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A COMPARATIVE STUDY ON FUNCTIONAL OUTCOME OF UNSTABLE INTER-TROCHANTERIC FRACTURES IN THE ELDERLY TREATED WITH BIPOLAR HEMI-ARTHROPLASTY AND DYNAMIC HIP SCREW FIXATION – A SHORT TERM PROSPECTIVE ANALYSIS

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ABSTRACT

Proximal femoral fractures in the elderly individuals have a tremendous impact on both the health care system and society. It occurs with both mild and moderate trauma. During an impact, the large amount of energy that is released is absorbed by the skin, fat, and muscles which surrounds the hip. There is an increased incidence of hip fractures with aging due to decrease in muscle mass around the hip and osteoporosis. This is becoming more common as the proportion of elderly people in the population has been steadily increasing. Nearly half of all hip fractures are of the inter- trochanteric variant. For over about 3 decades, fixation with the DHS device had been the gold standard treatment for stable inter-trochanteric fractures, there are many complications reported for unstable inter-trochanteric fractures (3 to 26%). In order to avoid imposing multiple surgeries in these elderly patients, treatment should aim at improving their function, quality of life and reduce fracturerates which shall entail further surgery.

Keywords: Proximal femoral fractures, Trochanteric,osteoporotic, Posterolateral, anatomical, sacral vertebral body

Introduction

Upon treatment of inter-trochanteric fractures with conservative management, it usually unites with a mal- union and with shortening, but the problem of trochanteric fractures has never been union but because of complications associated with prolonged recumbency and its associated morbidities.

Trochanteric hip fractures in the elderly patients have benefited from advances in internal fixation. In the last 2 decades these newer implants have been helping in early mobilization and thereby preventing complications of recumbency. Early failure of internal fixation occurs however in a number of cases. The failure after internal fixation has been due to the initial fracture pattern, communition, sub-optimal fracture fixation and poor bone quality. The problems associated with fixation of these
fractures are a loss of fixation, a varus collapse and implant cut-out of the lag screw[1]. As a result there is profound functional disability and pain[2]. In these patients treatment with primary bipolar hemi-arthroplasty decreases the post- operative complications due to prolonged immobilization or implant failure and also quickly returns the patients to their pre-injury activity level.

Our study shall aim to evaluate the clinical, functional and radiological outcomes of bipolar hemi-arthroplasty and compare them to those treated by dynamic hip screw fixation, for communited, osteoporotic, displaced trochanteric fractures in the elderly population.

AIM OF THE STUDY

The aim of this prospective comparative study is to analyse the short term follow-up results of unstable inter- trochanteric fractures in the elderly treated with Bipolar hemi-arthroplasty and Dynamic hip screw fixation done in our institution from March 2017 to October 2018.

ANATOMY

The proximal femur (fig 2) includes the head, neck, lesser and greater trochanters, and proximal femoral diaphysis. The adult neck- shaft angle averages 125 degrees (106 to 155 degrees).The angle of femoral torsion is about 15 degrees and is formed by the upper and lower ends of femur.

The area between the greater and lesser trochanter is the intertrochanteric region which is characterized by dense trabecular bone (fig 3). Similar to the cancellous bone of the femoral neck this region also transmit and distributes stress.

The major muscles of the gluteal region (iliopsoas, gluteus maximus, medius and minimus and short external rotators) gets inserted in the greater and lesser trochanters.

Calcarfemorale(fig 4, fig 5): it is a thin vertical wall of dense bone, extends from the posteromedial aspect of the femoral shaft to the posterior portion of the femoral neck . It acts as a strong conduit for stress transfer.

MUSCULATURE OF HIP:

ABDUCTORS:

The chief muscles producing this movement are gluteus maximus, gluteus medius and gluteus minimus. These are fan shaped muscles which originates from gluteal surface of Ilium, iliac crest and inserts on to the greater trochanter and ilio-tibial band, lineaaspera. The accessory muscles are tensor fasciae latae and sartorius.

INTERNAL ROTATORS OF HIP:

The chief muscles are anterior fibres of gluteus medius and gluteus minimus and tensor fascia latae. (lies between gluteal region and the front of thigh). The tensor fascia latae originates from anterior 5 cm of outer lip of iliac crest and also from anterior superior iliac spine and gets inserted in to iliotibial tract.

HIP FLEXORS:

The chief muscles are Psoas major and iliacus. They are located in the anterior aspect of the thigh. The ilio-psoas gets inserted onto the lesser trochanter. The accessory muscles are pectineus, rectus femoris and sartorius.

ADDUCTORS:

The chief muscles producing this movement are adductor longus, brevis and magnus. These muscles have their origin from pubis and get inserted on to lineaaspera. The accessory muscles are pectineus and gracilis.

EXERNAL ROTATORS:

The chief muscles are two obturators (internus and externus), two gemelli (superior and inferior) and the quadrates femoris. These muscles get inserted onto the posterior portion of the greater trochanter. The accessory muscles are pectineus, sartorius and gluteus maximus.

HIP EXTENSION:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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The chief muscles are gluteus maximus and hamstrings (semi-tendinosus, semi-membranosus and biceps femoris). These have their origin from ischium and get inserted on the tibia. The gluteus maximus originates from sacrum coccyx and Ilium; it gets inserted onto the gluteal tuberosity along the lineaaspera and the ilio-tibial tract, serves as an extensor and external rotator of the hip.

LIGAMENTS OF THE HIP JOINT:
The ligaments are: [Fig 6,7].

- The fibrous capsule.
- The ilio-femoral ligament.
- The pubo-femoral ligament.
- The ischio-femoral ligament.
- The ligament of the head of femur.
- The acetabular labrum.
- The transverse acetabular ligament.

