The Egyptian Journal of Hospital Medicine (January 2020) Vol. 78 (2), Page 348-355

Total Hip Arthroplasty in Femoral Neck Fractures in Zagazig University Hospitals

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ABSTRACT

Background: Femoral neck fractures are common in the geriatric population and are associated with high morbidity and mortality. The worldwide incidence of hip fractures is expected to approach 6.26 million by 2050. Studies showed that the functional outcome and pain scoring were improved in cases of femoral neck fracture treated by total hip arthroplasty than any other methods**.**

Objective: Assessment of functional and radiological outcomes of treatment of femoral neck fractures by total hip arthroplasty.

Materials and Methods: This study was performed on 18 patients presented with history of fracture neck femur who were admitted to Orthopedic Department, Zagazig University Hospital in the period from January 2019 to December 2019. All cases in this prospective study were treated by total hip arthroplasty (THA). All the patients were operated through Harding's approach. Both cemented and un-cemented types of arthroplasty were performed. Functional outcomes of hip were evaluated at 3 months and 6 months after surgery**.**

Results: 66.7 % of studied group had history of previous fixation. Previous operative fixation for neck femur (NF) fracture were 50 % cannulated screw, 25 % DHS and 25% IMN. Regarding cause of lesion most frequent were failure of other fixation for NF (66.7%) then acute NF associated with OA (22.2%) and neglected N F fracture (11.1%).

Conclusion: Total hip arthroplasty is one of the most successful orthopedic surgical procedures and has regained popularity during the last few decades with minimal pain.

Keywords: Total hip arthroplasty; neck Femur fracture.

INTRODUCTION

Femoral neck fractures are common in the geriatric population and are associated with high morbidity and mortality. The worldwide incidence of hip fractures is expected to approach 6.26 million by 2050 [(1)]**.** The optimal treatment for femoral neck fracture is a matter of debate for many years [(2)]. In the past it was assumed that internal fixation was gold standard treatment for femoral neck fracture arguing that retaining the femoral head always gives the good results than the prosthetic replacement [(3)]**.**

Treatment options for femoral neck fracture include closed reduction and internal fixation, hemi-arthroplasty including unipolar or bipolar arthroplasty and total hip arthroplasty [(4)]. Treatment by closed reduction and internal fixation is influenced by many factors like age of patient, displacement of fracture, quality of bone, delay in treatment, quality of fracture reduction, type of fixation devices and final position of the fracture. This method of treatment however gives high rate of non-union and avascular necrosis so that patients are ultimately landed into the revision surgery [(3)]**.** The majority of patients treated with hemi-arthroplasty developed the degeneration of acetabular cartilage by erosion of the prosthesis, which may sooner require the revision surgery. The incidence is even higher in young patients and overall revision rate is 7 to 12% within a few years [(5)]**.** Studies showed that the functional outcome and pain scoring improved in cases of femoral neck fracture treated by total hip arthroplasty than any other methods [(6)]**.**

AIM OF THE WORK

Assessment of functional and radiological outcomes of treatment of femoral neck fractures by total hip arthroplasty.

MATERIAL AND METHODS

This study was performed on 18 patients presented with history of fracture neck femur who were admitted to Orthopedic Department, Zagazig University Hospital in the period from January 2019 to December 2019. All cases in this prospective study were treated by total hip arthroplasty (THA).

Prior to commencing the study.

Ethical approval:

Ethical approval was taken from Zagazig University Hospitals and signed informed consent was obtained from all patients and their guardians before participation in the study.

Inclusion criteria:

- Management of fractures neck femur in older active patients.
- Both genders will be included.
- Fracture neck femur accompanied by other hip diseases as systemic lupus erythematosus, rheumatoid diseases and ankylosing spondylitis due to hip osteoarthritis.

Received:20/09/2019
Accepted:29/10/2019

- Old fracture neck femur after failed other fixation as cannulated screws, DHS and intra medullary nails that are used for fixation of neck femur fracture associated with mid shaft femur fracture as femoral gamma nail and femoral recon nail.
- Neglected neck femur fracture.
- Patients 18 years old or more.

Exclusion criteria:

- Patients with any active focus infection.
- Patients less than 18 years old.
- Multiple trauma patients with other surgical injuries.
- Medically unfit patients or those with extremely bad general condition who can't undergo anesthesia and surgery in general.
- Severe soft tissue problems at area of surgical approach as burn, necrosis and acute infection.
- Patients that refused to participate.

