORDS

Acetabular ante-version; Acetabular inclination; Total Hip Arthroplasty.

INTRODUCTION

"When total hip becomes a true science, there ought to be no need for a chapter on how to select patients, because then all hip disorders will be treated by total hip replacements" -John Charnley.

Total hip arthroplasty (THA) is one of contemporary medicine's true successes (1,2). People with crippling hip diseases could only look forward to living out their years in excruciating pain for generations. For most patients who were unfortunate enough to be afflicted, the unrelenting advancement of hip illness resulted in a downward spiral of limited function. Although early attempts at interpositional arthroplasty and resurfacing operations frequently failed, the development of contemporary THA has provided surgeons and patients with a dependable therapeutic option for hip arthritis.

Excision arthroplasty, at the cost of an unstable stride, results in a pain-free hip.

The osteotomy is beneficial in the early stages of unilateral hip disease, particularly in young adults; however, its usage is limited in the late stages of hip arthritis.

Arthrodesis provides a pain-free, stable joint at the expense of putting a lot of load on the lumbar spine and knee joint.

In an aged person who does not have an acetabulum association, hemiarthroplasty is recommended. It is not recommended for patients who have acetabulum involvement.

The position of the acetabular cup version in a total hip replacement is one of the critical parameters that influences the functional result of total hip arthroplasty. The acetabular cup version has a significant impact on the rate of dislocation and the range of hip movements.

AIM AND OBJECTIVES

The aim of this study is to analyze the acetabular cup positioning and functional outcome in total hip replacement based on pelvis radiograph and CT scan.

MATERIAL AND METHODS

Between September 2019 to August 2021, 30 consecutive patients who underwent Total Hip Replacement in the Department of Orthopaedics, King George Hospital , Visakhapatnam were the material in our study.

No. of Cases : 30 cases

Duration of study : September 2019 to August 2021

Inclusion Criteria:

Patients in the age groups between 25 to 70 years,

1. Patients of either sex.
2. Patients with informed written consent.

Exclusion Criteria:

1. Patient with malignancy or history of invasive malignancy within last five years.
2. Patients with active infection (e.g.Hepatitis,AIDS)- systemic or at the surgical site.
3. Patient having vascular insufficiency, muscular atrophy or neuromuscular disease in either leg.
4. Revision Total hip replacement.

Written and Informed Consent will be obtained from the Patient.

Patient will be subjected to General Physical Examination, Systemic Examination and hip examination done.

X-ray pelvis antero posterior and lateral views, CT PELVIS with both hip done to find the acetabular cup version.

CT examination of acetabular cup . After obtaining the CT picture of the hip, the version of the acetabular cup was assessed by using the Modified MURRAY method. The acceptable range of the cup version is 15 ± 10.

Analysis of functional outcome according to Harris hip score
All these patients were called over phone to attend the Orthopaedic OPD.

This study had been done to assess the post operative acetabular cup positioning and functional outcome of total hip replacement done for various indications.

These patients were also examined clinically to analyze the functional outcome based on Harris hip score at the latest follow-up. The results were compared and analyzed in these randomly selected patients.

Operative procedure:(For Total Hip replacement)
Approach: posterior (Moore's) or Lateral (Hardinge's) approach.

The posterior approach offers extensive exposure of the acetabulum, femur, and posterior soft tissue stabilizer of the hip. It is utilized in the vast majority of hip procedures such as primary and revision THA, hemiarthroplasty, or any other non-arthroplasty procedures.

Patient Positioning And Landmarks
In the lateral decubitus, The pelvis secured using two padded posts over the symphysis pubis and sacrum. We use regional hypotensive anaesthesia to reduce intraoperative bleeding. First, the PSIS and anterior-superior iliac spine (ASIS) and the highest point of the iliac crest (HPIC) are identified. Then the tip, the middle, and the posterior border of the greater trochanter are identified by internal/external rotation of the hip. The table is tilted anteriorly to bring the thigh and flexed knee to a horizontal position.

Superficial Dissection:
The incision is marked over the posterior one-third of the greater trochanter, and extends 5 to 10 cm distally along the femoral shaft 1 cm posterior to the midplane. It is extended superiorly at a 45-degree angle for 5 to 10 cm. The length of the incision is about 15 to 20 cm and is modified based on the patient's body habitus and adipose tissue. The interval between tensor and gluteus maximus over the greater trochanter is incised and extended distally to reach 2 cm in front of the gluteus maximus tendinous insertion. Proximally, it is extended over the greater trochanter into the gluteus maximus fibres.

