"AN INTERVENTIONAL STUDY TO KNOW THE OUTCOME OF TROCHANTERIC FRACTURE OF THE FEMUR TREATED WITH DYNAMIC HIP SCREW USING HARRIS HIP SCORE."

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ABSTRACT

Background and Objectives:

Trochanteric Fractures are the most common fractures encountered by an orthopaedic surgeon accounting for a good percentage of all fractures admitted. In elderly patients usually have associated diseases like hypertension, COPD and central nervous system disorders. Such patients do not tolerate treatment with prolonged recumbency. If treated with skeletal traction, mortality and morbidity become high. They develop pneumonia, bedsores, deep vein thrombosis, muscle wasting and joint stiffness. And once skeletal traction is removed, they develop coxa vara with shortening of limbs.

In this work, an attempt has been made to evaluate mechanism of injury, time delay in surgery resulting in complications, time of fracture union, effect of age and sex, outcome depending on fracture pattern, post-operative complications.

Methodology:

A prospective study, including 30 cases done in January 2009 to December 2009. The cases were followed up for 6 months at intervals of 6 weeks, 3 months and 6 months. All required routine investigations done pre-operatively. Study performed after obtaining consent of the patients. The Data analysis done for a period of 3 months using rates, ratios and Percentages of different outcomes as per HARRIS HIP SCORE, which will be computed and compiled.

Results:

At follow up of 6 months 10 patients had excellent results 16 had good results, 3 fair, and 1 had poor results. Achieved Excellent to good results of 86.67% with an Average Harris Hip Score of 85.40 points.

No revision surgery done for any of the patients. 5 patients had superficial wound infection post operatively managed with antibiotics and regular dressings. For all the patients physiotherapy was started.

Conclusion and Interpretation:

After treating 30 patients we conclude dynamic hip screw with barrel plate has better advantage in terms of stability, mobility, range of motion and functional outcome. This is also the observation of many authors in contemporary orthopaedic practice as reviewed from review of literature.

Keywords:

Inter-Trochanteric fracture femur; Dynamic Hip Screw; Harris Hip Score.

LIST OF ABBREVIATIONS USED

AGR	-	Agriculturist
C V S	-	Cardio Vascular System
C N S	-	Central Nervous System
DOA	-	Date of Admission
DOD	-	Date of discharge
DOS	-	Date of surgery
Dc	-	Differential count
D.H.S	-	Dynamic hip screw
DM	-	Diabetes mellitus
EA	-	Epidural anaesthesia
E S R	-	Erythrocyte Sedimentation Rate
EX.SRV	-	Ex. Service
Hb	-	Haemoglobin
HBsAg	-	Hepatitis B surface antigen
HIV	-	Human immunodeficiency virus
HTN	-	Hypertension
H/W	-	House Wife
IP No.	-	Inpatient Number
I.V	-	Intravenous
L	-	Left
R	-	Right
ROM	-	Range of movement
R S	-	Respiratory System

RTA	-	Road traffic accidents
RT.TCR	-	Retired teacher
SA	-	Spinal anaesthesia
Sl No.	-	Serial Number
TAP	-	Tip apex distance
Tc	-	Total count
T.P.R	-	Temperature Pulse Respiratory Rate

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INTRODUCTION

Trochanteric Fractures are the most common fractures encountered by an orthopaedic surgeon accounting for a good percentage of all fractures admitted.

The incidence of these fractures is gender and race dependent and varies from country to country and these fractures in elderly is due to trivial fall, advancing age in relation to osteoporosis.[1]

In younger age group, incidence is increasing day by day due to increase in high velocity road traffic accidents.

In elderly patients usually have associated diseases like hypertension, COPD and central nervous system disorders. Such patients do not tolerate treatment with prolonged recumbency. If treated with skeletal traction, mortality and morbidity become high. They develop pneumonia, bedsores, deep vein thrombosis, muscle wasting and joint stiffness. And once skeletal traction is removed, they develop coxa vara with shortening of limbs.[2]

The evolution in treatment of trochanteric fractures has been from conservative treatment to operative treatment in the form of nail plate device, dynamic hip screw, replacement by prosthesis.

The Dynamic Hip screw (DHS) offers provision of dynamic and static compression at fracture site along with sound fixation which favours union with reasonable cost efficiency ratio.[1]

In this work, an attempt has been made to evaluate mechanism of injury , time delay in surgery resulting in complications , outcome depending on fracture pattern, post-operative complications.

Epidemiology:[1-2]

Inertrochanteric fractures constitute almost half of all fractures of the proximal femur. The incidence of these fractures, particularly comminuted unstable types is increasing. The incidence of trochanteric fractures can be studied as follows:

1. **Age, Sex and Race:** These fractures occur in elderly patients, the average age reported being 56 to 76 yrs.

   The ratio of women to men is 2:1 to 8:1. It is believed that intertrochnateric fractures occur more commonly in women because of metabolic bone changes.

   The incidence shows a slight tilt towards white population than black population.
2. **Osteoporosis:** Is claimed to be the major cause of bone weakness leading to proximal femoral fractures. Osteoporosis is more common among the patients with hip fractures than in controls and is somewhat more common in trochanteric fractures than in femoral neck fractures.
3. **Physical and mental illness:** A number of physical illness including cardiac disease associated with syncopal attacks or arrhythmias, or neurological diseases as epilepsy and ataxias, and generalized debility are associated with falling leading to fractures.
4. **Other conditions:** People who are lean are found to be more prone because of lack of subcutaneous fat that protects the bone during a fall. A large number of studies have found that use of perimenopausal Estrogens is associated with a lower incidence of proximal femoral fractures in later life.

OBJECTIVES

- To study average time duration for union of these fractures.
- To study the effect of age and sex on trochanteric fractures and post operative management.
- To study the outcome of the trochanteric fractures treated with DHS.

REVIEW OF LITERATURE

The treatment of inter-trochanteric fractures has advanced greatly in the last few decades . In the 18th century patients suffering from trochanteric fracture were simply placed in bed for prolonged periods until healing . In the 19th century traction was used preventing the hip from falling into varus deformity.

Von Langenbeck[3] first used an advanced form of stabilization with the use of a hip nail in 1850.

In 1910 **Cotton**[4] classified fractures around the hip as fracture neck (intracapsular) and trochanteric (extracapsular) fractures. He observed that almost all fractures united, prognosis was good and some shortening and limp was encountered.

Hamilton Russell[5] in 1924 made a major breakthrough in the history of conservative treatment of trochanteric fractures, by his new method of skin traction.

In 1931, a study reported their series of open nailing with the triflanged nail. They advocated open reduction, impaction and internal fixation of the fracture[2].

In **1937, Lawson Thornton**[2] developed a plate to be attached to the Smith Peterson nail, called the **Thornton plate**. This was a breakthrough in the history of operative treatment of trochanteric fractures.

In **1941, E. L. Jewett**[6] devised a single piece angled nail plate called **Jewett nails** and used it for internal fixation of trochanteric fractures.

A study conducted in 1947 compared both operative and conservative treatment. The 38 cases treated by traction with an average age of 78 years, showed a

mortality rate of 34% and the 95 operated cases with an average age of 75 years, showed a mortality rate of 12.6%. The Jewett nail plate was used in most of the operated cases[7].

In **1947, Mc Laughlin**[8] introduced the adjustable nail plate combination. He used triflanged nail with its lateral end having a slot to which a plate is fixed with a washer and bolt.

Merwyn and **Evans**[9] treated 101 cases and classified trochanteric fractures into stable and unstable types. He suggested that, operative treatment should be routine in trochanteric fractures for early mobility, better comfort, reduced mortality and economy of hospital beds.

In **1949, Murray**[10] found that though trochanteric fractures heal with conservative treatment, there is a strong argument for early mobilization of these patients with adequate fracture stabilization using internal fixation.

In **1950, Earnest Roll**[11] in Germany was the first to use a sliding device for internal fixation of trochanteric fractures.

In 1949 **Boyd** and **Griffin**[12] presented a classification for trochanteric fractures which is still widely followed all over the world , his study showed 18% of mortality rate in 300 cases treated conservatively.

Leonard[13] in 1949 suggested that, the usual cause of failure of the implant was due to marginal position of the nail and to avoid this, both antero-posterior and lateral views are necessary.

In **1955, Schumpelick**[14] described the use of a sliding nail device with trephine tip.

A study in 1957 showed both stable and unstable fractures internally fixed with a nail plate and found that 41% of the fractures go into varus, and he concluded that for the unstable fractures traction was better than internal fixation with a nail plate[15].

Moore and **Cram**[16] discussed the importance of medial cortex and it's comminution and the subsequent collapse of the fracture into varus.

In **1958, Massie**[17] introduced a sliding nail plate fixation, which caused impaction.

Some authors in 1961 operated 100 cases observed that, in Type-III and IV of Boyd and Griffin (unstable trochanteric fractures) fractures medial migration of the distal fragment, with protrusion of proximal end of nail into the hip joint and pelvis was seen more frequently than appreciated[18]**.**

Muller[19] in 1962 used acrylic cement along with internal fixation in unstable comminuted trochanteric fractures. It was claimed to give better results, as stable fixation of the implants was achieved, the posteromedial cortex was reconstructed and early weight bearing was made possible.

In **1962, Massie**[20] modified the sliding nail plate device to allow collapse and impaction of the fragments, which lead to improved results in the treatment of trochanteric fractures.

A study conducted in 1964 showed 32% of failure rate with jewett nail plate device operated on stable fractures when compared to sliding plate and screw device showed only 5.2% of failure rate[21].

In **1966, Kuntscher G**[22] introduced Condylocephalic Intramedullary nails.

A study done in 1966 reviewed 100 cases using 150° angle nail plate and early mobilisation and observed that, migration of the nail, loss of fixation of the fracture or both resulted in delayed rehabilitation.[23]

In 1972 a study reviewed 350 trochanteric fractures treated with a sliding hip screw. They confirmed that stable fractures could be treated satisfactorily with virtually any rigid internal fixation device. They also pointed out that recognition of the unstable fracture was often difficult. The overall failure rate was 4.8%. [24].

In 1964, a clinical review of 122 cases recommended reduction and internal fixation for stable fractures and for unstable fractures, primary medial displacement of the distal fragment (shaft) beneath the proximal fragment (head and neck) to produce stability and to push the major fragments together rather than traction and distraction and then insert a short nail and plate. Functional results noted were excellent[25].

In 1973 **Augusto Sarmiento**[26] emphasized that improper reduction of medial cortex resulted in collapse into varus with migration of the nail out of the neck. Osteotomy gives maximum stability and in addition would change the angle of inclination of the fracture to a less vertical degree and introduces a valgus attitude to the proximal femur.

Herrington and **Johnston**[27] in 1973 described a modification of the medial displacement osteotomy and fixation technique of Dimon and Hughston, using a

Sliding compression screw plate device in 81 patients. Conventional internal fixation had 44% complications, whereas using medialisation technique, they observed complications in only 19.6% (11 out of 56%) cases.

In 1973 **Collado**[28] introduced the condylocephalic nailing method and concluded that this procedure is simple and the position of nail is favorable as it is in the long axis of the shaft and corresponds to the direction of mechanical forces acting on the fracture line and has obvious advantage that, the fracture site is not operate and hence infection is prevented..

In 1974 a study reported the results of using the Richards Compression Sliding Hip screw system, in the treatment of 48 trochanteric fractures and showed that this system could stabilize the fracture to such an extent that it is possible to mobilize the patient to walking with full weight bearing on the operated leg within a few days[29].

Herrington[30] in 1975 reported 42 unstable intertrochanteric fractures fixed with Jewett nail or compression screw plate fixation with bone cement. He allowed patients to sit up in chair on 2nd postoperative day and weight bearing within three weeks.

In 1975, few authors treated 104 intertrochanteric fractures in 102 patients with compression screw. They observed that union occurred in 59 of the 62 patients who were followed. The average healing time being 15 weeks and average time to weight bearing was 14 weeks. This study showed the compression hip screw to be a reliable, versatile and effective device for the treatment of all types of intertrochanteric fractures[31].

In 1978 a study reviewed 88 patients, followed-up 83 for average period of 27 months. Of the 56 living, only 24 (43%) demonstrated a good functional result. Medial displacement osteotomy should be combined with a sliding screw plate device. [32]

Jensen[33] in 1978, reported 80 unstable fractures stabilized with compression screw, and the overall rate of joint penetration and cutting out of the device was 5.3%.

Richard[34] in 1978 reported the use of compression hip screw in 236 patients. Rigid fixation was obtained and early mobilisation and weight bearing was allowed.

A study done in 1979, reported 75 patients treated with hip compression screws, concluded that central placement of the screw in the femoral head with its tip 10-13 mm from the subchondral bone is ideal and the design of the compression screw allows increased stability and impaction of the bone fragments in an intertrochanteric fracture[35].

Another study in 1979 showed treatment of 622 intertrochanteric fractures, of which 57% were stable (Types I and II), 28% were type III, and 15% were type IV (the unstable types). The 150 degree telescoping Massie nail proved superior to the fixed 135 degree Jewett nail (particularly for unstable fractures) because it allowed a controlled impaction of the fracture fragments to a stable position.[36]

Another study in 1979, showed the treatment of 236 patients with intertrochanteric fractures by compression hip screw. Bony union occurred in 234 patients, non-union occurred in 2 patients in whom there was excessive medial displacement of the distal fragment and concluded that rigid fixation with inter-

fragmentry compression using a compression hip screw permitted early mobilization and immediate weight bearing[37].

A study done in 1980 concluded that distraction forces at the site of an unstable intertrochanteric fracture can cause disengagement of the sliding hip screw from the barrel of the side plate[38].

Rae R. Jacobs, McClain O. and **Armstrong J.H.**[39] in 1980, reviewed 173 cases of intertrochanteric fractures treated by internal fixation, 72 were treated with Jewett nail and 101 with Richards compression hip screw. They concluded that compression hip screw is valuable in intertrochanteric fractures. In stable conditions it acts as a tension band producing more force transmission through the medial cortex, stressing the implant more in tension and less in bending.

Jensen and **Tondevold**[40] in 1980 presented a series of 375 patients with stable trochanteric fractures were treated with the McLaughlin or Jewett nail plate, the sliding screw plate or Ender nailing. Technical failure of fixation was encountered in 5% of the cases regardless of the method of fixation used. Reoperations were performed in less than 3% of cases treated with hip implants but in 20% of cases with Ender nailing, mainly because of distal slipping of the nails resulting in knee problems. With an improved technique, however, Ender nailing can be used as successfully as any of the hip implants for the internal fixation of stable trochanteric fractures.

Another study in 1981 showed that Ender's pins are ideally suited for elderly patients with stable fractures, particularly if the surgical risk is high. They must be used with caution in unstable fractures and postoperative protection in traction may be necessary. However, the occasional external rotation deformity and the high incidence

of problems with the knee make their use in younger, more active patients less desirable than the compression hip screw unless their unique advantages justify their use[41].

In 1982, in a retrospective study of 295 hips, in 287 patients noted that the average time in achieving full weight bearing in 179 hips with available films was 13.6 weeks, stable fractures averaging 11.7 weeks and unstable fractures averaging 19.1 weeks and concluded that sliding hip screw has been shown to be a reliable means of internal fixation of intertrochanteric fractures[42].

A study in 1982 reviewed a consecutive series of 61 unstable intertrochanteric fractures internally stabilized with a compression hip screw utilizing a medial displacement technique, suggests that this approach carries a low incidence of mechanical failure, acceptable morbidity and mortality rates, and no excessive shortening[43].

