

## Study of Early Clinical and Radiological Outcomes of Cementless Total Hip Arthroplasty in Young Adults

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### ABSTRACT

**Background:** The majority of people with hip arthritis get significant pain alleviation after undergoing total hip replacement.

**Objective:** Evaluation of both early clinical as well as radiological outcomes of cementless total hip arthroplasty in young adults.

**Subjects and Methods:** This was an interventional clinical trial that included 18 patients who were recruited from Orthopedic Department and had osteoarthritic hip who were treated with total hip arthroplasty (THA). Harris hip score (HHS) was utilized for clinical evaluation at 6 weeks, 3 months, and 6 months after surgery, and radiographs were evaluated for loosening signals at the end of 3 months and 6 months.

**Results:** All HHS items improved significantly from  $28.3 \pm 15.9$  to become  $85.9 \pm 6.7$  with a p-value  $< 0.001$  and the percent of improvement (70.4%) ranged from 43.1% to 89.2%. Postoperative HHS was significantly higher in patients without complications compared to those with complications, among males when compared to females, in cases under the age of 60 compared to those over the age of 60, and in cases with osteoarthritis compared to those who had avascular necrosis.

**Conclusion:** Cementless total hip arthroplasty (THA), offers promising outcomes where it led to pain reduction, functional recovery, and enhanced quality of life.

**Keywords:** Total hip arthroplasty, Cementless, Arthritic, Pain.

### INTRODUCTION

For patients with end-stage arthritic hip conditions, total hip arthroplasty (THA) is a successful treatment. Pain is reduced, mobility is improved, and function is recovered. The term "young" among studies for hip arthroplasty differs; typically, patients under the age of 60 are considered "young" <sup>(1)</sup>. Primary THA incidence rates increased by 30%. (101 to 131 per 100,000). Primary THAs increased across the board, with the highest rate seen in individuals aged 50–59 and the lowest seen in those aged 10–49 <sup>(2)</sup>.

The average age of patients receiving total hip replacement (THR) has dropped as a result of developments in implant technology. Mechanical failure is more common in younger people and those who engage in strenuous physical exercise <sup>(3)</sup>. Surgeons replace the damaged hip joint parts with new ones that are typically made of metal, ceramic, or very hard plastic during hip replacement surgery. This prosthetic joint (artificial joint) aids in pain relief and improved function. Hip replacement surgery, commonly known as total hip arthroplasty, may be an option if hip discomfort and severely interfering with daily life and other nonsurgical therapies that either failed or are no longer working <sup>(4)</sup>.

Total hip arthroplasty (THA) is recommended for patients who have undergone conservative treatment or prior surgery but still experience persistent, incapacitating pain and a significant reduction in daily living activities. Patients with significant motion restrictions and deformities might also qualify if they suffer from a significant disability that persists even in the absence of pain. Understanding the potential advantages and risks helps in making the decision to move forward with THA. An essential component of the

decision-making process is having a thorough understanding of the procedure and the expected result <sup>(5)</sup>.

The following are some potential risks of hip replacement surgery: Blood clots can develop in the veins of the legs (DVT). Both the incision site and the deeper tissue around the artificial hip are at risk for infection. Fracture of stable parts of the hip joint during surgery. Dislocation during the first few months following surgery. Leg length discrepancy. Loosening resulting in hip pain. Nerve damage resulting in pain, weakness, and numbness <sup>(6)</sup>. Pain can be drastically decreased because to the practically universal success of total hip replacement in treating arthritic hip pain. Increased mobility comes next in terms of importance after pain reduction <sup>(7)</sup>.

It was the goal of our study, evaluation of both early clinical as well as radiological outcomes of cementless total hip arthroplasty in young adults.

### SUBJECTS AND METHODS

Total Hip Arthroplasty was the intervention of choice in this prospective study of 18 patients admitted to the Orthopedics Ward with hip osteoarthritis.

**Inclusion criteria:** Cases indicated for total hip arthroplasty in age younger than 60 years old as: pain, functional limitation, stiffness, radiographic changes, both genders have been included, and who were surgically fit patients.