BLOOD SUPPLY:

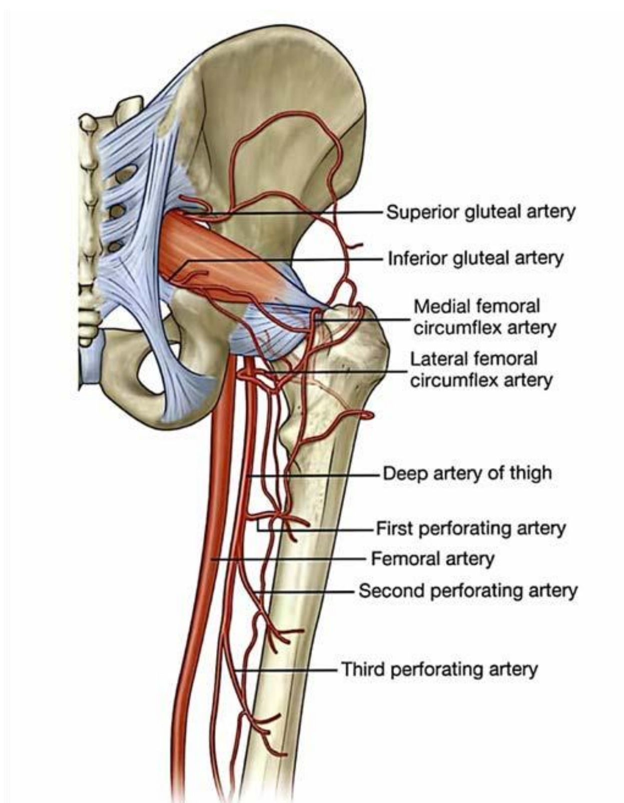

Fig.8:

Hip joint is supplied by obturator artery, medial and lateral circumflex femoral artery, superior and inferior gluteal arteries [Fig 8].

NERVE SUPPLY:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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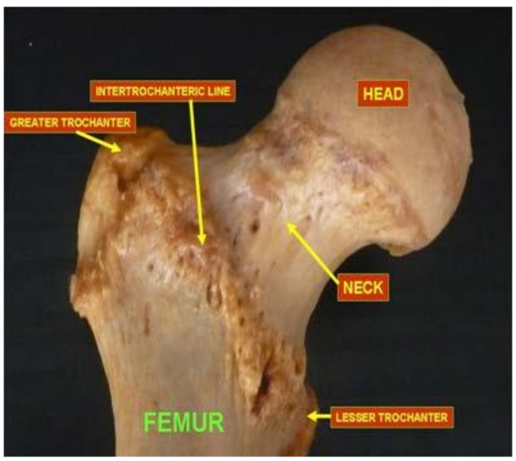
It is supplied by the

- Femoral nerve,
- The anterior division of obturator nerve,
- Accessory obturator nerve,
- Nerve to quadrates femoris,
- Nerve to rectus femoris,
- Sciatic nerve and
- Superior gluteal nerve.



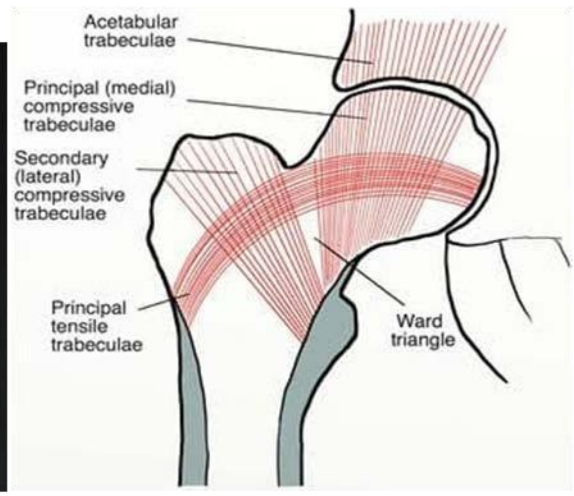
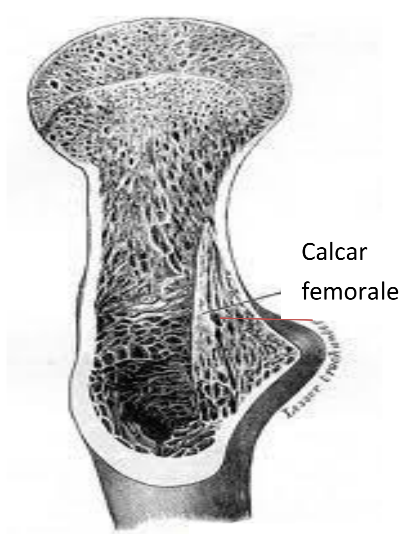


Fig.2: Fig.3:



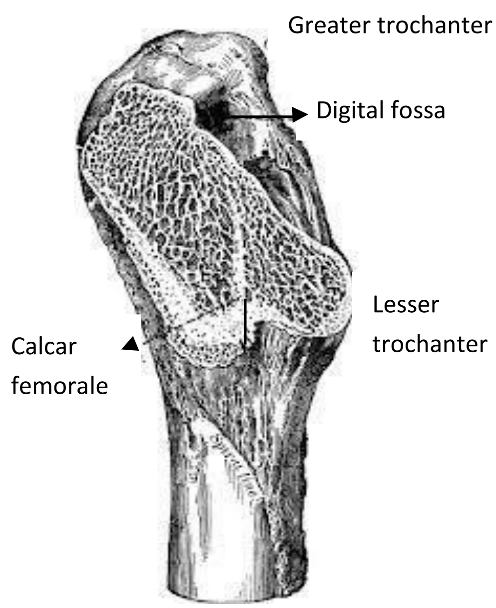


Fig.4: Fig.5:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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ANATOMY OF HIP JOINT:

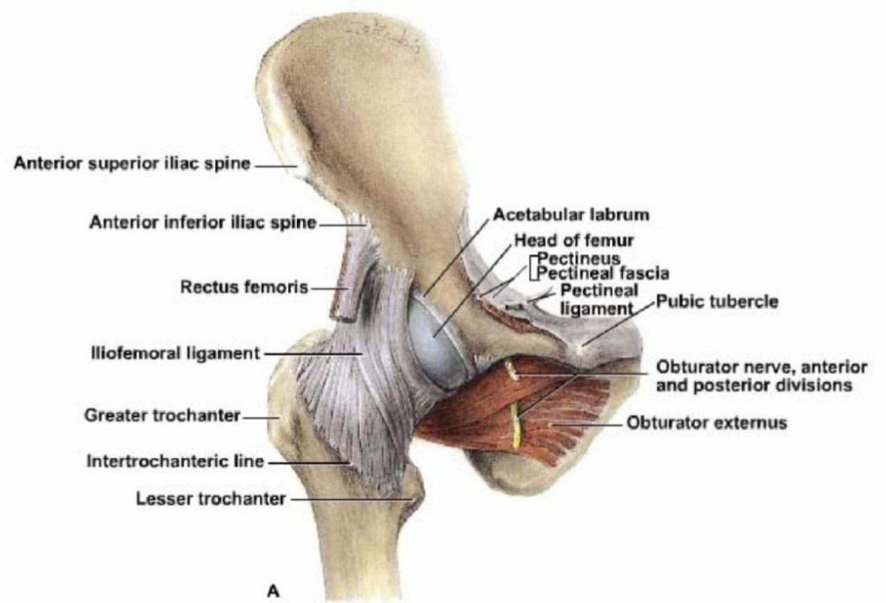

Fig.6:

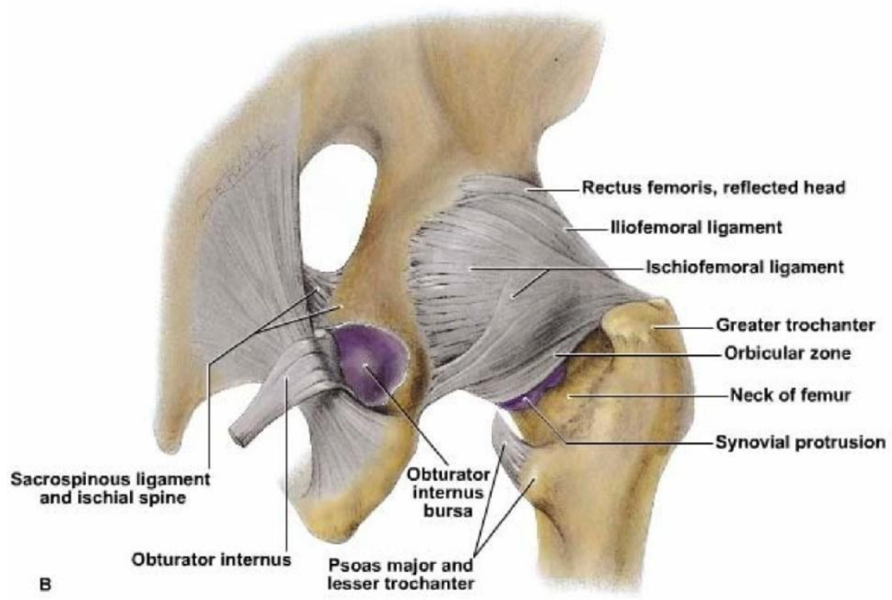

Fig.7:

BIOMECHANICS

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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BIOMECHANICS OF THE NORMAL AND REPLACED HIP JOINT:

Bone is a living tissue. The structural properties and shape changes according the load acting on it. The load transfer mechanisms in normal and replacement hips are quite different. The stresses generated are axial, bending and torsional loads in the femur and femoral stem and for compressive loads in the acetabulum. In practice, all methods of calculating stresses are only estimate, because the material properties of bone and the bone - implant interface properties are variable and cannot be determined accurately.

FORCES ACTING ON THE HIP [Fig.9]:

The body weight can be depicted as a load applied to a lever arm extending from the body's center of gravity to the center of the femoral head [8].

The abductor musculature, acting on a lever arm extending from the lateral aspect of the greater trochanter to the center of the femoral head, must exert an equal moment to hold the pelvis level when in a one- legged stance, and a greater moment to tilt the pelvis to the same side when walking or running.

When lifting, running, or jumping, the load may be equivalent to 10 times the body weight. Therefore excess body weight and increased physical activity add significantly to the forces that act to loosen, bend, or break the stem of a femoral component.

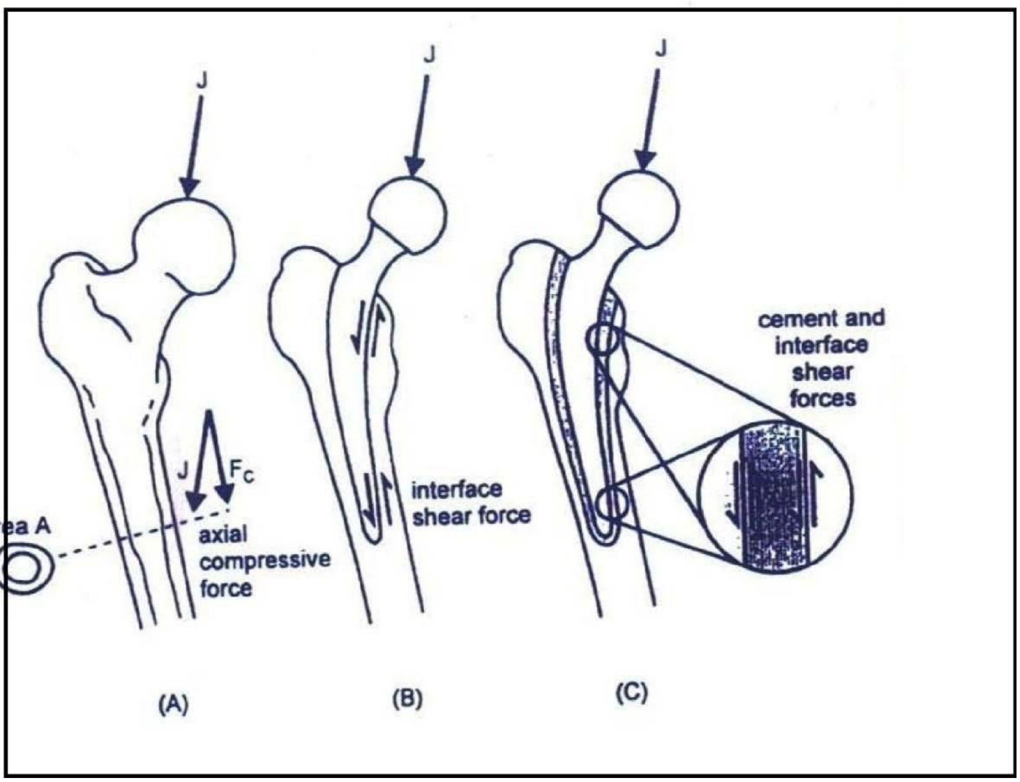

Fig.9: Forces acting on a hip prosthesis.

