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Research Article

SCREWING THE SCREWY SCREW IN TROCHANTERIC FRACTURE

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ABSTRACT

Traditionally DHS (Dynamic Hip Screw) is used in trochanteric fracture management with variable results. Torsion is gradually adjusted with the lifestyle activities. Results are not uniform. We thought about a cross screw banking on the mathematical considerations. We found out that the cross screw would give better mobility and stability.

Complications like shortening and deformity which were nagging problem in DHS could be minimized by this three-dimensional fixation to trochanteric fracture. Early union in this weight bearing joint maintaining the angularity is the prize of this procedure. Osteoporosis is also minimized by this fixture as the suggested mathematical construction is stable and rigid. Our surgeons dared early mobilization after operation. Patients could be discharged early and hospital stay was minimum thus the total management cost was cut down.

Key Words: *Dynamic Hip Screw, Torsion, Cross Screw*

INTRODUCTION

The screw is always screwy, especially in cases of trochanteric fracture. Initially we had worked out a mathematical solution for the practical problems in screwing the hip with trochanteric fracture. Later on, it was given a fair trial in 112 cases in an institute in Kolkata. Our present paper throws some light on this subject.

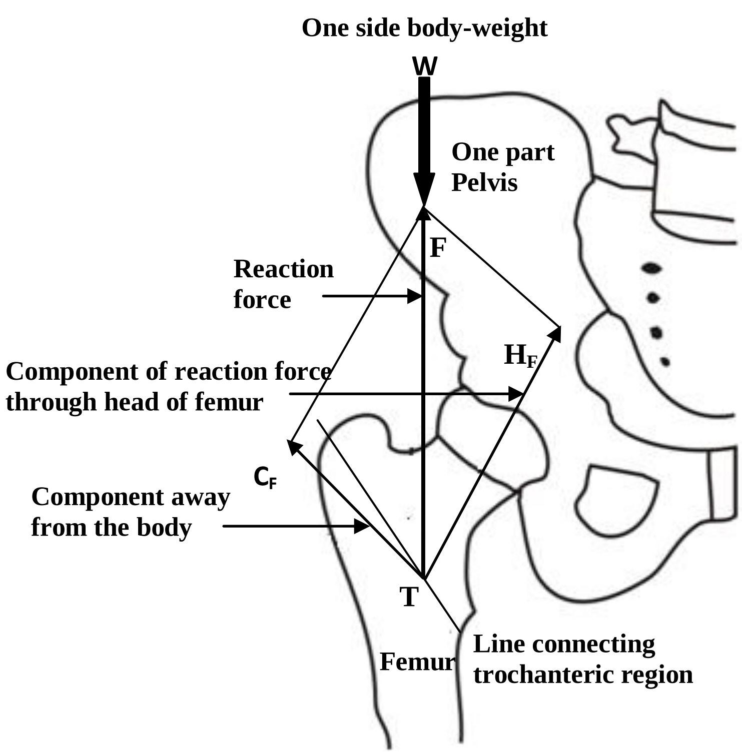

Figure 1: Resolution of forces on the trochanteric region

Under normal conditions forces acting at the trochanteric region: Let us take W as the weight acting on the one-side of the pelvis. F is the reaction force coming out of trochanteric region whereas it can be divided into two components H_F and C_F respectively. Here H_F is acting through the head of femur towards the pelvis to keep the adhere with bone structure of pelvis i.e. to the head of femur within the acetabulum1 and C_F acting outward and it is absorbed by the muscles. It is also seen that $H_F > C_F$ as inclination of H_F with F < inclination of C_F with F as $\cos \widehat{H_F F} > \cos \widehat{C_F F}$.

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Geometrical structure of the upper part of femur: Head is more than a hemisphere = where *a* = radius of the head. Normally, axis of the neck of the femur makes 135^0 with the line of the shaft of it.