**Exclusion criteria:** Cases who had any active infection focus, the age is above 60, patients with multiple traumatic injuries who also require surgery, patients

whose health makes it unsafe for them to undergo anaesthesia and who are considered surgically unsuitable, who had substantial damage to the soft tissues around the surgical incision, such as burns or necrosis, cases who refused to participate and psychotic patients.

**All cases undergone the following:**

**1- Preoperative evaluation:** Counseling the patient, conducting a clinical assessment, etc. Radiological evaluation (standard radiographs; AP & lateral views, and CT scan). All cases were evaluated by Harris hip score. Preoperative preparation of the patient (routine preoperative laboratory investigations, ECG and Echocardiography if needed).

**2. Clinical evaluation.**

**3. Radiological evaluation:** Traditional X-rays are a part of the normative radiologic examination. Additionally, CT thin-section imaging (CT).

**4. All cases were evaluated by Harris hip score (HHS),** in which patient is given a score <sup>(8)</sup>.

**Surgical approach (Figures 1 & 2):**

In lateral position, Hardinge's direct lateral approach was used. When the gluteus medius and minimus muscles are divided, the acetabulum is well exposed, allowing for anterior dislocation of the hip. Sutures for the gluteus medius and minimus are preserved by locating the gluteus medius muscle, which is split in two at its lower third (the Raddi procedure). Removing the labrum reveals the complete acetabular rim. After the femur has been properly prepared, the trial cup is taken out and the permanent cup is put in. Try moving it about and seeing how stable it is. After numerous heavy hammer blows, the cup's impact tone will alter, indicating that it is securely in place. The femur is reamed in an upward and outward motion to make room for the femoral stem. After inserting the trial neck of the femoral stem with the trial/rasp in the prepared femur, attach the selected trial neck. The trial neck length collar was fully inserted with the correct trial head that matched the cup bore size. Trial reduction was followed by evaluations of leg length, stability, impingement, and range of motion.

Insert the permanent stem implant after removing the trial components. Once you have the right neck and head trial model, try again. Hip reduction to prevent collision of articular components or head rubbing against cup rim. Check your flexibility, balance, and leg length again.

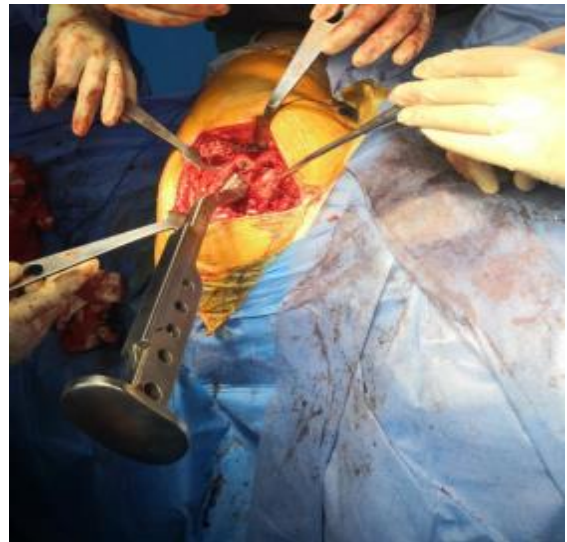
**Post operative radiological evaluation for hip prosthesis zones:**

Hip prosthesis zones are the regions where the prosthesis material and the surrounding bone interface after hip replacement. When describing issues like hip prosthesis loosening on medical imaging, for instance, these are used as reference regions. Projectional radiography is frequently used to perform postoperative controls following hip replacement surgery in the anteroposterior and lateral views.

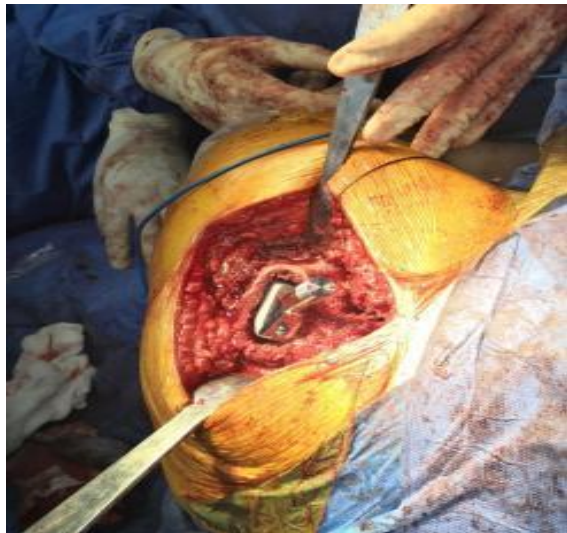
**DeLee and Charnley:**

Anteroposterior radiographs of the acetabular cup use the DeLee and Charnley system. It creates three equally sizeable zones in the acetabulum: the superior 1/3 zone, middle 1/3 zone, and inferior 1/3 zone.