SHEAR FORCES AT BONE-STEM AND BONE CEMENT-STEM INTERFACE:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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The body's center of gravity (in the midline anterior to the second sacral vertebral body) is posterior to the axis of the joint, hence the forces on the joint act not only in the coronal plane, they also act in the sagittal plane to bend the stem posteriorly. Such forces cause posterior deflection or retroversion of the femoral component.
Rotational stability of the stem can be increased both proximally and distally by increasing the width of the proximal portion of the stem to better fill the metaphysis of the femoral component.

Modifications of the distal portion of the stem may add to rotational stability as well. Longitudinal cutting flutes and extensive porous coatings that "scratch" the diaphysealendosteum improve rotational stability in the absence of cement.

COMPRESSIVE STRESSES IN THE FEMUR:
The highest moments occur in the coronal plane. However, there are also moments acting in the sagittal and transverse planes. The compressive joint force is transferred from the stem to the femur as a shear force, passing directly from the stem to the bone in a cementless prosthesis, or via the cement layer in cemented prosthesis, causing shear stresses in the cement. If the stem-bone bond or stem-cement-bone bond is not sufficiently strong, the prosthesis will loosen and sink down the medullary cavity. The compressive stresses in the stem itself can be found by dividing the compressive load taken by the stem at any section along its length by the area of that cross section.

MATERIALS AND METHODS

This study was conducted at SreeBalaji Medical College and Hospital, Chrompet, Chennai from March 2017 to October 2018 on 40 elderly osteoporotic patients with unstable inter- trochanteric fractures who were divided into two groups with Group A - bipolar prosthesis (20 cases approximately) and Group B – DHS (20 cases approximately). The recruitment of patients was from March 2017 to February 2018 [12 months], so that there would be a minimum follow-up of 8 months [range: 8 to 20 months].

Inclusion criteria:

1. Both female and male in the age group of 56 to 75 were included.
2. Unstable inter-trochanteric fractures AO [A2.1 TO A2.3] alone were included.
3. Osteoporotic fractures, meeting the above criteria were also included.
4. Cases were included only if they are within a 2 week window from the time of injury.

Exclusion criteria:

1. Age less than 56years and above 75 were excluded.
2. Patients with stable inter-trochanteric fractures AO [A1 and A3] were excluded.
3. Patients with pathological fractures were excluded.
4. Patients with associated fractures of the ipsilateral lower limbs were excluded.

CLASSIFICATION:

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Fractures were classified based on (AO-ATO) classification.

RADIOGRAPHIC EVALUATION:
Both antero-posterior and lateral radiographs were taken and the fracture geometry evaluation was done for subsequent classification. In selected cases 3D CT recon was sought for.

PRE-OPERATIVE PROTOCOL:
The general condition of the patient was assessed at the time of admission and associated co-morbidities were noted. Skin traction was applied for patients who had delay in getting anaesthetic fitness. Medicine and cardiology opinion was sought, prior to getting anaesthetic fitness. All patients were started on broad spectrum 3rd generation cephalosporins on the day of surgery. Low molecular weight heparin was given for 5 days until after surgery.

INTRA-OP PROTOCOL:
PREPARATION OFPATIENT:
On the day of the surgery, the skin is prepared using povidone iodine solution and covered with sterile sheets and brought to the theatre, where the final preparation is done. Prophylactic antibiotic is given on the table. A third generation cephalosporin is preferred in the dose of 1 gm given parenterally.

ANESTHESIA:
Epidural or General anesthesia is usually employed as deemed fit by the anaesthetist.

POSITION:
The patient is positioned on lateral or supine according to the procedure planned.

PROCEDURE:(Hemi-arthroplasty).
Through the above said approach either posterior or lateral (fig 18), the fracture site is exposed. The fractured fragment along with head (fig 19) is removed. Meticulous care was taken to preserve the integrity of the greater trochanter, abductor muscles, and all the vascularized bone fragments.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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Fig 18.

Fig 19.

Fig 20.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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Fig 21.

Appropriate head size measured and reaming (fig 20) of femoral medullary canal is done. Trial reduction was performed to determine the neck length, offset and version so that joint stability can be achieved. The femoral canal islavaged, dried before cementation. The femoral stem with or without graft was impacted gently into position (fig 21) until there was good bony co-aptationatthe inter-trochanteric fracture line.

Fig 22.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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Fig 23.

Small calcar bone fragments were reduced over the medial aspect of the femoral stem, for large calcar bone fragments; they were secured bycerclage wires. Other cases needed medial calcar bone reconstruction in the form of U- shaped autograft. The removed head and neck is used to fashion the graft so that it can fit around the medial portion of the femoral stem.

The fractured greater trochanter with the abductor mechanism was stabilized with the main fragment by using tension band wiring technique (fig.23). The wound was closed in layers with a suction drain.