Another study in 1984, reported 140 cases of trochanteric fractures treated with a Modified Richard's Compression screw. The overall failure rate was 6.3%. Early ambulation did not compromise the end results. Complications seen in 6 patients consisted of early infection in 2 patients, late infection in 2 patients, implant penetration in one patient and implant coming out of the head in one patient. Six patients had mild pain over the palpable nut. There was non-union in one patient[44].

Juluru P. Rao, Mark Hambly and **John King**[45] in 1988, compared the results of compression screw fixation and Ender's rod in intertrochanteric fractures of the hip. A retrospective analysis of 77 cases of both stable and unstable intertrochanteric fractures showed a higher incidence of complications in the Ender's group. The complications included implant backing out, distal femoral fractures, need

for a secondary procedure, external rotation deformity and knee pain. The authors report that the most popular method of internal fixation of both stable and unstable intertrochanteric fractures is the sliding compression hip screw, with high union rates. The disadvantages are wide exposure and infection.

In 1989, **Hornby** and **Evans**[46] studied all elderly patients with extracapsular hip fractures over a twelve months period and followed up for six months. Patients were randomised to treatment by AO dynamic hip screw or by traction. Operative treatment gave better anatomical results and a shorter hospital stay, but significantly more of the patients treated by traction showed loss of independence six months after injury.

In 1990, **Medoff**[47] modified the side plate and designed a modular side plate that allows collapse and impaction along the axis of the femoral shaft, known as the **Medoff Sliding Plate.**

A study in 1991 have prospectively compared the fixation of 100 intertrochanteric fractures of the proximal femur in elderly patients with random use of either a Dynamic hip screw or a new intramedullary device, the Gamma nail. They found no difference in operating time, blood loss, wound complications, stay in hospital, place of eventual discharge, or the patients' mobility at final review. There was no difference in failure of proximal fixation cut out occurred in three cases with the Dynamic hip screw, and twice with the Gamma nail and union was seen by six months in both groups[48].

Martyn J. Parker[49] in 1992 studied the screw position in 25 patients, in whom the screws later cut-out was compared with the position in 200 cases in which there was radiographic evidence of bone union without cut-out. They suggested the

aim should be to place the screw centrally or inferiorly on the AP view and centrally on the lateral view.

A study conducted in 1994 assessed the rigidity and strength of fixation provided by intramedullary and extramedullary devices for proximal femoral fractures. Stable and unstable intertrochanteric fractures were studied with the Gamma nail and Richards 135 degrees classic hip screw implants. There was no significant difference in the strength of fixation of stable and unstable intertrochanteric fractures between the Gamma nail and the hip screw[50].

Another study in 1995, compared the fractures treated with DHS and Gamma nail. There was no significant difference between the two groups with respect to intra-operative blood loss, days of hospital stay, time to union and eventual functional outcome. The length of the procedure and fluoroscopy time was longer for the gamma nail group and the DHS was associated with a lower risk of local complications. Hence the DHS is still considered to be the implant of choice for intertrochanteric fractures[51].

In 1995 , a prospective study of 106 patients with 37 stable and 69 unstable trochanteric fractures treated with 2 different implants: a sliding screw plate and a triflanged nail plate. The parameter migration was compared between the 2 implants and for the various areas of placement of the screw or nail within the femoral head. For stable fractures, the migration observed was independent of the area of implant placement or the type of implant used. For unstable fractures, central placement of the sliding screw resulted in a decreased mean value of migration. When the nail was used, the mean values of migration observed were independent of the areas of

placement within the femoral head. In cases of central placement, the sliding screw appeared to be superior to the triflanged nail[52].

Another study in 1996 compared Gamma nail with DHS, showed that the gamma nail had a significantly increased risk of fractures of the femoral shaft and an increased re-operation rate[53].

Baumgaertner and **Solberg**[54] in 1997 compared the results of the surgical treatment of trochanteric hip fractures before and after surgeons had been introduced to the tip apex distance (TAD) as a method of evaluating screw position.

A study done in 1998, assigned 131 patients with trochanteric fractures to treatment with either a sliding hip screw or an intramedullary hip screw showed intra-operative complications occurred exclusively in patients with intramedullary hip screw with no differences in the rates of functional recovery between the two fixation groups[55].

In 1998, a prospective randomized study of 100 patients who had an intertrochanteric fracture treated with a compression hip screw with a plate [50] or an intramedullary hip screw [50] showed that the Compression Hip Screw has better telescoping displacement and impaction of the fracture fragments compared to Intramedullary Hip Screw[56].

In 1998 a randomized, prospective study compared the Medoff sliding plate with a standard compression hip screw for the fixation of 160 stable and unstable intertrochanteric fractures with an average follow up of 9.5 months. Use of the Medoff plate for all fracture types was associated with a significantly higher amount of blood loss and operating time[57].

Baixauli and **Baixauli**[58] in 1999 treated three hundred fifty eight patients older than 60 years of age with a reinforced rigid fixation device with mean follow up, 16 months. Six months after surgery the fracture had united in 82% of the patients who were walking without aid or using only a cane. They found no difference regarding the results between stable and unstable fractures. Mechanical tests and clinical results showed that immediate weight bearing can be allowed in all types of intertrochanteric fractures. This reinforced device is effective in treating unstable intertrochanteric fractures and is especially indicated for the most unstable types[58].

In 1999 , a metanalysis of 14 studies, showed that the incidence of implant cut-out, breakage, fracture nonunion, and reoperation rates are significantly lower in patients treated with sliding implants than in those with fixed nail plates[59].

A study conducted in 1999, reported the clinical results of the treatment of intertrochanteric fractures treated with a 135^0 hip screw with a two-hole side plate showed average estimated blood loss was 77 cc., and the average surgical time was 31 minutes and concluded that the 135^0 sliding hip screw with a two-hole side plate produced satisfactory healing and results in relatively low blood loss and short surgical time without the loss of side plate fixation[60].

In 2000 **Parker** and **Handoll**[61] compared conservative with operative treatment for extracapsular fractures of the proximal femur (hip) in adults, they concluded no major differences in outcome between conservative and operative management programmes for extracapsular femoral fractures, but operative treatment appears to be associated with a reduced length of hospital stay and improved rehabilitation and conservative treatment will be acceptable when modern surgical facilities are unavailable.

A study done in 2001, in a prospective randomized study, compared 54 patients treated with Medoff sliding plate with 60 stabilized with a Compression hip screw showed that the mean femoral shortening, four months after the operation determined from radiographs of both femora was less in the group treated with the Compression hip screw[62].

In 2001 a study compared the surgical complications and functional outcome of the Gamma nail (Intramedullary fixation device) versus the Richards sliding hip screw and plate, in the intertrochanteric femoral fractures on 400 hips showed no difference between the two groups in terms of early or long term functional status at one year and concluded that routine use of the Gamma nail in this type of fracture cannot be recommended over the current standard treatment of dynamic hip screw and plate[63].

In 2002, a randomised, prospective study comparing a standard sliding hip screw and the intramedullary hip screw for the treatment of unstable intertrochanteric fractures in the elderly, showed the mean duration of operation and fluoroscopy screening time was significantly greater for insertion of the intramedullary hip screw. There was no difference between the groups with regard to transfusion requirements or time to mobilise after surgery.[64]

In 2010, a prospective randomized trial done comparing the long gamma nail with the sliding hip screw for the Treatment of AO/OTA 31-A2 fractures of the proximal part of the femur concluded the sliding hip screw should remain the gold standard for the treatment of AO/OTA 31-A2 fractures of the proximal part of the femur because it is associated with similar outcomes with less expense.[65]

ANATOMY

PROXIMAL FEMUR:[1-2,68]

The upper end of the proximal femur comprises of the head , neck , greater and lesser trochanters.

The Head:

It is a little more than half a sphere , is directed upwards , medially , slightly forward to articulate with the acetabulum . Its surface is smooth , but little below and behind its centre is roughened pit or fovea for the attachment of ligamentum teres. The inferomedial part of the head is related to the femoral artery, from which it is separated by the tendon of psoas major and articular capsule.

The Neck:

It is 5 cm long , directed upwards , medially and slightly forward , forming an angle of about 125^{o} ± 10° with the shaft of the femur . this arrangement facilitates the movement of hip joint and enables the lower limb to swing clear of the pelvis . the neck is narrowest at its middle and wider at its lateral than its medial end . its surface is entirely intracapsular , related to iliofemoral ligament and grooved by the obturator externus tendon . posterior surface is partly extracapsular .

The Greater Trochanter:

It is a large quadrangular projection at the upper part of the junction of the neck with the shaft of the femur. Its posterior-superior portion projects upwards and medially , so as to over hang the adjoining part of posterior surface of the neck , in this situation its medial surface presents a roughened depressed area , the trochanteric

fossa. The trochanteric fossa receives insertion of obturator externus tendon. The upper part of the projection receives insertion of pyriformis tendon and medial surface gives insertion to obturator internus and gemellii muscles tendon. The lateral surface of the greater trochanter has an oblique flattened strip running downwards and forwards for insertion of the gluteus medius tendon.

The Lesser Trochanter:

The lesser trochanter is a conical eminence. It is directed medially and backwards from the shaft at the lowest part of the neck. Its rounded surface medially provides attachment for the psoas major tendon. Iliacus is inserted into the front of this tendon and into the bone below the lesser trochanter. The smooth posterior surface is covered by a bursa deep to the upper horizontal fibers of adductor magnus.

The Intertrochanteric Line:

It marks the junction of anterior surface of the neck with the shaft of femur. It gives attachment to the anterior capsule of the hip joint , iliofemoral ligament and origin to highest fibres of vastus lateralis and vastus medialis muscles.

The Intertrochanteric Crest:

It marks the junction of posterior surface of the neck with the shaft of the femur. It is asmooth rounded ridge extending from greater trochanter to the lesser trochanter, above it an oval eminence , the ***quadrate tubercle***, providing attachment for the quadratus femoris.

The angle of femoral torsion :

It is the angle subtended by the long axis of the femoralneck and the transcondylar axis of the lower end femur. Average in the newborn is 40^0 and in adult is 15^0 .

The calcare femorale :

It is a dense vertical plate of bone extending from the posterior-medial portion of the femoral shaft under the lesser trochanter and radiating laterally to the greater trochanter, serving to reinforce the femoral neck posterior-inferiorly. It also forms the distal anchorage of the medial arrangement of the trabeculae in the internal weight bearing system.

Trabecular System:

In 1838, **Ward**[1-2,68] described the internal trabecular system of the femoral head (Fig. 1). These trabeculae are lines of stress. They are 5 types:

Primary Compressive Trabeculae: These are the strongest trabeculae, extending from the medial cortex at the base of the femoral neck to the subchondral bone of the superomedial part of the head.

Primary Tensile Trabeculae: These extend from the inferior region of the foveal area across the head and superior portion of the femoral neck into the greater trochanter, hence to the lateral cortex.

Secondary Compressive Trabeculae: These extend from the medial femoral cortex in the region of the lesser trochanter towards the greater trochanter.

Secondary Tensile Trabeculae: These extend from the lateral femoral cortex, inferior to the primary tensile trabeculae towards the middle of the femoral neck.

Greater Trochanteric Trabeculae: These extend from the superior border of the greater trochanter to its base . The space bounded by the primary compressive and tensile trabeculae and the secondary compressive trabeculae is known as the **Ward's Triangle**.

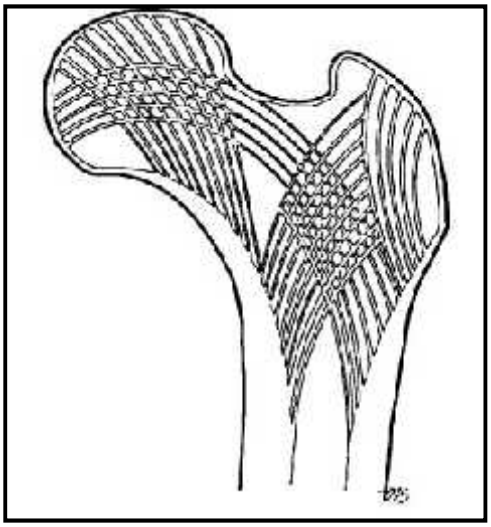


Fig. 1 : Trabecular pattern of proximal femur

The **Singh's Index**[1-2, 66] is an easily learned and applied method of assessing the quality of bone (Fig. 2). It is based on the trabecular pattern of the proximal femur.

Grade 6- Normal trabecular pattern with primary compression and tension trabeculae and secondary compression tension trabeculae.

Grade 5- Decrease in secondary trabecular pattern and Ward's triangle becomes prominent.

Grade 4- Secondary trabecular pattern is absent. Primary trabecular pattern is decreased.

Grade 3- A break occurs in the tension trabeculae.

Grade 2- Loss of primary of primary tension trabeculae is complete. Marked reduction in compression trabeculae.

Grade 1 – Only a few compression trabeculae seen.

Grade 3 and below indicate significant osteoporosis. These grades should be determined when considering internal fixation and whether or not weight bearing will be tolerated.

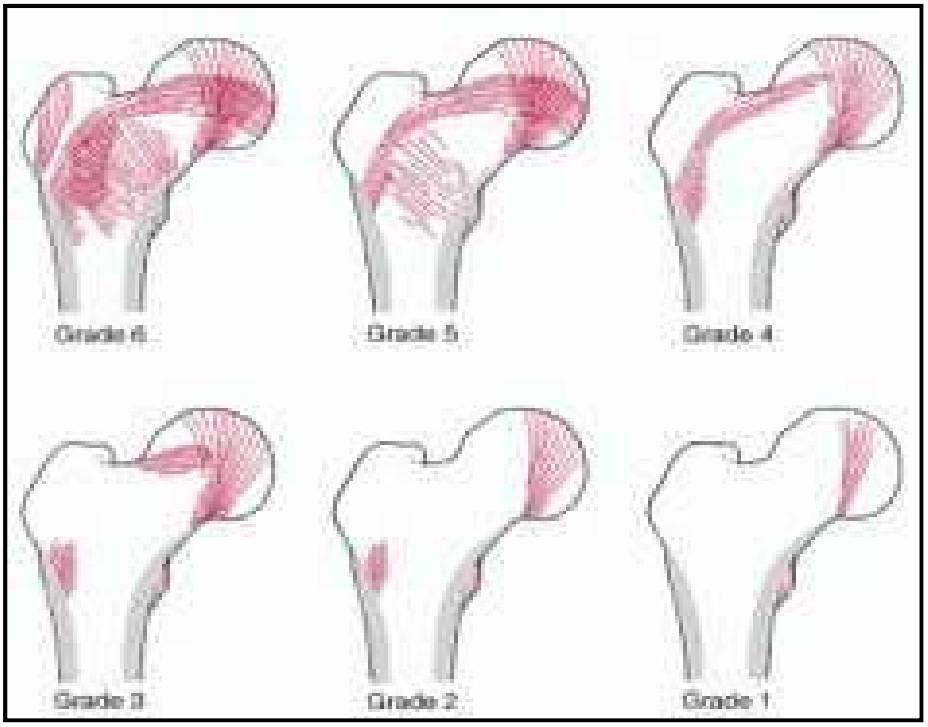


Fig. 2: Singh's Index

The Vascular Anatomy:[1-2,68]

Crock described the arteries of the proximal end of the femur in three groups (Fig.3):

(a) an extracapsular arterial ring located at the base of the femoral neck;

(b) ascending cervical branches of the extracapsular arterial ring on the surface of the femoral neck; and

(c) the arteries of the round ligament.

The extracapsular arterial ring is formed posteriorly by a large branch of the medial femoral circumflex artery and anteriorly by branches of the lateral femoral circumflex artery.