Postoperative evaluation was performed at regular intervals in the first year at three months interval, then yearly for 5 years and evaluated by Harris hip score.



**Fig. (1):** Reaming the femur gradually upward to prepare it for the femoral stem.



**Fig. (2):** Original femur stem.

**Ethical approval:** This study was approved by The Ethical Board, Faculty of Medicine, Zagazig University. After being fully informed, all participants provided written consents. The study was conducted out in line with the Helsinki Declaration.

**Statistical analysis**

The quantitative research was carried out using SPSS for Social Sciences, version 20. (SPSS). The data were presented in the form of tables and charts. Means, medians, standard deviations, and confidence intervals were displayed with the numerical data. Data visualisations made use of numerical examples, such as frequency and %. The student's t test (T) was frequently

used for analysing quantitative data with independent variables. Using Pearson’s Chi-Square and Chi-Square for Linear Trend, we analysed data that was qualitatively different from one another ( $X^2$ ). To be statistically significant, we determined that a P value of 0.05 or lower was necessary.

**RESULTS**

Table (1) showed that study participants ranged in age from 28 to 52 years, with 55.6% being under the age of 40. More than half (61.1%) were males and 38.9% were females. 50% were afflicted on the left side and 50% on the right. The most prevalent kind of joint damage was avascular necrosis (72.2%), followed by osteoarthritis (27.1%) among the study population.

**Table (1):** Demographic, affected sites and pathology characteristics of the studied cases

	Number= (18)	%
<b>Age (in years)</b>		
Mean ± SD	41.4±7.4	
Median	40	
(Range)	(28-52)	
<b>Age (years)</b>		
Less than 40 years	10	55.6%
40 years or more	8	44.4%
<b>Sex</b>		
Male	11	61.1%
Female	7	38.9%
	<b>The studied group</b>	
<b>Variables</b>	No= (18)	%
Left	9	50.0%
Right	9	50.0%
<b>The pathology</b>		
Osteoarthritis	5	27.8%
Avascular necrosis	13	72.2%

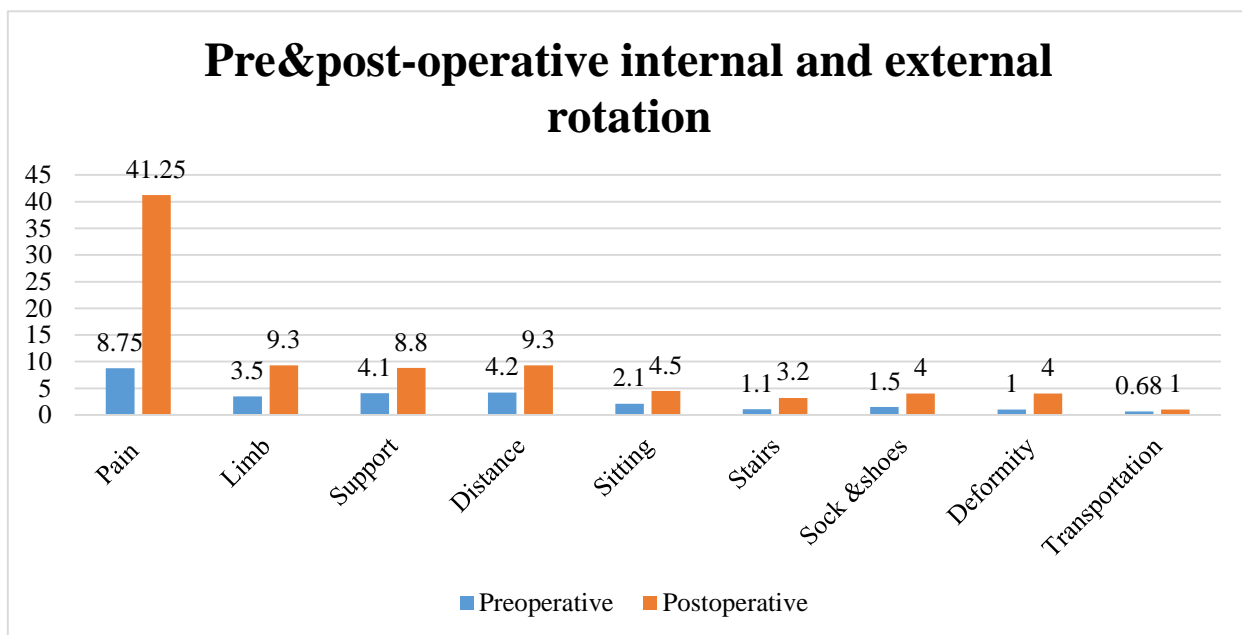
According to the data presented in table (2), 89% of the study population experienced no complications whatsoever, while 5.5% experienced a surgical site infection that was successfully treated with parental antibiotics for 2 weeks and 5.5% experienced a hematoma that was successfully treated by early drain removal and frequent squeezing.