PROCEDURE: (Dynamic hip screw). Position: supine**.**

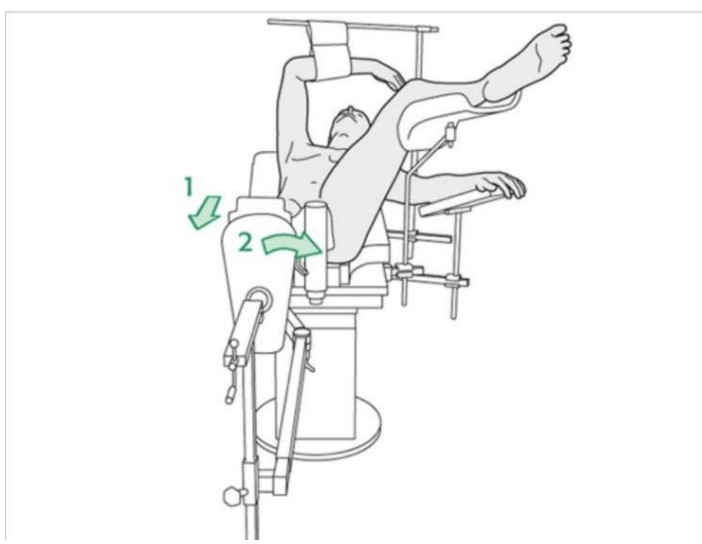

Fig 24: Closed reduction

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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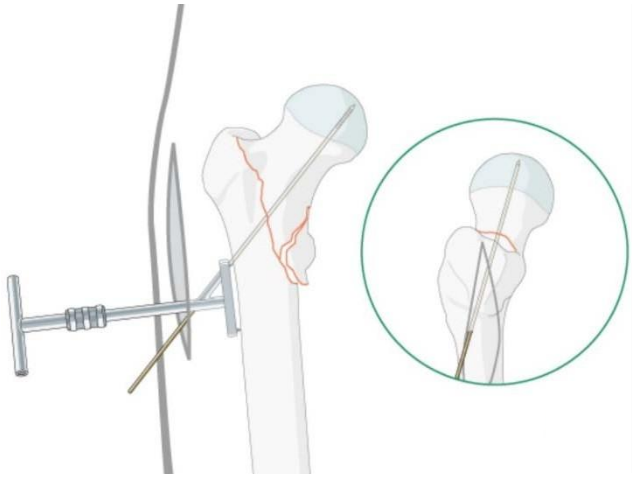

Fig 25: Guide wire insertion.

Under fluoroscopic guidance reduction of the fracture is attempted by longitudinal traction initially by external rotation of the leg followed by internal rotation. Lateral incision is made and the vastuslateralis reflected (fig 24). If reduction not satisfactory in image intensifier, then fracture site is opened. With appropriate angle guide(135 degree) a guide pin is inserted into the femoral neck and head (fig 25).

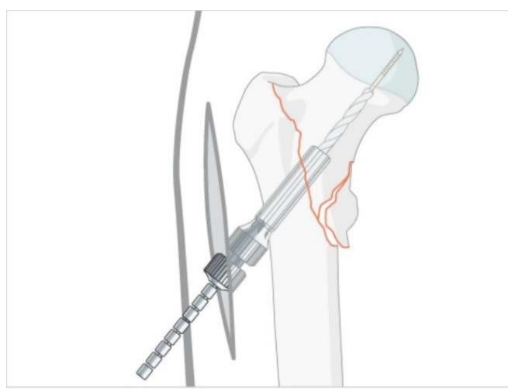

Fig 26: Reaming of femoral necka

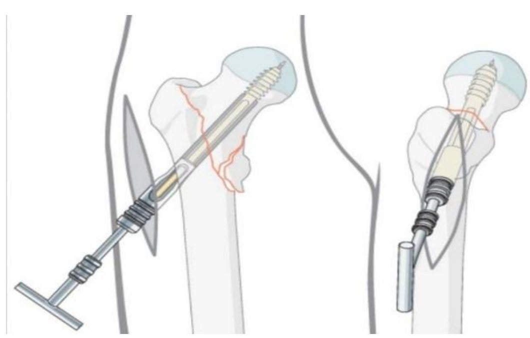

Fig 27: Insertion of the lag screw.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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After confirming the position of guide pin(center of femoral head) in both AP and lateral planes, reaming of the femoral neck and head is done (fig 26). The measured lag screw is then inserted so that the tip is within 1 cm of the subchondral bone (fig 27).

After position of the lag screw in femoral head is confirmed, a four or five holed plate is placed over the screw (fig 28). The fractured greater trochanter with the abductor mechanism was stabilized with the main fragment by using tension band wiring technique.

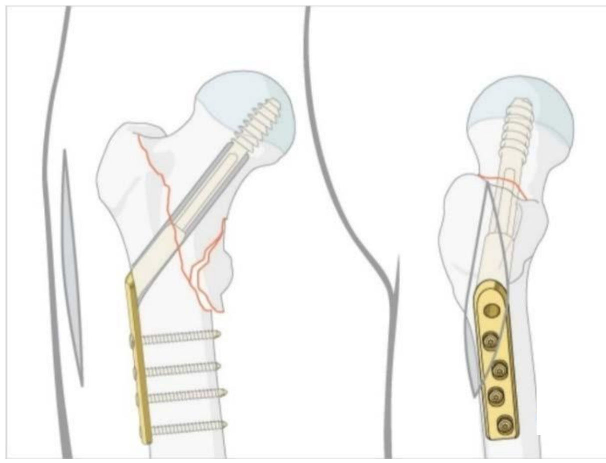

Fig 28: Fixation of plate.

POST-OPERATIVE PROTOCOL:
Intra-venous antibiotic prophylaxis was given routinely to all patients and were continued for 5 days and then switched on to oral antibiotics untill suture removal. Drain wasremovedon POD2.

Patients in group A (BPHA) were ambulated with tolerated (toe touch) weight bearing on the POD 5 with the help of a walker.

Patients in Group B were ambulated non-weight bearing on the POD 5 and gradually progressed to partial and then full weight bearing depending on the quality of bone fixation usually by upto 4 to 6 weeks.

Suture removal was done on POD 12. Patients were followed up bi-weekly for 2 months and then monthly for the next 6 months. During every follow-up patient were assessed clinically and x-rays taken at monthly intervals. Functional outcome was assesed by using the Harris hip score (HSS) at 9 months post-op and tabulated and the results analysed.

