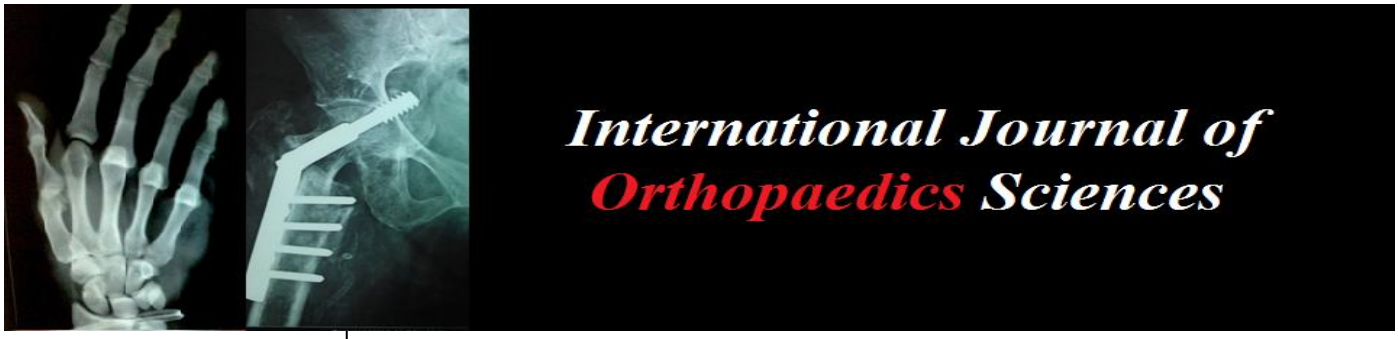

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(2): 572-577

www.orthopaper.com
Received: 25-02-2020
Accepted: 27-03-2020

Milind G Kulkarni
Department of Orthopaedics
P.G.I. Swasthiyog Pratishthan
Miraj, Maharashtra, India

Lokesh Yadav
Department of Orthopaedics
P.G.I. Swasthiyog Pratishthan
Miraj, Maharashtra, India

Shreya Joshi
Department of Orthopaedics
P.G.I. Swasthiyog Pratishthan
Miraj, Maharashtra, India

Prajwal BN
Department of Orthopaedics
P.G.I. Swasthiyog Pratishthan
Miraj, Maharashtra, India

Manojeet Basak
Department of Orthopaedics
P.G.I. Swasthiyog Prathishthan
Miraj, Maharashtra, India

Krishna Kabra
Department of Orthopaedics
P.G.I. Swasthiyog Prathishthan
Miraj, Maharashtra, India

Corresponding Author:
Lokesh Yadav
Department of Orthopaedics
P.G.I. Swasthiyog Pratishthan
Miraj, Maharashtra, India

Clinical and functional outcome of total hip arthroplasty (cemented/ uncemented) in failed proximal femur fracture: A Prospective study

Milind G Kulkarni, Lokesh Yadav, Shreya Joshi, Prajwal BN, Manojeet Basak and Krishna Kabra