The ascending cervical branches arise from the extracapsular arterial ring. Anteriorly, they penetrate the capsule of the hip joint at the intertrochanteric line, and, posteriorly, they pass beneath the orbicular fibers of the capsule. The ascending cervical branches pass upward under the synovial reflections and fibrous prolongations of the femoral head from its neck. These arteries are known as **retinacular arteries of Weitbrecht**.[68] The proximity of the retinacular arteries to bone puts them at risk for injury in any fracture of the femoral neck.

As the ascending cervical arteries traverse the superficial surface of the femoral neck, they send many small branches into the metaphysis of the femoral neck. Additional blood supply to the metaphysis arises from the extracapsular arterial ring and may include anastomoses with intramedullary branches of the superior nutrient artery system, branches of the ascending cervical arteries, and the subsynovial intra-articular ring.

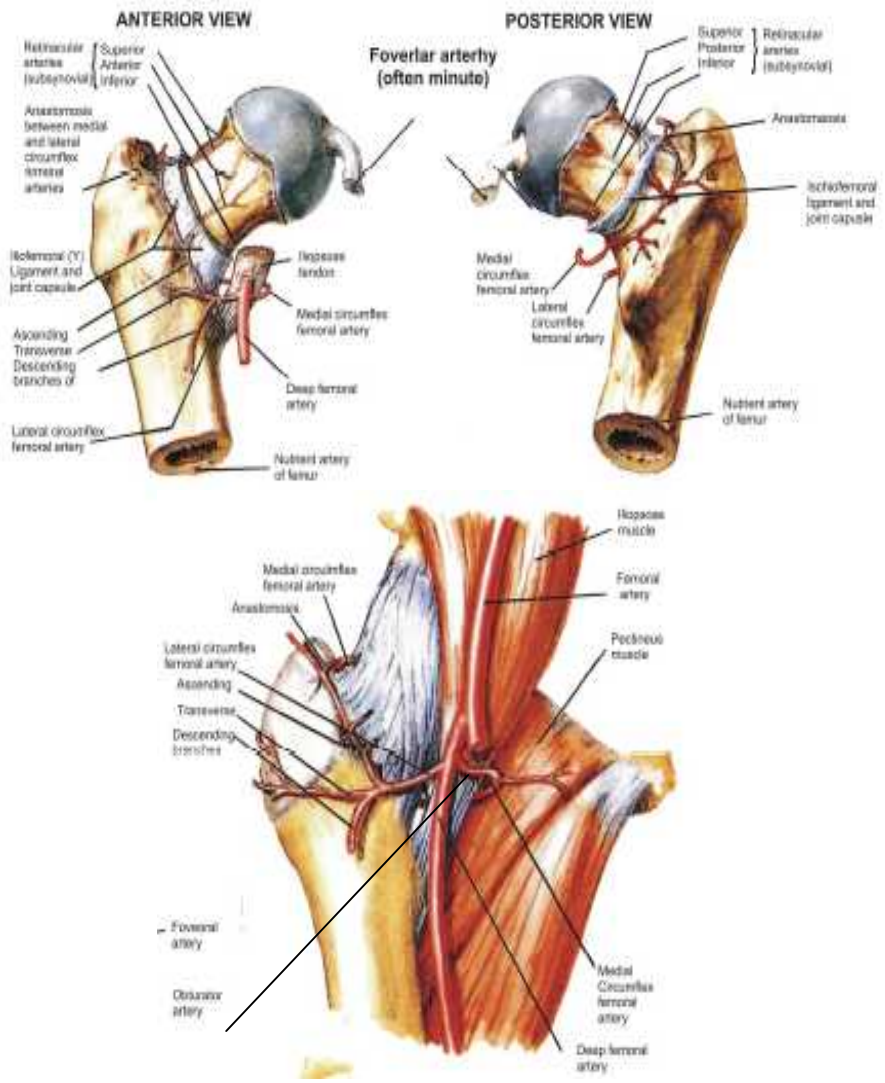


Fig. 3: Arteries of femoral head and neck

LIGAMENTOUS ANATOMY[1-2,68]

The hip joint is a constrained ball-and-socket joint. The head rotates within the acetabulum and is incompletely covered. The depth of the acetabulum is supplemented by the fibrous labrum, which makes the joint functionally deeper and more stable. The labrum adds more than 10% to the coverage of the femoral head, creating a situation that keeps the head more than 50% covered during motion. It takes more than 400 N of force just to distract the hip joint. The capsule of the hip is strong and extends from the rim

of the acetabulum to the intertrochanteric line anteriorly and the femoral neck posteriorly. The longitudinal fibers are supported by spiral capsular thickenings termed ligaments.

Anteriorly, the iliofemoral or Y ligament originates from the superior aspect of the joint at the ilium and anterior inferior iliac spine. It runs in two bands inserting along the intertrochanteric line superiorly and just superior to the lesser trochanter inferiorly (Fig. 4).

The inferior capsule is further supported by the pubofemoral ligament, which takes its origin from the superolateral superior ramus and inserts on the intertrochanteric line deep to the Y ligament

Posteriorly, the capsule inserts on the femoral neck just inferior to the head medially and extends to the base of the greater trochanter laterally. The ischiofemoral ligament within the capsule posteriorly originates at the junction of the inferior posterior wall with the ischium. It runs obliquely lateral and superior to insert on the femoral neck with the capsule. In addition to these ligaments, the short external rotators lie on the posterior capsule, providing additional support.

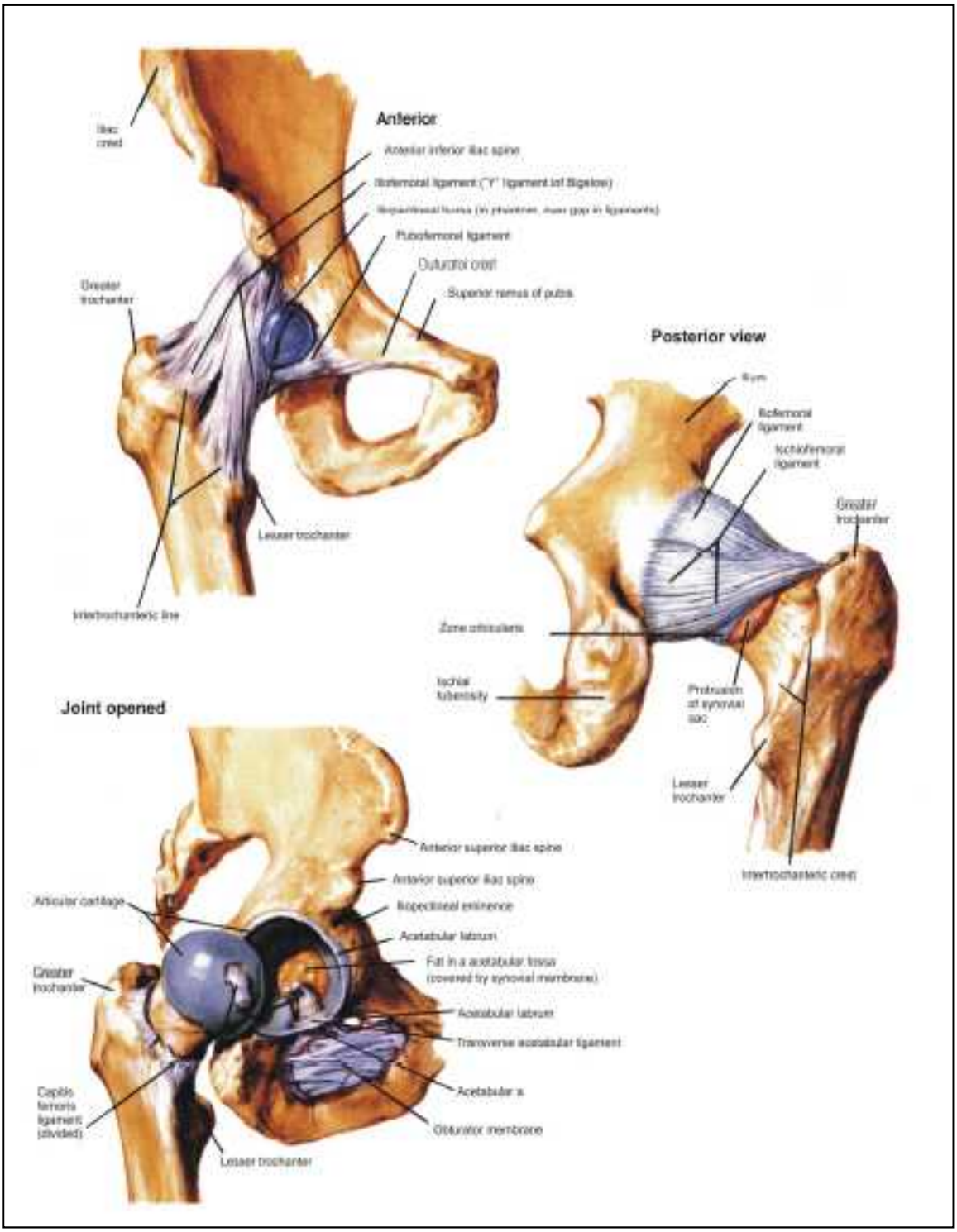


Fig. 4 Ligaments around hip joint

CLINICAL AND RADIOLOGICAL EVALUATION[1-2,9,18]

A history of trivial trauma, usually a slip while walking, inability to stand up after the fall and pain around the hip joint in an elderly is the usual presentation.

The salient clinical features are:

1. The attitude of the affected limb will be in the classical external rotation with shortening and the lateral border of the foot touches the bed completely.
2. There is also slight flexion at hip and knee.
3. Swelling around the hip and proximal end of the thigh depending upon the severity of the trauma.
4. Acute tenderness may be elicited over the greater trochanter.
5. Shortening of the limb.
6. Abnormal movements and crepitus at the fracture site.

Roentgenograms are diagnostic; both anteroposterior and lateral view should be taken. It shows the site and type of fractures .

CLASSIFICATION

Boyd and Griffin (1949) classification[12]:

This classification includes all the fractures from the extracapsular part of the neck to a point 5cm distal to the lesser trochanter (Fig. 5).

Type 1: Fractures that extend along the intertrochanteric line from the greater to the lesser trochanter. Reduction usually is simple and is maintained with little difficulty.

Type 2: Comminuted fractures, the main fracture being along the intertrochanteric line but with multiple fractures in the cortex. Reduction of these fractures is more difficult because the comminution can vary from slight to extreme.

Type 3: Fractures that are basically subtrochanteric with at least one fracture passing the proximal end of the shaft just distal to or at the lesser trochanter. Varying degree of comminution are associated. These fractures are usually more difficult to reduce and result in more complications.

Type 4: Fractures of the trochanteric region and the proximal shaft, with fracture in atleast two planes. If open reduction and internal fixation is used two plane fixation is required.

Type 3 and 4, most difficult types to manage account for only one third of the trochanteric fractures.

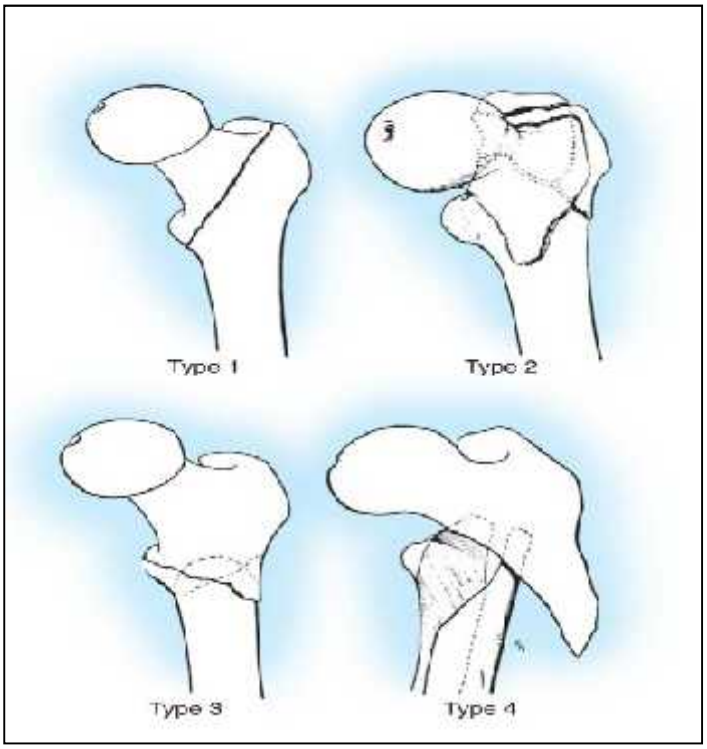


Fig. 5: Boyd and Griffin Classification (1949)

Evans classification[9]:

Type 1: The fracture line extends upwards and outwards from the lesser trochanter.

Type 2: The fracture line is of reversed obliquity, the major fracture line extends outward and downward from the lesser trochanter and are unstable.(Fig.6)

A widely used classification system based on the stability of the fracture pattern and the potential to convert an unstable fracture pattern to a stable reduction. Evans observed that the key to a stable reduction is restoration of posteromedial cortical continuity.

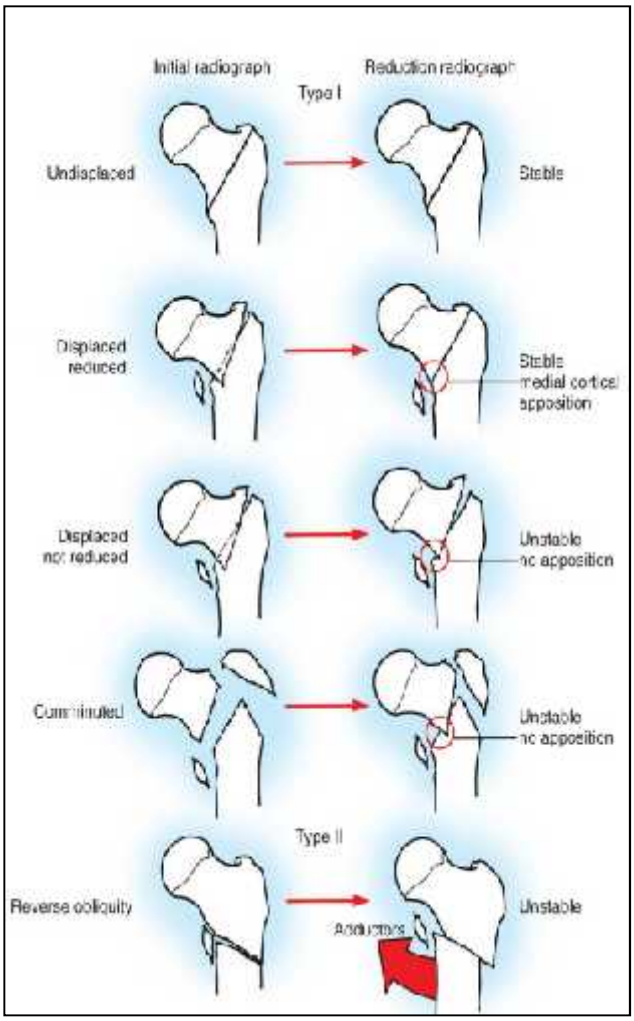


Fig. 6: Evan's Classification of Trochanteric Fractures

AO Classification of intertrochanteric fractures[1-2]:

These can be divided into the (1) easily stabilized fractures and into the (2)unstable problem fractures. Stable fractures (about 70% of all intertrochanteric fractures) have an intact medial buttress. In unstable intertrochanteric fractures, there is in addition to the medial fragment a large posterior fragment. These are so called 4 part fractures, in which at times may be even more comminuted than described (Fig.7).

I Stable Intertrochanteric fractures:

a) Fracture runs from greater trochanter obliquely downwards and medially to exit just above the lesser trochanter. A good portion of the calcar is attached to the proximal fragment anteromedially. Quite commonly there is an avulsion fracture of lesser trochanter. As a rule the distal fragment is in external rotation. Rarely the inferomedial spike of the proximal fragment is impacted into the metaphysis of the distal fragment.

b) An avulsion fracture of lesser trochanter - this type of avulsion does not result in instability because it does not weaken the medial buttress.

