

Evaluation of Outcome of Non-cemented Total Hip Arthroplasty in Avascular Necrosis of Femoral Head in 25 to 40 Years Age Group

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ABSTRACT

Background: The proper treatment of Avascular Necrosis (AVN) of Femoral Head has become a major challenge worldwide in younger age group as they are main effective force of family and society. The patients who are young and suffer from AVN of femoral head become immovable, workless and unproductive. Thus they become burden to family and society. The Hip Replacement is a better way of treatment for this type of patients, making them pain free and movable and improving their everyday activity.

Objective: To evaluate outcome of non-cemented total hip arthroplasty in avascular necrosis of femoral head among the active younger age group of patients.

Method: This was a prospective observational study of 30 patients and all the patients had done non-cemented total hip arthroplasty (THA) through lateral approach at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka.

Results: Mean age of the patients was 32 ±5.12 years, patients were diagnosed as Avascular Necrosis of Femoral Head in which 63% were affected at Right sided Hip 37% patients were at Left sided hip. Final outcome after six months of operation evaluated with Modified Harris Hip Score revealed that, there was significant ($p < 0.005$) improvement in functional ability of the patients after THA. Among the 30 studied cases, 21 (70%) patients carried slight pain and 63.4% of them were

able to walk unlimitedly. Outcome of supporting function analysis indicated 76.7% patients could walk and climb stairs without support and 100% patients could sit on chair, 66.7% patients among them could walk without limping. On clinical assessment of deformity, range of motion before and after operation, significantly resolved the deformities and increased the range of motion (210° - 230°). After evaluation with Modified Harris Hip Score showed that 60% excellent (HHS 90-100), 30% good (HHS 80-89), 10% had fair (HHS 70-79) outcome.

Conclusion: The progressive study of the patients of THA showed that non-cemented THA has resulted in a better way among the younger age group of people.

Keywords: Arthroplasty, Femoral, Necrosis, Non-cemented.

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INTRODUCTION

Hip joint is unique in having both a high degree of stability and an excellent range of movements. It is a multiaxial ball and socket variety of synovial joint. It is the articulation between the head of the Femur (the ball) and the acetabulum of the innominate bone

(the socket). Painful hip disorder can limit our locomotion and some of them can even damage the joint. Total Hip Replacement (THR) of the articular surfaces seems the ideal way of treating any disorder causing joint destruction.¹ Total Hip Arthroplasty (THA) is

the last resort in the practice of orthopaedic surgery for a good number of hip disease like Osteoarthritis (OA), Rheumatoid arthritis, Ankylosing spondylitis, Diseased acetabulum, Deficient acetabulum, Congenital hip diseases and so on. THA for this reason has become the most commonly performed adult reconstructive hip procedure.² The World Health Organization (WHO) considers THA to be one of the most cost effective interventions in medicine.³ In 2010, prevalence of total hip replacement in the total U.S. population was 0.83%. Prevalence was higher among women than among men and increased with age, reaching 5.26% for total hip replacement. These estimates corresponded to 2.5 million individuals (1.4 million women and 1.1 million men) with total hip replacement in 2010.⁴ The normal hip joint is subjected to many stresses during daily activities performed by an individual. Since it is one of the major weight bearing joints of the body, its normal function is necessary for peaceful and enjoyable day to day life. Avascular necrosis (AVN) of the femoral head is one of the common causes of painful hip. The natural course of this disease is one of relentless progression with eventual collapse of the femoral head, followed by secondary osteoarthritic changes in the hip.⁵