Deep Dissection:
A self-retaining Charnley retractor is placed to expose the proximal femur, the vastus lateralis, and the gluteus medius and minimus muscles. The trochanteric bursa is incised to expose the SERs (piriformis, superior gemellus, obturator internus, and inferior gemellus). The gluteus maximus tendon insertion is partially released, leaving a cuff of the tendon for later repair. Next, the piriformis tendon is identified under the gluteus medius, and a bent Hohmann retractor is placed between the plane of the gluteus medius and minimus. The hip is internally rotated to aid visualization and to tense the SERs and capsule. Electrocautery is then used to detach the SERs and the posterior capsule as one layer starting from the superior border of the piriformis and gluteus minimus, incising along the posterior border of the femoral neck. An inferior capsulotomy at the 5 o'clock position is done, and the soft tissue sleeve of the posterior capsule and external rotators is reflected posteriorly protecting the sciatic nerve. The terminal branches of medial femoral circumflex are identified and coagulated. Release of the quadratus femoris is performed with electrocautery. The first perforator branch of the profunda femoris artery may be encountered during the release of the gluteus maximus insertion and is coagulated.

Intraoperative assessment of the leg length is performed prior to dislocation of the hip by placing a Steinmann pin vertically at the 5 o'clock position into the cotyloid groove, and a mark is made on the greater trochanter.[85] This landmark can be reproducibly identified at a trial reduction by placing the Steinmann pin in the cotyloid groove. The femur and the operating table are returned to a neutral position. The Steinmann pin is replaced during femoral head trials for assessing the leg length with the mark on the femur as a reference.

The hip is then dislocated by flexion, adduction, and internal rotation. The centre of the femoral head is then marked using an acetabular trial component that matches the femoral head circumference; which is placed over the head and the centre of the femoral head is identified and marked, and the distance from the centre of the femoral head to the highest point of the lesser trochanter is identified, measured, and recorded. From the centre of the head to the greater trochanter, a reference mark is made, and the distance is measured to reproduce offset. The neck cut is made perpendicular to the neck at a level based on preoperative templating, using an oscillating saw; care should be taken not to cut into the greater trochanter.

Acetabular Exposure:
The femur is retracted anteriorly using a C-shaped retractor that is placed over the anterior acetabular wall above the anterior-inferior acetabular spine after releasing the capsule and oblique head of rectus. A small bent Hohmann retractor is placed intracapsularly posterior to the labrum, an Aufranc retractor is placed inferiorly under the transverse acetabular ligament, and finally, a Steinmann pin is placed superiorly retracting the gluteus medius, but not the minimus. The labrum is removed. The pulvinar is then cleaned from the fovea using electrocautery to allow visualization of the medial wall of the acetabulum. The foveal artery is cauterized at this step. Next, sequential acetabular reaming is performed and cup is fixed with adequate acetabular inclination and acetabular version**.**

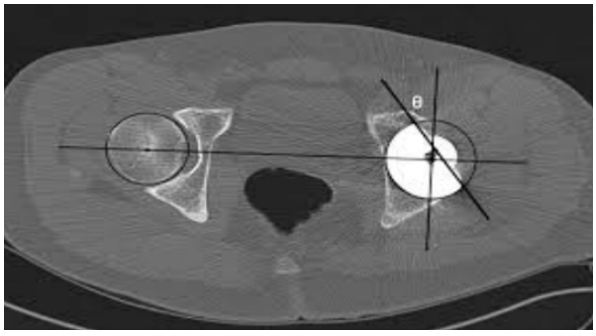
Wound Closure
After copious irrigation, an extended posterior soft tissue repair is done. The quadratus femoris is repaired using a non-absorbable suture, along with the repair of the gluteus maximus insertion. The SERs and posterior capsule are then repaired to the trochanteric fossa, very close to their insertion, through two drill holes, approximately 2 cm apart. A non-absorbable suture is passed through the posterior capsular flap and the piriformis. A second suture is passed through the capsule and the conjoint tendon.[86] With the help of a suture passer, the sutures are passed through the drill holes and tied with the leg in slight external rotation and neutral abduction to bring the femur close to the posterior structures and to take tension off the flap.

Postoperative Radiological Assessment
Assessment Of Acetabular Cup:
The cup ante-version is defined as the angle between the acetabular axis and the coronal plane.

Among various methods to measure the acetabular cup version in both X-Ray and CT, the CT scan measurement is the best. CT scan measurement has high accuracy and more reliability.[78,79]

In CT scan modified Murray's concept is used.

METHOD:
In an axial cut of a CT picture, showing both hips, Draw a first line connecting the centre of the two hips and a second line perpendicular to the first line**(Figure-14)**. The third line from the most anterior point of the acetabular cup component to its most posterior point. The angle drawn between the second and third line is the version of the acetabulum.



Axial cut of Ct picture showing the version of acetabulum.

θ is an acetabular version.
Normal acetabular version is 10 -20 degrees.
But safe zone of acetabular ante-version is 5-25 degrees.

Femoral Version
In a horizontal axial view of CT scan; showing ipsilateral hip.

Draw a line from the centre of the femoral head to the centre of the greater trochanter.

A second line drawn horizontally connecting the centres of two acaetabuli.

The degree between these two lines indicates the degree of femoral ante-version [FH].

