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Original Research Article

Prospective study of functional outcome of total hip replacement at VIMS, Ballari

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Abstract

Purpose: To study the functional outcome of Total Hip Replacement in primary and secondary osteoarthritis of hip.

Materials and methods: The study consisted of 20 patients with diseased hips treated with total hip replacement operated in the Department of Orthopaedics, Vijayanagar Institute of Medical Sciences, Ballari from August 2020 to August 2022. Information of the patients was compiled from clinical details, case files and operation theatre records. This was a prospective study. The patient follow up was for a minimum of 6 months to maximum of 24 months (2 years). Modified Harris hip score was used for evaluation of functional outcome.

Results: Functional outcome of the procedure was done by following Modified Harris hip score. The results showed excellent results in 10 (50%) diseased hips, good in 06(30%) hips, fair 04(20%) hips. No poor outcome was noted in the study.

Conclusion: Our study demonstrated that total hip replacement provides an overall satisfactory functional and clinical outcome. Even though the study was not free of complications, the overall functional and radiological outcome showed excellent results.

Keywords: Total hip replacement, modified harris hip score, osteoarthritis, and neuropraxia

Introduction

Total Hip Arthroplasty (THA) is the most commonly performed reconstructive procedure that replaces the Femoral Head, Neck and Acetabular Articular Surface [1]. Total hip replacement has helped millions of patients who suffer from incapacitating hip pain. It is currently the most popular adult reconstructive hip operation [2]. It relieves pain and functional disability experienced by patients with moderate to severe arthritis of the hip, improving their quality of life. The success of Total Hip Replacement (THR) is its ability to relieve the pain associated with hip joint pathology, while maintaining the mobility and stability of the hip joint [3].

The most common condition for which total hip arthroplasty is done is severe osteoarthritis of the hip, accounting for 70% of cases [4].

THA can either be cemented or uncemented.

From the days of Charnley until the mid-1980s cemented total hip arthroplasty was the ideal mode of joint replacement [5]. But it was noted later that bone cement is the weakest link between the implant and bone. Subsequently failures of cemented total hip arthroplasty were seen due to various reasons like microfractures of cement mantle under torsional loading, loosening due to particulate induced osteolysis, bone loss with difficulty in future revision. Further the direct life-threatening adverse effects of bone cement such as sudden hypotension, myocardial depression, fat, air and pulmonary embolism, local bone necrosis are noted complications [6].

The above-mentioned adverse effects of bone cement led to the popularity of uncemented total hip arthroplasty.

Many designs have been studied in an attempt to minimize these adverse effects and thus improve outcome. The anatomically designed prosthesis can provide good results, with low prevalence of pain in the thigh and loosening of the component, in younger active patients [7].

The Modified Harris hip score is the most widely used scoring system for evaluating hip arthroplasty [8].

This study is undertaken to assess the clinical and functional outcome of the total hip replacement at our institution.

Materials and Methods

Study design

The study was carried out on 20 patients for Total Hip Replacement operated in Department of Orthopaedics at VIMS Ballari, from August 2020 to August 2022. Information of the patients was compiled from clinical details, case files and operation theatre records. This was a prospective study. Patient follow up was for a minimum of 6 months to a maximum of 24 months.

The following inclusion and exclusion criteria were used for recruitment of patients in the study.

Inclusion criteria

All the patients who had undergone Total Hip Replacement for isolated hip pathologies at our hospital.

Exclusion criteria

Patient not willing to give informed written consent.

The patients who had undergone Total Hip Replacement with deformities or pathologies of other joints of the lower limb, which may have had an adverse bearing on the functional outcome of the surgery.

Patient selection and procedure of the study

On admission to the ward, a detailed history of the patients was taken according to proforma was taken. Following this, they were subjected to thorough clinical examination and general condition was assessed and accordingly corrective measures were taken to correct the general being of the patients.

Routine blood investigations were done for all patients. Special attention was paid to CRP and ESR and if these were abnormal, surgery was deferred. Standard anteroposterior and lateral X-rays were taken including pelvis with both hips.