Once the diagnosis of AVN is confirmed, management varies depending upon the age of the patient, stage of the AVN, occupation and previous treatment received etc. Core decompression, bone grafting and valgus osteotomy can be considered in early stages and total hip arthroplasty in later stages of AVN of femoral head. Total hip replacement has proved to be a boon for such patients.¹ In younger patients recent advancement is various types of non-cemented fixation, computer assisted design and isoelastic materials. The diameter of the femoral component was reduced from the 40mm or more to 20mm to reduce resistance to movement on lever arm to reduce frictional forces. Because of excessive wear and tissue reaction polytetrafluoroethylene was replaced by high-density polyethylene (HDPE) and later by ultra-high molecular weight polyethylene (UHMWPE) for acetabular component. Considerable laboratory and clinical investigation carried out in an effort to eliminate the use of cement and provide for biological fixation of femoral component. Modern second-generation non-cemented stems, with proximal circumferential porous or HAcoating, seems to be a good choice for young patients in secondary OA. Similarly, modern pressfit porous and HA-coated cups appear to have good invention against loosening in young patients. A good long-term outcome has been recorded for patients under 50 years of age with modern non-cemented (porous and/or HA-coated) femoral and acetabular components.⁶ The major long-term problems with replacement are difficulties in removal of both acetabular and femoral component due to biological fixation. With progression in time bones grow in between bone and implant. Secondly, body reacts to minute fragment of plastic and attempt to remove them but unfortunately the process also remove bone adjacent to the particles, leading to bone structurally weakened. If the implant is loosening, a second surgery is necessary. The popularity of non-cemented THR has ebbed and flowed with surgical fashion. In some patients, revision surgery is necessary, possibly on more than one occasion and the problems of revisioning on cemented implant remain considerable. There are also problems in non-cemented total hip arthroplasty in revision surgery. Total hip replacement is a very successful operation about 40000 are

carried out annually in the UK. The published results suggested that for most implants the revision rate is about 10% at ten years. Revision operations cost more and do not give as good as functional result or last as long as primary total hip arthroplasty. About 5000 revisions of THR are performed in the UK⁷ and the number is increasing.⁸

The outcome of non-cemented primary total hip arthroplasty depends on many factors including component design, patient selection and surgical technique. Particulate debris from polyethylene wear and osteolysis remain the primary factors limiting the longevity of hip prostheses. Early overall assessments are usually carried out with clinical scoring systems based on relief of pain and improvement in function and movement. There are many scoring systems as Merle d'Aubigne and Postel 1954, Larson 1963, Harris 1969, Charnley 1972. Harris hip score is most common and popular among surgeon for evaluation of functional outcome in hip scoring system and will also be used in this study.⁹ The purpose of the study is to evaluate the early results of primary non-cemented total hip arthroplasty in our country and assess factors influencing the outcome of this highly sophisticated and demanding surgery. In our country, there are many patients who have been suffering from severe pain in the hip due to advance stage of avascular necrosis of femoral head. Young patients have been suffering from avascular necrosis of femoral head due to corticosteroid in any form and many other idiopathic causes. The outcome of non-cemented THA is usually excellent. Modern second generation non-cemented stems, with proximal circumferential porous or HAcoating, seem to be a good choice for young patients with secondary OA. Similarly, modern press-fit porous and HA-coated cups appear to have good endurance against aseptic loosening in these young patients.⁶ The major long-term problems with replacement are wearing of socket and loosening of the bone between the implant and the bone. In time cement can crack directly resulting in loosening. Secondly body reacts to minute fragment of cement and plastic and attempt to remove them but unfortunately the process also remove bone adjacent to the particles, leaving the bone structurally weakened. In developed countries all over the world more and more non-cemented prostheses are being used for THA. In our country, still non-cemented prosthesis are not that much familiar due to many reasons, including lack of data regarding the outcome of this surgery with the sort of implant and experienced surgeon. As we know, most of these patients with replaced joint will eventually require revision arthroplasty very soon, it is inevitable to encourage more research work in this field. Non-cemented primary total hip arthroplasty is a good option in case of avascular necrosis of femoral head irrespective of causes in 25 years to 40 years age group.

OBJECTIVES

General Objective

To evaluate the clinical and functional outcome of non-cemented primary total hip arthroplasty in late stage avascular necrosis of femoral head irrespective of causes in 25 to 40 years age group.