This thesis performed upon 18 hips in 18 cases with fracture neck femur. The study was performed on the left side of 10 cases and right side of 8 cases.

Preoperative and operative steps:

- **History:** Sheet was taken for every case including: Name, age, sex, address, complaint, side, onset, progression of the complaint and when fracture had occurred.
- **Clinical Examination:**
  - General examination was done to exclude other metabolic, congenital or developmental causes.
  - Back examination to exclude back as a source of pain or as associated back disorder.
  - Local examination including site of hip pain, range of movement, leg-length discrepancy using blocks and rotational deformity.

- **Full laboratory pre-operative evaluation including:**
  - Complete blood count.
  - PT, PTT, INR.
  - Random blood sugar.
  - Liver and kidney function tests.
  - Complete urine analysis.
  - E.S.R, C.R.P
  - Hepatic viruses; HCV and HBV.
  - HIV virus.
  - Blood type.

- **Preoperative planning:**
  - Preoperative planning by plastic overlay templates supplied by the prosthesis manufacturer can shorten the operative time by eliminating repetition of steps. The wide array of implant sizes and femoral neck lengths allows precise fitting to the patient.

- **Surgical technique:**
  - **A nesthesia:** Spinal or epidural anesthesia was given.
  - **Surgical position:**

Positioning the patient in a dead lateral position by using side supports of operating table with support in between legs (Fig. 1).

Step (1): Surgical approach: Hardingexc direct lateral approach in lateral position was used. A muscle-splitting incision through the gluteus medius and minimus allows anterior dislocation of the hip and provides excellent acetabular exposure. Residual abductor weakness and limp after this approach was avoided by identifying gluteus medius muscle which is divided at its lower third and stay sutures for gluteus medius and minimus (Radi procedure) [7] during approach for hip arthroplasty, which is later approximated at the end of surgery.

The capsule is incised transversely and the femoral head is visualized. The head is dislocated helped by the assistant by flexion, adduction and external hip rotation and an oscillating saw is used to transect the femoral head. At first, preservative cut as possible. Later on, cut could be revised by calcar reamer. The head is then removed with a corkscrew. After removal of the head, a complete capsulotomy is performed, and visualization of the acetabulum is maximized by placing Homan retractors anteromedially and posterolaterally

Step (2): Preparation of the acetabulum: Excision of the labrum and if necessary remove extensive osteophytes to visualize the entire acetabular rim. Landmarks of the acetabulum, such as the true floor and the transverse acetabular ligament are necessary for optimal placement of the cup. Successive size reamers (reaming in 1mm increments) are used to ream to the ideal acetabular size without excessive thinning of the walls.

Reaming start close to the transverse acetabular ligament 45 degree from horizontal plane and 10-15 degree anteversion. The assessment of the reamed cavity should always be made with the trials. There must be a firm fit when fully seated in the acetabulum. It is important to inspect the anterior wall and remove any extended anterior wall beyond the rim of the acetabular component to avoid impingement. Acetabular trial handle is used to hold the selected sizing trial and positioned carefully and impacted into the acetabulum and checked to be stable press-fit.

We used the alignment rod with the pelvis oriented in the true lateral position that should be horizontal and in line with the trunk. Removal of the trial and insertion of the definitive cup, which should be stable then test for stability and range of motion after femoral preparation. Cup impaction with several firm hammer blows until fully seated when change in impact tone is heard. We try to gently rock the pelvis with the cup introducer to check for cup press-fit. Also cup can be fixed with screws which should be

directed towards the posterosuperior or posteroinferior quadrants which, are the safe zones of the acetabulum. Then, we checked for any prominent osteophytes, which may cause impingement later on. Also, we took a fluoroscopic image to check for cup orientation (Fig. 2).

Step (3): Preparation of the femur: Preparing the femur for the femoral stem by gradual ascending reaming. We did not implant the final stem but we left the trial stem/rasp in its final position for the trial reduction and cup alignment procedures. Inserting the femoral stem trial neck with the stem trial/rasp in its final position in the prepared femur and attachment of the desired trial neck. The appropriate trial head matching the cup bore size inserted fully in the trial neck length collar. Trial reduction followed by assessment range of motion, stability, impingement and leg length. Change the neck trial model if required to achieve correct soft tissue tension and repeat the procedure. Then, we took fluoroscopic image to check for cup and stem position**.** Remove all trial components and implant the definitive stem implant. Then, we tried again with appropriate neck and head trial model. The definitive head was placed over the neck sleeve and pressed down firmly until resistance is felt. It was essential that the head is not tilted or placed at an angle on the sleeve to ensure proper seating.