II. Unstable intertrochanteric fractures:

a) The medial fragment varies in size and reaches distally to a varying degree. As a rule it contains the lesser trochanter. If the lateral wall remains intact then the distal fragment migrates proximally because of muscle pull. Commonly there is in addition quite a large posterior fragment. Occasionally the proximal fragment contains a long medial spike made up of calcar and lesser trochanter. This makes it into a long oblique or spiral fracture.

b) If the greater trochanter is fractured, then the distal fragment is not pulled upwards.

c) A badly comminuted intertrochanteric fracture has in addition to the fracture of lesser and greater trochanter further comminution posteriorly and medially.

d) The intertrochanteric fracture line is almost horizontal. Often one finds this fracture associated laterally with a further anterior or posterior fragment, and occasionally both.

e) Occasionally the fracture has reverse course beginning laterally and distally and running upwards and medially. Medially it exits above the lesser trochanter.

Commonly it is associated with a fracture of the greater trochanter.

The problem with fractures (d) and (e) (about 5% of intertrochanteric fractures) is their reduction and stabilization which, because of muscle pull and fracture pattern, are particularly difficult.

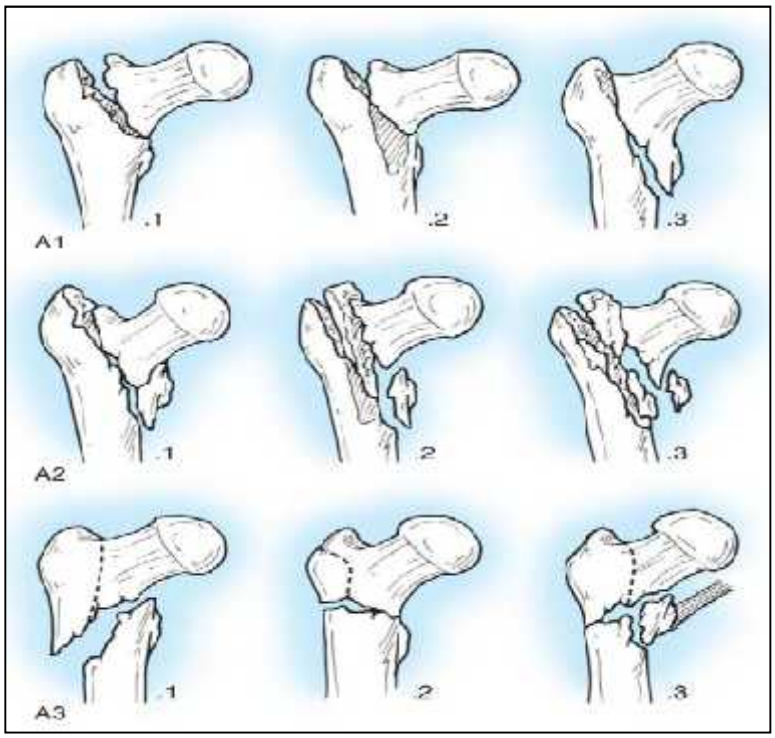


Fig. 7: A.O Classification of Trochanteric Fractures

Biomechanics of the Dynamic Hip Screw:[1-2,12,34,41]

The sliding hip screw allows controlled collapse at the fracture site and also allows slight medialization of the fracture fragments (Fig. 8).

The sliding plate has following biomechanics:

Plate as a tension band : This biomechanical function comes into effect when there is medial cortical stability .the plate is fixed onto the tension side of the bone and helps in converting tensile forces into compressive forces.

However, when the sliding screw passed through the fracture site with no cortical screw in the proximal fragment then the plate acts as a sliding device and allows for the compression of the fracture fragments.

Large proximal screw obtains better purchase in proximal fragment than nail – plate device. Screw has blunt nose which results in less penetration into femoral head and acetabulum on compression.Ability of screw shaft to slide in collar of plate allows impaction at fracture site.

Sliding also permits slight medial displacement of shaft in relation to head and neck fragment. This tends to reduce bending moment and resulting forces that lead to collapse of medial buttress and varus displacement. For this sliding to occur plate must not be fixed with screw into proximal fragment.

Fig. 8: Dynamic hip screw assembly

MANAGEMENT OF TROCHANTERIC FRACTURES

Trochanteric fractures can be treated by conservative and operative method. To reduce the prolonged recumbency and immobilization operative method is preferred over conservative method. Conservative method is preferred only when the patient is not medically fit for surgery.

According to Watson Jones intertrochanteric and peritrochanteric fractures unit because of good blood supply no matter what treatment is used.

Types of Conservative treatment:[1-3,5]

The various conservative methods used in a patient who is unfit for surgery or unwilling for surgery are:

1) Derotation boot: A below knee plaster cast is applied from tibial tuberosity upto, the base of the toes with a wooden bar attached to the heel to prevent lateral rotation. After clinical and radiological union of fracture (10-12 weeks), it is removed and physiotherapy is begun. This is an old form of treatment.

2) Buck's extension skin traction: Adhesive plaster is applied to skin below knee of the affected limb with a spreader bar and light weight.

3) Skeletal traction: The commonest method used in conservatively treated cases. Heavy skeletal traction is used through the upper tibial skeletal pin over a Bohler Brown splint. About 10% of the body weight is used for the traction; patient is advised to do the quadriceps exercises for five minutes in every hour of all waking hours. After 10-12 weeks traction is removed and patient is gradually mobilised and walking aids are used initially till consolidation of the fracture.

4) Hamilton Russell traction:[5] Continuous traction is obtained in the line of the femur by the traction weight suspended through several pulleys. Since no splint is used, the patient is more comfortable. The knee is flexed over a pillow and the limb is also supported while on traction, it is claimed that this controls both angulatory and rotational deformity.

There are many disadvantages of the conservative method of treatment. They are mainly knee joint stiffness, pin tract infections, deep vein thrombosis, hypostatic pneumonia and prolonged hospital stay in the bed, bed sores etc., Coxa vara deformity, shortening, limitation of hip movements are complications encountered around the hip. The mortality and morbidity rates are very high in conservative line of treatment.

OPERATIVE MANAGEMENT:[1-2,8-9,44,49]

The goals of operative treatment is –

- Strong and stable fixation of the fracture fragments.
- Early mobilization of the patient.
- Restoration of the patient to his or her pre-operative status at the earliest.

Surgical Techniques:

1)Plate and screw devices :

a) **Fixed Angle Nail Plate devices**[6] (e.g., Jewett nail, Holt nail) with a fixed plate angle of 130 to 150 degrees providing stabilization of the femoral head and neck fragment to the femoral shaft.

Disadvantages of fixed angle nail plate :

1) Penetration of the tip of the nail into the hip joint on collapse of fracture.

2) Inadequate fitting of the side plate to the shaft of the femur.
3) Inadequate purchase within the cancellous bone of the femoral head.
4) Not useful in unstable fracture .

b) **Sliding Nail Plate devices**[7-9,12,15,21,34] consisting of Screw threads on the hip nail for good purchase in the porotic bone of the femoral head. Blunt tip on the screw minimizing the chance of penetration into the hip joint . Sliding mechanism allowing collapse and impaction of the fracture . maintaining the neck-shaft angle and controlling rotation by a Tongue in groove barrel collar**.**

c) **Medoff Plate**[47] utilises a lag screw (from the standard sliding hip screw set) to allow compression along the axis of the femoral neck. In place of standard femoral side plate, however, it utilises a coupled pair of sliding components that enable the fracture to impact parallel to the axis of the femur. A locking set screw may be used to prevent independent sliding of the lag screw within the plate barrel; if the locking set screw is applied, the plate can only slide axially on the femoral shaft (uniaxial dynamisation). If, however, it is applied without the locking set screw, sliding may occur along both the femoral neck and femoral shaft (biaxial dynamisation).

2) Intramedullary Devices:[1-2]

In 1964 **Kuntscher**[22] introduced non-flexible nails inserting through the medial femoral condyle, where the cortex was thinner and minimal soft tissue requiring less exposure but the large diameter of the nail, the use on guide wire and inflexibility of the nail led to problems with its use.

Ender[45] in 1970 advocated the use of multiple, flexible nail known as **Ender's Nail** inserted just above the adductor tubercle to hold these fractures in

reduction. These devices are inserted under image intensification in a retrograde manner. The advantages of this technique are less chance of bleeding and infection , minimal soft tissue dissection, fracture impaction with weight bearing while maintaining the normal neck shaft angle but with complications such as rotational deformity , Proximal migration of the nails through the femoral head , back out of the nail with resultant knee pain and knee stiffness.

Other intramedullary devices such as the **Gamma Nail, Intramedullary Hip Screw, Proximal Femoral Nail and Russell Taylor Reconstruction Nail** have been used for the fixation of intertrochanteric fractures. Second generation of interlocking nails called the **Trochanteric Gamma Nail** can be used without extension into the subtrochanteric area.

The **Gamma Nail** being an intramedullary device lies medial than the standard sliding compression hip screw and plate, hence less force is dissipated on the implant with weight bearing. The device transmits the patient's body weight closer to the Calcar, resulting in greater mechanical strength. The duration of surgery and blood loss is minimal.

The **Intramedullary Hip Screw** couples a sliding hip screw with a locked intramedullary nail. This design offers several potential advantages –

- The intramedullary fixation, because of its location, theoretically provides more efficient load transfer than does a sliding hip screw.
- The shorter lever arm of the intramedullary device can be expected to decrease tensile strain on the implant, thereby decreasing the risk of implant failure.
- As it incorporates a sliding hip screw, the advantage of controlled fracture impaction is maintained.

- It theoretically requires shorter operative time and less soft tissue dissection.

These devices are associated with the risk of late femoral fractures at the tip of the device or the distal locking screws.

3) External Fixators:[67]

Simple, safe and economical method of fixation in high-risk geriatric patients. Two or three 6.5mm Cancellous Shanz pins are passed percutaneously, into the femoral neck under image intensification, after reducing the fracture on a fracture table. The advantages of external fixator are application as well as removal of the external fixator is simple, early mobilization of the patient short operative time , minimal blood loss ,early mobilization but with few complications like pin tract infection , varus collapse at the fracture site , pin breakage , proximal pin migration.

4) Prosthetic Replacement:[1-2]

Generally indicated in elderly, debilitated patients with a comminuted, unstable intertrochanteric fracture in severely osteoporotic bone, as the primary indication for prosthetic replacement symptomatic ipsilateral degenerative hip disease, non union, extensive comminution and poor bone quality, where hemiarthroplasty or total hip replacement should be carried out. Disadvantages are extensive and invasive procedure then internal fixation, with the potential for increased morbidity and complications including prosthetic dislocation.

5) Internal fixation of unstable intertrochanteric fractures:

a) Dimon and Hughston's technique[25]**:** Briefly, it consists of osteotomising the greater trochanter transversely, insertion of the guide pin in the proximal fragment

in the required position, to place the displaced beak of the neck fragment into medullary cavity of the displaced fragment, then fixed with the dynamic hip screw and securing the plate to the cortex of the shaft, thus the unstable fracture is stabilized.

b) Sarmiento's technique[26]**:** Here, an oblique osteotomy of the distal fragment is made, the angle being 45°, a guide pin is inserted into the proximal fragment exactly at 90° i.e., perpendicular to it, the Richard screw is inserted over the guide pin and then the plate part is secured to the lateral aspect of the shaft thus stabilising the fracture.

COMPLICATIONS[1-2,25-26]

The complications following the surgical management of trochanteric fractures are –

General Complications:

As a result of prolonged immobilization of the elderly patients, following the fracture and surgery, they may develop some general complications. These include

- Thromboembolism.
- Pneumonia.
- Urinary tract infection.
- Cerebrovascular accidents.
- Deep vein thrombosis (DVT).

Local Complications:

As a result of surgery there may be certain complications locally at the operative site. These include –

- Hemorrhage.
- Wound infection.
- Early Deep Sepsis.
- Late Sepsis with or without Joint involvement.

Mechanical and Technical Failures: These include

- Varus Displacement.

  It is accompanied by

  a. Implant bending.
  b. Breaking.
  c. Cutting out of the head.
  d. Pulling off the femoral shaft.

- Nail Penetration.
- Rotational Deformity
- Nonunion
- Aseptic Necrosis
- Stress Fracture
- Miscellaneous Complications.
  - **Peritonitis** secondary to a guide pin's violating the pelvis during hip nailing and
  - **laceration of the superficial femoral artery** by a displaced lesser trochanteric fragment in an elderly patient with an intertrochanteric fracture.
  - **Effusion of the ipsilateral knee**.

METHODLOGY

The present study was conducted in the department of Orthopaedics, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum, on the patients who have sustained an extracapsular trochanter fracture femur during the period of January 2009 to December 2009.

Study design:

One year prospective study.

Source of data:

Patients treated with dynamic hip screw and barrel plate for the trochanteric fracture of the femur at the department of orthopaedics, KLES Dr. Prabhakar Kore Hospital and Medical Research Center, Belgaum, Karnataka, were selected for this study.

Sample Size:

30 patients with Trochanteric fractures of the femur referred to the department of orthopaedics, KLES Dr. Prabhakar Kore Hospital and Research Centre, Belgaum were selected randomly, for this study.

Sampling procedure:

Sample size was calculated by taking 80% of the average of the patients with trochanteric fractures treated with Dynamic hip screw and plate assembly at the department of orthopaedics, KLES Dr. Prabhakar Kore Hospital And Medical

Research Centre, Belgaum, over a period of last 3 years. Sample will be collected from 1st January 2009 to 30th December 2009 for a period of one year.

Selection Criteria:

Inclusion criteria:

1. All extracapsular trochanteric fractures of the femur treated with DHS

Exclusion criteria:

1. Patients not consenting for surgery.
2. Patients operated with other than DHS.

Procedure:

The study was approved by the Ethical and Research Committee of Jawaharlal Nehru Medical College, Belgaum. After finding the suitability as per inclusion and exclusion criteria ,patients were selected for the study and briefed about the nature of the study, the interventions used and written ,informed consent was obtained (Annexure–I). The consented patients were enrolled in the present study. Further, descriptive data of the participants like name, age, sex, detailed history, were obtained by interviewing the participants and clinical examination and necessary investigations were recorded on predesigned and pretested proforma (Annexure II).

Pre-Operative Evaluation:

As soon as these patients were admitted in the ward, history was recorded and detailed clinical examination was done.

Name:

Age: Age is an important factor to be noted, to select the type of procedure to be done. There could be a difference between the chronological and physiological age. Usually trochanteric fracture of femur occurs at an older age. In the elderly, bone is usually osteoporotic and osteosynthesis may fail due to poor regenerative osteogenic potential of bone. Many a times, it is ideal to replace the head and mobilize the patient early to prevent the complications of prolonged immobilization. The Dynamic hip screw and plate can be used in comparatively younger active patients.

Sex : Fracture trochanter is common in older females due to hormonal imbalance in the post menopausal age and associated osteoporosis.

Address: Address was noted to communicate with the patient and for further follow-up.

History of Present Illness:

The patient usually present with a history of trivial injury following which pain and inability to walk.

Past History:

History of any disease like hypertension, diabetes mellitus, tuberculosis or stroke were noted. History of major cardiac or pulmonary problems is noted. Any History of previous anaesthesia and its details noted.

History of previous operation on hip, with any evidence of infection, aspirate of the hip was taken and cultured and patient operated only if culture was negative.

History of abnormal gait due to insufficient abductor musculature or neuropathic joint or progressive neurological diseases.