Specific Objective

- To evaluate the clinical outcomes such as pain, limping, deformity, range of motion
- To evaluate anatomical outcome by radiological examination such as malposition, migration of implant, hip dislocation

- Overall evaluation of functional outcome to establish a method of treatment that can reduce the burden of prolonged treatment and disability of a patient

MATERIALS AND METHODS

Type of Study: Prospective observational Study.

Place of Study: National Institute of Traumatology and Orthopaedic Rehabilitation.

Period of Study: From July 2016 to June 2018.

Study Population: All the adult patients of avascular necrosis of femoral head regardless of age, sex group of 25 to 40 years.

Sampling Method: Purposive non randomized sampling according to availability of the patients and strictly considering the inclusion and exclusion criteria.

Sample Size: 30 patients were included in the study.

Inclusion Criteria

- Age: 25 to 40 years age group.
- Sex: Both sex.
- Any side.
- The patients who are mentally and physically fit (ASA-group 1-3) (Whinnie et al., 2013).
- AVN of femoral head with secondary osteoarthritis of the hip joint irrespective of cause. According to Ficat and Arlet stage- Stage III & Stage IV.

Exclusion Criteria

- Below the age 25 years and above the age of 40 years.
- History of previous replacement surgery in the involved hip due to any cause.
- Unstable medical illness that would significantly increase the risk of morbidity and mortality
- Active infection of the hip or any other region
- Insufficiency of abductor musculature.
- Rapidly progressive neurological disease.
- Malignant tumor of femoral head or acetabulum with very few little life expectancy.

Study Procedure: A data collection form was prepared by the researcher considering the key variables like age, sex, presenting symptoms, clinical findings, associated medical conditions, investigations, preoperative findings and outcome of surgery which was verified by the guide. Data were collected by the

researcher himself. Aims and objectives, procedure, risks and benefits of the study were explained to the selected patients. They were also assured about the secrecy of information and records. Then written informed consent was taken from each patient.

RESULTS

All of the respondents were taken between age group of 25-40 years of age. The mean age of the respondent was 32years with standard deviation (SD) of ± 5.12 years. Minimum age of the respondents was 25years and maximum age was 40 years. Here, n= 30. (Table 1)

In figure 1, out of 30 patients 20 (67%) were male and 10 (33%) were female.

Figure 2 indicates the distribution of occupations of the patients. Majority of the patient’s occupations were Businessman 33.3% and about 26.7% were Housewives. Among other occupations were Service holder 30% and Student 10%.

Figure 3 shows the causes of Avascular Necrosis of Femoral Head among patients, Idiopathic was the majority, which was about 50%. The next major cause was Steroid induced (44%). But both the perthes (3%) and alcohol (3%) were the lowest among the causes.

In figure 4, among all patients, 63.3% were affected at Right side Hip, 36.7% patients were affected at Left side.

Three patients developed superficial surgical site infection in early post-operative period. Rest of the patients did not develop any kind of other complications like Implant migration, peritrochanteric fracture, hip dislocation, sciatic nerve palsy. (table 2)

The average duration of hospital stay after operation was 7.6 ± 0.57 days ranging from 5 to 15 days. 14 (46.7%) patients stayed in the hospital for 7 to 9 days, 10 patients (33.3%) 5-6 days and 4 (13.3%) patients stayed in the hospital for 10 to 12 days. Only 2 patients (6.7%) had to stay longer than usual that is for 13-15 days. (table 3)

The pain status among patients indicated that the pain significantly decreased following operation ($p=0.000$). The Statistics shows majority of the patients had moderate (60%) to severe (33.3%) pain before surgical approach including 6.7% mild pain. Whereas after operation no pain was observed in 1 patients (3.3%), however 21 (70%) patients had slight pain and 8 (26.7%) patients had mild pain. (table 4)