DOI: https://doi.org/10.22271/ortho.2020.v6.i2i.2101

Abstract
Background: Since its introduction in the 1960s, THA has proved to be an excellent and reliable treatment procedure for the end stages of hip pathology, with satisfactory clinicaloutcomes. However, the long-term survival of a THA is a multifactorial issue and numerous factors are also important in survival. Despite successful outcomes, THA revision rates have grown steadily in recent years and has become a challenging concern among orthopedic surgeons.
Aim: The present study was done to assess the clinical and radiological outcome of total hip arthroplasty in patients with failed neck of femur or intertrochanteric fractures.
Methodology: Sixty patients, aged more than 18 years, who failed osteosynthesis of neck of femur or intertrochanteric fracture were included in the study. For all patients, we used the posterior approach (Moore's). For all patients we noted the indication for re-operation. Functional assessment was done pre-operatively and immediate post- operatively using Harris Hip Score (HHS).
Results: The most common indication for revision surgery was fracture of the neck of femur (58.3%) followed by Intertrochanteric fracture (35%). Pre-operative mean HHS score was 33.95 ± 9.57 which increased significantly to 89.25 ± 6.59 (p value < 0.001). All the patients had HHS score less than 60 pre-operatively. Post-operatively, it was observed that none of the patients had HHS of less than 60 and one patient had HHS of 60 to 69. HHS of 70 to 79 was observed in 11.7%, 30% had HHS of 80 to 89 and 56.7% had HHS of 90 to 100. Post-operative complications included varus deformity of the femur in 25%, nerve injury in 1.7%, superficial infection in 6.7%, anterior thigh pain in 5% and osteolysis in 3.3%
Conclusion: It was found that the most common indication for revision THA was fracture neck of femur. Assessment with HHS pre- and post-operatively revealed significant improvement, in all subcomponents of HHS as well as the overall HHS

Keywords: Arthroplasty, cemented, uncemented, failed proximal femur fracture

Introduction
As the population is aging, fractures of the proximal aspect of the femur are becoming more common. The annual number worldwide is estimated to rise from 1.7 million in 1990 to 6.3 million by the year 2050. [1] Recent data indicate that the health related quality of life index is significantly impaired after a displaced fracture of the femoral neck compared with before the fracture and also compared with an undisplaced fracture. Femoral neck and intertrochanteric fractures are the most common fractures of the proximal.
Total hip arthroplasty (THA) is a highly successful and cost-effective intervention for addressing pain and functional deficits in patients with advanced hip disease. [2] For patients with hip pain due to a variety of conditions, THA can relieve pain, can restore function, and can improve quality of life. Although the results of THA are generally excellent, some prostheses eventually fail. In many such cases, revision surgery is performed. As a result, revision THA is often used as a proxy for implant failure. Long-term population-based studies have documented rates of THA failure of 1% per year or less, though there is considerable variation in revision rates among patient groups defined by factors such as age and sex [3].

Failure of total hip arthroplasty is most commonly due to instability, mechanical loosening, or infection. Complications such as limb-length discrepancy, tendon disorders, heterotopic ossification, and chronic pain all constitute extrinsic etiologies of failure. A systematic evaluation is crucial to identify the etiology, with a high index of suspicion for infection. Once the diagnosis has been established, the treatment can then be divided into surgical and nonsurgical options. An exploratory surgical procedure for the purpose of making a diagnosis in a patient with a painful total hip replacement is helpful.

Identifying risk factors for arthroplasty failure is challenging because revision arthroplasty is a relatively infrequent outcome that often occurs a decade or more after the primary procedure. Thus, individual studies require large sample sizes and/or lengthy follow-up periods to detect statistically and clinically significant differences in the risk of revision associated with purported risk factors. Several articles have identified risk factors for revision of primary THA based on data from registries or individual centres, and these findings represent a potential wealth of evidence on the effects of a range of risk factors on revision of primary THA.

There is limited data for the clinical outcomes of Indian patients who undergo revision THR procedure. Therefore, the present study evaluated the clinical and radiological outcome of total hip arthroplasty in patients with failed neck of femur or intertrochanteric fractures.

Aim

To study the clinical and radiological outcome of total hip arthroplasty in patients with failed neck of femur or intertrochanteric fractures.

Specific Objectives

1. To evaluate hip disabilities using the Harris Hip Score before and after undergoing THA.
2. To evaluate the proximal femur fracture radiologically before and after undergoing THA.
3. To understand the etiology of failure of fracture treatment.
4. Evaluate intra- and post-operative complications in patients undergoing THA.

Material and Methods

Study Area and Study Design

This prospective observational study was conducted at post graduate institute of Swasthiyog pratisthan miraj from July 1, 2017 to October 30 2019. The hospital caters to the healthcare needs of large population of Sangli district. Patients who failed prior treatment neck of femur or intertrochanteric fracture were included in the study. Complete information of the study, along with purpose of the study was given to patients in their vernacular language. A semi- structured case report form was used to collect patient related information in a systematic manner. The study was submitted to the Institutional Ethics Committee for approval before commencement.