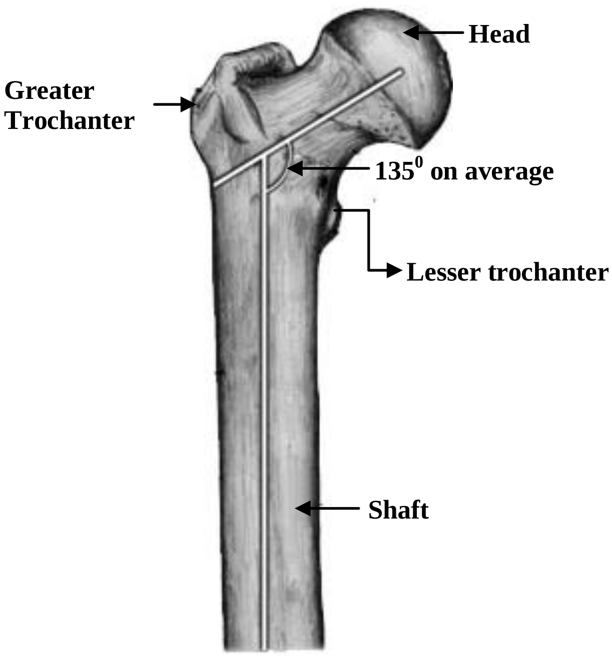

Figure 2A: Geometrical structure of upper portion of femur

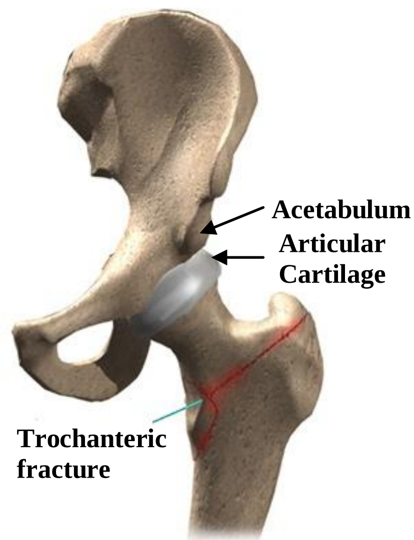

Figure 2B: Anatomical structure of upper portion of femur

Trochanteric region: It is the region along the line of greater and lesser trochanter.

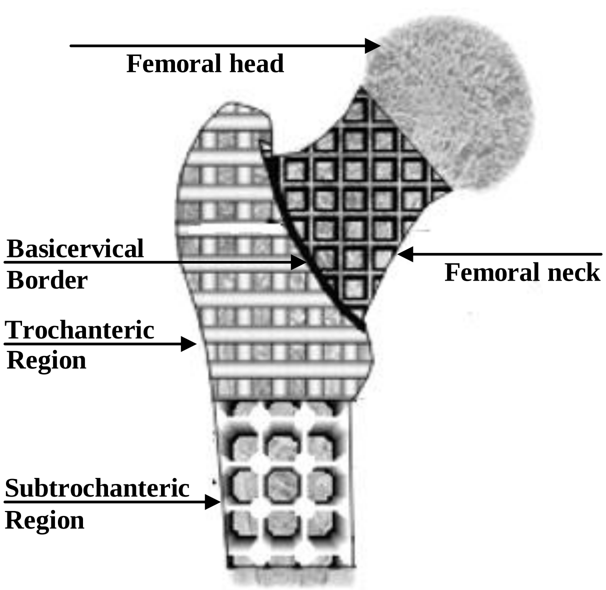

Figure 3A: Anatomical location of hip fracture modification

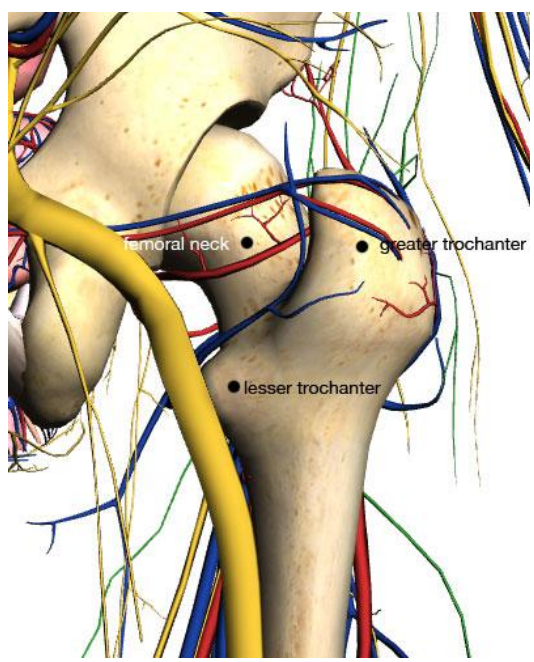

Figure 3B: Actual hip anatomy

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Division of hip fracture region: Hip fractures can be divided into four categories based on their anatomical location (Fig.3A): 1. femoral neck fracture. 2. basicervical fracture 3. trochanteric fracture and 4. subtrochanteric fracture.