Analgesics, antibiotics, tetanus toxoid and blood transfusions were given as needed before surgery.

Pre-operative assessment

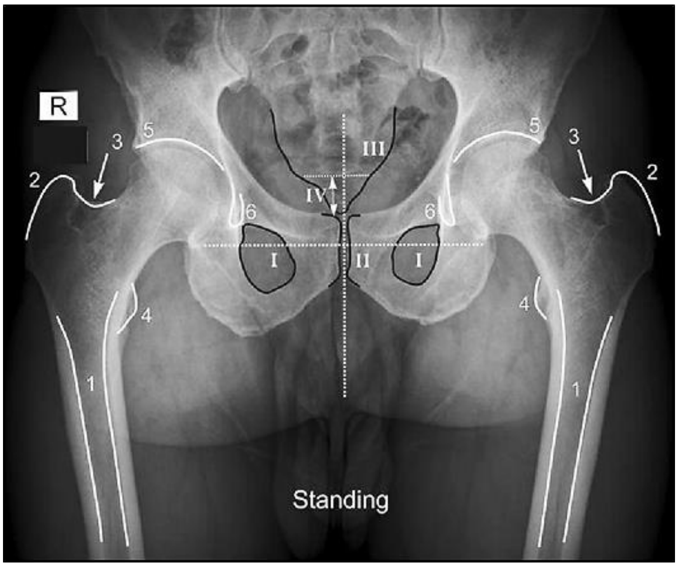
The patients were evaluated according to the modified Harris hip scoring system. The scores taken into account were of pain, function, range of motion and deformities. Also, a mention of limb length discrepancy and flexion contracture is made. The physical fitness of the patient undergoing a major surgery was assessed. Physical examination included examination of

spine and both lower extremities including opposite hip, both knees and foot. Trendelenburg test to assess the abductor musculature mechanism was done.
Neurovascular status of affected extremity was evaluated. Any occult infections like skin lesions, dental caries and urinary tract infections were identified and treated preoperatively.

Radiographic evaluation

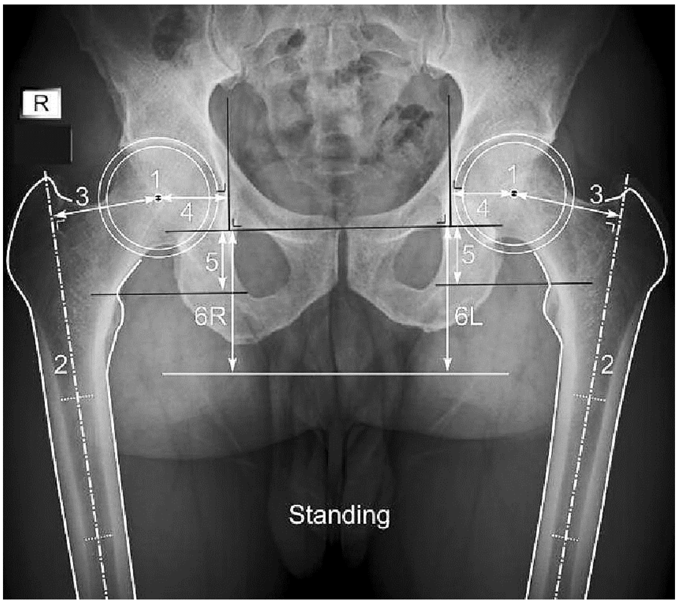
Standard pelvic roentgenogram AP view with both hips along with upper end femur in 15 degrees of internal rotation and lateral X-ray of hip were taken.
Following features were noted:
Femur: Bone stock, medullary cavity, limb length discrepancy and neck.
Acetabulum: Bone stock, floor, migration, protrusion, osteophytes and approximate cup.

Templating of radiographs for pre-op planning of cemented HIP



Standard anteroposterior pelvic radiograph suitable for hip templating.
Anatomic landmarks:
1. Femoral shaft.
2. Greater trochanter.
3. Saddle.
4. Lesser trochanter.
5. Acetabular roof.
6. Teardrop.