Based on the Harris Hip Score (HHS), the results were graded as

TABLE 1. Grading of functional outcome based on points deduced by HHS[41].

Excellent	≥ 90 points.

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Good	80-89 points.
Fair	70-79 points.
Poor	< 70 points.

RESULTS

TABLE 2.AGE AND SEX DISTRIBUTION

AGE (in years)	**GROUP A (BPHA group) Sex and 'n'**		**GROUP B (DHS group) Sex and 'n'**		**SAMPLE SIZE'n' Group A + Group B**	**% age of patients in the total sample.**
	Male 'n'	**Female 'n'**	**Male 'n'**	**Female 'n'**		
56 - 60	3	5	5	3	16	40
61 - 65	3	3	1	4	11	27.5
66 - 70	1	2	1	1	5	12.5
71 - 75	1	2	2	3	8	20
Total	8	12	9	11	40	100
% age in total	20	30	22.5	27.5	Net total	100%
% age within group	8/20 (40%)	12/20 (60)	9/20 (45%)	11/20 (55%)		

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In our study, of the total 40patients recruited, most of them were in the age group of 56 to 60 (40%). Females out- numbered males in both the groups,60% in group A and 55% in group B. Together in both groups put together the females were 57.5%.GROUP A:

SEX DISTRIBUTION IN GROUP A(BPHA GROUP):

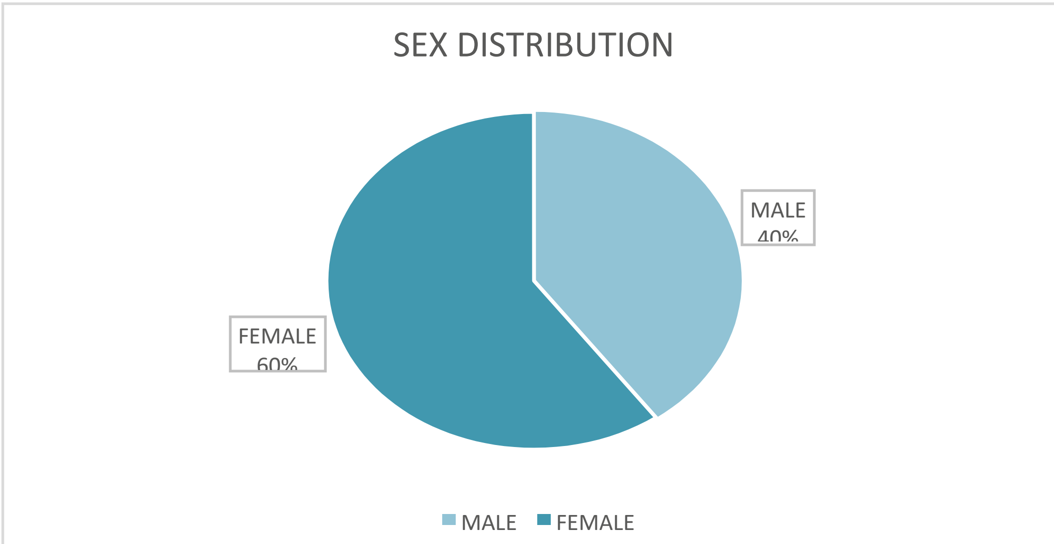

Fig.30:

In group A (BPHA), among the 20 patients, there were 8 male (40%) and 12 female (60%).

AGE DISTRIBUTION IN GROUP A (BPHA GROUP):

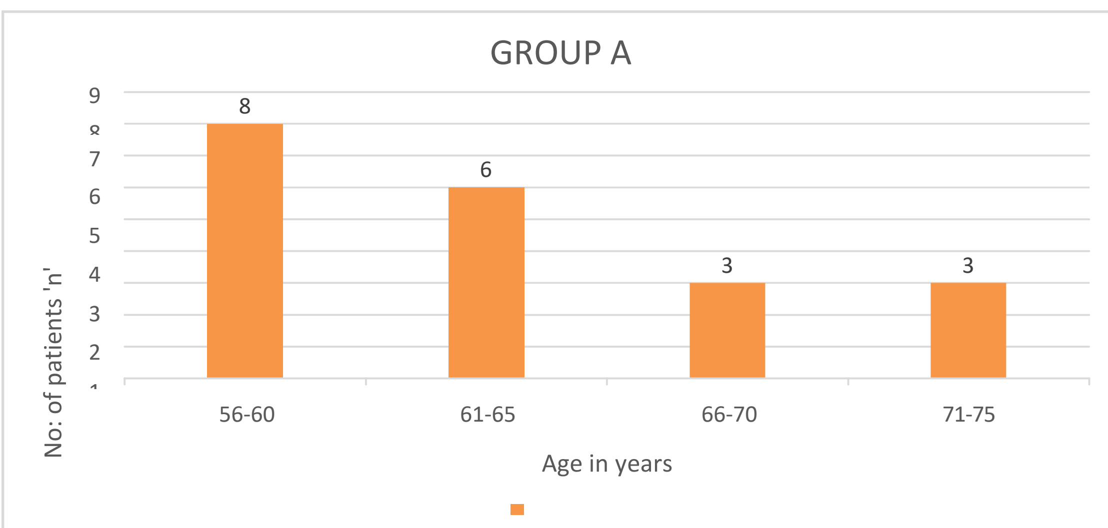

Fig.31:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
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- Eight patients were in the age group of 56 to 60, of these3 were male and 5 were femalepatients.
- Six patients were in the age group of 61 to 65, of these 3 were male and 3werefemale patients.
- Three patients in the age group of 66 to 70,of these 1 was male and 2 were female patients.
- There was one male and 2 female patients in the age group of 71 to 75 years.

CASE ILLUSTRATION

GROUP- A (BPHA):

CASE – 1

Mrs.J, 65 years female had an accidental fall and sustained AO type A2.3 fracture. Patient had a Harris hip score of 91 after 9 months follow up.