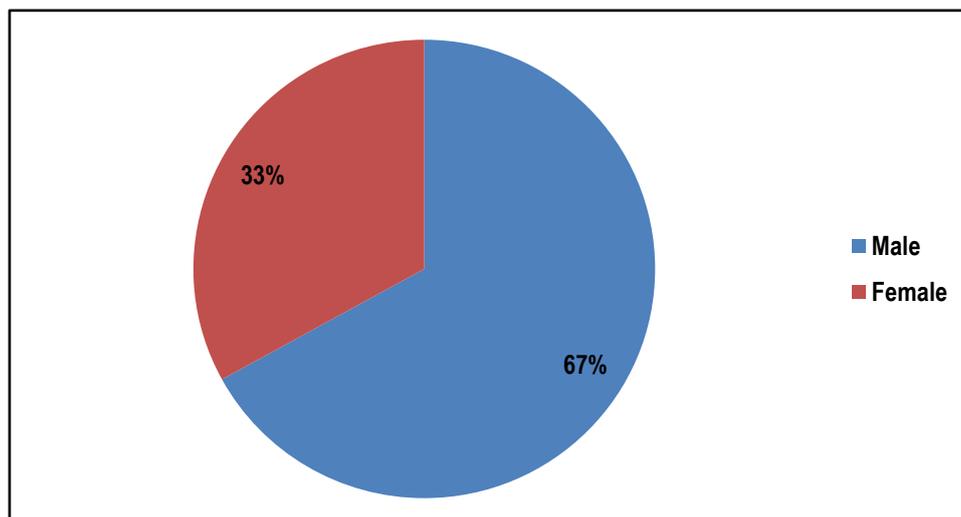


Figure 1: Sex distribution of the patients

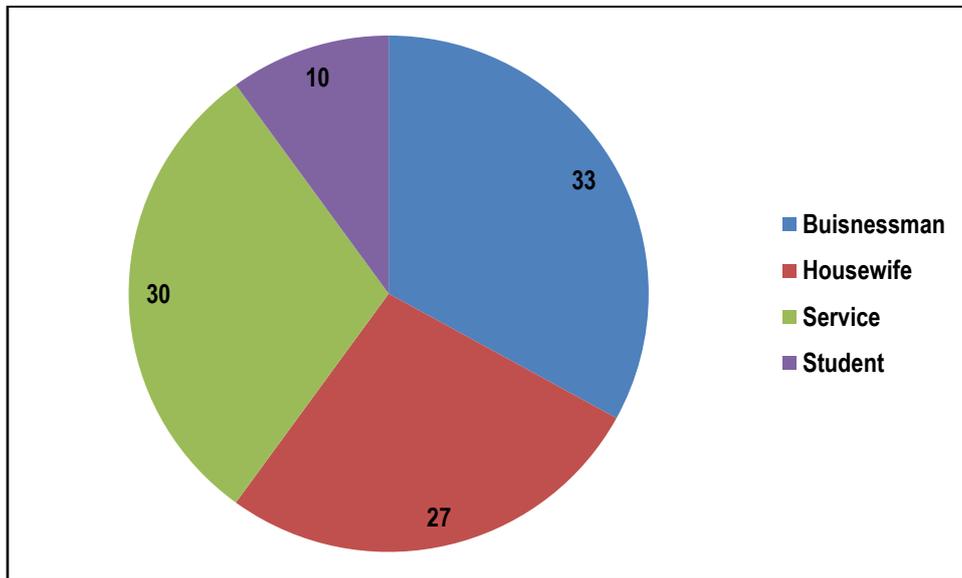


Figure 2: Occupations of the patients.