**Table (2):** Complications post-operative among cases

Complications	The studied group	
	Number= (18)	%
None	16	88.9%
Infection	1	5.5%
Hematoma	1	5.5%

In figure (3), All HHS metrics showed statistically significant improvement (p-value<0.001) where:

- Pain was improved from  $8.75 \pm 6.2$  ranging from 0 to 20 to become  $41.25 \pm 1.9$  ranging from 40 to 44. Limb was improved from ( $3.5 \pm 2.9$ ) ranged from 0 to 8 to be ( $9.3 \pm 1.5$ ) ranged from 8 to 11.
- Support improved since ( $4.1 \pm 1.2$ ) ranging from 2 to 7 to become  $8.8 \pm 2.1$  ranging from 7 to 11. Distance was improved from  $4.2 \pm 2.1$  ranging from 2 to 8 to become  $9.3 \pm 1.5$  ranging from 8 to 11.
- Sitting was improved from  $2.1 \pm 1.8$  ranging from 0 to 5 to become  $4.5 \pm 0.89$  ranging from 3 to 5. Stairs were improved from  $1.1 \pm 0.95$  ranging from 0 to 2 to become  $3.2 \pm 1$  ranging from 2 to 4.
- Socks & shoes were improved from  $1.5 \pm 1.4$  ranging from 0 to 4 to become  $4 \pm 0.1$  ranging from 4 to 4. Deformity was improved from  $1.0 \pm 1.8$  ranging from 0 to 4 to become  $4 \pm 0.1$  ranging from 4 to 4. Transportation was improved from ( $0.68 \pm 0.48$ ) ranging from 0 to 1 to become ( $1 \pm 0.1$ ) ranging from 1 to 1.



**Fig (3):** Bar chart for the pre and postoperative items of HHS among the studied group.

In table (3), Half of the instances had a good outcome (33.3%), one-third had an exceptional outcome (55.6%), and only two cases (11.1%) had a mediocre outcome.

**Table (3):** The post-operative Harris Hip scores among the studied group

The post-operative HHS	The studied group	
	No= (18)	%
Fair	2	11.1%
Good	6	33.3%
Excellent	10	55.6%

In table (4), 11 HHS items improved significantly (increased) with significant increase (improvement). Regarding Harris Hip score, it increased from  $28.3 \pm 15.9$  to become  $85.9 \pm 6.7$  with a p-value < 0.001 and the percent of improvement (70.4%) ranged from 43.1% to 89.2%.