The entire joint was flushed with saline, cleaned and the articulating surfaces were inspected. Reduction of the hip with great care to avoid either scraping the head along the cup rim, or allowing impact between the articular components. Finally, re-assessment of range of motion, stability and leg length (Fig. 3).

Fig (1): Patient positioning and preparation.

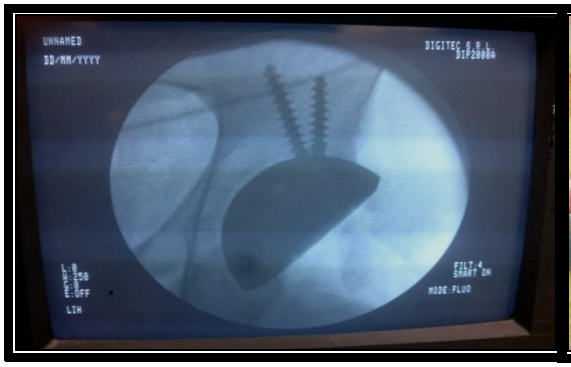

Fig. (2): Fluoroscopic assessment for cup orientation.

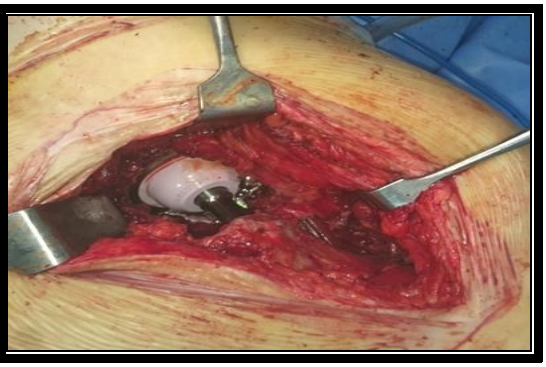

Fig. (3): Final hip reduction.

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x^2) test of significance was used in order to compare proportions between two qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
- Probability (P-value)
- P-value <0.05 was considered significant.
- P-value <0.001 was considered as highly significant.
- P-value >0.05 was considered insignificant.

RESULTS

Table (1): Side and previous operative fixation for fracture N F

	no	%
Side of lesion		
Left side	10	55.6
Right side	8	44.4
Previous fixation for fracture N F		
yes	12	66.7
no	6	33.3
Previous operative fixation for fracture N F (n=12)		
Cannulated screw	6	50
DHS	3	25
IMN	3	25
Cause of lesion		
Failure of other fixation	12	66.7
Acute fracture associated with OA	4	22.2
Neglect	2	11.1

This table showed that 55.6 % of studied group complained from left side lesion and 44.4 % complained from right side lesion. Also, table showed that 66.7 % of studied group had history of previous fixation. Previous operative fixation for fracture N F were 50 % cannulated screw, 25 % DHS and 25% IMN. Regarding cause of lesion, most frequent were failure of other fixation for N F fracture (66.7%) then acute fracture N F associated with OA (22.2%) and neglected N F fracture (11.1%).

Table (2): pre-operative X-ray finding of studied group:

	no	%
X - ray		
▪ Secondary osteoarthritis hip (posttraumatic following un-united fracture neck of femur.	12	66.6
▪ Unilateral avascular necrosis of femur head.	2	11.1
▪ Ankloysing spondylitis with destructive erosion of both hips with erosion of both sacroiliac joints.	3	16.6
▪ Systemic lupus with destructive erosion of hip.	1	5.5

This table showed that 66.6% of studied group had secondary osteoarthritis hip followed by 11.1% had unilateral avascular necrosis of femur head, then 16.6% had X-ray manifestation of ankylosing spondylitis and lastly 5.5 % of studied group had systemic lupus with destructive erosion of hip.

Postoperative X-ray finding of studied group:

- **Position**

1. **Acetabulum;** according to angle of inclination, 12 cases (66.6%) were registered 45 degree, 4 cases (22.22%) were registered 50 degree and 2 cases (11.1%) were registered 40 degree.
2. **Femur;** 16 case 88.88% were registered central stem position, one case 6.25% was registered varus stem position and one case 6.25% was registered valgus stem position.

DeLee and Charnley zones of the hip were distinct zones used in assessment of aseptic loosening in THR and there was no translucent line registered in our study.

