SHORT TERM FUNCTIONAL OUTCOME OF REVISION TOTAL HIP REPLACEMENT

Orthopaedics

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ABSTRACT

Objective: The primary objective of this study is to assess various factors that lead to revision THR in a tertiary care teaching hospital and Analyse the short term functional outcome of the revision THR in a tertiary care teaching hospital using HARRIS HIP SCORE and haemato-radiological study.

Introduction: Total hip replacement (THR) is one of the most successful procedures carried out by orthopaedic surgeons worldwide. Conventional, primary total hip replacement is a durable operation in most patients. Over time, however, a hip replacement can fail for a variety of reasons, which include version, infections, periprosthetic fractures as well as aseptic loosening of the prosthesis. Revision hip replacement is a longer, more complex procedure. It requires extensive planning, as well as the use of specialized implants and tools, to achieve a good result. Controversy remains regarding the best method of fixation in total hip replacement (THR).

Methodology: A prospective and retrospective cohort of 30 patients with requirement of revision total hip replacement surgery from January 2016 to December 2017 were analysed for minimum of 1 year and final result were analysed with HARRIS hip score and haematological,clinico-radiological investigation

Result: Majority of the patients undergoing revision THR are males.
- The most common indication for revision THR is version defect / instability followed by infection.
- There was correction of version defects after revision THR
- Gradual decrease in the inclination angle was seen after revision THR
- There was statistically significant increase in Harris Hip Score after revision THR in all the patients
- In patients with infected primary THR prosthesis, there was normalization of the haematological parameters after revision THR.
- In patients needing revision THR due to infection, the surgical procedure was undertaken in two stages with heat stable antibiotic (vancomycin) impregnated cement spacer directed against most commonly isolated organism- Methicillin resistant staphylococcus aureus.

KEYWORDS

THR, revision THR, version, infection, instability.

INTRODUCTION:
Total hip replacement (THR) is one of the most successful procedures carried out by orthopaedic surgeons worldwide. Conventional, primary total hip replacement is a durable operation in most patients. Over time, however, a hip replacement can fail for a variety of reasons, which include version, infections, periprosthetic fractures as well as aseptic loosening of the prosthesis. Most elderly patients who receive a hip replacement retain the prosthesis for 15 to 20 years, and sometimes for life. However, some patients may need one or more revisions of a hip replacement, particularly if the initial hip replacement surgery is performed at a young age and the patient chooses to have a very active physical lifestyle. Pre-operative investigations in patients who will undergo revision surgery are more extensive than those required in patients scheduled for a primary surgery. Often, special radiographic projections CT scan, or MRI of the hip may be necessary to determine position and fixation of the replacement parts (components), and to determine with precision the extent of bone loss around the failed implant. A preoperative aspiration (fluid sample) and/or special blood work may be needed if the surge on suspects an infection in the failed hip. Revision hip replacement is a longer, more complex procedure. It requires extensive planning, as well as the use of specialized implants and tools, to achieve a good result. Even after the revision surgeries the pain of the patient goes down, range of motion improves, the general well-being since the patient mobilizes better improves. Hence in experienced hands it's a surgery which may be said to give new life to the patient.

Controversy remains regarding the best method of fixation in total hip replacement (THR).Literature search revealed that there is a lack of research articles which mention about the functional outcomes of the revision THR, which may be done due to one of the reasons of failure of primary THR mentioned above. Hence, we planned to conduct a study which will follow- up patients who have undergone revision THR and assess the functional outcomes of these patients based on multiple parameters.

METHODOLOGY:
a. Design: A retrospective study (to assess the indication of revision THR) and a prospective follow-up study(to assess the short-term functional outcome of revision THR)
b. Place of study: A tertiary care teaching hospital
c. Proposed duration of study: 24 months
d. Sampling size: 30 patients
e. Sampling method:In this study, all the patients presenting to the Orthopaedic department of the tertiary care teaching hospital with dislocated/implant failure of THR were included.

f. Inclusion Criteria:
1) Patients with implant failure
2) Patients with periprosthetic fractures
3) Patients that are willing to come for regular follow up
4) Patients with loosening of stem due to infection
5) Aseptic loosening of stem
6) Infected THR
7) Dislocated/instability of THR
8) Impingement
9) Polywearg.