Radiological Outcome

Pre-operative X-ray. Post-operative X-ray.

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X-ray at 9 months follow-up.

CLINICAL OUTCOME AT 9 MONTHS OF FOLLOW-UP

Standing. Flexion.

Abduction. Adduction.

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Internal Rotation. External Rotation.

CASE- 2:
Mr.L, 70 years male had an accidental fall and sustained type AOtype A2.3 fracture. Patient had a Harris hip score of 90 after 9 months follow-up.

Radiological Outcome


Pre-operative X-ray. Post-operative X-ray.

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X-ray at 9months follow-up.

CLINICAL OUTCOME AT 9 MONTHS OF FOLLOW-UP

Standing. Flexion.

Abduction. Adduction.

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Internal Rotation. External Rotation.

DISCUSSION

Inter-trochanteric fractures in elderly patients are associated with notable morbidity and mortality. Internal fixation in these patients has reduced the mortality associated with these fractures[20], however failure rate in certain literature are as high as 56%[21,22] and early mobilization is avoided in these cases because of osteoporosis, poor screw fixation and comminution.

The weak and porotic bone in these patients do not provide for a firm purchase of screw which leads to early bio- mechanical failure[23]. As a result the femoral head collapses and migrates into varus and retroversion. This leads to limping gait due to shortening and decreased abductor muscle lever arm[24].

Primary hemiarthroplasty in these patients provides for adequate fixation and early mobilization. It alleviates pain and improves function. It also prevents post-operative complications such as pneumonia, lung atelectasis and pressure sores.

In our study, there was female preponderance in both the groups accounting for 60% in group A (BPHA) and 55% in group B (DHS). This is due to post-menopausal osteoporosis and lower peak bone mass.

The results in group A (BPHA) were better than group B (DHS) with respect to blood loss, operative time, peri- operative blood transfusion this compares favourably with the study alone bySinno K et al[18]; where one hundred and two patients participated in the study. Bipolar hemi-arthroplasty was done in 48 patients and 54 patients were treated with dynamic hip screw fixation.

The mean operative time was just less in group A (BPHA) (99.5 minutes) than that in group B (DHS) (101 minutes),which coincides with study by Sinno K et al[18] where it is 112 minutes.

The amount of blood loss (mean) was lower in group A (BPHA) (111 ml) than in group B (DHS) (148ml) with a P value of 0.03,which is similar to the study by Sinno K et al[18]; where it was reported 129 ml in the hemiarthroplasty group with a P value of 0.005.

The mean blood transfusions (units)was higher in group B (DHS) (1.9 units) than in group A (BPHA) (1.4 units) with a P value of 0.02.This compares well with the study by MdEmami et al[37]; where the mean blood transfusions was greater in internal fixation group (1.9 units) than in Bipolar hemiarthroplasty group (1.37 units),with a P value of0.01.

CONCLUSION

In the outcomes of DHSvs BPHA for trochanteric fractures are sometimes contraindicatory and controversial[38]. Device failure is the most dreaded complications with DHS fixation done for unstable trochanteric fractures with a range from 10% to 16.7%[38,39]. The rate of infection are also higher in DHS group study, as reported by Ehlinger et al[40]. In this short term study, we would humbly conclude that for unstable trochanteric fracture BPHA (bipolar hemi-arthroplasty) gives better functional outcomes. In stable trochanteric fractures, probably DHS is a preferable implant.

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Ethical approval: The study was approved by the Institutional Ethics Committee

CONFLICT OF INTEREST

The authors declare no conflict of interest

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REFERENCES

[1] Canale&Beaty: Campbell's Operative Orthopaedics, 11thed.

[2] Rockwood & Green's Fractures in Adults, 6thEdition.

[3] Bartucci EJ, Gonzalez MH, Cooperman DR. The effect of adjunctive methylmethacrylate on failures of fixation and function in patients with intertrochanteric fractures and osteoporosis. J Bone Joint Surg Am 1985; 67:1094-1107.

[4] Audige L, Hanson B, Swiontkowski MF. Implant-related complications in the treatment of unstable intertrochanteric fractures: meta-analysis of dynamic screw-plate versus dynamic screw-intramedullary nail devices Int Orthop2003 ; 27 :197-203.

[5] Im GI, Shin YW, Song YJ. Potentially unstable inter trochanteric fractures.JOrthop Trauma 2005 ; 19 :5-9.

[6] Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemi-prosthesis for unstable intertrochanteric fractures. IntOrthop 2002;26:233-237.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
Received 15 December 2020; Accepted 05 January 2021.

[7] Hernigou P, Poignard A, Mathieu G, Cohen G, Manicom O, Filippini P. Total hip arthroplasty after failure of per- and subtrochanteric fracture fixation in elderly subjects. (French). Rev ChirOrthop2006 ;92.

[8] Green S, Moore T, Proano F. Bipolar prosthetic replacement for the management of unstable intertrochanteric hip fractures in the elderly. ClinOrthopRelat Res 1987;224:169-177.

[9] Waddell, James P. MD, Morton, Jane RN; The role of total hip replacement in inter-trochanteric fractures of femur; CORR (429): 49 – 53, Dec2004.

[10] Tronzo RG; The use of an endoprosthesis for severely comminuted trochanteric fractures. OrthopClinNor Am 5; 679 – 681,1974.

[11] Stern MB, Goldstein PB; The use of Leinbach prosthesis in intertrochanteric fractures of the hip. CORR 128: 325-331,1977.

[12] Shin Yoon Kim MD, Yong – Goo Kim, Jun – Kyung Hwang; Cementlesscalcar replacement hemiarthroplasty compared with intramedullary fixation of unstable intertrochanteric fractures; JBJS (Am) 2005; 87: 2186- 2192.

[13] Harwin SF, Stern RE, Kulick RG; Primary Bateman Leinbach bipolar prosthetic replacement of the hip in the treatment of unstable intertrochanteric fractures in the elderly; Orthopaedics 13: 1131 – 1136,1990.