Sampling technique

Consecutive type of sampling for the selection of study subjects was done. All patients who underwent THA at Department of Orthopedics, Post graduate Institute of Swathiyog Pratisthan were approached for inclusion in the study. All the patients fulfilling the inclusion and exclusion criteria during the study period were included in the study after taking their informed written consent.

Inclusion criteria

1. Patients with failed osteosynthesis of neck of femur fracture.
2. Patients with failed osteosynthesis of intertrochanteric fracture.
3. Aged more than 18 years

Exclusion criteria

1. Patients with failed primary arthroplasty /hemiarthroplasty (unipolar/bipolar)
2. Infected proximal femoral fixation
3. Refused consent.

Operative Procedure

Pre-operative preparation

Detailed history and proper clinical examination was done to find out: Duration of illness, focus of infection in the body, sensory motor examination, vascularity of limb, ambulatory status of the patient, deformities of the hip, ROM of the hip and status of the other joints. The deformity and ROM were measured with goniometer. All the patients were assessed using Modified Harris Hip Score pre- operatively. Radiogram of the pelvis with both hips with proximal half of shaft of femur AP view was taken for all patients.

Surgical technique

All surgeries were performed with absolute aseptic precautions in the operation theatre. In all cases a dose of intravenous antibiotic (ceftriaxone) was given prior to the incision. All patients were operated under combined spinal and epidural anaesthesia. In this study, the posterior approach (Moore's) also labelled as "The Southern Exposure" was followed [4] The patients were followed up at 6 weeks, 3 months, 6 months, one year and at yearly intervals. Patient follow up was for a minimum of 3 months to maximum of 24 months (2 years)

Outcome assessment

During each visit, medical history was taken and physical examination was done. Range of movements (ROM) was recorded. The clinical and functional outcomes were evaluated by Harris Hip Score evaluation [5].

Data Collection

All clinical information was abstracted from the patients and their medical records. Detailed history and proper clinical examination was done to find out duration of illness, sensory and motor examination, vascularity of the limb, ambulatory status of the patient, deformities of the hip using HHS, range of movements (ROM) of the hip, limb length discrepancy and status of the other joints using radiographs. The indication for re-operation were also be noted for all patients. Dimensions of the implant used in the current surgery were noted as well. The deformity, ROM and limb length discrepancy was measured for all the patients in the standard proforma. Immediate post-operatively, the patients were assessed using HHS and radiographs of the affected leg, apart from their usual postoperative and rehabilitative care. Any complications experienced by the patients were noted.

Data Analysis

The collected data were numerically coded and entered in Microsoft excel 2007 and then transferred to SPSS version 17. Quantitative data were described as means and standard deviations and qualitative data were described as median and

interquartile range. Normality of the data was checked using the Kolmogorov– Smirnov test. Means were compared using the paired t test for normal data and Wilcoxon signed rank test for not normal data. Categorical data were compared using the $\chi 2$ test. A two-sided p-value less than 0.05 was considered statistically significant. All analyses were performed using the Statistical Package of Social Sciences (SPSS).

Ethical Consideration

This research is carried out in India on human subjects adhering to the ICMR‟s ethical guidelines for biomedical research on human subject.

Results

Mean age of the 60 patients was 55.2 ± 13.76 years, ranging from 34 to 90 years. It was observed that 48% of the patients were between the age of more than 40 to 60 years and 30% of the patients were between the ages more than 60 to 80 years. Only 15% were aged 40 years or less. In the present study, 55% of the patients were females (n=33) and rest being males (45%, n=27). In our study population, the most common indication for revision surgery was fracture of the neck of femur (58.3%) followed by Intertrochanteric fracture (35%). Right side was affected in 51.7%.