Femoral neck fractures (46% to 54% of all hip fractures) and trochanteric fractures (34–46%) are the most common types of hip fracture. Basicervical fractures (2–8%) and subtrochanteric fractures (2–7%) are rare (Jalovaara *et al.* 1992, Berglund-Rödén *et al.* 1994). Femoral neck fractures are intra-capsular, but all the others are extra-capsular. Blood supply is more critical in femoral neck fractures, especially displaced ones, because the severity of the damage to the major blood supply depends on the extent of displacement of the fragments (Fig.3B).

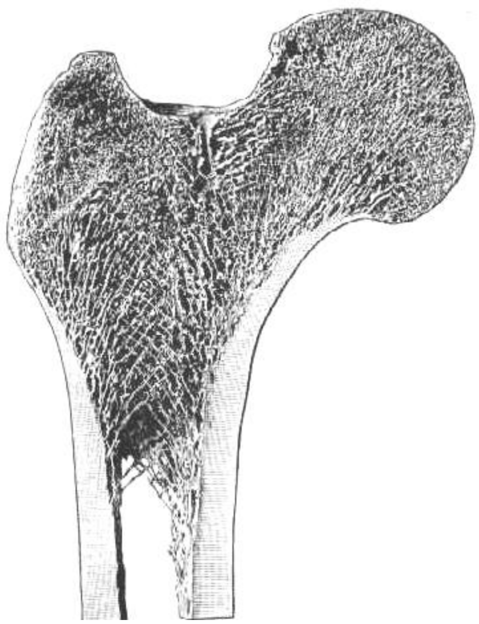

Figure 4A: Actual bone structure within the upper part of femur

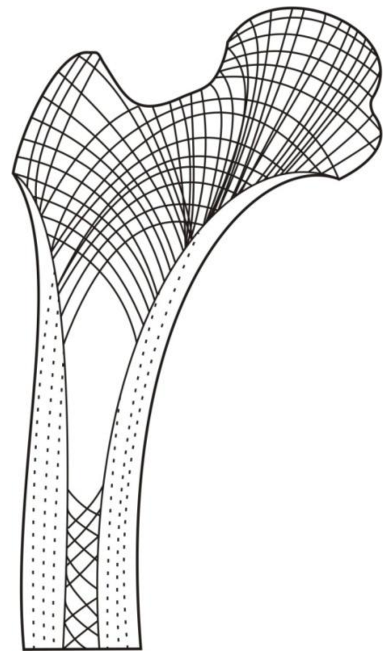

Figure 4B: Internal bone structure upper part of femur (Line sketch)

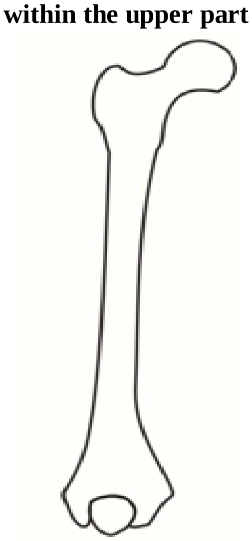

Figure 5A: Femur without external load

Additional load absorbance by femur: The bone structures within the femur are different types. Of them structures within the head and upto the trochanteric region are of trabecular pattern where as within the shaft it is of cylindrical spiral type [Fig.4A & 4B].

This cylindrical spiral type structure has the capacity to absorb additional external load and it is managed by contraction i.e. reducing gap between bone grains. But it appears bending due to presence of compact bone at the outer side of shaft and it is longer in length in the inner side where inner bone is spongy type [Fig.5A & 5B].