**Table (4):** comparison between pre-operative Has well as Postoperative Harris Hip scores among cases

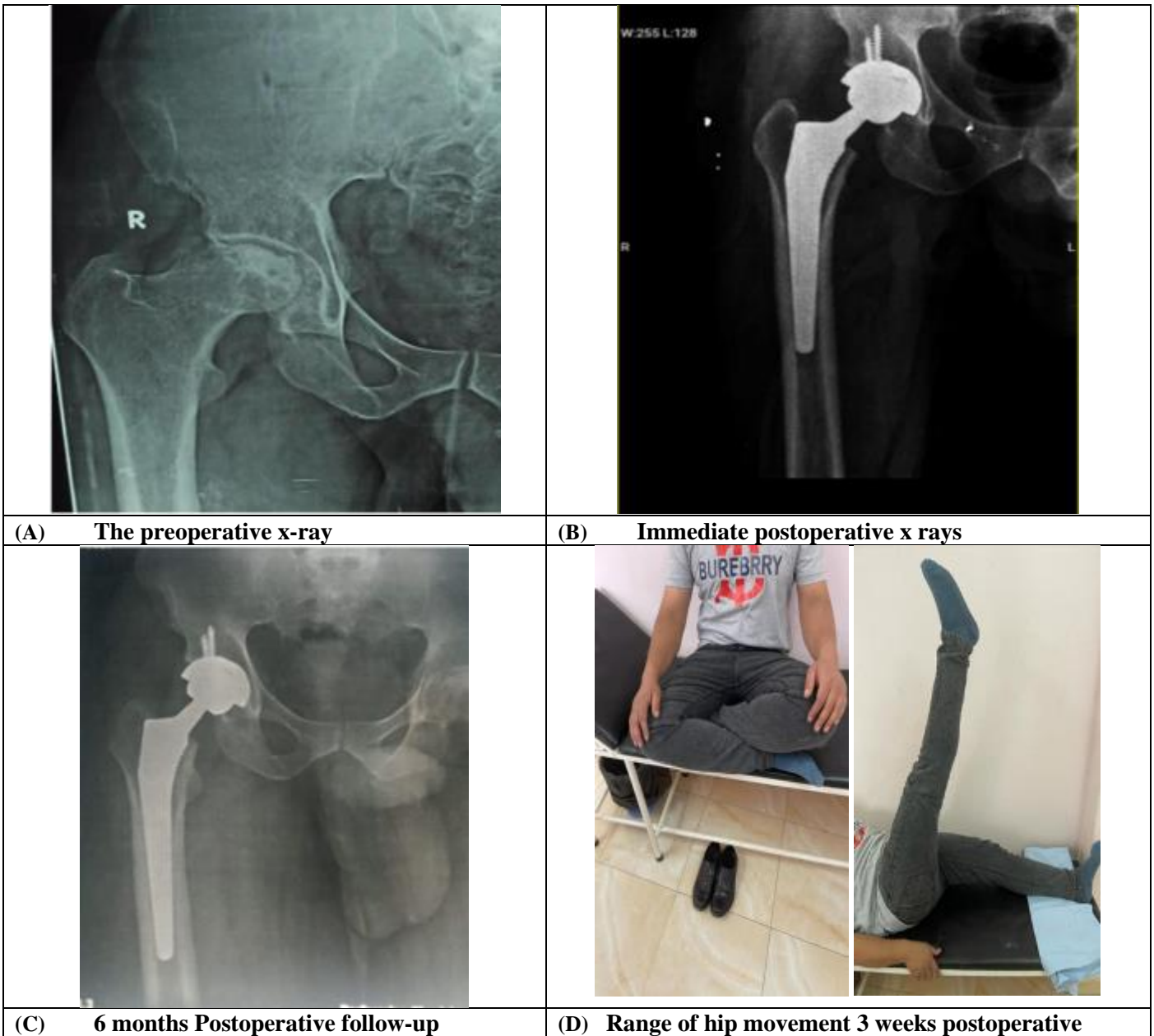
Harris Hip Score	Pre-operative Mean $\pm$ SD Median (Range)	Post-operative Mean $\pm$ SD Median (Range)	Paired t-test	p-value
HHS	$28.3 \pm 15.9$ 32 (9-53)	$85.9 \pm 6.7$ 87.5 (77-93)	25.9	<b>0.001</b> **
Percent of improvement	70.4% (43.1%-89.2%)			

\*\*Statistically highly significantly different

Table (5) showed that postoperative HHS was significantly higher in patients without complications compared to those with complications, in men compared to females, in younger patients compared to older patients, and in patients with osteoarthritis compared to those with avascular necrosis. There was no statistically significant correlation between Harris Hip score and the side of the body afflicted.