Stem size of implant ranged from 9 to 14 mm. The most commonly used stem size was 11 mm and 13 mm (21.7% each). The next most commonly used stem size was 12 mm (in 16.7%) and 14 mm (in 15%). Head size used in our study population were either 28, 32 and 36. The most commonly used was 28 mm head size (in 65%). Head size of 32 and 36 mm was used in 21.7% and 13.3% respectively. Offset of +3 was most frequently used (31.7%). Offset of +1.5 was used in 26.7%, +3.5 in 18.3% and +5 in 23.3% of the patients. The shell size ranged from 50 to 58. The most commonly used shell size was 52 (25%). Shell size of 54 was used in 21.7%, shell size was 58 in 20%, shell size was 56 in 18.3% and shell size was 50 in 15% of the patients. The liner size used in this patient population was 28, 32 and 36. Liner size was 28 in 65%, 32 in 21.7% and 36 in 13.3% of the patients. We observed that acetabular angle was more than 50 degrees in 41.7% and less than 50 degrees in 58.3%. Acetabular coverage was good in 80% and average in 20%.

The means of individual HHS components pre- and post-operatively were compared. Mean pain score of HHS improved significantly from 12.83 to 41.6. Both the function scores improved, mean Function Gait score increased significantly from 10 to 26.95 and mean

Function Activity score also increased significantly from 5.38 to 12.03. Mean of Absence of deformity score improved from 3.4 to 4 and mean ROM score also improved significantly from 2.33 to 4.66. (Table 1)

It was observed that pre-operative mean HHS score was 33.95 ± 9.57 which increased significantly to 89.25 ± 6.59 (p value < 0.001). All the patients had HHS score less than 60 pre-operatively. Post-operatively, it was observed that none of the patients had HHS of less than 60 and one patient had HHS of 60 to 69. HHS of 70 to 79 was observed in 11.7%, 30% had HHS of 80 to 89 and 56.7% had HHS of 90 to 100. (Table 2)

Post-operative complications included varus deformity of the femur in 25%, nerve injury in 1.7%, superficial infection in 6.7%, anterior thigh pain in 5% and osteolysis in 3.3%. (Table 3)

Table 1: Comparing pre- and post-operative scores of individual HHS components

HHS components	Mean	Std. Deviation	Std. Error Mean	p value
Pain - Pre op	12.833	4.5442	0.5867	<0.001
Pain - Post op	41.6	4.2594	0.5499	
Function Gait - Pre op	10	8.4111	1.0859	<0.001
Function Gait - Post op	26.95	5.1038	0.6589	
Function activity - Pre op	5.383	2.6303	0.3396	<0.001
Function activity - Post op	12.033	1.3525	0.1746	
Absence of deformity - Pre op	3.4	1.4403	0.1859	<0.01
Absence of deformity - Post op	4	0	0	
ROM Score - Pre op	2.333	1.3105	0.1692	<0.001
ROM Score - Post op	4.667	0.4754	0.0614	

Table 2: Comparing pre- and post-operative HHS scores

HHS	Mean	Std. Deviation	Std. Error	p value
Total score - Pre op	33.95	9.5712	1.2356	<0.001
Total score - Post op	89.25	6.5938	0.8513	
HHS score	**Pre-operative**		**Post-operative**	
	N	%	N	%
Less than 60	60	100	0	0
60 to 69	0	0	1	1.7
70 to 79	0	0	7	11.7
80 to 90	0	0	18	30
90 to 100	0	0	34	56.7
Total	60	100	60	100

Table 3: Distribution of patients according to the post-operative complications

Post-operative complications	Frequency	Percent
Femoral - Varus		
No	45	75
Yes	15	25
Nerve injury		
No	59	98.3
Yes	1	1.7
Superficial infection		
No	56	93.3
Yes	4	6.7
Anterior Thigh Pain		
No	57	95
Yes	3	5
Osteolysis		
No	58	96.7
Yes	2	3.3
Total	60	100