Landmark for radiographic quality assessment:
i) Foramen obturator.
ii) Symphysis.
iii) Sacrum.
iv) Distance between symphysis and sacrococcygeal joint.



Mechanical landmark:
1. Hip rotation centre.
2. Longitudinal axis of the proximal femur.
3. Acetabular offset.
4. Hip length.
5. The "leg length discrepancy" is calculated as the difference between the distance 6L and 6R.

All surgeries were performed on an elective basis using standard aseptic precautions under spinal anaesthesia and epidural anaesthesia.

Patient position: Lateral position with the patient lying on the unaffected side. For all patient's posterior approach (modification of Gibson's and Moore's Approach) [9] was used in our study.
Patient was painted and draped.

Technique
The incision, superficial and deep dissection was done as per the Moore's approach and the femoral head is exposed after incising the capsule. The head is dislocated by flexion, adduction and internal rotation. If internal rotation is restricted a capsular and psoas release can be done for facilitation of the rotation and dislocation of the hip.
Osteotomized the neck at pre-planned level using saw or sharp osteotome. For acetabular exposure, place anterior swan neck retractor along anterior lip of acetabulum after making a capsular opening. Place Hohman's retractor below transverse ligament. Retract posterior soft tissues with a right-angle retractor or posterior cobra retractor with hip in extension.
Complete the excision of the capsule and labrum to provide 360 degrees exposure of the bony margins of the rim of acetabulum. Remove osteophytes that protrude beyond the bony limits of the true acetabulum.
Excise fibro fatty tissue, ligamentum teres and medial/inferior osteophytes to expose medial wall of acetabulum. This depth indicates the limit to which acetabulum can be safely deepened.
Direction of reamer should be 45 degrees to longitudinal axis of the body and 15 degrees of anteversion [10]. Push reamer posteriorly to keep away from anterior wall.

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Reaming is completed when all cartilage is removed and reamer has cut bone out to the periphery of acetabulum to expose bleeding subchondral bone. Protect and retain subchondral bone of the roof as much as possible.
Select the correct size of the acetabular gauges. Place trial cup in 45-50 degrees of inclination. Note orientation and containment of the cup. Make 6 mm anchor holes throughout the acetabulum. Large 10 mm holes may be made in ilium and ischium. Clean the anchor holes with a curette. Use copious wash to clean the acetabular floor and pack the cavity with hydrogen peroxide pack. Attach cup to holder in the correct orientation of long posterior wall.
For preparation of the femur, rotate femur internally so that tibia is perpendicular to the floor while covering the acetabulum with a sponge. Deliver proximal femur from the wound by pushing on the knee and keeping a toothed retractor below the neck.
Retract posterior edge of gluteus medius to expose piriformis fossa.
Remove soft tissue from lateral aspect of neck and piriformis fossa with rongeur.
Remove bone from lateral portion of neck and medial aspect of greater trochanter to form a groove. This prevents varus placement of the prosthesis.
Insert tip of initial reamer into lateral aspect of the neck and swing the reamer into greater trochanter so that it points towards medial femoral condyle. Follow this with a large reamer. Curette loose cancellous bone from the medial aspect of neck.
Insert the trial stem, cup and head (as system is Modular) and do trial reduction. Note range of movements, stability of the joint and limb length correction. Not more than 5 mm separation should be present on traction on limb.

For cemented THR

The acetabular cup placement is done, after that cement is mixed [11]. The cement is inserted. when it reaches the doughy stage. The cup clipped to the holder is pushed into the depth of acetabulum pressing onto the cement with cup holder directed towards the patient’s foot.
Handle is brought into final orientation where the transverse arm is parallel to transverse axis of pelvis and 5 to 10 degrees anteversion. Finally, the femoral component is inserted. Plug the femoral canal with bone plug 2-3 cm below anticipated tip of stem.
Mix the cement and make a roll out of it when it reaches the doughy stage. Insert it into the medullary canal. Push the cement with tip of index finger going right inside the medullary canal. Insert the prosthesis predetermined direction and anteversion. Impact the stem with an impactor.
Closure is done. Reattach short external rotators through drill holes made in posterior aspect of greater trochanter. Suture fascia, subcutaneous tissue and skin in layers. Drain is inserted.