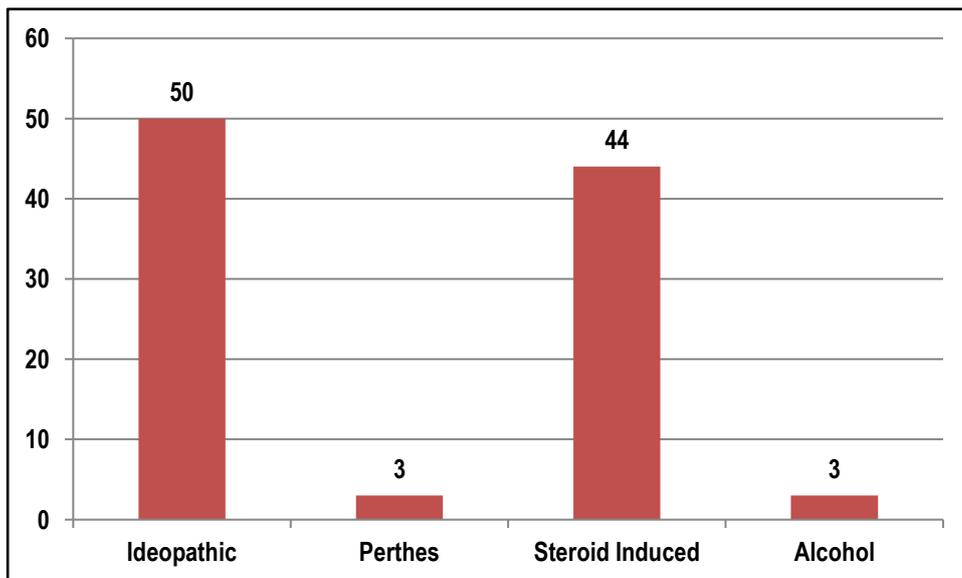


Figure 3: Distribution of causes of illness.

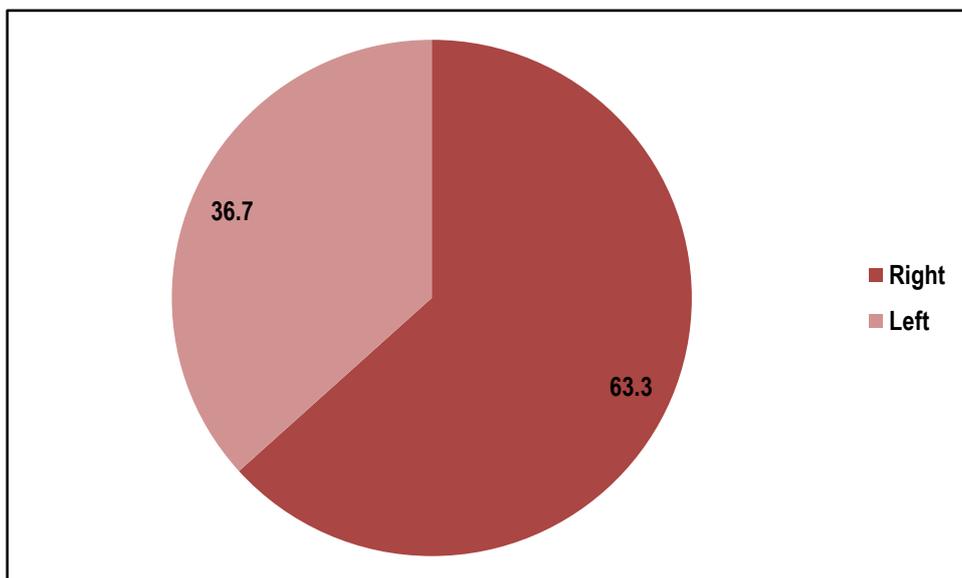


Figure 4: Distribution of Side affected

Table 1: Distribution of Ages in year

Age of respondents (In years)	n	%	Mean ± SD
25-30	12	40	32±5.12
31-35	11	37	
36-40	7	23	
Total	30	100	

Table 2: Distribution of patients by post-operative complications

Variables	n	%
Complication	3	10
No complication	27	90

Table 3: Comparison of the patients by post-operative hospital stay

Postoperative hospital stay	n	%
13-15 days	2	6.7
10-12 days	4	13.3
7-9 days	14	46.7
5-6 days	10	33.3
Total	30	100

Table 4: Distribution of patients by pre and post-operative pain status

Severity of pain	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
No pain	0	0	1	3.3	Mean of Difference 20.13±5.92 t = 18.64 p= 0.000
Slight	0	0	21	70	
Mild	2	6.7	8	26.7	
Moderate	18	60	0	0	
Severe	10	33.3	0	0	
Crippled	0	0	0	0	
Total	30	100	30	100	