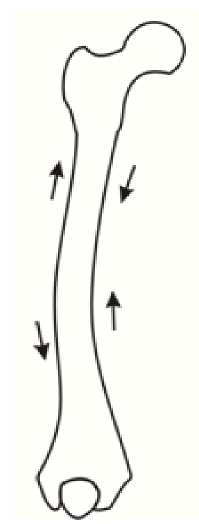

Figure 5B: Femur with external load

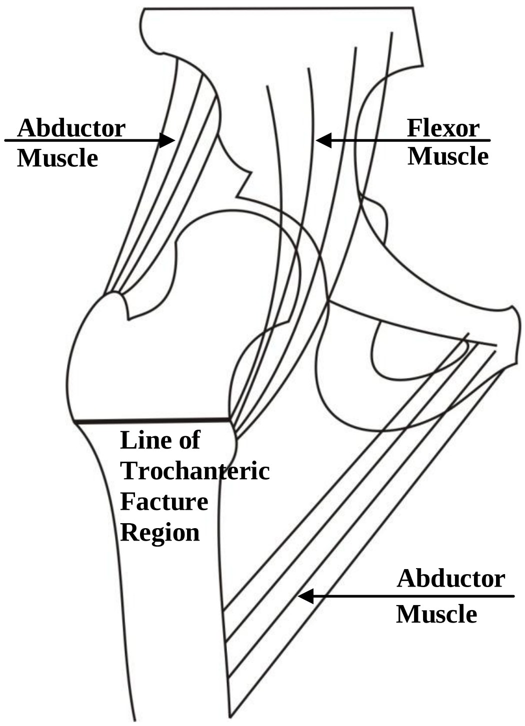

Figure 6A: Muscles affected by trochanteric fracture

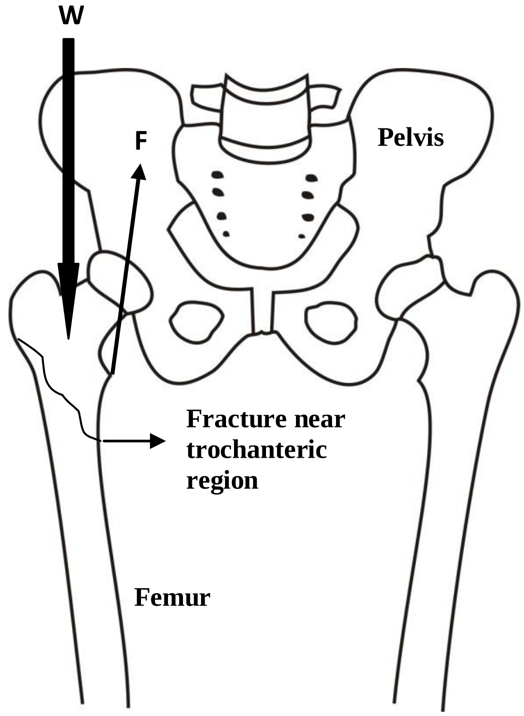

Figure 6B: Distribution of forces after trochanteric fracture

Affected muscles by trochanteric fracture [Fig.6A]**:** The abductor and flexor muscles connecting pelvis with upper part of femur become loose when a facture takes place along the intertrochanteric region. The result is that the person will be unable stand immediately.

Change of point of application of reaction force due trochanteric fracture [Fig.6B]**:** Weight of the body W comes down on the same way but reaction force F could not act just opposite to W due breakage at the trochanteric region and begins to act near lesser trochanteric region. As a result lower portion of femur bend down.