Table (3): Frequency distribution of complaint of studied group

		no	%
Pain	▪ yes	18	100
Tenderness	▪ yes	2	11.1
	▪ no	16	88.9
Limited mobility	▪ yes	14	77.8
	▪ no	4	22.2
Limping	▪ yes	3	16.7
	▪ no	15	83.3
Enabled to weight bear	▪ yes	3	16.7
	▪ no	15	83.3

This table showed that the studied group had pain, which was trigger for seeking medical advice and 77.8% had limited mobility, then 16.7 % had limping and the same percent enabled to weight bear. Lastly 11.1 % of the studied sample had tenderness.

Table (4): Frequency distribution of post-operative complications

		no	%
Superficial infection	▪ yes	2	11.1
	▪ no	16	88.9
Dislocation	▪ yes	2	11.1
	▪ no	16	88.9
Early deep infection	▪ yes	1	5.6
	▪ no	17	94.4
DVT	▪ yes	1	5.6
	▪ no	17	94.4

This table showed that 11.1% had post-operative superficial infection and the same percent had post-operative hip dislocation. Lastly 5.6% of the studied group had early deep infection and the same percent of the studied group had DVT.

Table (5): Comparison of parameters of Harris score pre and post-operative for studied group

parameters	Harris' score		W	p	Percent of change
	Pre operative	Post operative			
pain					
▪ Mean ± SD ▪ Median (range)	8.3 ± 9.2 10(0-30)	37.9 ± 6.6 40(30-44)	3.73	0.0001	128.1%
walked					
▪ Mean ± SD ▪ Median (range)	4.8 ± 2.2 5(2-11)	10.2 ± 1.4 11(8-11)	3.69	0.0001	72%
Support					
▪ Mean ± SD ▪ Median (range)	5.4 ± 2.3 5(2-11)	10.1 ± 1.7 11(7-11)	3.52	0.0004	60.6%
Limp					
▪ Mean ± SD ▪ Median (range)	4.8 ± 1.9 5(2-8)	10 ± 1.5 11(8-11)	3.68	0.0002	70.3%
Stair					
▪ Mean ± SD ▪ Median (range)	1 ± 0.7 1(0-2)	3.6 ± 0.9 4(2-4)	3.66	0.0002	113%

W=Wilcoxon Signed Ranks Test

Table (6): Comparison of parameters of Harris score pre and post-operative for studied group

parameters	Harris' score		W	p	Percent of change
	Pre operative	Post operative			
Shoes socks					
▪ Mean ± SD ▪ Median (range)	0.9 ± 0.6 0(0-2)	3.6 ± 0.9 4(2-4)	3.75	0.0001	120%
Sitting					
▪ Mean ± SD ▪ Median (range)	0.33 ± 0.97 0(0-3)	4.8 ± 0.6 5(3-5)	3.9	0.00008	174.3%
Transportation					
▪ Mean ± SD ▪ Median (range)	0.6 ± 0.5 1(0-1)	0.8 ± 0.4 1(0-1)	1.4	0.157	28.57%
Deformity					
▪ Mean ± SD ▪ Median (range)	2.2 ± 2 4(0-4)	4 ± 0 4(4-4)	2.83	0.005	58%
Range motion					
▪ Mean ± SD ▪ Median (range)	2.7 ± 1.6 2.5(1-5)	4.6 ± 0.5 5(4-5)	3.21	0.001	52.1%

W=Wilcoxon Signed Ranks Test

Table (7): Comparison of Harris score pre and post-operative for studied group

	Total Harris' score		W	p	Percent of change
	Pre operative	Post operative			
Total Harris hip score					
▪ Mean ± SD ▪ Median (range)	31.6 ± 15.8 30.5(13-71)	89.5 ± 5.2 90(82-97)	3.72	0.0001	95.6%

W=Wilcoxon Signed Ranks Test

This table showed that pre-operative Harris score for studied group was 31.6 ± 15.8 with range (13-71). While post-operative Harris score for studied group increased to 89.5 ± 5.2 with range (82-97). Difference was statistically significant $p < 0.05$.

Table (8): Comparison of Harris grade pre and post-operative for studied group

	Harris' grade		*p
	Pre-operative	Post- operative	
	No (%)	No(%)	
Harris hip grade			
▪ Poor(<70)	17(94.4)	0	0.00003(S)
▪ Fair(70-79)	1(5.6)	0	
▪ Good(80-89)	0	8(44.4)	
▪ Excellent (90-100)	0	10(55.6)	

***Marginal Homogeneity Test s= significant**

This table showed that pre-operative Harris grade for studied group was 94.4 % poor and 5.6 % of them had fair Harris grade. While post-operative Harris grade for studied group was 44.4 % good and 55.6% of them had excellent Harris grade. Difference was statistically significant $p < 0.05$.