For uncemented THR
The acetabulum is prepared excising the soft tissues attached to it and reaming it upto the bleeding subchondral bone. We have used the morcellized femoral head as graft to cover the defect in the acetabulum caused by subchondral cyst in acetabulum. Acetabular cup sizes used were one size higher than the last reamer used. In three patients we have used screws to fix the acetabular cup along the posterosuperior quadrant keeping in mind centre of the offset placed superiorly or posterosuperiorly.
The proximal femur was exposed and delivered out by markedly internal rotating the limb. The femoral canal was hand reamed to the anticipated stem size as determined by templating and maintaining the anteversion. The prosthetic head of appropriate size was placed on the trunnion and affixed with mallet over a plastic capped head impacter.
The femoral head was reduced, the stability confirmed through a functional range of motion wound was closed over a suction drain.

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Post-operative protocol

The hip is positioned in approximately 15 degrees of abduction.

First post op day, check X-rays were taken. The patient is taught static quadriceps exercises, knee and ankle mobilization exercised and made to sit.

Gait training was started using a walker with weight bearing to tolerance on second postoperative day. Drains were removed 24 to 48 hours after surgery.

IV antibiotics were given for 48 hours later switched over to oral antibiotics for further 5 days more. DVT prophylaxis was given [12].

12th post op day sutures were removed and discharged from hospital to be reviewed after one month.

They were advised

- Not to squat.
- Not to sit cross legged.
- Not to use Indian toilets.
- Not to cross the lower limb across the midline.

Follow Up

The patients were followed up at 6 weeks, 3 months, 6 months, 1 year and at yearly intervals. Patient follow up was for a minimum 0f 6 months and maximum of 24 months (2 years).

Clinical assessment

During each visit, medical history was taken and physical examination was done.

The deformity and ROM were measured with goniometer. The clinical and functional outcomes were evaluated by Modified Harris Hip score.

Radiological Assessment

A radiograph was taken at the end of the procedure and during follow up visits.

The standard radiograph was an anteroposterior view of pelvis including both hips and sufficient length of femur.

The prevalence, location, and extent of osteolytic lesions, progressive radiolucent lines, and calcar resorption were determined on anteroposterior radiographs made at time of last follow up.

Clinical and radiological photographs

Case 1

Secondary osteoarthritis of left hip

Pre-op X-ray

Immediate Post Op X-ray

6 Months post op X-ray

Operative scar

Hip flexion with knee in flexion

Hip flexion with knee in extension

Hip adduction, abduction, external rotation, internal rotation

Case 2

Pre-op X-ray

Immediate post op X-ray

6 Month post op X-ray

Results

The series consisted of 20 patients with diseased hips treated with total hip replacement between November 2019 and November 2021. The follow up was minimum of 6 months to maximum of 2 years. Results were analyzed both clinically and radiologically.

Age distribution

Out of 20 patients, 02 patients (10%) belonged to age 36-45, 07 patients (35%) belonged to the age group between 46-55 years of age. 09 (45%) patients belonged to age group of 56-65 years of age and 02 (10%) patients belonged to age group between 66-75 years of age.

Age in years	Number of patients	Distribution in percentage
36-45	2	10
46-55	7	35
56-65	9	45
66-75	2	10
Total	20	100