**Table (5):** Correlation between patients' characters as well as Post-operative Harris Hip score and among cases

	HH score Post-operative Mean $\pm$ SD	Test	
		T	p-value
<b>Sex</b>			
Male (no.=11)	$89.8 \pm 4.1$	2.6	<b>0.009</b> *
Female (no.=7)	$82.7 \pm 6.3$		
<b>Age</b>			
Less than 40 years (no.=10)	$90.5 \pm 3.5$	7.6	<b>0.001</b> **
40 years or more (no.=8)	$79.3 \pm 2.4$		
<b>Affected side</b>			
left (no.=9)	$86.6 \pm 5.2$	0.5	0.6
Right (no.=9)	$84.8 \pm 7.3$		
<b>Pathology</b>			
Osteoarthritis (no.=5)	$92.2 \pm 1.1$	3.5	<b>0.001</b> **
Avascular necrosis (no.=13)	$85.0 \pm 3.3$		
<b>Postoperative complications</b>			
Yes (no.=2)	$81.0 \pm 0.1$	3.1	<b>0.004</b> *
No (no.=16)	$86.1 \pm 6.6$		



**Fig. (4):** Male, 31 years old, manual worker from Belbis. Patient had covid-19 infection 1.5 years ago, and was treated by medical treatment including corticosteroids, after 3 months of treatment, he began complaining from limping and hip pain, by examination and x-ray, he was diagnosed RT hip AVN with failed conservative measures. THR was done. Diagnosis: Postcovid-19 AVN Rt hip due to corticosteroid therapy. Follow up period: 6 months with no complications.

## DISCUSSION

For people with a wide variety of severe hip joint issues, total hip arthroplasty (THA) is a very effective and commonly utilized operation. Today, patients have higher expectations for their recovery after THA, taking into consideration quality of life difficulties and recreational choices<sup>(9)</sup>. As implant technology has advanced, the median age of patients undergoing total hip replacement (THR) has declined. Young age and strenuous physical exercise are known to increase the likelihood of mechanical failure.

We performed this study for evaluation of both early clinical as well as radiological outcomes of cementless total hip arthroplasty in young adults.

**In our study**, the studied group mean age was  $41.4 \pm 7.4$  years ranged from 28 to 52 years and less than 40 years were 55.6% of the studied group. Regarding sex, more than half of them (61.1%) were males, and 38.9% were females. This coincides with **Hernandez et al.**<sup>(10)</sup> who reported that studied group mean age was 35.7 years, 43.1% of patients were women. However, **Navas et al.**<sup>(11)</sup> reported the mean age of the studied group was  $31.5 \pm 5$  (19–39) years and Female patients were 36% while male patients represented 64% of the studied group.

Regarding the affected side of the studied group, half (50.0%) of the studied group were left-sided affected and half of them (50.0%) were right-sided. That is in agreement with **Navas et al.**<sup>(11)</sup>.

Regarding the pathology among the studied group, in the population under study, avascular necrosis was the most prevalent (72.2%), followed by osteoarthritis (28%). However, **Navas et al.**<sup>(11)</sup> showed the leading to arthroplasty were secondary osteoarthrosis due to femoroacetabular impingement syndrome (FAIS) in 6 hips (15%), developmental dysplasia (DDH) in 19 hips (47.5%), trauma in 10 hips (25%), and avascular necrosis of the femoral head (AVN) in 5 hips (12.5%). Additionally, **Berliner et al.**<sup>(12)</sup> reported osteoarthritis in 88.4%, femoral neck fracture in 5.2 %, and avascular necrosis in 2.5 %.