Discussion

Lim *et al* compared the functional outcomes and survivorship of acetabulum-only revision total hip arthroplasty (ArTHA) with an age-matched and gender- matched total revision THA (TrTHA) group [6]. A total of 269 patients underwent TrTHA with a mean age of 72 ± 9 years and Female: Male ratio of 165:104. Patil *et al* assessed the clinical and functional outcome and complications of uncemented THA in failed primary hemiarthroplasty. In their study, age of patients ranged between 56 years to 70 years and majority of the patients were in the middle age group and male patients constitute 66.6%. Viste *et al* determined the clinical outcomes, implant survivorship, and complications of proximal femur replacements used in revision THA for indications other than malignancy [7]. Their mean age was 79 years (53 to 97); 31 (70%) were women. Im *et al* evaluated clinical and radiological outcomes of revision surgery with ceramic-on-ceramic components after ceramic bearing fractures in young (i.e., under 60 years old) and active patients [8]. In their study, the mean ages at the time of the initial and revision operations were 39 years (range, 31-50 years) and 43.8 years (range, 33-60 years) years old, respectively. Kock *et al* analysed the long-term outcome of revision hip arthroplasty using Bioball adapter system in highly morbid elderly patients [9]. The most frequent indications for revision hip arthroplasty were implant loosening and/or dislocation in 10 patients.

In our study population, the most common indication for revision surgery was fracture of the neck of femur (58.3%) followed by Intertrochanteric fracture (35%). Angerame *et al* valuated the incidence of early failure of primary THA [10]. Among 6,894 primary THAs included, there were 103 revisions overall. The most common indication for performing total THA in the study by Lim *et al* was aseptic loosening (61.5%), followed by infection (23.7%), dislocation (7.4%), fracture (2.7%), unexplained pain (2.3%), instability (1.9%) and none had implant failure. In the study by Patil *et al*, the main indication for surgery was pain in all the patients associated with the problems related to the implant used in primary hip arthroplasty [11]. Gwam *et al* studied the inpatient sample database to identify all revision THA performed from 2009 to 2013 in the US. [12] The most common etiologies of revision THA procedures were dislocation (17.3%), closely followed by mechanical loosening (16.8%). The remaining etiologies associated with revision THA included other mechanical problems of prosthetic joint implant (13.4%), infection/inflammation (12.8%), periprosthetic osteolysis (5.7%), periprosthetic fracture (4.8%), bearing surface wear (4.7%), implant failure/breakage (3.3%), and other mechanical complication of other internal orthopedic device, implant, or graft (2.6%). In the study by Viste *et al* the indications for the use of a proximal femur replacement included aseptic loosening (n= 16; 36.4%), peri-prosthetic fracture (n = 15; 34%), prosthetic joint infection (PJI) (n= 12; 27.3%), and instability (n = 1; 2.3%) [13].

In our study, stem size ranged from 9 to 14 mm and the most commonly used stem size was 11 mm and 13 mm (21.7% each). The most commonly used head size was 28 mm (in 65%), shell size was 54 (in 21.7%) and liner size was 28 in 65%. Patil *et al* used stem size of 11, head size of 28 and shell size of 52 most commonly in their patients of revision THA [11] In our study, the offset of +3 was used most frequently in our study population (31.7%). Offset of +1.5 was used in 26.7%, +3.5 in 18.3% and +5 in 23.3% of the patients.

We observed that pre-operative mean HHS score was 33.95 ± 9.57 which increased significantly to 89.25 ± 6.59 (p value < 0.001). Patil *et al* demonstrated that average pre- operative HHS of 45.25 improved to 81.66 post operatively after revision THA at last follow- up. [11] In the study by Viste *et al*, mean HHS increased from 42.8 (SD 20) pre-operatively to 68.5 (SD 15.6) post- operatively (p = 0.0009) for all patients [13]. Clinical evaluations in the study by Im *et al* revealed that the average HHS improved from 63.2 points (range, 41-82 points) to 91.8 points (range, 86-96 points) (p=0.01) [8] Favorable HHS outcomes were achieved in all cases (excellent, 5; good, 3). Bhosale *et al* retrospectively analyzed the functional outcome, assess survivorship of revision total hip arthroplasty (THA) at mid to long term follow up. [14] Average HHS improved from 65 preoperatively (range 42–73) to 87 (range 76–90) at 1 year follow up and to 86 (range 75–89) till the last follow up.