Table 5: Distribution of patient by support function

Support function	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
None	0	0	23	76.7	Mean of Difference 6.57± 2.37 t = 15.15 p=0.000
Cane for Long walk	3	10	7	23.3	
Cane most of the time	8	26.7	0	0	
One Crutch	10	33.3	0	0	
Two Canes	7	23.3	0	0	
Unable to walk	2	6.7	0	0	
Total	30	100	30	100	

Table 6: Distribution of patients by their pre and post-operative limping

Limping	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
None	1	3.33	20	66.7	Mean of Difference 4.87± 3.09 t = 8.62 p = 0.000
Mild	6	20	10	33.3	
Moderate	19	63.3	0	0	
Severe	4	13.3	0	0	
Total	30	100	30	100	

Table 7: Distribution of patients by their pre and post-operative walking distance

Distance walked	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
Bed & Chair	3	10	0	0	Mean of Difference 6.7± 2.41
Indoor	17	56.7	0	0	
2 to 3 Blocks	7	23.3	1	3.3	t = 15.23
Six Blocks	3	10	10	33.3	p = 0.000
Unlimited	0	0	19	63.4	
Total	30	100	30	100	

Table 8: Distribution of Patients by pre and post-operative use of stairs

Use of stairs	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
Unable	14	46.7	0	0	Mean of Difference 3.33± 0.85
In any manner	14	46.7	0	0	
Normally with railing	2	6.67	1	3.3	t = 21.63
Normally without using a railing	0	0	29	96.7	p=0.000
Total	30	100	30	100	

Table 9: Distribution of patients by pre and post-operative capacity to sit

Capacity to sit	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
Unable	21	70	0	0	Mean of Difference 4.1± 1.39
High Chair	9	30	0	0	
Comfortable	0	0	30	100	t = 16.06
Total	30	100	30	100	p=0.000

Table 10: Distribution of patients by using transport

Use of Transport	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
Unable	30	37	0	0	Mean of Difference 1.03± 0.18
Able to Use	0	0	30	100	
Total	30	100	30	100	t = 31 p=0.000

Table 11: Distribution of patients by presence of deformities in patients

Deformities	Pre-operative		Post-operative	
	n	%	n	%
<30 degree fixed flexion contracture	25	83.3	30	0
<10 degree fixed abduction	13	43.3	30	0
<10 degree fixed internal rotation in extension	12	40	30	0
Limb length discrepancy <3.2cm	30	100	30	100
No deformity	0	0	30	100

Table 12: Distribution of patients by pre and post-operative Range of motion

Range of motion	Pre-operative		Post-operative		Paired "t" statistics
	n	%	n	%	
0°-30°	0	0	0	0	Mean of Difference 0.27± 0.52
31°-60°	0	0	0	0	
61°-100°	0	0	0	0	t = 2.80
101°-160°	6	20	0	0	p<0.0045
161°-210°	24	80	22	73.3	
211°-305°	0	0	8	26.7	
Total	30	100	30	100	

Table 5 is showing that prior to surgical intervention 2 patients were not able to walk and 28 patients (93.3%) used Crutch or Cane for support to walk. After operation 23 patients (76.7%) could walk without support. The difference was statistically significant ($p=0.000$).

Table 6 shows the considering limping of the patients, 1 patients (3.3%) had no limping gait, 6 patients (20%) had mild limping gait, 19 patients (63.3%) had moderate limping gait and 4 patients (13.3%) had severe limping gait. Following operation, 20 patients (66.7%) with no limping gait and 10 patients (33.3%) among them carried mild limping. This indicate that following operation limping feature of the patients significantly decreased ($p=0.000$).