Exclusion criteria:
1) Neuropathic Joints
2) Patients not ready to give written informed consent or not ready to follow up at regular time points.

Patients fulfilling all inclusion and exclusion criteria were explained about the study and invited to participate in the study and an informed consent was taken. Patients were explained about procedure and about the need for follow up immediate post operatively, in between at periodic intervals and at the end of one year.

h. Parameters to be studied:
Patient evaluation will be done on a post -operative follow up basis at 2 weeks, 6 weeks, 3 months, 6 months, 1 year for the following parameters.
1) Version of Acetabulum and Femur
2) Acetabular Protrusion
3) X-ray
4) CT Scan to check inclination of acetabular cup
5) Erythrocyte Sedi mentation Rate (ESR)
6) C- Reactive Protein (CRP)
7) Total Leucocyte Counts
8) THR Scoring - Harris Hip Score

i. Organisation of work elements:
This study was undertaken after Ethical Committee clearance and was completed according to the fulfilment of closure criteria of the study.

j. Work already done in the field:
1) Lacunae in subject knowledge:
The primary objective was to study the is short term functional outcome of revision total hip replacement.

2) Proposed outcome of the project

a) Improvement in patient care: YES
b) Attainment of more knowledge: YES
c) Bridging the lacunae in the knowledge: YES

OBSERVATION AND ANALYSIS:
30 patients with failed primary THR treated with revision THR were included in the study.

Table 1.1: Demographic Details of the All Patients Enrolled in

the Study
Total Number of patients = 30
Gender Distribution: 23 Males, 7 Females
Mean age of the patients Enrolled (mean + SD) = 64.6 + 5.19 years
Minimum Age = 54 years
Maximum Age = 74 years

Table 1.2: Pre-operative and Post-Operative Acetabular and Femoral Version Angles

	Pre-operative	2 weeks	6 weeks	3 months	6 months	1 year
Acetabular Version	19.46+6.88	16.23+2.91	15.66+2.15	15.26+1.89	15.33+1.47	15.03+1.63
Femoral Version	14.79+1.08	20.68+0.81	20.2+0.8	20+ 0.76	19.51+0.94	18.55+1.45

Values in mean + SD

Table 1.3: Pre-operative and Post-Operative Inclination of Acetabular Cup on CT Scan

| Pre-operative	2 weeks	6 weeks	3 months	6 months	1 year
41.53 + 6.8	38.86+3.67	38.3 + 3.21	38.1 + 3.43	38.1 + 3.3	37.9 + 2.86

Values in mean + SD

**Table 1.4: Pre-operative and Post-Operative Hematological Parameter Assessment**

|	Pre-Operative	2 weeks	6 weeks	3 months	6 months	1 year
Erythrocyte Sedimentation Rate (ESR)	27+28.68	16.17 +12.42	13.2 + 7.29	11.63+ 6.37	8.3+4.11	7.1+3.03
C- Reactive Protein (CRP)	9.03+8.03	7.36+4.91	6.63+3.2	5.47+ 2.46	4.93+1.7	4.53+1.16
Total Leukocyte Count (TLC)	9354.4+4086.5	8226.9+2077.8	7459.4+1010.4	7138.9+ 814.17	6951.7+853.5	6616.1+799
Values in mean + SD						