[14] Haidukewych GJ, Berry DJ – Hip arthroplasty for salvage of failed treatment of intertrochanteric hip fractures; JBJS (Am): 2003; 85- A(5):899–904.

[15] Grimmsrud C, Monzon RJ, Richman J, Ries MD; Cemented hip arthroplasty with a novel circlage cable technique forunstableintertrochanteric hip fractures; J Arthroplasty: Apr 2005; 20(3): 33743.

[16] Jean-Michel laffosse, François molinierCementless modular hip arthroplasty as a salvage operation for failed internal fixation of trochanteric fractures in elderly patients ActaOrthop. Belg., 2007, 73, 729-736.

[17] Parvjeet Singh Gulati, Rakesh Sharma Comparative study of treatment of intertrochanteric fractures of femur with long-stem bipolar prosthetic replacement versus dynamic hip screw fixation Pb Journal of OrthopaedicsVol-XI, No.1,2009.

[18] Sinno K, Sakr M, Girard J, Khatib . The effectiveness of primary bipolararthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. North Am J Med Sci 2010; 2:561-568.

[19] KH Sancheti, PK Sancheti primary hemiarthroplasty for unstable intertrochanteric fractures in elderly – a retrospective case series. Indian J Orthop:October 2010,vol 44,issue4.

[20] White BL, fisherWD. Rate of mortality for elderly patients after fracture of hip in the 1980's.J bone and joint surgeryAm1987;69:1335-40.

[21] Kyle RF, Cabanela ME, Russell TA, Swiontkowski MF, Winquist RA, Zuckerman JD, Schmidt AH, Koval KJ. Fractures of the proximal part of the femur. Instr Course Lect 1995;44:227-253.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
Received 15 December 2020; Accepted 05 January 2021.

[22] Haidukewych GJ, Israel TA, Berry DJ. Reverse obliquity fractures of the intertrochanteric region of the femur. J Bone Joint Surg Am 2001; 83:643-650.

[23] Wolfgang GL, Bryant MH, O'neill JP. Treatment of Intertrochanteric Fracture of the Femur Using Sliding Screw Plate Fixation. ClinOrthop 1982; 163:148-158.

[24] Liang YT, Tang PF, Gao YZ, Tao S, Zhang Q, Liang XD, Han G, Cui G, Yang MY. Clinical research of hemiprosthesisarthroplasty for the treatment ofunstable intertrochanteric fractures in elderly patients. Zhonghua Yi XueZaZhi. 2005;85(46):3260-3262.

[25] Levy RN, Siegel M, Sedlin ED, SiffertRS.Complications of Ender- Pin Fixation in Basicervical, Intertrochanteric, and Subtrochanteric Fractures of the Hip. J Bone JointSurg 1983; 65-A:66-69.

[26] Broos PL, RommensPM, GeensVR, StappaertsKH. Pertrochanteric fractures in the elderly. Is the Belgian VDPprosthesis the best treatment for unstable fractures with severe comminution? ActaChir Belg1991;91:242- 249.

[27] Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesis for unstable intertrochanteric fractures. IntOrthop 2002;26:233-237.

[28] K.El abed reported on comparison of outcomes following uncementedhemiarthroplasty and dynamic hip screw of displaced subcapital fractures in patient aged greater than 70 years. Actaorthop, belg., 2005, 71, 48-5.

[29] Wolfgang GL, Bryant MH, O'Neill JP. Treatment of intertrochanteric fracture of the femur using sliding screw plate fixation. ClinOrthop. 1982;163:148–158.

[30] Li P, Yang H, Zheng L, Shan HH. Postoperative complications of Dynamic hip screw and its prevention in the treatment of intertrochanteric fracture. J Dalian Med Univ. 2009;3:17.

[31] Nordin S, Zulkifli O, Fisham WI. Mechanical failure of Dynamic Hip Screw (DHS) fixation in intertrochanteric fracture of the femur. Med J Malaysia. 2001. pp. 12–7.

[32] Ehlinger M, Adam PH, Delpin D, Moser T, Bonnomet F. Osteosynthesis of periprosthetic femoral fractures with Locking Plate fixation using an LCP: A consecutive series of 36 fractures with mean 26 months follow- up. J Bone Joint Surg Br. 2011;93:531.

[33] Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. N Am J Med Sci. 2010;2(12):561–8.

[34] Bhattacharyya T, Iorio R, Healy WL. Rate of and risk factors for acute inpatient mortality after orthopaedic surgery. J Bone Joint Surg Am. 2002;84:562–572.

[35] Clawson DK. Trochanteric Fractures Treated by the Sliding Screw Plate Fixation Method. J Trauma. 1964. pp. 737–52.

[36] Kyle RF, Gustilo B, Premer RF. Analysis of six hundred and twenty-two intertrochanteric hip fractures. J Bone Joint Surg Am. 1979;61(2):216–21.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 2368 - 2391
Received 15 December 2020; Accepted 05 January 2021.

[37] Yong C, Tan C, Penafort R. Dynamic hip screw compared to condylar blade plate in the treatment of unstable fragility intertrochanteric fractures. Malaysian orthopaedic j. 2009. pp. 13–18.

[38] MohamadEmami, MD, AlirezaManafi, MD and Saeed Safari, MD..Comparison of Intertrochanteric Fracture Fixation with Dynamic Hip Screw and Bipolar HemiarthroplastyTechniques.Arch Bone Jt Surg. 2013 Sep; 1(1): 14–17.

[39] Nordin S, Zulkifli O, Fisham WI. Mechanical failure of Dynamic Hip Screw (DHS) fixation in intertrochanteric fracture of the femur. Med J Malaysia. 2001. pp. 12–7.

[40] Ehlinger M, Adam PH, Delpin D, Moser T, Bonnomet F. Osteosynthesis of periprosthetic femoral fractures with Locking Plate fixation using an LCP: A consecutive series of 36 fractures with mean 26 months follow- up. J Bone Joint Surg Br. 2011;93:531.

[41] Orthopaedicscore.com/scorepages/harris_hip_score.