According to the statistics 3 patients (10%) were in bed and chair status, 27 patients (90%) were able to walk small distance from indoor to six blocks. It appeared after operation walking condition significantly increased ($p=0.000$). All the patients could walk up to or beyond two to three blocks after operation and 19 patients (63.4%) could walk unlimited. (table 7)

In table 8, it was evident that 14 patients (46.7%) were unable to use stairs and 14 patients (46.7%) were able to use stairs in any manner and 2 patients (6.67%) were able to use stairs normally with railing preoperatively. Following operation, 29 patients (96.7%) were able to use stairs without using railing, and only 1 patient (3.3%) had to use stairs with railing. Analysis indicated that use of stairs was improved following operation ($p=0.000$).

According to the study analysis 21 patients (70%) were unable to sit comfortably and 9 patients (30%) were using high chair to sit on. The post-operative capacity to sit on chair increased significantly ($p=0.000$), 100% patients could sit comfortably following operation. (table 9)

Before operation 30 patients (100%) were unable to use public transport whereas 30 patients were able to use public transport after operation which is statistically significant ($p=0.000$). (table 10)

Table 11 shows that before operation selected patients were clinically studied for presence of any deformities. Among them, 30(100%) patients had one or multiple deformities. Following operation clinical status of patients improved significantly where no patients had any deformities.

Range of motion in patients with AVN before operation were restricted within the range from 0 to 210 degrees. Whereas after Total Hip arthroplasty the Range of motion has been elevated up to 230 degrees. (table 12)

DISCUSSION

Total hip arthroplasty is the most commonly performed adult reconstructive hip procedure. The present prospective observational study was targeted to find out evaluation of outcome of non-cemented total hip arthroplasty in avascular necrosis of femoral head in 25 to 40 years old age group. For this 30 respondents were selected and in all cases non-cemented modular porous acetabular and HA-coated femoral stem prosthesis were used. In this study minimum age of the patients was 25 and maximum age was 40 years. The majority of the patients were between 25-30 years of age. The mean age of the respondent was 32 years with standard deviation (SD) of ± 5.12 years.¹⁰ A study showed 18 cases at Zagazig University Hospital, India where mean age of the patients was 29.5 years.¹¹ No significant correlation was found between clinical outcome and

age of the patient at the time of surgery or underlying disease process.¹² Out of 30 patients 20 (67%) were male and 10 (33%) were female. Outcome of total hip arthroplasty were fairly unaffected by age until the patients were in their late sixties, after which age had a negative effect (Gordon et al., 2014).¹³ The occupational history of respondents revealed that majority of the patient's occupations were Businessman (33.3%) and Housewives (26.7%). Among other occupations Service holder and students were 30% & 10% respectively. The causes of Avascular Necrosis of femoral head, idiopathic was majority that was about 51%. The next major cause was use of steroid 43% and perthes disease about 3% and alcohol abuse about 3%. A study showed etiology of avascular necrosis was idiopathic 52%, use of steroids 36%, alcohol abuse 8% which was similar to the study.¹⁴ A report showed most commonly associated factors in patients operated 35% idiopathic, 26% ethanol abuse, 20% corticosteroid use and it is also nearly similar to this study (Johansson et al., 2011).¹⁵ Use of high dose steroids is the one of the major causes of Avascular Necrosis.¹⁶ Among patients 63% were affected at right sided hip and 37% patients were affected at left sided hip. All the hips were diagnosed as avascular necrosis of femoral head in where Ficat & Arlet stage IV 21 hips & stage III 9 hips. All patient were operated through lateral approach. It was recommended that modified direct lateral approach has greatly diminished the potentially devastating complication of postoperative instability and is associated with an acceptable level and severity of limp and heterotopic ossification (Mulliken et al, 1998).¹⁷ The approach provides excellent exposure in primary total hip arthroplasty to allow accurate placement of components in an efficient manner. Among 30 operated cases 3 patients developed superficial surgical site infection (10%) in early post-operative period which was treated as local wound care & long time antibiotics were given according to culture and sensitivity test. Factors that increased the risk of infection of THR some are inherent to host, diabetes mellitus, obesity, duration of preoperative hospital stay, nosocomial infection, annual volume of surgery; choice of antibiotics, doses, time of administration of 1st dose, duration of surgery, surgical technique & operating room environment. Prolong duration of surgery was the only independent factor ($> 75\%$) for SSI & statistically significant confounding risk factor for THR (Van Kasteren et al, 2007). However there is lack of statistical power to ensure accurate prevalence in a small sample size. The average duration of hospital stay after operation was 7.6 ± 0.57 days ranging from 5 to 15 days. 14 (46.7%) patients stayed in the hospital for 7 to 9 days, 10 patients (33.3%) 5-6 days and 4 (13.3%) patients stayed in the hospital for 10 to 12 days. Only 2 patients (6.7%) had to stay longer than usual that is for 13-15 days. The pain status among patients indicated that the pain significantly decreased following operation ($p<0.05$). The statistics shows that patients had moderate pain 18 patients (60%), severe pain 10 patients (33.3%) & mild pain 2 patients (6.7%) before surgical approach. After operation no pain was observed in 1 patient (3.3%), 21 (70%) patients had slight pain and 8 (26.7%) patients had mild pain & no patients had severe pain. It was showed that 22% had only slight pain, 6% had mild pain, 4% had moderate pain & no patients had severe pain which is similar to the study (McLaughlin et al., 2000).²⁰ Prior to surgical intervention 2 patients were not able to walk and 28 patients (93.3%) used crutch or cane for support to