Cases with intraoperative photographs,preoperative and postoperative x rays

The following photos show the procedure carried out during the revision THA
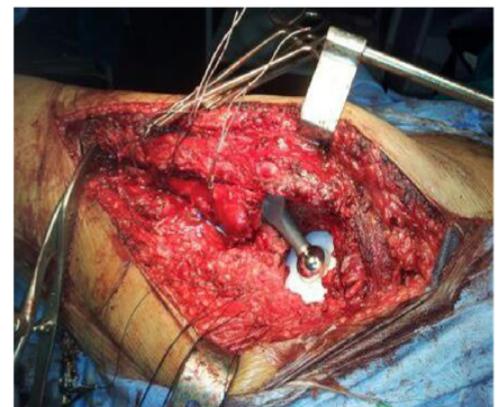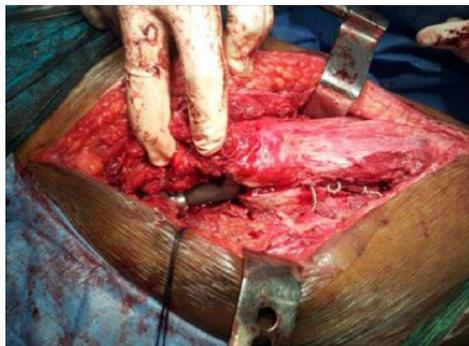
The following X -rays depict the revision THA, through the pre - operative and post -operative hip.
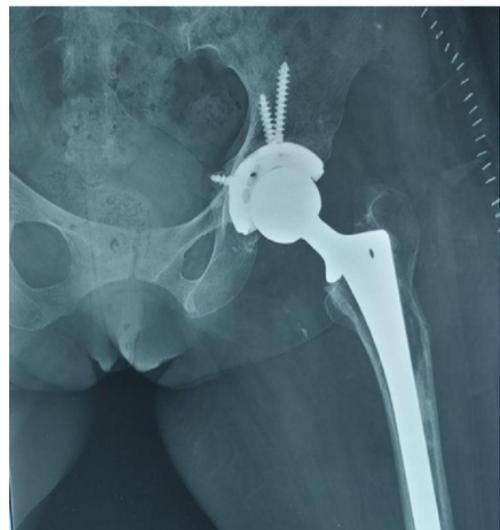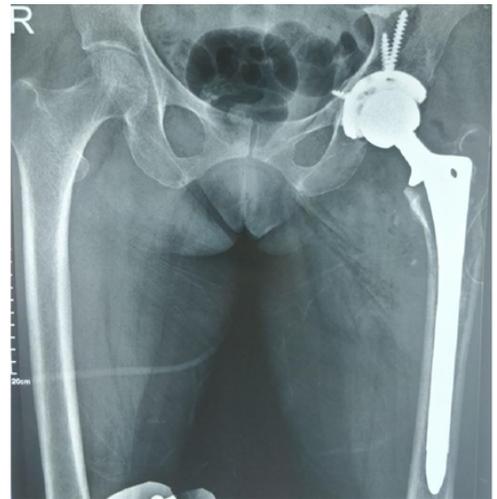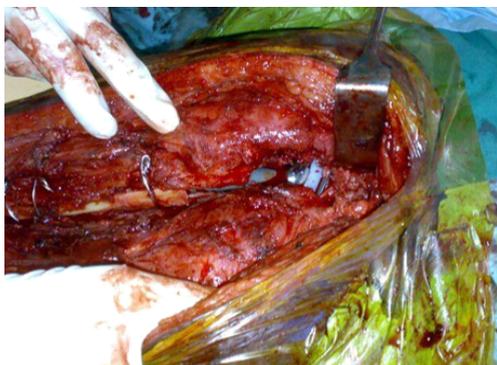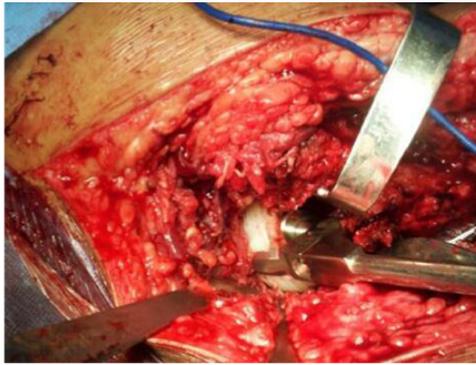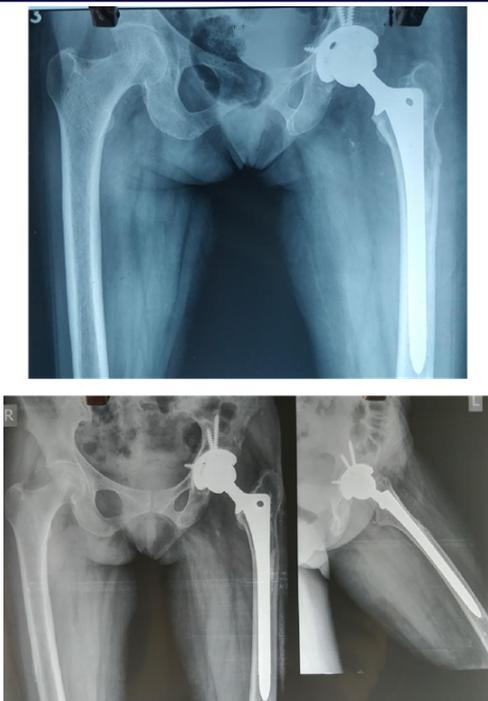
DISCUSSION:

Total hip replacement (THR) is one of the most successful procedural advances carried out by orthopaedic surgeons worldwide. The successrates of total hip arthroplasty at 10 years or longer exceeds 95% survivorship in patients older than 75 years of age. THR has also increased the life expectancy of patients, which has positioned a growing demand on these arthroplasties. Revision hip arthroplasty, which contributes close to a quarter of all arthroplasties in the USA, places huge financial burden on healthcare and has a less favourable outcome than primary total hip arthroplasty. Also, the revision THR surgeries are more complex and take longer time to complete. There are various causes of primary THR failure, which include osteolysis, aseptic loosening, periprosthetic fractures, implant related problems and infections. Literature search revealed that though therehave been few studies conducted in the west which have assessed the indications of revisions THR and the functional outcomes of the same, there is a complete lack of such research in India. Hence, we planned to conduct a study which will follow - up patients who have undergone revision THR and assess the functional outcomes of these patients based on multiple parameters.

In our study, we had recruited 30 patients after taking ethics committee permission and the patients' written informed consent. Majority of these patients were males (76.67%) with the mean age being 64.6 + 5.19 years (range: 54 -74 years). In the study by Ulrich et al , 52% of the patients undergoing revision THR were females (117 out of the 225 enrolled patients) while the mean age in this study was near to our finding, that is 59 years. In the meta -analysis by Saleh et al, the weighted mean age of the patients was 67.3 years, very close to the mean age of the patients in our study.64.3% of the patients considered in the meta -analysis were females. In the study by Nageswaran et al, 24 patients were enrolled, and the mean age of these patients was 66 years, similar to our study. In the study by Bozic et al, the mean age of the enrolled patients was 68 years, very similar to our study. Also, most patients in this study were males (58.3%), just like in our study.

There is a wide variation over the research data available over the common causes of failure of primary THR. We assessed the causes of primary THR failure and the indication of revision THR in our study. We found that majority of the cases were of version defect which indicate instability. 12 of the 30 cases (40%) had acetabular or femoral version defect in our study. 6 of the 30 cases (20%) had infection as a cause of primary THR failure while 5 of these 30 (16.67%) had peri - prosthetic fracture as a cause of primary THR failure. 4 of the 30 cases (13.33%) had aseptic loosening while 3 of the 30 cases (10%) reported implant failure. In the study by Jafari et al, the most common cause of primaryTHR failure was infection (30%) while instability was seen in 25% of cases.19.4% of the cases in this study had aseptic

loosening15% of the cases had periprosthetic fracture. In the study by Ulrich et al, the most common cause of primary THR failure was aseptic loosening (51.3%). In this study, instability was seen in 16.9% while 5.5% cases had infection as the reason for revision. In the 2004 study by Clohisy et al, out of the 439 hips assessed, 7% had failed primary THR due to infection while 5% had periprosthetic fracture. In the studyby Girard et al, the most common indication for revision THR was found to be aseptic loosening in about 41% cases. The next common causes in this study were peri -prosthetic fracture and infections. Bozic et aldetermined that the most common reason for revision was instability or dislocation (22.5%), followed by aseptic loosening (19.7%) and infection (14.8%).We assessed the femoral and the acetabular version angles to assess the outcome of revision THR, to make sure ab out the stability of the revised prosthesis. We found that post -operatively at multiple time points, the femoral and acetabular stability was retained in those patients with instability after primary THR. The inclination of acetabular cup was also assessed by CT scan in our study. We found that there was a gradual decrease in the inclination angle as compared to the pre - operative values. Very few studies have assessed these anglesafter revision THR and ours is a novel attempt at doing so. In the study by Chang et al, the mean cup anteversion pre -operatively was found to be 25.8 degrees, close to the 19.46 degrees found in our study. In thisstudy the mean femoral anteversion was found be 15.3 degrees, close to the 14.79 degrees in our study. The acetabula r inclination on CT was found to be 40.8 degrees in this study, similar to the 41 .53 degrees in our study. The trend of decrease in these angles post -operatively was seen in both our study and the study by Chang et al. Though there is no clear -cut consensus over the ideal set of version angles required for THR, Lewinnek defined the 'safe zone' of the cup alignment as 40°±10°for acetabular inclination and 15°±10° of anteversion.There is a consensus though over the fact that acetabular and femoral components in a relatively safe zone for impingement -free range of motion.