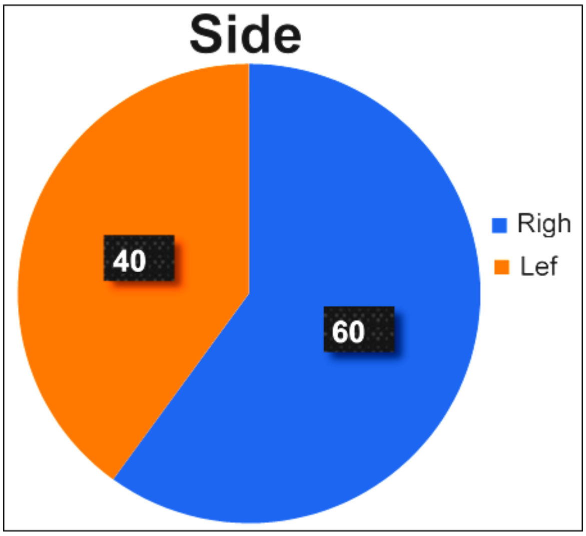
Sex distribution

Out of 20 patients, 14 (70%) were males and 06 (30%) were females, thus showing male preponderance.

Sex	Number of patients	Distribution in percentage
Male	14	70
Female	06	30
Total	20	100

Side affected

In our study, 12 (60%) patients had right side affection and 08 (40%) patients had left side affections.

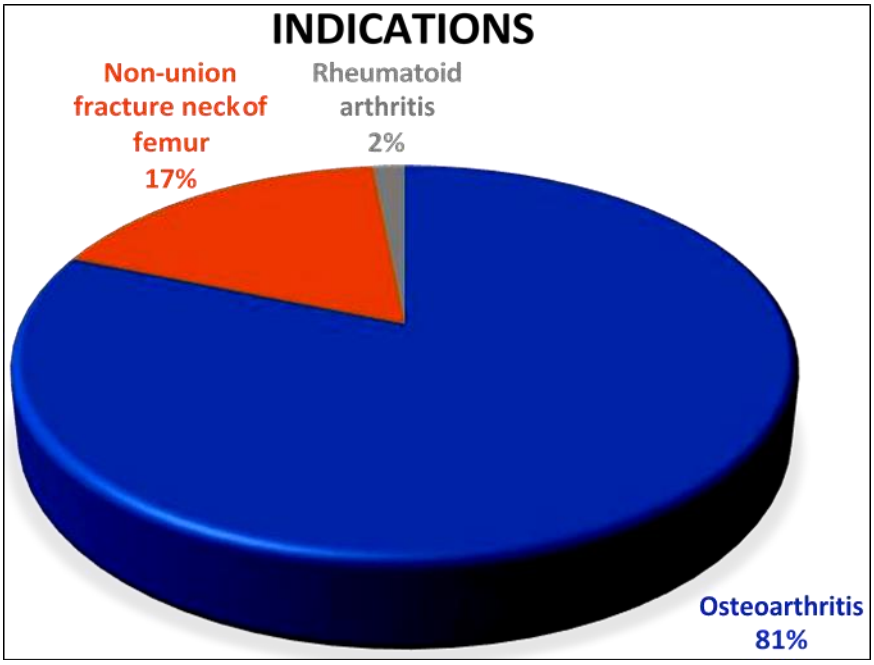


Indications

The most common indications for surgery was secondary osteoarthritis of patients being 14(70%). The other causes were nonunion fracture neck of femur 3 (15%), rheumatoid arthritis 3 (15%).

The causes of secondary osteoarthritis of the hip were Advanced stages of AVN of the head of femur-08 Healed tuberculosis-03.

Old trauma to hip joint-02 Ankylosing Spondylitis-01.



Complications

In our study it was found that in one patient there was sciatic nerve neuropraxia it was due to excessive stress on the nerve intraoperatively, patient was advised passive dorsiflexion and plantar flexion exercises. Patient recovered from neuropraxia in 6 weeks. Weight bearing was delayed in this patient.

Complications	No. of hips	Distribution in percentage
Nerve injuries	1	5
Vascular injuries	--	--
Haemorrhage	--	--
Bladder injuries	--	--
Limb length discrepancies	--	--
Dislocations	--	--
Thromboembolism	--	--

Modified harris hip score

Functional outcome of the procedure was done by following Modified Harris hip score. The results showed excellent results in 10 (50%) diseased hips, good in 06(30%) hips, fair 04(20%) hips. No poor outcome was noted in the study.