walk. After operation 23 patients (76.7%) could walk without support. The difference was statistically significant ($p < 0.05$). Considering pre-operative limping of the patients, 1 patient (3.3%) had no limping gait, 6 patients (20%) had mild limping gait, 19 patients (63.3%) had moderate limping gait and 4 patients (13.3%) had severe limping gait. Following operation, 20 patients (66.7%) with no limping gait and 10 patients (33.3%) had mild limping gait. Limp and dependency on walking aids by the patients decreased substantially after the arthroplasty (Kim et al, 1995).²¹

According to the statistics, 3 patients (10%) were in bed & chair status, 27 patients (90%) were able to walk small distance from indoor to six blocks preoperatively. After operation walking condition significantly increased ($p < 0.05$). All the patients could walk up to or beyond 2 to 3 blocks after operation and 19 patients (63.4%) could walk unlimited. After operation 42 patients walked normally and only 4 patients had limping problem (Charnley, J.C., 1972).²²

In this study 14 patients (46.7%) were unable to use stairs and 14 patients (46.7%) able to use stairs in any manner and 2 patients (6.67%) were able to use stairs normally with railing preoperatively. Following operation, 29 patients (96.7%) were able to use stairs normally without using railing, and only 1 patient (3.3%) use stairs with railing. Analysis indicated that use of stairs was improved following operation ($p < 0.05$). According to the study analysis, 21 patients (70%) were unable to sit and 9 patients (30%) were using high chair to sit on. The post-operative capacity to sit on chair increased significantly ($p < 0.05$), 100 patients could sit comfortably following operation. Before operation 30 patients (100%) were unable to use public transport whereas 30 patients were able to use public transport after operation which is statistically significant ($p < 0.05$). Before operation all patients were clinically studied for presence of any deformities. All patients (100%) had one or multiple deformities. Range of motion in patients with AVN before operation were restricted within the range from 0 to 210 degrees. Similar study showed mean HHS increased from 41.5 (range 33-52) to 87.5 (range 74-96) (Celebi et al, 2006).²³

As our study period was merely 2 years which is not sufficient for overall assessment. But outcome of non-cemented total hip replacement is developing in perspective of Bangladesh particularly at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR).

CONCLUSION

So it was founded that non-cemented total hip arthroplasty in young patients with good bone quality who have been suffering from AVN of femoral head in advance stage is an excellent promising method to improve in health related quality of life. The bond strength and high coefficient of friction assure rigid, mechanical stability which is an essential factor for bone growth.

LIMITATIONS

- Small sample size.
- Non-randomized sampling.
- Non homogenous group of patients
- Relatively shorter period of follow up.

Moreover, the operating surgeons were not same in all cases which renders the operator dependent variation to some extent.

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