One of the most important scoring system used worldwide to assess the functional outcome of the THR, both primary and revised, is Harris Hip Score (HHS). In our study, we found that there was a statistically significant increase in the post -operative HHS (mean score 80.5) as compared to the HHS before the revision THR (mean score 50.43). In the study by Brown et al, the increase in the post -operative HHS was to a mean value of 76 from the p re-operative value of 46, similar to our study.In the study by Nageswaran et al, the mean post -operative HHHS increased to 83 from a mean pre -operative score of 38.6, similar once again to our study results. In the meta -analysis by Saleh et al, the mean difference between pre -operative and post -operative HHS was expressed as 37.7, with the difference being 30.07 in our study. In the study by Chang et al, the post -operative HHS increased to a mean of90.7, slightly higher than the post -operative value in ours study. In the study conducted by Lee et al, the HHS increased from a pre -operative mean of 41 to the post -operative mean of 77. The haematological parameters which were assessed in our study were the mean ESR, CRP and the TLC levels. These para meters were assessed to diagnose the presence of infection as a cause of failed primary THR. 20% of the cases in our study were diagnosed with infected primary THR based on the deranged values of these haematological parameters. According to Kurtz et al, the incidence of infection in THR ranged from 2.0 to 2.4%. The Musculoskeletal Infection Society (MSIS) proposed a criterion for diagnosis of periprosthetic joint infection, which mentions that elevated ESR, CRP and W BC are the mainstay to diagnose the condition. Aggarwal et al mention in their review on periprosthetic joint infection that ESR and CRP are the best available screening tests for the diagnosis of it and hence, should be assessed to rule out failure of THR. In our study, after revision THR, we found the normalization of the elevated ESR, CRP and TLC which indicated successful revision.

We had planned this study as a pilot to assess the short-term functional outcomes of revision THR. The goal of revision total hip arthroplasty is to return the patients to the pre -injury functional state as quickly as possible.Based on the parameters used in the study, which are the radiological and the HHS along with the haematological variables, thefunctional outcome of the revision THR has been positive for all the cases with none of the patients needing re -revision of THR.

Our studies had a few limitations. Since our study was conducted with a view to assess short term outcomes, we could not comment on the effect of revision THR over the survivorship of patients. In the study by

Jafari et al, the 5 -year survivorship was found to be 83.3% indicating positive long -term outcome. This study also mentions the reduced survivorship of patients undergoing revision THA for infection and instability. Another limitation was the study did not assess the effect of risk factors like body mass index or smoking on the THR outcome.

CONCLUSION:

Total hip replacements (THR) are commonly done worldwide by orthopaedic surgeons. However, there are chances of the surgery to fail due to various reasons like version problems, infections, periprosthetic fractures and aseptic loosening of primary prosthesis. These causes lead to the "revision" surgeries in these patients. Though the revisions are considered safe and successful surgeries, they are complex operations which need intricate planning. Literature search revealed that there is a deficiency of research which mention about the functional outcomes of the revision THR. Hence, we planned to conduct a study which will assess the indications of revision THR, and follow -up patients who have undergone revision THR and assess the functional outcomes of these patients based on multiple parameters.

On assessment of the femoral and acetabular version angles, we found thatpost-operatively, the femoral and acetabular stability was retained in those patients with instability after primary THR. The inclination of acetabular cup showed a gradual decrease in the inclination angle as compared to the pre - operative values. The deranged haematological parameters (elevated ESR,CRP and TLC levels) in infected primary THR prosthesis showed normalization of the elevated ESR, CRP and TLC which indicated successful revision .

On assessment of HHS, we found that there was a statistically significant increase in the post -operative HHS (mean score 80.5) as compared to the HHS before the revision THR (mean score 50.43).

With our study, we conclude the following points:
- Majority of the patients undergoing revision THR are males
- The most common indication for revision THR is version defect, followed by infection
- There was correction of version defects after revision THR
- Gradual decrease in the inclination angle was seen after revision THR
- There was statistically significant increase in Harris Hip Score after revision THR in all the patients
- In patients with infected primary THR prosthesis, there was normalization of the haematological parameters after revision THR.

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