It is well known that revision THA is commonly associated with a higher complication rate, associated with more extensive blood loss and a longer operative time, than primary THA. [15] Surgeons are generally more cautious when selecting patients for revision THA as patients are older and often less healthy than they were at the time of the primary arthroplasty [16]. Despite that, Parvizi *et al* demonstrated that revision THA can provide substantial clinical benefits to octogenarians and the prevalence of medical complications did not appear to differ significantly when compared to younger patients [17] In our study, post- operative

complications included varus deformity of the femur in 25%, nerve injury in 1.7%, superficial infection in 6.7%, anterior thigh pain in 5% and osteolysis in 3.3%. In the study by Patil *et al*, about 30% of the cases presented with pain postoperatively till the last follow-up, of which two cases reported mild pain with no effect on average activities and one case reported with moderate pain with some limitation of ordinary activity or work [11] Two cases presented with anterior thigh pain and one case with foot drop which was not recovered till their last follow-up. In a study published by Springer *et al*, they studied 1100 hips that underwent revision THA and followed them up for a minimum of 24 months [18] Out of the patients that underwent revision for aseptic loosening and then subsequently underwent a re-revision (15%), 5% had infection as the second revision diagnosis. Out of the patients who underwent original revision for instability and then had re-revision (12%), the prevalence of infection was 10%. In the study by Viste *et al*, 27% of the patients had a complication [13] The most common was dislocation, which occurred in 13.6% at a mean of two years post-operatively, followed by infection and intra- operative periprosthetic fracture (two of each, treated with wiring), aseptic loosening (one) and wound drainage requiring irrigation and debridement, and revision closure (one). Bhosale *et al* reported the overall complication rate to be 4.5%, deep infection occurred in two patients, loosening occurred in two patients after 10 years follow up, 5 patients had limb length discrepancies (<2.5 cm), six patients had persistent groin pain [14]. Heterotopic ossification and distal neurovascular deficits were not observed in any of our patients.

In addition, revision THA is thought to be associated with lower patient satisfaction and less functional improvement than primary THA [19]. Eisler *et al* further reported that patients actually have high expectations regarding revision THA: 92% of 66 consecutive revision THA patients expected to have much less pain and 82% of them expected the same walking ability as with primary THA, following revision THA [20]. This needs to be investigated further, as we could not assess patient satisfaction rates in our study.

Conclusion

The study demonstrated that revision THA can improve the clinical and functional outcomes significantly with minimal complications. However, the co-morbidities and the cost of the procedure can be prohibitory for a number of patients. Further studies are needed to analyse the etiology and other factors which result in revision surgeries. Also, patient and surgery related factors need to be identified which affect the clinical outcomes of revision THA. Gathering such scientific evidence will help in generating a consensus among experts, which can be used to standardize the surgical approach and post-operative rehabilitation protocols.

Limitations of the study

The clinical outcomes of patients undergoing revision THA would depend on the experience and technique of the operating team. Therefore, the results of our single centre study should be applied to other surgical centres with caution. In addition, financial constraints forced many patients to refuse revision surgery, due to which we could not accurately assess the etiology leading to revision THA. Furthermore, we did not note the surgical approach used in the primary THA in our patients, as different techniques have been associated with varying rates of revision [10] Lastly, long term follow up studies are required to ascertain if revision THA can improve the quality of life of the patients and overall survivorship.