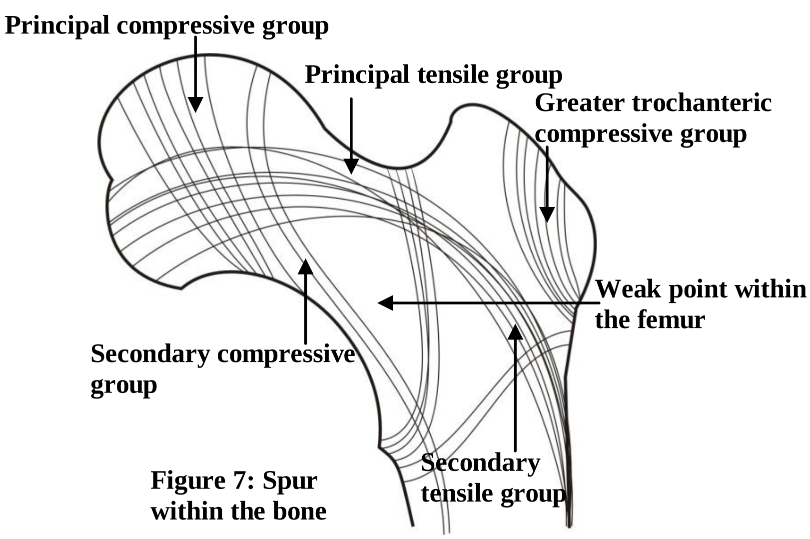

Figure 7: Spur within the bone

Trabecular structure of bone within the after part of femur: Internal arrangement of spurs within the femur, head and its neighbouring area, are connected by curvilinear lines of forces either by tensile or by compressive

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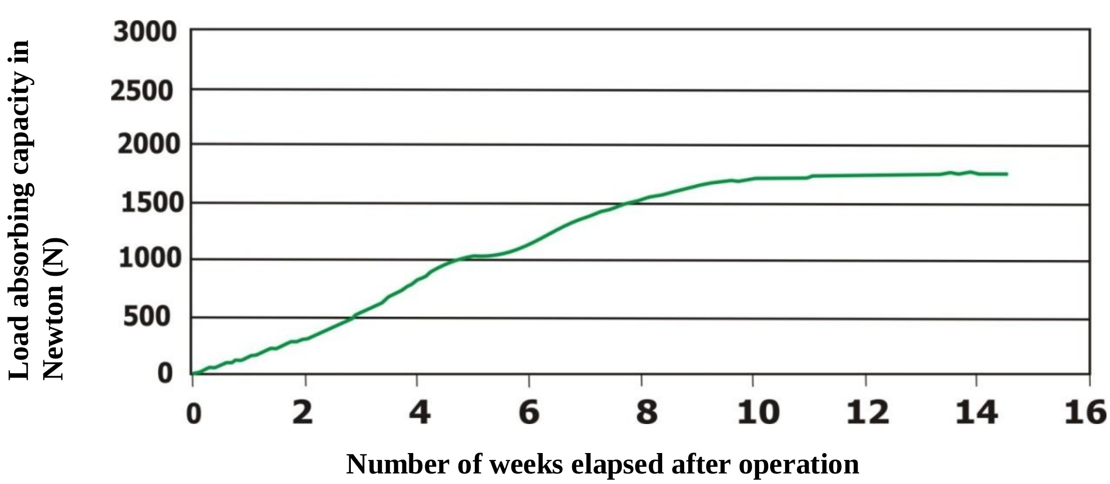
types. These lines of forces keep the stability of the bone structure as well as capacity of absorbing compression, thrust etc.

Figure 8: Dynamic hip screw

Dynamic hip screw (DHS) [Fig.8] or **Sliding Screw Fixation** [Fig.9]**:** It is a type of orthopaedic implant designed for fixation of certain types of intertrochanteric and sub-trochanteric fractures which allows controlled dynamic sliding of the femoral head. The idea behind the dynamic compression is that the femoral head component is allowed to move along one plane; since bone responds to dynamic stresses, the native femur may undergo remodelling and proper fracture healing. Dynamic hip screws are used for internal fixation of fractures of the femoral neck and intertrochanteric region. The screw is a large cancellous lag screw that glides freely in a metal sleeve. The sleeve is attached to a side plate that is fixed to the lateral femoral cortex with screws. Weight bearing cause the femoral head to becomes impacted on the femoral neck producing dynamic compression of the fracture. The shaft of the lag screw slides down the sleeve maintaining reduction of the fracture as compression occurs.

Figure 9: X-ray of implantation DHS on trochanteric fracture (Antero-posterior view)

Insertion with Dynamic Hip Screw in trochanteric fracture: In the years of 90's DHS (Dynamic Hip Screw) was the most effective implanting method / device for the management of trochanteric fracture. In 1995, **O'Brien et al,** eminent orthopædic surgeons and scientists said: *Dynamic hip screw should be considered as implant of intertrochanteric fractures for its low risk in complication.*



Graph-1: Curve on load-bearing capacity gained with period after application of DHS