History of drug intake like aspirin, anticoagulants or steroids. Aspirin and anticoagulants were stopped prior to surgery but patients who were dependent on cortisone continued drugs and booster was given during surgery to avoid crisis.

History of fever or burning micturition if present, was treated before undergoing the operation.

With a history of familial bleeding tendencies like hemophilia, factor VIII was maintained preoperatively and 4 weeks post operatively.

Personal History:

Whether the patient was a smoker, alcoholic, having vegetarian or non-vegetarian food with a normal or altered bladder and bowel function noted. Whether the patient used Western style or Indian style of toilet was also noted. (There is a high bleeding tendency in alcoholics, so liver profile should be looked for).

Menstrual history was also noted in females.

General Examination:

Detailed clinical examination was done regarding the built, nutrition, pallor, cyanosis, icterus, pedal edema, lymphadenopathy, physiological age, psychological status, intelligence, willingness to undergo operation and post operative cooperation of the patient. The temperature, pulse, blood pressure and respiratory rate were also noted.

A thorough examination of the hip was done and deformities, contractures, weakness and limb length discrepancies if any were noted.

A detailed systemic clinical examination of C.V.S, R.S, C.N.S and per abdomen and Genito-urinary system was done and if there was anything significant, it was noted and treatment obtained.

Condition of skin around the hip was noted. Height and weight of the patient was also noted.

A detailed examination of spine, knee and ankle was done to rule out any deformities or contractures.

True hip pain has to be differentiated from sacroiliac pain and lumbar pain, trochanteric bursitis, pubic ramus fracture or intra-abdominal problem by clinical examination.

Per-rectal examination was carried out if required.

Radiological Investigations:[1-2]

X-ray of the pelvic with both hips, anteroposterior view was taken with both the lower limbs in 15° internal rotation and lateral view was also taken. Thickness of the cortex of the femur, width and bone stock, type of fracture (Boyd and Griffen classification), amount of calcar present, pre operative size of the lag screw (magnification deducted) .

Laboratory investigations

- Complete blood count
- Mini-renal, Blood sugar level

- Urine analysis
- HIV, HBsAg
- Chest X-ray
- Electrocardiogram

Liver function tests, renal function test and analysis of cardiac enzymes were done if required.

In the study, Trochanteric fractures were classified according to the **Boyd and Griffin**[12] classification as follows –

Type 1: Fractures that extend along the intertrochanteric line from the greater to the lesser trochanter.

Type 2: Comminuted fractures, the main fracture being along the intertrochanteric line but with multiple fractures in the cortex. Is a deceptive fracture in which an anteroposterior linear intertrochanteric fracture occurs as in type 1, but with an additional fracture in the coronal plane, which can be seen on the lateral roentgenogram.

Type 3: Fractures that are basically subtrochanteric with at least one fracture passing across the proximal end of the shaft just distal to or at the lesser trochanter. Varying degrees of comminution are associated.

Type 4: Fracture of the trochanteric region and the proximal shaft, with fracture in at least two planes.

Preoperative Planning and Treatment:

For fresh fractures, Buck's traction with 3 kg weight was applied to relieve the pain and muscle spasm. For fractures older than 1 week and with gross proximal migration, an upper tibial skeletal traction with 5 kg weight was applied till the limb lengths could be equalized and apparent length of the lag screw, angle plate should be assessed (Fig.9).

Preoperative anaesthetic assessment was done.

The following training was given to the patients pre-operatively, so that the same was carried out post operatively like-

- Deep breathing exercises
- Static quadriceps exercises
- Ankle and toe movements
- Active hip exercises (of the normal hip to familiarize the exercise)
- Building of muscle power in the upper extremities.

A written consent of the patient and relatives was taken. Inj. cefotaxime 1 gm I.V was given 8 hours prior to surgery.

OPERATIVE TECHNIQUE[1-2]

Patient under General, Spinal or Epidural anesthesia is positioned supine on the fracture table , normal limb is held in abduction(Fig.10).

The C-arm image intensifier is used , closed reduction of fracture by manipulation is performed by traction , abduction , internal or external rotation till reduction is achieved .

Reduction is checked under C-arm in antero-posterior and lateral views for posterior and medial cortical contact.

If closed reduction is not possible or reduction not achieved then open reduction is done.

1. Operated site scrubbed , painted and draped(Fig.11).
2. The incision of exposure is the standard lateral approach , by taking 5cms proximal and anterior to the greater trochanter and incising along the shaft of the femur upto 15 cm (Fig.12).
3. The dissection is deepened by separating skin , sub-cutaneous tissue , fascia lata and vastus lateralis layer by layer.
4. Periosteum is elevated with a periosteal elevator and the lateral and anterolateral surface of the femoral shaft is exposed.
5. Guide pin is inserted approximately 2cms below the vastus lateralis ridge with the help of fixed angle guide(Fig.13).
6. The guide pin with is aimed towards the apex of the femoral head, confirming the central placement of the pin on both anteroposterior and lateral views.
7. The length of the guide pin inserted is measured.
8. Length of the triple reamer is adjusted according to the length of the guide pin and then the head and neck is reamed by the triple reamer(Fig.14).
9. Tapping of Femoral Head for lag screw is done (Fig.15).
10. Lag screw is introduced with help of T-handle and after insertion it is checked under C-arm (Fig.16).
11. Then the side plate is advanced onto the lag screw shaft (Fig.17).
12. The insertion wrench and the guide pin are removed.

13. The plate is secured to the shaft of femur by bi-cortical screws(Fig.18).
14. Compression of the Fracture is obtained by the compression screw advocated into the distal end of the lag screw shaft.
15. The traction on the leg is released.
16. Compression screw is tightened to compress the fracture.
17. The position of the lag screw, side plate and fracture compression is again checked under image intensification in both antero-posterior and lateral views.
18. Drain is kept ,wound closed layer by layer and sterile dressing done over the wound.

POST-OPERATIVE MANAGEMENT

1. Antibiotics were given intra-operatively and continued for 5 days post-operatively.
2. Post operative x-ray were taken on the next day.
3. Quadriceps exercises , active hip and knee movements as soon as the pain and inflammation subsided.
4. Suture removal was done on the 10th – 12th day.
5. After suture removal active mobilization of the hip and knee was started with non-weight bearing with crutches or a walker until 6 weeks after that partial weight bearing was started and after 12 weeks full weight bearing was started .

FOLLOW UP

X-Rays were taken at 6weeks , 3 months and 6 months by clinical and radiological evaluation, and the results were assessed based on Harris Hip Score[1-2] (Annexure II).

Fig.9 : Instruments

Fig.10 : Patient positioning

Fig.11 : Painting and draping of operative site

Fig.12 : Incision and Dissection

Fig.13 : Entry point and guide wire insertion

Fig.14 : Triple reaming

Fig.15 : Tapping for lag screw

Fig.16 : C-arm image of lag screw tapping

Fig.17 : Plate fixation

Fig.18 : Cortical screw fixation

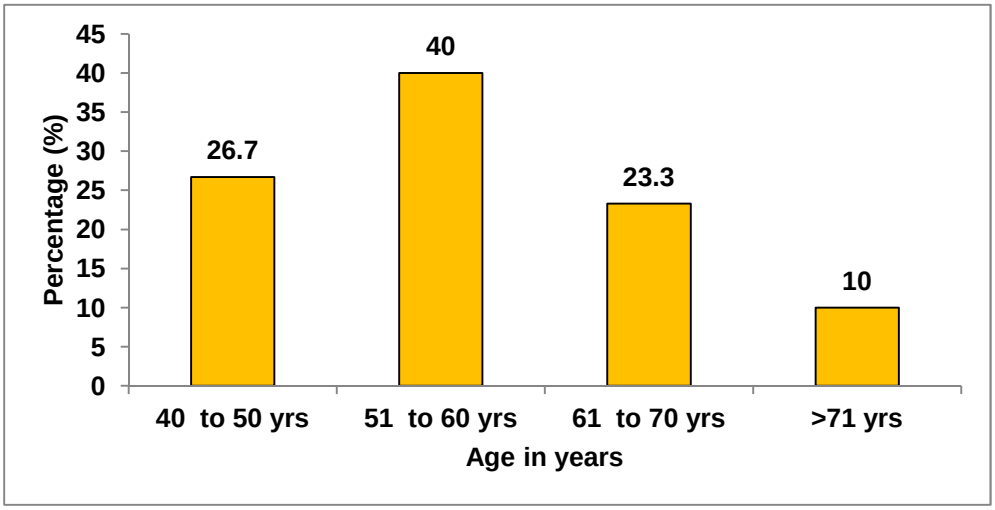
RESULTS

In this series of 30 patients with trochanteric fractures treated with dynamic hip screw and barrel plate assembly. Following are the observations made.

Table No. 1: Age wise Distribution

Age (Year)	Number	Percentage (%)
40 to 50	08	26.7
51 to 60	12	40
61 to 70	07	23.3
>71	03	10
Total	30	100

Age of all the patients in this study ranged above 40 years. Majority of the patients were in the age group between 51 to 60 years and seven patients (23.3%) were in the age group 61 to 70 years. There were three patients (10%) in the age group of above 70 years.

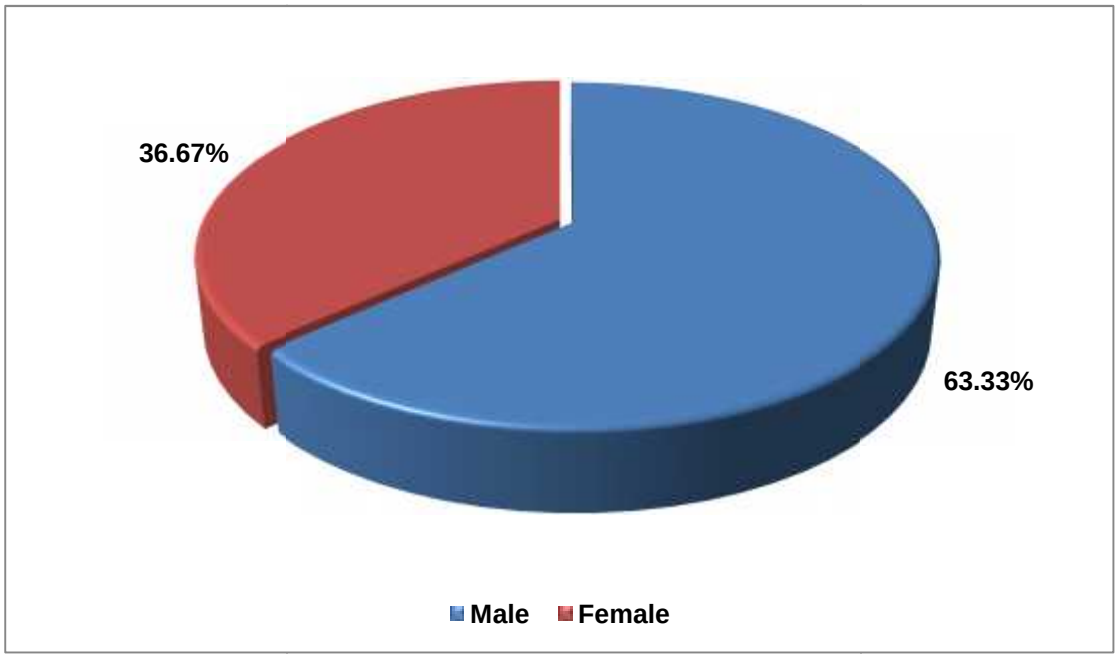


Graph No. 1: Age wise Distribution

Table No. 2 : Gender Distribution

Gender	Number	Percentage
Male	19	63.33%
Female	11	36.67%
Total	30	100%

In the present study, out of the 30 patients there 11 were females accounting to 36.67% and 20 males patients making up the remaining 63.33%.

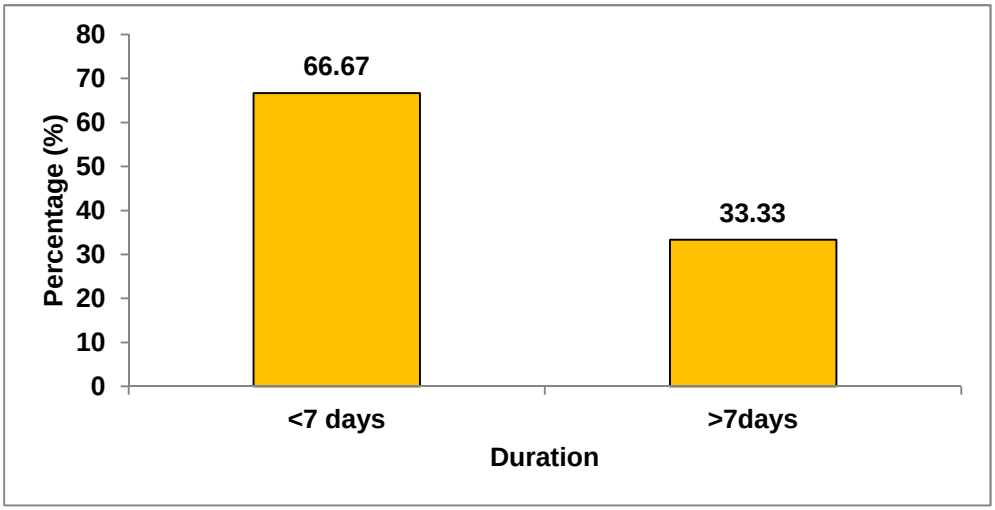


Graph No. 2 : Gender Distribution

Table 3 : Interval Between Injury and surgery:

Gender	Number	Percentage
<7 days	20	66.67%
>7days	10	33.33%
Total	30	100%

About 20 patients operated in the hospital within 1 week accounting to 66.67% and 10 patients more than 1 week (33.33%).

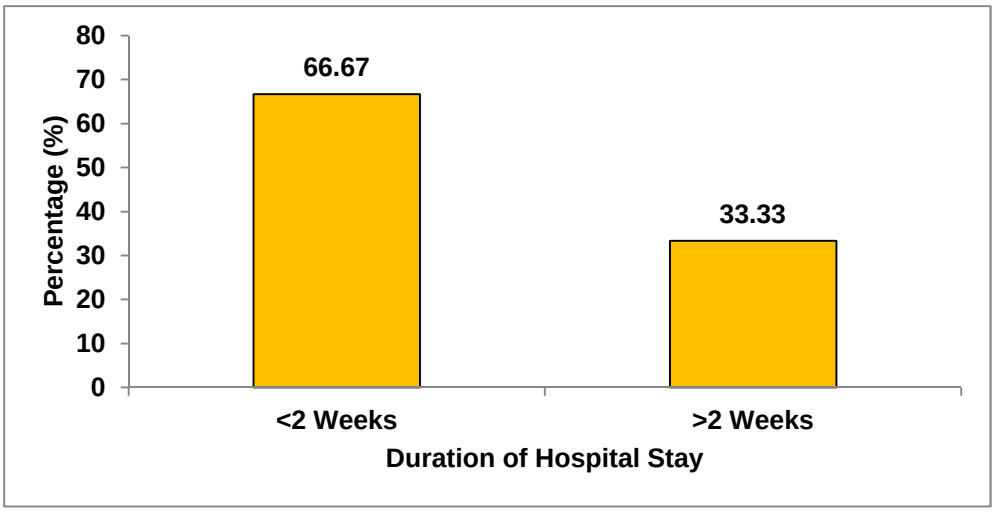


Graph No. 3 : Interval between Injury and surgery

Table 4: Duration Of Hospital Stay:

weeks	Number	Percentage
<2weeks	20	66.67%
>2weeks	10	33.33%
Total	30	100%

About 20 patients accounting for 66.67% stayed in hospital <2weeks and remaining for >2weeks (33.3%). The duration of hospital stay is less in our series as the patients were mobilized early.