Results	No. of hips	Distribution
Excellent	10	50
Good	6	20
Fair	4	30
Poor	0	0
Total	20	100

Discussion

Total hip arthroplasty is considered to be one of the most successful orthopaedic interventions of its generation [13]. The orthopaedic surgeon Sir John Charnley, who worked at the

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Manchester Royal Infirmary, is considered the father of the modern THA. His low friction arthroplasty designed in the early 1960's is identical, in principle, to the prostheses used today. It consisted of three parts; a metal femoral stem, a polyethylene acetabular component and acrylic bone cement-which was borrowed from dentists [14]. It was called the low friction arthroplasty as Charnley advocated the use of a small femoral head which reduces wear due to its smaller surface area.

As the number of successful operations has increased, techniques have become standardised and the average age of those receiving hip replacements has reduced.

Metal-on-polyethylene (M-on-PE) bearings are the most widely used of all the prostheses, making up the majority of THA undertaken today. Currently the M-on-PE bearing provides a safe, predictable and cost-effective bearing for the majority of patients and for many represent the gold standard in THA [15].

The main concern for M-on-PE prosthesis is PE debris which creates periprosthetic osteolysis by the release of cytokines and proteolytic enzymes-ultimately leading to implant failure [16]. PE wear debris is cited as the ultimate cause of most total joint arthroplasty failures today [17], leading to an increased frequency of hip revision due to aseptic loosening.

Metal-on-metal (M-on-M) prostheses are experiencing a revival after falling out of favour in the 1970's. Previously, concerns were raised of the bearings potential to generate metal ions (metallosis), which had a theoretical carcinogenic risk, as well as associated hypersensitivity reactions and prosthetic loosening. Prosthetic wear in M-on-M has been reported to be 60 times less than expected with conventional M-on-PE prostheses [18]. In addition, as the metal femoral heads are less brittle than other materials they can have a larger diameter, increasing joint stability, and therefore the incidence of dislocation in these arthroplasties is lower [19], M-on-M implants also reduce osteolysis and peri-prosthetic inflammatory tissue compared to its polyethylene counterpart [20]. An unknown entity in M-on-M bearings is the long-term effects of metal ions liberated, with cobalt and chromium ion blood levels tending to be 3-5 times higher than those patients with M-on-PE prostheses.

Furthermore, many patients who receive M-on-M implants are younger (due to its wear characteristics), therefore potentially increasing the total length of the exposure to these metal ions over their lifetime. But such a carcinogenic risk from these metal ions remains theoretical, with only a few case reports of malignancies (mainly sarcomas) in publication to date [21].

There is currently insufficient clinical follow-up to draw firm conclusions about the current new generation of M-on-M implants. Studies into the long-term outcomes are currently being conducted and results eagerly awaited.

Developed to address the problems of friction and wear reported in other materials, the ceramic used in orthopaedics consist of either alumina or zirconia. The benefits of ceramic-on-ceramic (C-on-C) bearings are its high level of hardness, scratch resistance and the inert nature of debris compared to metal or Polyethylene versions [22].

Furthermore, these hydrophilic prostheses create improved lubrication, therefore resulting in a lower coefficient of friction and excellent wear resistance [23]. Hence C-on-C bearings are a good choice of implant in young, active patients due to reduced wearing. However, the cost of ceramic implants is significant and for this reason these bearings are used infrequently in our institution.

A hybrid hip prosthesis is formed from a cemented femoral stem and acetabular cup fixed in place with cementless techniques. This is an option for young, active patients as it prevents pelvic bone loss, to aid revision, yet still providing solid fixation and good usage. A major study in Norway showed that the use of hybrid systems offer better survivorship than a cemented socket in younger patients [24].

Cementing hip arthroplasties was first described by Glück in 1891, using methacrylate bone cement to improve prosthetic fixation, but it was Charnley in the late 1950's that popularised this technique with a cement taken from dentists. Between these dates cementing often failed and attention was placed in the development of cementless techniques. Cementless prosthesis has a specialized coating, hydroxyapatite that allows ingrowth of bone and thus fixation of the prosthesis.