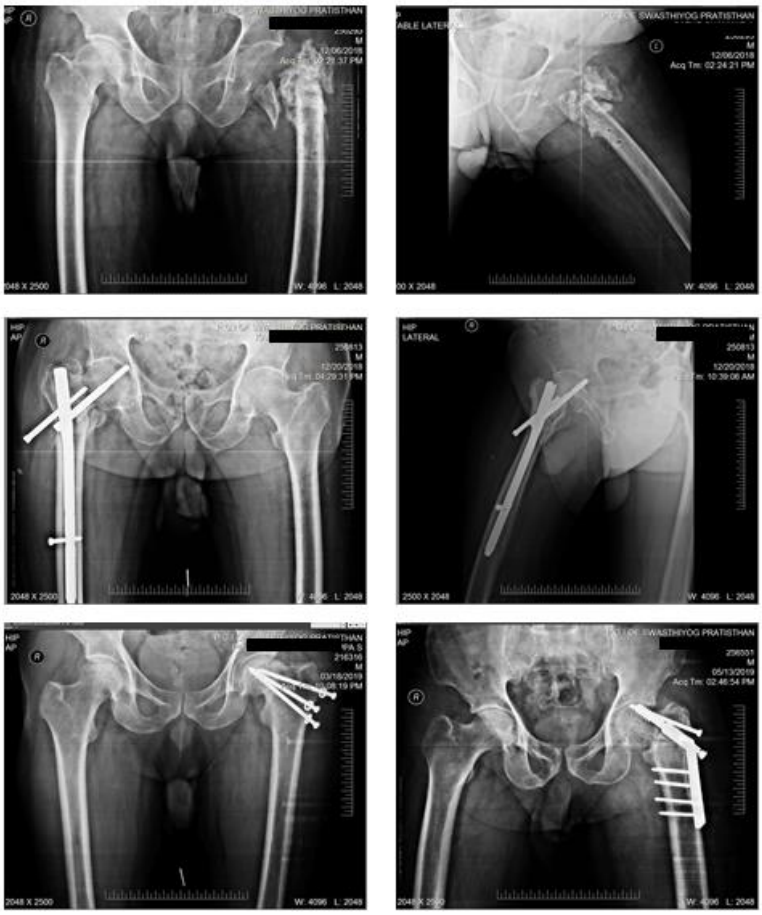

Fig 1: Pre-operative x-rays of various patients included in the study

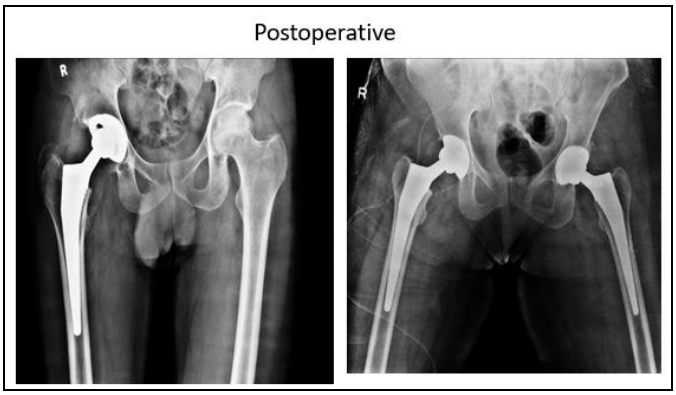

Fig 2: X-ray findings pre- and post-operatively

Fig 3: Clinical examination pre- and post-operatively

References

1. Cooper C, Campion G, Melton LJ. Hip fractures in the elderly: a world-wide projection. Osteoporos Int. 1992; 2(6):285-9.
2. Berry DJ, Harmsen WS, Cabanela ME, Morrey BF. Twenty-five-year survivorship of two thousand consecutive primary Charnley total hip replacements: factors affecting survivorship of acetabular and femoral components. J Bone Joint Surg Am. 2002; 84(2):171-7.
3. Corbett KL, Losina E, Nti AA, Prokopetz JJZ, Katz JN. Population-based rates of revision of primary total hip arthroplasty: a systematic review. PLoS ONE. 2010; 5(10):e13520.
4. Moore AT. The self-locking metal hip prosthesis. J Bone Joint Surg Am. 1957; 39- A(4):811-27.
5. Söderman P, Malchau H. Is the Harris hip score system useful to study the outcome of total hip replacement? Clin Orthop Relat Res. 2001; (384):189-97.
6. Lim JW, Ridley D, Johnston LR, Clift BA. Acetabulum-Only Revision Total Hip Arthroplasty Is Associated With Good Functional Outcomes and Survivorship. J Arthroplasty. 2017; 32(7):2219-2225.e1.
7. Viste A, Perry KI, Taunton MJ, Hanssen AD, Abdel MP. Proximal femoral replacement in contemporary revision total hip arthroplasty for severe femoral bone loss: a review of outcomes. Bone Joint J. 2017; 99-B(3):325-9.
8. Pubmeddev IC *et al*. Revision Total Hip Arthroplasty after Ceramic Bearing Fractures in Patients Under 60-years Old; Mid-term Results. - PubMed - NCBI [Internet]. [cited 2020 Mar 20]. Available from: https://www.ncbi.nlm.nih.gov/pubmed/30202749
9. Kock H-J, Cho C, Buhl K, Hillmeier J, Huber FX. Long-term outcome after revision of hip arthroplasty with the BioBall® adapter system in multimorbid patients. Journal of Orthopaedic Translation [Internet]. 2019 Sep 1 [cited 2020 Mar 20]; Available from: https://www.scilit.net/article/354f7cc77ac8f6e46f5f3c053934c881