DISCUSSION

Hip fracture is an established public health concern globally owing to longer life expectancy, improvements in medical technology and increased vehicular traffic accident-associated with bone fractures [(8)]. On reviewing underline causes of NF fracture, researchers found that 66.7 % of studied patients had previous fixation for NF fracture. Previous methods of fixation were 50 % cannulated screws, 25 % DHS and 25% IMN. Dissimilarity with Norwegian Arthroplasty Registry was reviewed by **Gjertsen *et al.*** [(9)]. They reported 96% of the patients, THA was performed after failed internal fixation.

In present study, underlying cause of NF fracture of studied group was 4/ 18 (22.2%) due to acute NF fracture associated with OA. Differing with **Trung *et al.*** [(10)] who defined that THA was operated to 86.7% of patients due to osteoporosis situation. One of etiology of THA in present study was neglected N F fracture (11.1% of patients).

According to Post-operative complications of THA, our current study defined that 11.1% of follow up patients had post-operative superficial infection and 5.6% of the studied group had early deep infection, which is similar to **Rogmark and Leonardsson** [(11)] who declared the most common complications after fracture THA was infection.

Our current study showing that 8.3% of patients who done THA after previous failed internal fixation suffered from post-operative superficial infection. Also, our current study showed that patients of neglected NF fracture had no infection. This is similar to **Mahmoud *et al.*** [(10)] who declared that there are significantly more risk of complications in patients with salvage THA following failed internal fixation compared to primary total hip replacement for NF fracture. While **Sassoon *et al.*** [(13)] who analyzed hospital complication rates found that infection occurred in 1.7% of NF fracture patients.

Our current study, showed that 11.1% of whole patients who done THA suffered from post-operative hip dislocation. This disagrees with meta-analysis which reported that dislocation rate was 6.9% following THA for NF fracture [(14)]. Also **Sassoon *et al.*** [(13)] who analyzed hospital complication rates found that acute dislocation occurred in 0.14% of NF fracture patients. Also, this disagrees with **Ismail *et al.*** [(15)] who determined that postoperative dislocation was 2.5% among elderly patients with NF fracture managed by THA at 2-year follow-up.

The risk of dislocation after THA included factors such as age, sex, diagnosis, dementia, neuromuscular and cognitive disorders or surgical risk factors such as surgical approach, component positioning, soft tissue tension and head size [(16)]. Patients with NF fracture undergoing THA have a higher rate of dislocation that is possibly due to relative laxity of the hip capsule, violation of the hip capsule during the acute injury and poor compliance for medical advices of elderly patients' population [(17)].

Our current study showed that 22.22% from whole group had complication after THA were suffering from failed internal fixation of NF fracture compared to11.11% who suffered from acute NF fracture and showed complication after THA. While **Stafford *et al.*** [(18)] declared that THA for treatment of acute NF fracture gives comparable results with other indications for THA. **McKinley and Robinson** [(19)] compared patients treated for failed internal fixation of NF fracture with an age and sex-matched group who had undergone THA acutely for NF fracture. They found significantly more early complications, a higher revision rate at 5 to 10 years and inferior functional outcomes in those treated for failed internal fixation when compared to those treated acutely.

Our study reported that the incidence of DVT was 5.6% among whole patients who had failed NF fracture fixation and managed via THA. This is in agreement with a prospective study that was conducted by **Jain *et al.*** [(20)] in India on 60 NF fracture hip in 45 patients who underwent THA without any known risk factors for thromboembolic disease. DVT was studied by serial color Doppler ultrasonography. DVT was found in 3.3% of patients who had undergone THA. Dissimilar to **Fujita *et al.*** [(21)] who detected DVT in 22.6% of 164 patients undergoing THA.