Cementless techniques allow for easier planning of hip revision surgery, particularly in the younger patients, with greater preservation of bone tissue. However, better short to medium-term clinical outcomes were found for cemented over uncemented techniques, with no radiological differences seen [25]. Long-term comparison is difficult to make due to lack of large randomized controlled trials.

Gaining popularity in recent years, minimally invasive techniques are currently being developed. The use of a single-incision, less than 10 cm in length using conventional surgical approaches, provides soft-tissue sparing and bone conservation options. Studies have demonstrated that it provides the possibility of reduced intra-operative blood loss, shorter hospital stay, faster rehabilitation and an improved cosmetic result while not compromising complication rates or physical function post-op [26, 27].

Meanwhile opponents cite the risks of such an approach, including limited visibility of anatomical landmarks and vital structures [28].

Entering its second decade of use, computer-assisted total hip replacement utilizes digital image systems to map the position of surgical instruments in relation to anatomical landmarks, helping to obtain reproducible and accurate placement of implants.

In actuality navigation leads to increased surgical time, elevated costs and operative complexity. On the other hand it is a useful tool in order to conduct research into prosthesis positioning and clinical outcome. Some discussion as to whether the combination of computer-assisted surgery with a minimally invasive approach can help to improve outcomes is ongoing-but at present greater quality designed studies and the mastering of this surgical technique is required before such techniques can be formally analysed [29].

Total hip replacement is a well-documented surgical procedure which improves the quality of life of the patients when properly performed and managed. Male preponderance was observed in our study with 70% of cases which explains that males are more prone to trauma and secondary osteoarthritis which is a common indication for replacement of the hip. 45% of the cases in the study were in the age group of 56-65 years. Secondary osteoarthritis of the hip was the commonest indication, the number being 14(70%) out of 20 patients.

Modified Harris score was used to evaluate the functional outcome of the cases in the present study. In our study, excellent results were obtained in 50% of the cases, good in 30% of cases and fair in 20% after total hip arthroplasty. The outcome noted in this series is comparable to other studies which had longer follow up.

The strength of this study is that all hips were primary replacements, all were done at the same hospital and no patient lost for follow-up. Although long term follow up is required in our study for assessment of late complications. The short term follow up in this study showed good clinical and functional outcome.

The Primary Total Hip Arthroplasty has revolutionised the treatment of Hip diseases in the past 3 decades. The indications for the primary THA has been extended to complex hip pathologies which were previously considered ineligible for the procedure. Such complex hip cases fall into the categories of Developmental Dysplasia Hip Ankylosed Hip, Protrusio acetabuli, Failed Osteosynthesis (previous bony procedures around hip), Skeletal Epiphyseal Dysplasia (SED), Neuromuscular disorders (polio, down’s syndrome, cerebral palsy, stroke), Prior hip fractures (acetabular fractures), Severe soft tissue contractures around hip and Post excision arthroplasty hip.

In our study we experienced that primary cemented total hip arthroplasty still holds the edge in the Indian scenario and is excellent procedure in the management of arthritic hip especially in the elderly with abrupt change in the restricted life style post-surgery. While uncemented

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Total hip arthroplasty is mainly indicated in young patients with adequate bone stock. Degenerative arthritis of hip has debilitated many patients. Secondary degenerative arthritis is more common than primary degenerative arthritis and has affected mainly people of younger age group. Careful patient selection along with preop and postop evaluation of both patients and radiographs is essential for the success of total hip arthroplasty.

Conclusion

In conclusion, total hip replacement gives good clinical and functional outcomes. However, the outcomes are influenced by multiple factors which include indication for surgery, age of the cases, and type of prosthesis, operative technique and post-operative follow up. Better analysis can be made if long term studies are done and follow up for a long period. Our study demonstrated an overall satisfactory functional and clinical outcome. Even though the study was not free of complications, the overall functional and radiological outcome showed excellent results.

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