10. Angerame MR, Fehring TK, Masonis JL, Mason JB, Odum SM, Springer BD. Early Failure of Primary Total Hip Arthroplasty: Is Surgical Approach a Risk Factor? J Arthroplasty. 2018; 33(6):1780-5.
11. Patil PH, Pamarathi S. Assessment of clinical and functional outcomes following uncemented total hip arthroplasty in failed primary hemiarthroplasty. In, 2017.
12. Gwam CU, Mistry JB, Mohamed NS, Thomas M, Bigart KC, Mont MA *et al*. Current Epidemiology of Revision Total Hip Arthroplasty in the United States: National Inpatient Sample 2009 to 2013. J Arthroplasty. 2017; 32(7):2088-92.
13. Viste A, Perry KI, Taunton MJ, Hanssen AD, Abdel MP. Proximal femoral replacement in contemporary revision total hip arthroplasty for severe femoral bone loss: a review of outcomes. Bone Joint J. 2017; 99-B(3):325-9.
14. Bhosale P, Suryawanshi A, Mittal A. Total hip arthroplasty for failed aseptic Austin Moore prosthesis. Indian J Orthop. 2012; 46(3):297-303.
15. Stathopoulos IP, Lampropoulou-Adamidou KI, Vlamis JA, Georgiades GP, Hartofilakidis GC. One-component revision in total hip arthroplasty: the fate of the retained component. J Arthroplasty. 2014; 29(10):2007-12.
16. Koenig K, Huddleston JI, Huddleston H, Maloney WJ, Goodman SB. Advanced age and comorbidity increase the risk for adverse events after revision total hip arthroplasty. J Arthroplasty. 2012; 27(7):1402-1407.e1.
17. Parvizi J, Pour AE, Keshavarzi NR, D'Apuzzo M, Sharkey PF, Hozack WJ. Revision total hip arthroplasty in octogenarians. A case-control study. J Bone Joint Surg Am. 2007; 89(12):2612–8.
18. Springer BD, Fehring TK, Griffin WL, Odum SM, Masonis JL. Why revision total hip arthroplasty fails. Clin Orthop Relat Res. 2009; 467(1):166–73.
19. Jibodh SR, Kandil AO, Malchau H, Estok DM. Do commonly reported outcome measures reflect patient satisfaction after revision hip arthroplasty? J Arthroplasty. 2010; 25(1):41-5.
20. Eisler T, Svensson O, Tengström A, Elmstedt E. Patient expectation and satisfaction in revision total hip arthroplasty. J Arthroplasty. 2002; 17(4):457-62.