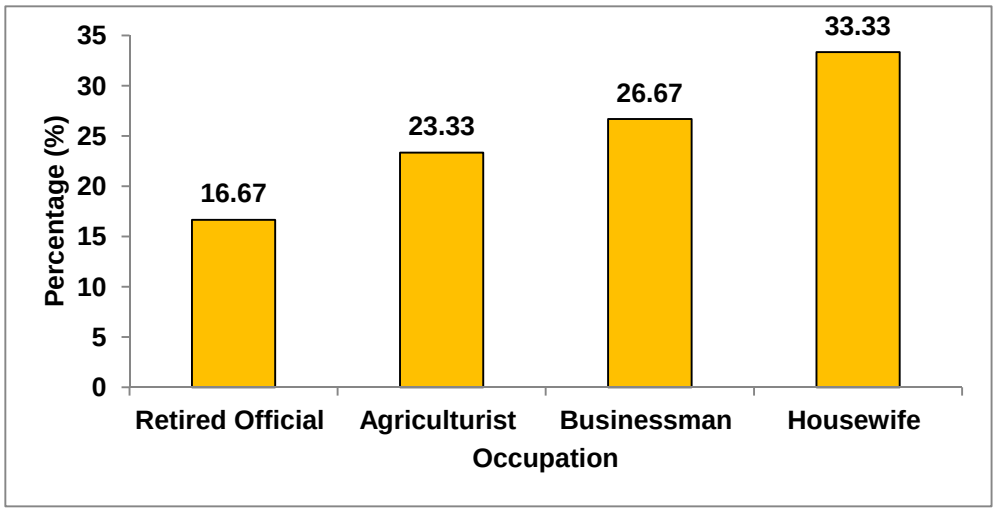


Graph No. 4 : Duration Of Hospital Stay

Table No. 5: Occupational Distribution

Occupation	Number	Percentage (%)
Retired Official	05	16.67
Agriculturist	07	23.33
Businessman	08	26.67
Housewife	10	33.33
Total	30	100

All the patients went back to their old occupation following the surgery with only a slight limitation in their pre-fracture routine activities.

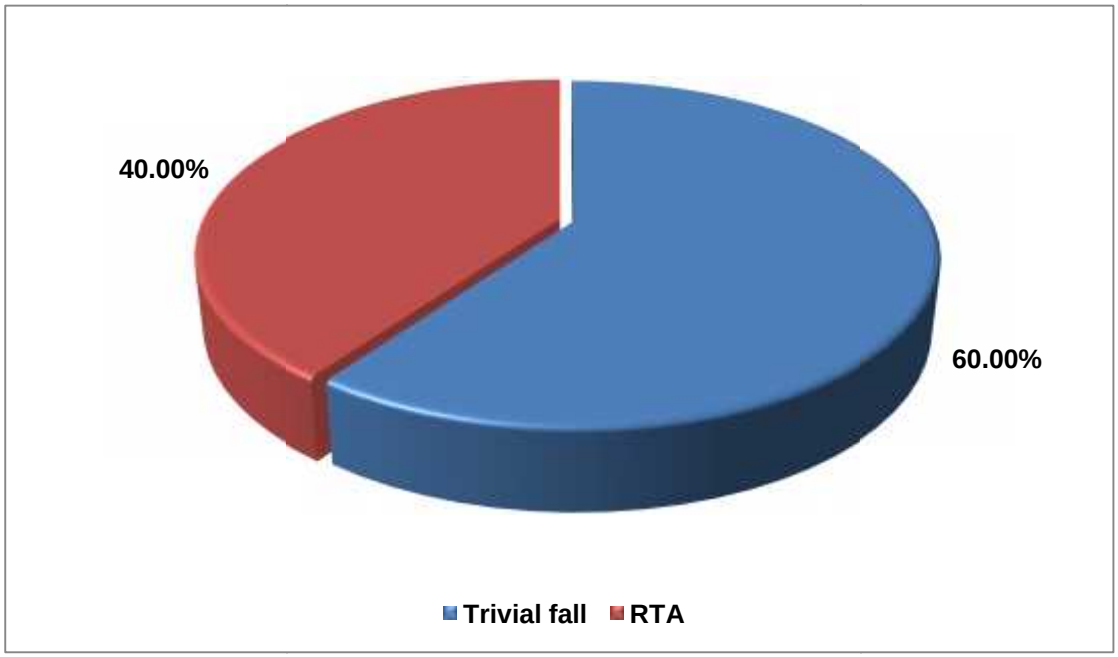


Graph No. 5 : Occupational Distribution

Table No. 6: Nature of trauma

Nature of trauma	Number	Percentage (%)
Trivial fall	18	60
RTA	12	40
Total	30	100

Majority of the fractures occurred due to fall on a trivial fall were 18 (60%) and 12 (40%) due to RTA.

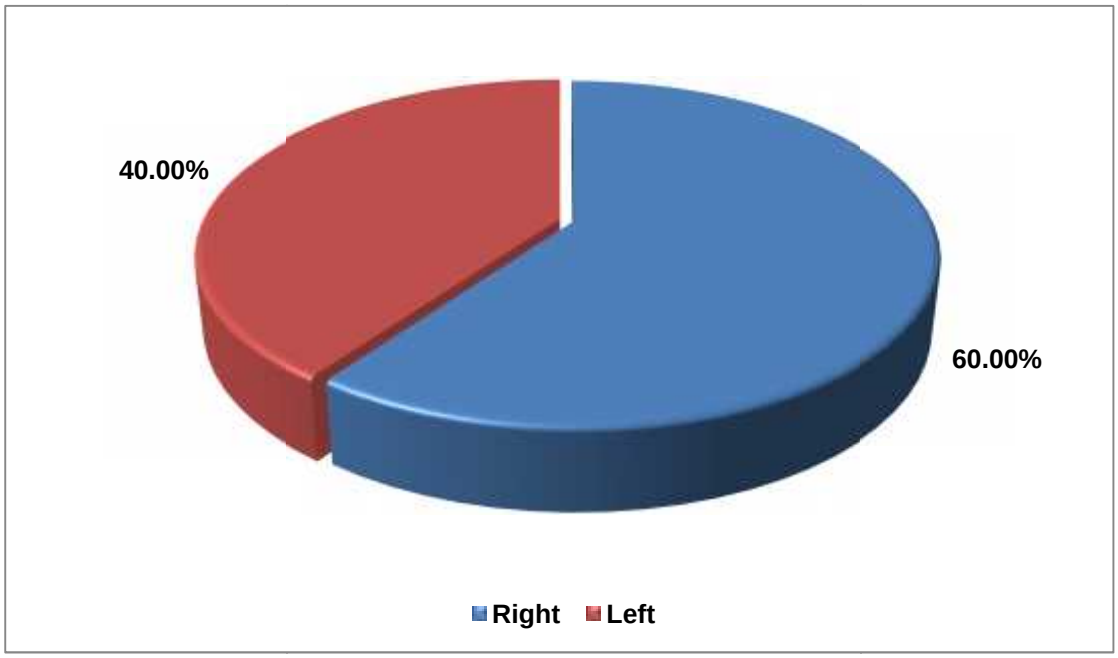


Graph No. 6 : Nature of trauma

Table No. 7: Injury laterality

Side	Number	Percentage (%)
Right	18	60
Left	12	40
Total	30	100

Right side involvement was more commonly seen than the left in this study group. Right side was involved in 18 patients making up for 60% of the fractures and the left was involved in 12 patients accounting for 40% of the fractures. None of the patients had bilateral fractures.

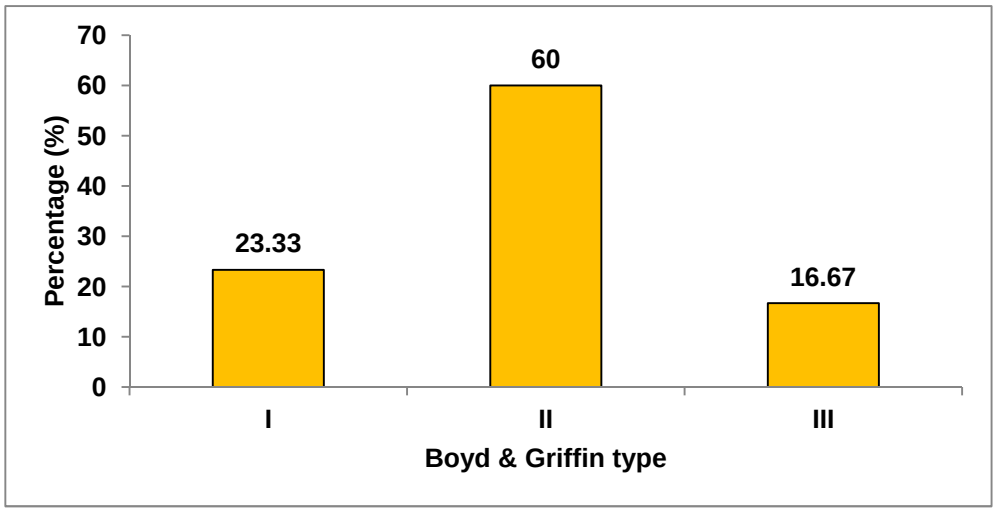


Graph No. 7 : Injury laterality

Table No. 8: Boyd and Griffin type

Boyd & Griffin Type	Number	Percentage (%)
I	07	23.33
II	18	60
III	05	16.67
Total	30	100

Out of the 30 fractures, majority were type II fractures (18 patients) accounting for 60% and remaining 23.33% and 16.67% of type I (7 patients) and III (5 patients) respectively.

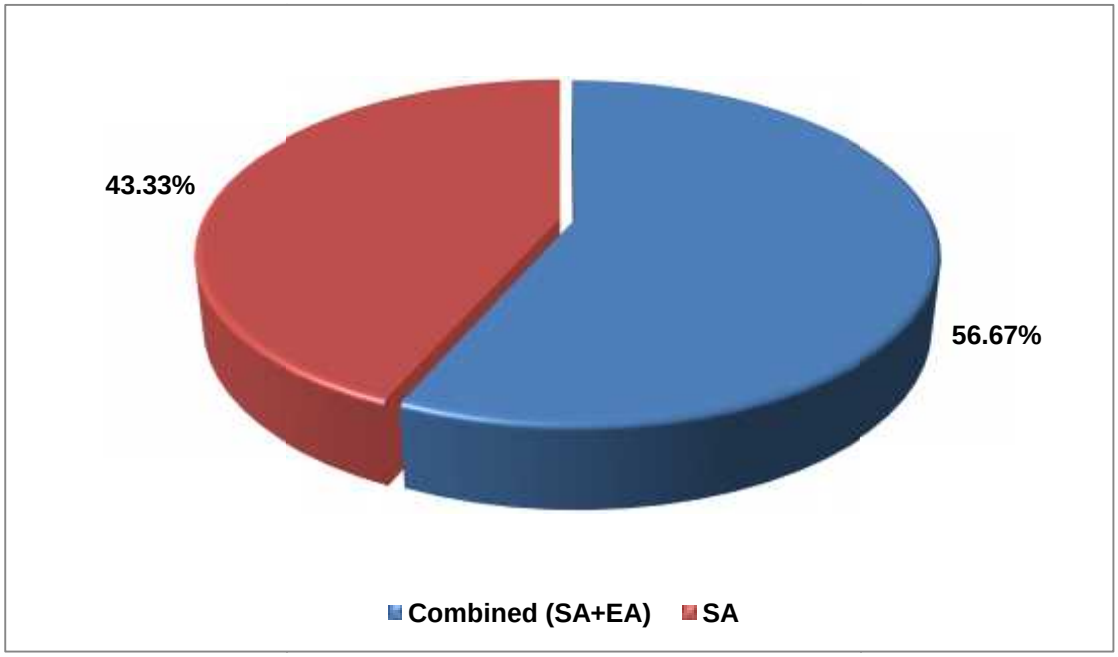


Graph No. 8 : Boyd and Griffin type

Table No. 9: Type of Anaesthesia

Anaesthesia	Number	Percentage (%)
Combined (SA+EA)	17	56.67
SA	13	43.33
Total	30	100

17 patients (56.67%) were operated under combined (spinal and epidural) anaesthsia and 13 patients (43.33%) were operated under spinal anaesthesia.

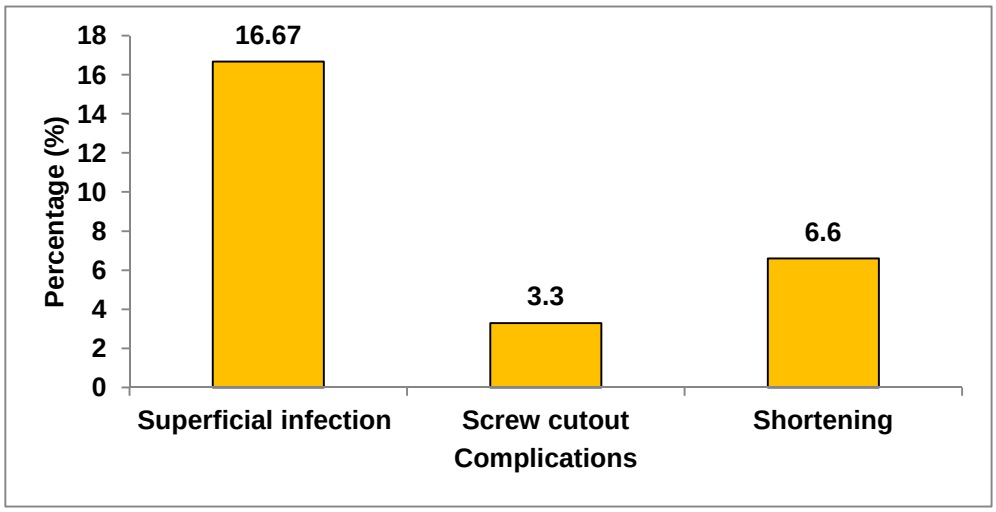


Graph No. 9 : Type of Anaesthesia

Table No. 10: Complications

Complications	Number	Percentage (%)
Superficial infection	05	16.67
Screw cutout	01	3.3
Shortening	02	6.6

Superficial infection was in five patients (16.67%) and was treated with I.V antibiotics according to pus and culture report. screw cutout in one patient (3.33%) who had difficulty in squatting and had continuous pain and shortening in two patients of 1.5 cm (6.6%) but they had no difficulty in daily activities

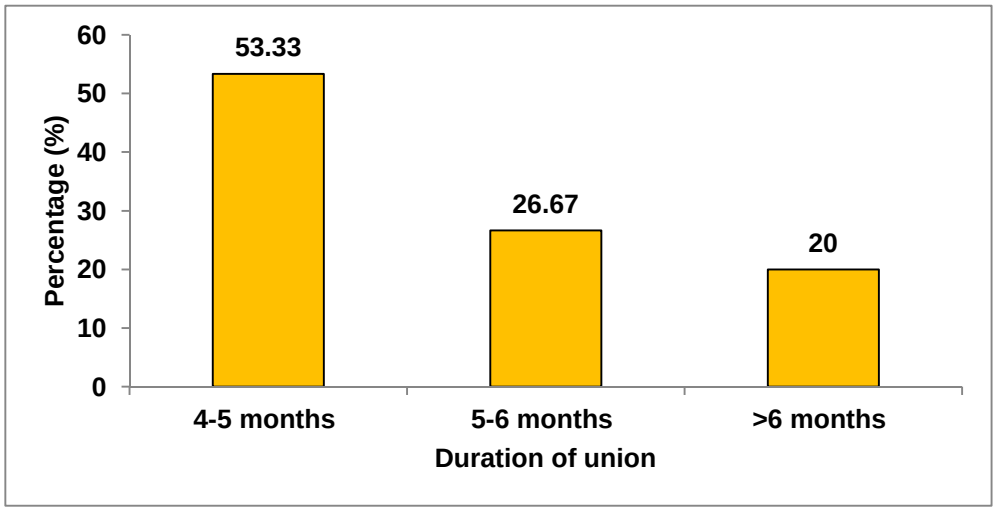


Graph No. 10 : Complications

Table No 11 : Duration of union

duration of union	Number	Percentage (%)
4-5 months	16	53.33
5-6 months	08	26.67
>6 months	06	20

In this series, 53.33% (16) showed union at 4-5months, 26.67% (08) in 5-6 months and remaining showed union more than 6 months accounting for 20% (06).