The collapse of the femoral head and the development of osteoarthritis are common complications of avascular necrosis. Creation of devices with porous coatings designed for bone ingrowth fixation are the optimum treatment for femoral head avascular necrosis in advanced stages is THA<sup>(13)</sup>. Additionally, **Docter et al.**<sup>(14)</sup> who examined 69 studies with a total of 283k participants between 1987 and 2019. These included 19 RCTs, 14 prospective cohort studies, and 36 retrospective cohort studies. There was a significant decrease in anterior dislocation risk (RR 0.66, 95 percent CI 0.54-0.77, p 0.01), posterior approach than the anterolateral or lateral one (RR 0.50, 95% CI 0.32-0.77, p = 0.03) or the lateral one (RR 0.74, 95% CI 0.58-0.96, p = 0.02). In contrast to the posterior approach, which was found to have a lower risk of loosening, the lateral and anterolateral methods were

associated with a significantly higher risk (RR 1.21, 95% CI 1.02-1.44, p = 0.03).

**In our study**, Eighty-nine percent of the study population experienced no complications, one case (5.5%) had a surgical site infection treated by parental antibiotics for 2 weeks and one case (5.5%) had a hematoma, which was treated by early removal of drain and frequent squeezing. While, **Hernandez et al.**<sup>(10)</sup> reported that ninety-day complications included 26 visits to the emergency room, 11 readmissions, 3 revisions, and 3 dislocations. Adverse local tissue reaction following a metal-on-metal (MOM) total hip arthroplasty (16 hips) and periprosthetic joint infection (6 hips) were the most frequent causes of revision. Sickle cell disease (SCD) and conversion THA were connected with 90-day readmissions in a multivariate logistic regression model. Revision was connected to both MOM THA and SCD (P<.05).

In contrast to the findings of **Lee et al.**<sup>(15)</sup>, who reported that one patient with antiphospholipid antibody syndrome experienced symptomatic deep vein thrombosis on day 8, our investigation found no incidence of DVT among whole individuals managed through THA. During the observation period, there were no cases of dislocation, periprosthetic joint infection, or ceramic component fracture. **Shin and Moon**<sup>(16)</sup> reported in the last follow-up, the average HHS rose from 67.47 before surgery to 97.42 after (p < 0.001). **Reddy et al.**<sup>(17)</sup> revealed that HHS showed statistically significant increase in function. The average HHS was 43 before surgery and rose dramatically to 89 afterwards. Pain was reduced, functional capacity was enhanced, and range of motion was increased, as evidenced by the results (Harris hip score  $\geq 80$ ). After 12 months, all 30 patients had a pain score of 44 (total relief of pain), representing the most significant improvement.

In our study regarding post-operative HHS among the studied group, more than half of the studied group (55.6%) had an excellent outcome, about one-third (33.3%) had a good outcome, while only two cases (11.1%) had a fair outcome. This is in agreement with **Reddy et al.**<sup>(17)</sup> who reported that the outcomes for everyone were quite excellent. Additionally, **Karimi et al.**<sup>(18)</sup> reported that 29 (97%) patients had excellent and only 1 (3%) patient had a good outcome.

In our study, All HHS items improved significantly with significant increase in HHS from  $28.3 \pm 15.9$  to become  $85.9 \pm 6.7$  with a p-value < 0.001 and the percent of improvement (70.4%) ranged from 43.1% to 89.2%. This coincides with **Lee et al.**<sup>(15)</sup> who reported that the average HHS before to surgery was 59.4 (23-79). The final follow-up evaluation for HHS resulted in an improvement to 96.3 (64 out of 100 points). Additionally, **Karimi et al.**<sup>(18)</sup> HHS was reported to be 100% in 27 (90%) patients, 96% in 2 (7%) patients, and 83% in 1 (3%) patient. We calculated an HHS average of 99.2%. These results suggest that

THA is beneficial for people in terms of their overall quality of life.

**In our study**, postoperative HHS was significantly higher in patients without complications compared to those with complications, in men compared to females, in younger patients compared to older patients, and in patients with osteoarthritis compared to those with avascular necrosis. To the best of my knowledge, no studies have been conducted on this relation.

Our study had a number of limitations. The sample size was not large enough, our follow up time was not long enough and the study was single center study so we cannot do generalization to the data. In order to generalize the results, we suggest doing larger, multi-center investigations.

## CONCLUSION

Cementless total hip arthroplasty (THA) offers promising outcomes. In particular, it leads to pain reduction, functional recovery, and enhanced quality of life.

**Disclosure statement:** No author had any financial interest or received any financial benefit from this research.

**Conflict of interest:** The authors state no conflict of interest.

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