Condylar Version

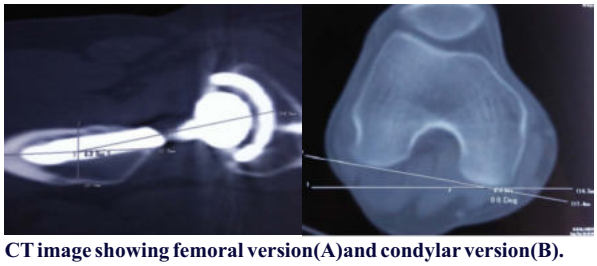
Draw the first-line, tangentially along the posterior surface of the two condyles in the axial cut.

The second line is drawn corresponding to the floor.

The true femoral ante-version is calculated with the femoral condylar version [CH].

True Femoral Anteversion

If femoral condyle is in internally rotated
The femoral version is = FH+CH If femoral condyle is in externally rotated.



CT image showing femoral version(A)and condylar version(B).

The femoral version is = FH-CH

If femoral condyle is in neutral

The femoral version is - FH=CH

RESULTS:

Out of these 30 patients, 16 patients were male and 14 were female. Right side affected in 18 patients and left side in 12 patients. The most common indication for total hip replacement in 14 patients is avascular necrosis, Rheumatoid arthritis in 3 patients, Non-union neck of femur in 3 patients, neglected fracture of neck of femur in 2 cases, secondary osteoarthritis in 6 patients and ankylosing spondylitis in 2 patients. All patients were assessed clinically using the HARRIS HIP SCORE SYSTEM for hip function in our study. Complications like dislocation, abductor weakness or sciatic nerve palsy were not encountered in our study.

Pain

	No of Patients
No pain	27
Mild pain	3

Limping

	No of Patients
None	28
Moderate limp	2

Support On Walking

	NO OF PATIENTS
NONE	27
CANE FOR LONG WALKS	3

Distance Walked

	NO OF PATIENTS
UNLIMITED	25
SIX BLOCK	3
2 OR 3 BLOCK	2

Stairs

	NO OF PATIENTS
WITHOUT USING A RAILING	26
USING A RAILING	4

Put On Shoes And Socks

	NO OF PATIENTS
WITH EASE	28
WITH DIFFICULTY	2

Sitting

	NO OF PATIENTS
SITTING COMFORTABLY IN ORDINARY CHAIR 1 HOUR	30

Public Transportation

	NO OF PATIENTS
YES	30

Absence Of Deformity

	NO OF PATIENTS
NIL	30

Range Of Movements Of Hip's Score

ROM	NO . OF PATIENTS
211-300	20
161-210	10
101-161	0
61-100	0
31-60	0
0-30	0

Range Of Movements Score

ROM	HIP SCORE	NO . OF PATIENTS
211-300	5	20
161-210	4	10

Range Of Movements Score

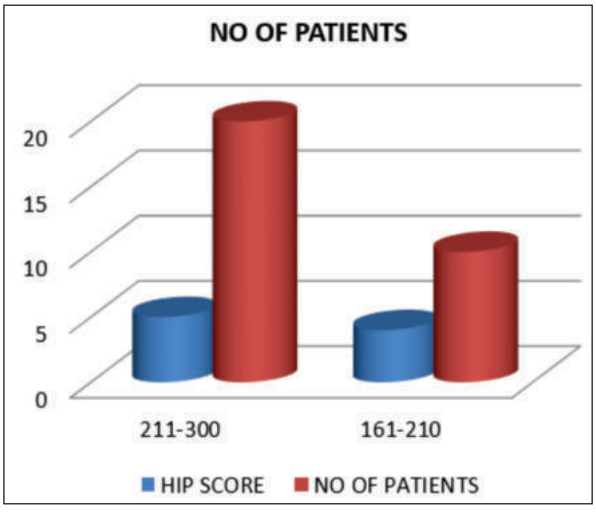
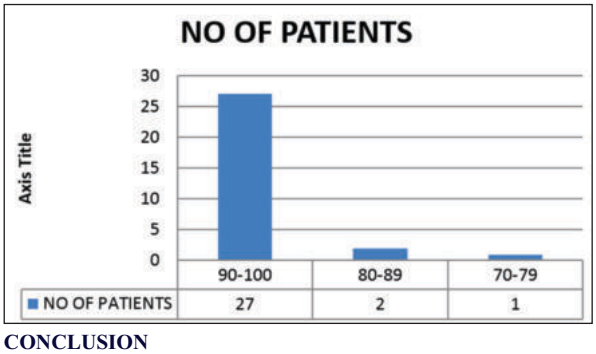


Table : 16 Total Harris Hip Score

SCORE	NO . OF PATIENTS	OUTCOME
90-100	27	EXCELLENT
80-89	2	GOOD
70-79	1	FAIR

Chart : 13 Total Harris Hip Score



CONCLUSION

In our study, 90% of the cases had an exceptional Harris hip score,

whereas 10% had a good or fair Harris hip score. Internal rotation is limited in patients with significant acetabular cup anteversion. In our investigation, there was no post-operative dislocation or sciatic nerve palsy. This study will provide surgeons with a solid prognosis for intraoperative free hand assessment of acetabular cup position and will aid in the reduction of post-operative complications.

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