Graph No. 11 : Duration of union

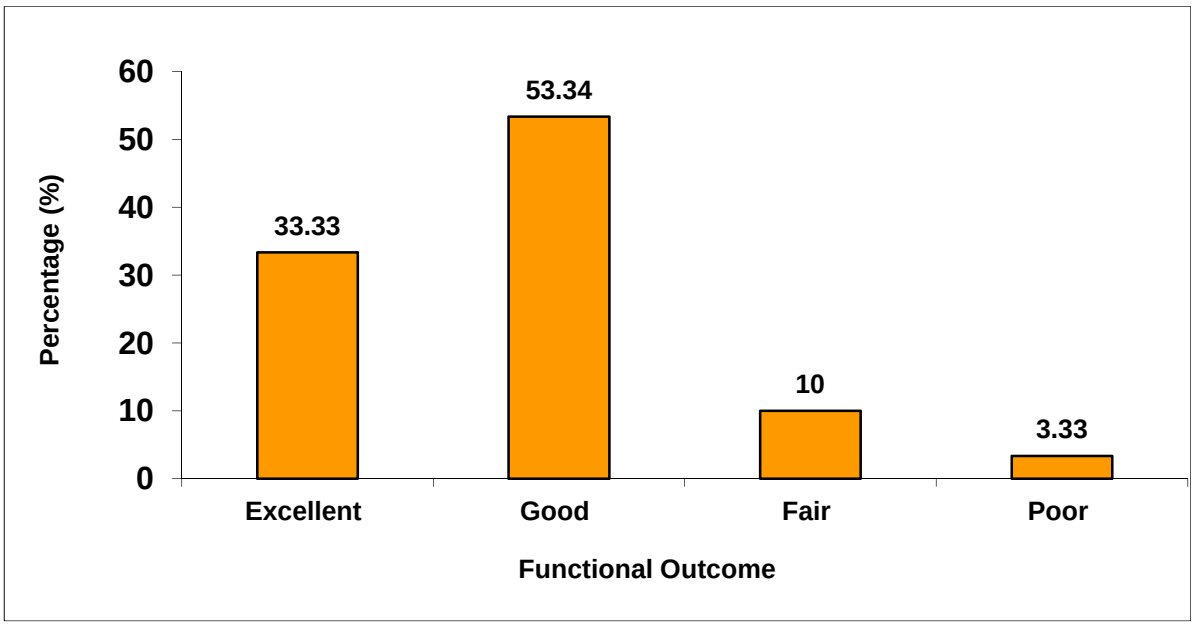
Follow-Up Period

All the patients were followed up at 6 weeks, 3 months and 6 months.

Table No. 12 : Outcome: Harris hip score

Outcome	Number	Percentage (%)
Excellent	10	33.33
Good	16	53.34
Fair	03	10
Poor	01	3.33

Harris hip score was used to evaluate the functional results. Using this rating scale at sixth month, based on range of motion**, s**hortening (cm), pain, walking ability, stair climbing and return to work, there were 10 patients (33.33%) with excellent results, 16 patients (53.34%) with good results, three patients (10%) with fair results and one patient (3.33%) with poor outcome.



Graph No. 12 : Outcome: Harris hip score

FINAL OUTCOME

In the present study, 30 cases of intertrochanteric fracture of the femur were managed with a dynamic hip screw and barrel side plate.

The data collected in this study is assessed, analyzed, and the results were evaluated as per the criteria stated above. Of the thirty cases, there were 10 cases with excellent results, 16 cases with good results, 3 cases with fair results and 1 case with poor results.

All the patients did not have pain in the hip joint or swelling in the trochanteric region, or deformity but 2 patients had in shortening of 1.5 to 2 cm in category good , but these patients had full range of hip movements , able to sit cross-legged and squat without any difficulty. These patients were able to walk without any support. There was radiological evidence of bone union by 16 weeks. There were no complications. The patients were fully satisfied with the treatment.

3 of the patients had fair results. They had slight pain in the hip with restriction of terminal degrees of hip movements and they were not able to sit cross-legged or squat but one of the patients was able to sit cross-legged and squat for a short duration. These patients were walking with support and two patients had an associated limp. Radiologically the fractures united without any signs of malunion.

Out of 30 patients 5 had a superficial wound infection, which delayed the wound healing by a week but had no other complications.

1 patient with poor results continued to have pain in the hip due to screw cut out from the femoral head and had an adduction deformity and prominence of the trochanter with gross restriction of hip movements and was not able to sit cross legged or squat.

DISCUSSION

In our study, 30 cases of trochanteric fracture of femur were treated with Dynamic hip screw and barrel plate assembly in age groups above 40 yrs. The results were analyzed and the observations were made. The study was also compared with studies conducted by other authors. Various aspects of the procedure have been observed and discussed in detail.

1. AGE INCIDENCE :

The average age of the patients in our series was 58 years with a range of 40 to 75 years with majority of the patients in the age-group 50 to 61 years. The average age in the reported series is as follows;

Series	Year	Average Age in yrs
Schumpelick W.[14]	1955	65
Sahlstrand T. [29]	1974	75
Ecker ML.[31]	1975	75
Wolfgang GL.[41]	1982	73.2
G.S. Kulkarni[44]	1984	62
Present study	2010	58

2. SEX INCIDENCE:

In this series, it was observed that the male to female ratio was 1.72:1, the female being 36.67%. In the literature, a lot of variation is reported, female being more common than male.

Series	Year	Male	Female
Ecker ML.[31]	1975	171(26%)	484 (74%)
Wolfgang GL.[41]	1982	102 (35.6%)	185 (64.4%)
Juluru P. Rao et al.[45]	1983	52 (32.1%)	110 (67.9%)
G.S. Kulkarni[44]	1984	64 (45%)	76 (55%)
Watson et al.[57]	1998	76 (40%)	117(60%)
Present study	2010	19 (63.33%)	11 (36.67%)

3.MODE OF INJURY:

Out of 30 patients, 18 had trivial fall (60%) and remaining 12 had RTA (40%). The present study shows similar results as compared to other series. The higher incidence of trochanteric fractures due to trivial fall reported in other series are as follows :

Series	Year	Incidence of trivial fall
Kyle[36]	1979	78%
Hornby et al.[46]	1989	80%
Parker et al.[49]	1992	72%
Watson et al.[57]	1998	71%
Present study	2010	60%

4. ASSOCIATED INJURIES:

In our study, three patients had colles fracture, one patient had both bone forearm fracture. These were managed with closed reduction and Plaster of Paris cast application and open reduction and internal fixation respectively.

One patient had Fracture of the 7 and 8 rib on the right side following an RTA which was treated conservatively.

5. SIDE INVOLVED:

In this present study 18 (60%) were on right side , 12 were on left side (40%). In other studies Cleveland et al[7] , Leonard et al.[13] showed left side more involved whereas study done by Cameron et al.[38] and Juluru et al.[45] showed more involvement of right side.

6. ASSOCIATED DISEASES:

In this present study, ten patients were hypertensive, two known were diabetes and two were known hypertensive and diabetes.

7. TYPE OF FRACTURE:

According to Boyd and Griffin's classification there were seven type I (23.33%) , eighteen type II (60%) and three were type III (16.67%) .

In this study majority were type II fractures, which is the same as that observed by many other authors in the literature.

8. COMPLICATIONS:

In this present study five had superficial wound infection (16.67%) which delayed wound healing by a week. Similar infection rates were observed in other series by Jacobs et al.[39] (1976) 4% , Jensen et al.[40] (1980) 20%.

Other complications like shortening were observed in two patients (6.66%) and screw cutout in one patient (3.3%), these results were similar to other series by Doherty et al.[35] (1979) 10% and Juluru P.Rao et al.[45] (1983) 3.1% respectively**.**

9. FRACTURE UNION:

In this present study sixteen patients (53.33%) showed radiological fracture union in 4 to 5 months , eight (26.67%) showed at 5 to 6 months and remaining six (20%) at > 6months . the average time for union was 4 to 5 months. When compared to other studies showed similar results.

Series	Year	Union time in wks
Ecker et al.[31]	1975	15
Wolfgang GL.[41]	1982	11.7
Juluru P. Rao[45]	1983	18
Present study	2010	16

10. OUTCOME:

In this present study results were evaluated according to Harris Hip Score. Using this rating scale at sixth month, based on range of motion**, s**hortening (cm), pain, walking ability, stair climbing and return to work, there were 10 patients (33.33%) with excellent results, 16 patients (53.33%) with good results, three patients

(10%) with fair results and one patient (3.33%) with poor outcome and with excellent to good results in 82.6% and with a mean Harris Hip Score of 82.1 points. Similar results were observed in others series:

Series	Year	Excellent to good results
Sahlstrand T.[29]	1974	72%
Juluru et al.[45]	1983	76%
G.S. Kulkarni[44]	1984	81%
Present study	2010	86.67%

CONCLUSION

After treating 30 patients with intertrochanteric fracture of femur with dynamic screw with barrel side plate assembly. we conclude it has better advantage in terms of stability, mobility, range of motion, and functional outcome.

Intertrochanteric fracture of the femur is common in the elderly, due to osteoporosis on a trivial trauma, but in the young individuals it occurs due to high energy trauma. The degree of comminution is high in the elderly due to poor bone quality (osteoporotic).

Early reduction and internal fixation increases patient comfort, facilitates nursing care, helps in early mobilization of the patient and decreases the duration of hospitalization.

The dynamic hip screw with a barrel side plate has the advantage that it allows controlled collapse of the fracture site. The fixation with dynamic hip screw is rigid even in osteoporotic bone. The implant design and its biomechanical properties have reduced the incidence of joint penetration and implant failure.

Treatment with dynamic hip screw and barrel plate assembly markedly reduces the morbidity and mortality and with excellent to good results in 86.67% and mean Harris hip score of 85.4 points.

The Dynamic Hip Screw with Barrel Side Plate assembly is the mainstay and standard treatment for trochanteric fractures as observed in the study. This is also the observation of many authors in contemporary orthopedic practice as reviewed from review of literature.

SUMMARY

This series consisted of 30 cases of intertrochanteric fracture of femur treated surgically by Dynamic Hip Screw and Plate assembly. The results are summarized as follows ;

- Majority (40%) of patients were in the age group of 51-60 years.
- Males (63.33%) were most commonly affected.
- Predominantly right side (60%) was involved.
- Majority (60%) of patients had Boyd and Griffin type II fracture.
- Majority (66.7%) of patients were operated within a week since time of injury.
- Most (60%) of the patients were operated under Spinal anesthesia with epidural anesthesia.
- Most common mechanism of injury accounted was trivial fall (60%).
- Most of the fractures united within 4-5 months (53.34%).
- 22 patients had associated diseases such as Hypertension , Diabetes Mellitus, Bronchial Asthma. The interval between the date of injury to the date of surgery was <7 days in 20 patients accouting for 66.67%.
- In our study 10 females were house wives. Among the males five were retired from their jobs and seven males were still working in the fields and eight patients were doing business. All the patients went back to their old occupation following the operation with only a slight limitation in their routine activities.

- Out of 30 patients 22 were internally fixed with 135° dynamic hip screw and barrel plate assembly , 6 with 130° and 2 with 125° dynamic hip screw and barrel plate assembly.
- Out of 30 patients 2 patients had shortening, of around 1.5 to 2cm but had no other complaints, 5 had superficial wound infection which delayed healing by a week and 1 patient with screw cut out.
- In 30 patients no cases reported with implant failure like breakage of the plate, Non-Union or Avascular Necrosis of the femoral head or Secondary Osteoarthritis of the hip joint following the surgery during the period of follow-up.
- **Harris hip score** was used to evaluate the functional results. Using this rating scale , based on range of motion**, s**hortening (cm), pain, walking ability, stair climbing and return to work, the functional outcome was measured. There were
    - 10 patients (33.33%) with excellent results,
    - 16 patients (53.34%) with good results,
    - 3 patients (10%) with fair results and
    - 1 patients (3.33%) with poor outcome.

After analyzing the data in the present study , we feel that for trochanteric fractures Dynamic hip screw and plate assembly remains the ideal treatment of choice.

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ANNEXURE I

INFORMED CONSENT

TITLE OF THE STUDY: "AN INTERVENTIONAL STUDY TO KNOW THE OUTCOME OF TROCHANTERIC FRACTURE OF THE FEMUR TREATED WITH DYNAMIC HIP SCREW USING HARRIS HIP SCORE".

PRINCIPAL INVESTIGATOR: BL0108003

INTRODUCTION AND PURPOSE:

DYNAMIC HIP SCREW AND PLATE FIXATION is the preferred operative technique, for the treatment of trochanteric fractures of the femur in patient owning to its good range of movements, early mobilisation and the stability which it provides the subject following surgery.

The main purpose of the current study is to, assess the functional outcome and physical quality of life of these patients with trochanteric fractures treated with DYNAMIC HIP SCREW AND PLATE, with regard to functional mobility, stability and the range of movements using HARRIS HIP SCORE .

PROCEDURE

If you CONSENT to be in this study, the relevant data is collected as per the proforma, and the final diagnosis is confirmed after correlating both clinical and radiological evidences. The subject is then posted for the proposed surgery after obtaining the fitness for surgery. Following this the patient is operated wherein the trochanter and femoral head are rimmed and correct size lag screw and plate are fixed

taking all aseptic precaution. After 1 week partial weight bearing advised using a walker. Subject discharged on day 14 with a cane in the opposite hand and advised to continue exercises to strengthen muscles around the hip. Follow up of the patient carried out at 6weeks, 3 months and 6 months.

BENEFITS

1.Early mobilisation

2.Avoids all decubitus problems.

RISKS

1. Fractures during fixation of implant.
2. Infection.
3. lag screw cut-out due to wide medullary canal.

ALTERNATIVES:

VOLUNTARY PARTICIPATION/WITHDRAWAL:

Taking part in this study is voluntary. I may choose not to take part in this study, or if I decide to take part I can later change my mind and withdraw from the study. My decision will not change the present or future health care or other services that I receive. The study doctor or the sponsor may stop my participation in this study. I will tell of any important new findings that may change my willingness to continue to take part. If I choose not to take part in the study I will receive the standard treatment for patients with my condition.

COSTS : Each DHS implant will cost around Rs 1500/- to 2500/-.

COMPENSATION: As the subject voluntarily consents to be a part of the study, no compensation will be given.

CONFIDENTIALITY:

All information collected about the subject during the course of the study will be kept confidential to the extent permitted by the law. The code numbers will identify the subject in this research record. Information from this study may be published but the subjects identity will be confidential in any publication.

QUESTION:

If any enquiries in the future or in case of study related injury or illness, you may contact following person.

CONSENT TO PARTICIPATE IN RESEARCH STUDY:

I voluntarily agree to take part in this study by signing below. I may withdraw at any time. I am not giving up any of my legal rights by signing this form. My signature below indicated that I have read this entire consent form or it has been read to me, and had all my questions answered. I will be given a copy of this consent form.

Signature of the Participant or legally authorized representative.

Participant's Name : …….

Signature : …….

Name of the legally authorized representative : …….

Signature : …….

Witness's Name : …….

Signature : …….

Investigators name and Signature : …….