Regarding improvement of quality of life, the present study clarified that NF fracture patients managed by THA pre-operative mean HHS????? for studied group was 31.68 with range 13-71, which raised up post-operative to be 89.5 with range 82-97 with statistically significant difference. Consistence with **Rudelli *et al.*** [22] who reported excellent functional outcomes and up to 90% of patients returning to their pre-injury activity levels following THA. On the same line, a large cohort study found that patients suffering from NF fracture and treated with THA had a lower level of pain and a higher level of satisfaction [23]**.**

In present study; pre-operative HHS grade for studied group was 94.4 % poor and 5.6 % of them had fair Harris grade. While post-operative HHS grade for studied group was 44.4 % good and 55.6% of them had excellent HHS grade with statistically significant difference. Similar study was done on outcome of THA for NF fracture and found that HHS was 40% excellent, 45% good and 15% fair [24]. Also, it is consistence with **Tuteja *et al.*** [25] who defined that HHS at the end of 6 months was excellent for 19%, good for 66.7% and fair for 14.3%. Moreover, patients managed by THA (75%) were able to do daily activity. Concerning pain level, 76.2% of patients had no pain, 19% of them suffered from slight pain and 4.8% reported mild pain at end of 6 months follow up. This is in agreement with **Katchy *et al.*** [26] who determined that pre-operative HHS was 44.65 ± 5.91 while after one year post-operative, improvement of HHS was 88.52 ± 5.56. In addition, our result is consistent with **Mingli *et al.*** [27] who reported that the mean HHS of the patients were 47 and 85 before and after THA, respectively. The rate of excellent and good results was 82.7%. The difference between pre- and post-operation HHS was statistically significant. **Ismail *et al.*** [15] evaluated hip function by HHS. Scoring of 40 patients was done at 6 weeks, 3months, 6 months and every 6 months thereafter. At 6 weeks, the mean HHS was 84 and Harris grade was good. At 6months, the mean HHS was 90.5 and at end of follow up period, HHS was 94.

In present study, we found that the mean HHS was 35 pre–operative in patients with failed internal fixation of NF fracture, while the post-operative THA mean HHS was 88.9. Compared to pre-operative in patients who had acute NF fracture, HHS was 19.5 that raised up post-operatively to be 91. This is consistent with the study of **McKinley and Robinson** [19] who declared that patients with failed internal fixation of NF fracture and patients who had acutely NF fracture with an age and sex-matched group and underwent THA. They found significantly more early complications and inferior functional outcomes in those treated for failed internal fixation NF fractures. On the same line, study found that mean HHS post THA for failed internal fixation of NF fracture was 81.8 at 2-years follow-up period [28]**. Trung *et al.*** [10] declared that cementless THA with minimally invasive surgery for NF fracture had 93.3% good and excellent results. From above finding**,** it is evidence that THA globally improve the total quality of life.

In pain studying following THA, our present study estimated Harris pain score was preoperatively 8.3 ± 9.2 (0-30) improved post-operatively to be 37.9 ± 6.6 (30-44), which is similar to **Park *et al.*** [29] who estimated Harris pain score post-operatively to be 40.65 ± 3.6.

In limping studying following THA, our present study estimated that Harris limping score was preoperatively 4.8 ± 1.9 (2-8) and improved post-operatively to be 10 ± 1.5 (8-11), which is similar to **Pongcharoen and Chaichubut** [30] who estimated Harris limping score after one year THA via direct lateral approach to be 10.66 ± 1.27 (5-11).

In range of motion studying following THA, our present study estimated that Harris range of motion score was preoperatively 2.7 ± 1.6 (1-5) and improved post-operatively to be 4.6 ± 0.5 (4-5), which Agrees with **Park *et al.*** [29] who estimated Harris of motion score post-operatively to be 4.50 ± 0.73.

In deformity studying following THA, our present study estimated that Harris deformity score preoperatively was 2.2 ± 2 (0-4) and improved post-operatively to be 4 ± 0 (4-4), which is comparable with **Park *et al.*** [29] who estimated that Harris deformity score post-operatively was 3.75 ± 1.9.

In walking studying following THA, our present study estimated that Harris walking score preoperatively was 4.8 ± 2.2 (2-11) and improved post-operatively to become 10.2 ± 1.4 (8-11). It is the same finding of **Abd El- Ismail *et al.*** [15] who evaluated hip function by HHS for 40 patients, which was done at 6 weeks, 3months, 6months and every 6months thereafter. They showed that improvement in limping and distance walked was unlimited.

CONCLUSION

NF fractures are common in the geriatric population and are associated with high morbidity and mortality. THR is one of the most successful orthopedic surgical procedures and has regained popularity during the last few decades with minimal pain. We assessed the clinical signs and symptoms using Harris hip score, and radiological evaluations pre- and post-operatively in all cases of recent NF fracture with OA hip, old neglected and old failed NF fracture fixation and all cases managed by THR.

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