Date and Place : …….

ANNEXURE II

PROFORMA

"AN INTERVENTIONAL STUDY TO KNOW THE OUTCOME OF TROCHANTERIC FRACTURE OF THE FEMUR TREATED WITH DYNAMIC HIP SCREW USING HARRIS HIP SCORE"

Sl. No: ID No:

1.Name: 2.Age:

3.Sex: 4.Occupation:

5.DOA: 6.DOD:

7.Address:

8.Complaints:

9.Nature of trauma:

a. RTA b. Sports injuries

c. Trivial fall d. Others

10.Affected limb: Right/Left

11.Duration since injury:

a. < 1 Week b. > 1 Week

12.Significant past history:

a. History of diabetes, hypertension, asthma, epilepsy: Yes / No

b. Previous history of fractures Yes / No

13General physical examination:

a. Pulse Rate: ___beats/min

b. Blood Pressure: ___mmhg

c. Respiratory Rate: ___/min

d.Anaemia: Present/Absent

14.Presence of any associated injury: Yes / No

If yes specify:

15.Local examination:

A.Inspection:

a.Attitude of the limb: Externally/Internally Rotated

b.Shortening : _cm

c.Wasting of muscles Present/Absent

B.Palpation:

a.Trochanteric:

Tenderness: Yes/No

Thickening: Yes/No

Migration: Upwards/Downwards

b.Vascular sign of Narath: Positive/Negative

C.Measurements: Diseased Normal

a .Apparent length:

b.True length: (cm)

c.Shortening: (cm)

D.Movements:

a.Flexion:	__°	__°
b.Extension:	__°	__°
c.Abduction:	__°	__°
d.Adduction:	__°	__°
e.Internal rotation	__°	__°
f.External rotation:	__°	__°

E.Trendelenburg's Test: Positive/Negative

G.Telescopic Test: Positive/Negative

16.Relevant investigations:

a) x-ray pelvis with both hips –ap view	Yes / No
b) x-ray of affected hip- lateral view	Yes / No
c) blood: hb%, tc ,dc ,esr.	Yes / No
d) urine: albumin ,sugar, microscopy	Yes / No

17.Radiological evaluation

a.Type of fracture Boyd and Griffen classification	1/2/3/4
b.Singhs Index:	6/5/4/3/2/1

18.Treatment:

A.First aid:

a.Immobilisation of the injured limb in skin traction:	Yes / No
b.Analgesics:	Yes / No
c.Antibiotic therapy	Yes/No

B.surgical details:

a.date of surgery : _____

b.Relevant investigations and medical fitness for surgery Yes / No

c.Anaesthesia Spinal / General

d.Antibiotic therapy- Yes/No

e.Intraoperative:

- C arm guide wire position superior/centre/inferior
  Anterior/centre/posterior
- Length of the hip screw _ mm
- DHS plate long/short barrel
  No of holes_
- Angle of the plate 125/130/135/140
- Tip apex distance _mm
- Blood transfusion Yes / No

e.Complications intraoperatively

- Fall in B.P Yes/No
- Wrong placement of implant Yes /No
- Occurance of any fracture of the shaft during reduction Yes / No

f. Postoperative:

- Infections: Present/Absent
- Dislocations: Present/Absent

g .Radiological evaluation:

- Position of the hip screw AP view superior/inferior/centre
  LAT view anterior/posterior/centre

h.Drain removal _POD

i. Mobilisation

NWB on day _POD

PWB on day _POD

FWB on day _POD

j.Type of aid invalid walker/axillary crutches

k.Antibiotics stopped on _POD

l.Suture removal _POD

C.Reoperation Done Yes/No

a.Resons for Reoperation

-loss of fixation: Yes/No

-improper screw placement: Yes/No

-other(specify):

D.Evaluation at the time of discharge:

a.Pain(score between 1 to 10)

b.Wound infection Yes/No

c.Mobilisation NWB/PWB/FWB

Crutches/walker/tripod stick

FOLLOW-UP SHEET

1.ID NO:

2.Date:

3.Serial no. Of follow up:

4.Time since surgery:

5.Clinical union:

A.Pain at the hip: Yes / No

B.Abnormal mobility: Yes / No

C.Transmission of movements Yes / No

D.Range of movements at the hip joint:

	Right	Left
a.Flexion	_°	_°
b.Extension	_°	_°
c.Abduction	_°	_°
d.Adduction	_°	_°
e.Internal rotation	_°	_°
f.External rotation	_°	_°

s.no		1.5months	3months	6months
1	Harris hip score			
2	Radiological union			
3	Screwbackout			
4	Screw cut-out			
5	Tip apex distance			
6	Others (specify)			

Signature of examiner Signature of patient Signature of Guide

HARRIS HIP SCORE

Maximum points possible-100

Excellent	90-100
Good	80-89
Fair	70-79
Poor	< 70

Pain relief	44
Function.	47
Range of motion	5
Absence of deformity	4
	100 points

I. PAIN (44 Possible)

A.	None or ignores it	44
B.	Slight, occasional, no compromise in activities	40
C.	Mild pain, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin	30
D.	Moderate pain, tolerable but makes concessions to pain, some limitation of ordinary activity or work, may require occasional pain medicine stronger than aspirin	20
E.	Marked pain, serious limitation of activities	10
F.	Totally disabled, crippled, pain in bed, bed ridden	0

II. FUNCTION (47 possible)

A. GAIT (33 possible)

1.	Limp		
	a. None	-	11
	b. Slight	-	8
	c. Moderate	-	5
	d. Severe	-	0
2	Support		
	a. None	-	11
	b. Cane for long walks	-	7
	c. Cane most of the time	-	5
	d. One crutch	-	3
	e. Two canes	-	2
	f. Two crutches	-	0
	g. Not able to walk (specify reason)	-	0
3.	Distance walked		
	a. Unlimited	-	11
	b. Six blocks	-	8
	c. Two or three blocks	-	5
	d. Indoors only	-	2
	e. Bed and chair	-	0

B. <u>ACTIVITIES</u> (14 possible)

1.	Stairs		
	a. Normally without using a railing b. Normally using a railing c. In any manner d. Unable to do stairs	- - - -	4 2 1 0
2.	Shoes and socks		
	a. With ease b. With difficulty c. Unable	- - -	4 2 0
3.	Sitting		
	a. Comfortably in ordinary chair for one hour b. On a high chair for half an hour c. Unable to sit comfortably in any chair	- - -	5 3 0
4.	Enter public transportation	-	1

ABSENCE OF DEFORMITY

Points (4) are given if the patient demonstrates

A. Less than 30° fixed flexion contracture
B. Less than 10° fixed adduction
C. Less than 100 fixed internal rotation in extension
D. Limb length discrepancy less than 3.2 cm

III. RANGE OF MOTION (5 points possible)

(Index values are determined by multiplying the degrees of motion possible in each arc by the appropriate index)

A.	**Flexion**			**(Max possible)**
	0°-45°	X	1	45
	45 45°-90°	X	0.6	27
	90°-100°	X	0.3	6
	Over 100°	X	0	0
B.	**Abduction**			
	0°-15°	X	0.8	12
	15°-20°	X	0.3	1.5
	Over 20°	X	0	0
C.	**External rotation in extension**			
	0°-15°	X	0.4	6
	Over 15°	X	0	0
D.	**Internal rotation in extension**			
	Any	X	0	0
E.	**Adduction**			
	0°-15°	X	0.2	3
	Over 15°	X	0	0
F.	**Extension**			
	Any	X	0	0
		Total	**100.5 points**	

To determine the over-all rating for the range of motion, multiply the sum of the index values x 0.05

Maximum points possible = 100.5 x 0.05

= 5 points

The Trendelenburg test is recorded as positive, level or neutral.

ANNEXURE III
PHOTOGRAPHS

CASE I (EXCELLENT RESULT)

Preoperative X-ray

Immediate Postoperative X-ray
AP View

Immediate Postoperative X-ray
Lateral View

3 months

X-ray after 6 months AP View

After one year

PATIENT IN SITTING POSITION

PATIENT IN SQUATTING POSITION

FLEXION OF THE HIP (OPERATED LIMB)

CASE 2 (GOOD RESULT)

PRE-OPERATIVE X- RAY

POST OPERATIVE XRAY AP VIEW

POSTOPERATIVE XRAY LATERAL VIEW

AFTER 6 WEEKS

AFTER 3 MONTHS

AFTER 6 MONTHS

FLEXION OF HIP ON OPERATED LIMB

PATIENT IN SQUATTING POSITION

CASE 3 (POOR RESULT)

PREOPERATIVE XRAY

POST OPERATIVE XRAY

5 MONTHS XRAY SHOWING GREATER TROCHANTER FRACTURE

RESTRICTED HIP FLEXION OF OPERATED LIMB

Master Chart

Sl. No.	IP No.	Gender	Age	Occupation	Time since injury	D.O.A	D.O.S	D.O.D	Nature of trauma	Past History	Associated injuries	BOYD & GRIFFIN TYPE	Laterality	ANGLE PLATE IN deg	TAP(mm)	NO.OF HOLES	Anaesthesia	Complications		Functional Results		
																				Harris Hip Score		
																		Intra Op	Post Op	6 weeks	3 months	6 months
1	302342	M	55	AGR	<1	05/01/2009	10/01/2009	21/01/2009	TRIVIAL FAL	DM,HTN	NAD	II	R	135	22	4	SA+EA	NAD	NAD	53.5	65.4	76.5
2	302487	F	45	HW	<1	06/01/2009	10/01/2009	18/01/2009	R.T.A	HTN	NAD	I	L	135	21	4	SA	NAD	NAD	66.3	73.5	81.6
3	302706	F	50	HW	<1	07/01/2009	09/01/2009	13/01/2009	RIVIAL FAL	NAD	Colles #	II	R	130	22	6	SA+EA	NAD	FICIAL INFI	67.3	74.5	84.9
4	305605	M	74	EX.SRV	>1	02/02/2009	03/02/2009	06/02/2009	TRIVIAL FALL	HTN	NAD	II	R	135	21	7	SA+EA	NAD	NAD	61.5	70.5	77.8
5	307876	M	48	RT.TCR	<1	20/02/09	25/02/09	28/02/09	TRIVIAL FALL	HTN	NAD	III	L	135	23	5	SA+EA	NAD	NAD	65.7.1	73.1	81.7
6	308007	M	61	AGR	<1	22/02/2009	23/02/2009	28/02/2009	RTA	NAD	NAD	III	L	135	20	4	SA+EA	NAD	NAD	62.3	71.5	82.8
7	312990	M	55	BS	>1	06/04/2009	09/04/2009	28/04/2009	RTA	NAD	NAD	II	R	130	21	4	SA	ff in reductio	NAD	53.1	58.3	66.6
8	314393	M	50	AGR	<1	16/04/2009	17/04/2009	07/05/2009	RIVIAL FAL	NAD	NAD	I	L	125	20	6	SA	NAD	NAD	61.5	68.5	84.3
9	313709	F	70	HW	<1	12/04/2009	13/04/2009	29/04/2009	TRIVIAL FALL	NAD	CLAVICLE #	II	R	135	22	7	SA	NAD	FICIAL INFI	67.3	82.5	83.6
10	317950	F	45	TCR	<1	16/05/2009	22/06/2009	06/06/2009	TRIVIAL FAL	HTN	NAD	III	L	135	20	6	SA+EA	NAD	NAD	59.3	75.5	84.5
11	322355	F	47	HW	>1	18/06/2009	22/06/2009	29/06/2009	TRIVIAL FALL	NAD	NAD	II	R	135	21	6	SA+EA	blood loss	NAD	65.5	78.5	82.6
12	323488	F	57	HW	<1	26/06/2009	01/07/2009	14/07/2009	RTA	HTN, IHD	NAD	I	L	130	24	8	SA	NAD	NAD	54.7	86.5	91.6
13	309677	F	55	HW	<1	01/07/2009	04/07/2009	14/07/2009	TRIVIAL FAL	NAD	Colles #	II	R	135	22	5	SA+EA	NAD	FICIAL INFI	51.5	69.4	72.4
14	327006	M	50	BS	<1	22/07/2009	24/07/2009	08/08/2009	RTA	NAD	NAD	I	R	130	23	4	SA+EA	NAD	NAD	64.3	80.5	85.3
15	328423	F	60	HW	>1	02/08/2009	03/08/2009	07/08/2009	RIVIAL FAL	HTN	NAD	II	R	135	24	4	SA	NAD	NAD	67.3	80.5	87.7
16	330418	M	63	BS	<1	16/08/2009	17/08/2009	27/08/2009	TRIVIAL FALL	DM,HTN	NAD	II	R	135	25	5	SA	blood loss	SHORTENING	57.3	83.5	91.2
17	330687	M	50	BS	<1	18/08/2009	22/08/2009	08/09/2009	RTA	NAD	NAD	III	L	135	23	4	SA+EA	NAD	NAD	67.1	67.3	81.9
18	330834	M	66	RT.TCR	<1	19/08/2009	22/08/2009	01/09/2009	TRIVIAL FAL	HTN	NAD	II	R	130	22	4	SA	NAD	NAD	67.5	70.3	88.6
19	333009	M	53	BS	>1	04/09/2009	09/09/2009	19/09/2009	RTA	NAD	NAD	II	R	125	23	6	SA	NAD	NAD	67.2	86.5	91.5
20	335838	F	65	HW	>1	24/09/2009	28/09/2009	13/10/2009	RIVIAL FAL	DM	NAD	I	R	135	21	5	SA+EA	NAD	FICIAL INFI	52.5	89.5	92.6
21	337335	M	57	EX.SRV	>1	07/10/2009	10/10/2009	27/10/2009	RTA	DM	Rib # Rt. 7,8	II	L	135	22	4	SA+EA	NAD	NAD	55.5	78.3	83.6
22	337936	M	73	AGR	>1	12/10/2009	14/10/2009	24/10/2009	TRIVIAL FALL	NAD	NAD	II	L	135	24	6	SA	diff in reduction	NAD	54.1	92.5	91.5
23	339416	F	55	HW	<1	24/10/2009	27/10/2009	07/11/2009	TRIVIAL FAL	HTN	NAD	II	L	135	21	6	SA+EA	NAD	HORTENIN	67.3	88.5	94.9
24	339995	M	58	BS	<1	28/10/2009	30/10/2009	10/11/2009	RTA	NAD	NAD	III	R	135	23	4	SA	NAD	NAD	67.3	88.5	92.7
25	342843	M	62	AGR	>1	18/11/2009	23/11/2009	04/12/2009	RTA	NAD	Colles #	II	R	130	22	6	SA	NAD	NAD	63.5	90.5	85.4
26	343779	M	55	RT.TCR	<1	25/11/2009	27/11/2009	30/11/2009	RTA	NAD	NAD	I	L	135	24	5	SA+EA	NAD	NAD	56.3	67.3	91.1
27	344110	M	80	AGR	<1	28/11/2009	01/12/2009	12/12/2009	TRIVIAL FAL	HTN	NAD	II	R	135	21	4	SA	NAD	NAD	54.7	76.3	84.2
28	345994	F	57	HW	>1	13/12/2009	23/12/2009	02/01/2010	TRIVIAL FALL	NAD	NAD	II	R	135	24	5	SA+EA	NAD	NAD	67.3	82.5	93.2
29	347240	M	63	BS	<1	22/12/2009	24/12/2009	04/01/2010	TRIVIAL FALL	HTN	NAD	I	L	135	21	4	SA+EA	NAD	FICIAL INFI	65.3	88.5	91.8
30	350147	M	58	AGR	<1	30/12/2009	05/01/2010	25/01/2010	RTA	NAD	B# FOREARI	II	R	135	22	4	SA+EA	NAD	NAD	64.3	82.5	84.6