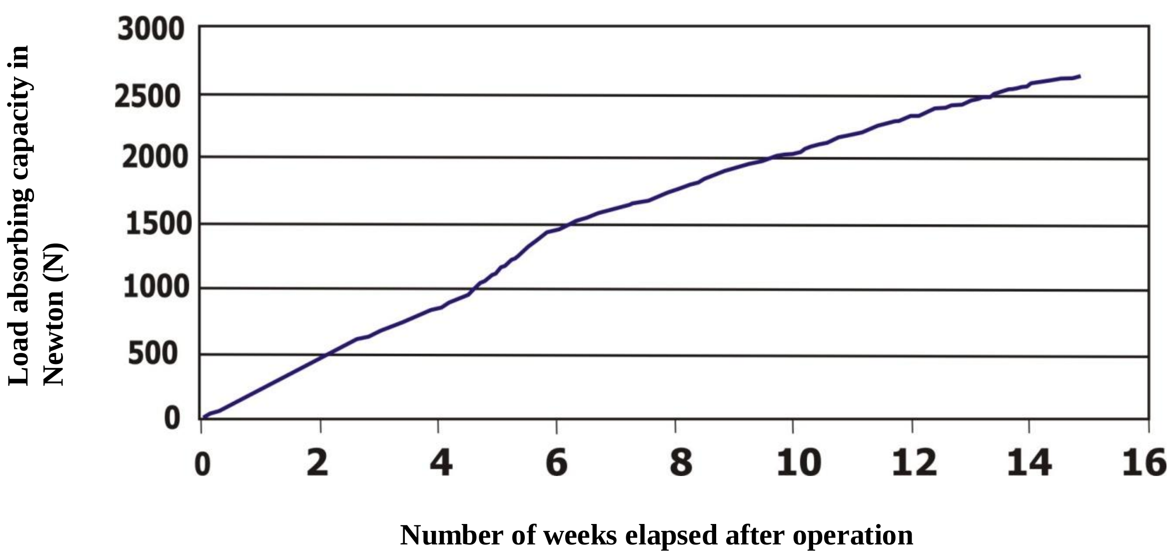
In Graph-1, we see maximum load bearing capacity is lying within 1500 – 2000 N i.e. 150 – 200 Kg.Wt.

Figure 10: Full-threaded (left) & partial-threaded cancellous screw

Fully-threaded (left) and partially-threaded (right) cancellous screw [Fig.10]**:** Cancellous screws are designed for fixation of cancellous bone. They are most commonly used in the metaphyses of long bones where cancellous bone is abundant. They have more deeply cut and more widely spaced threads compared to cortical screw. Since cancellous bone is much less dense than cortical bone, the screw threads cut their path in the bone when the screw is inserted, i.e. cancellous screws are self-tapping. Partialy threaded cancellous screws are often used as lag screws for metaphyseal fractures.

Insertion of additional parallel screw with DHS [Fig.11]**:** In some cases due more torsional force anti-torsional binding is needed. There additional cancellous screw has been inserted parallel to DHS. In 1996, it was strongly recommended by orthopædic surgeons and scientists, **Bartle et al,** as *implantation of anti-rotational parallel screw with dynamic hip screw fixation*.

Figure 11: Additional parallel screw with DHS



Graph-2: Curve on load-bearing capacity gained against period after application of DHS + parallel screw

In Graph-2, we see maximum load bearing capacity is lying within 2500 – 3000 N i.e. 250 – 300 Kg.wt but nearer to 250 Kg.wt.

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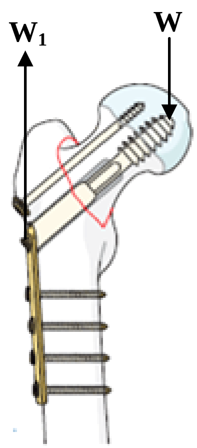

Figure 12: Effective forces on DHS due to body-weight

Effective forces on DHS due to body weight [Fig.12]**:** Body-weight is generally coming down through the head of femur. But here as the femur is implanted with dynamic hip screw due experiencing trochanteric fracture (red-marked) the one-sided body weight W will transmit on the DHS and pass through it towards the plate of DHS whereas a part of the body-weight is being absorbed by the bone itself due to its compactness and heliacal trabecular structure within.

The compressive force due to body weight on the head of femur i.e. on the thread-end of DHS will be accompanied by a parallel force W_1, vertically upward, at the lower end of DHS i.e. on the head of the screw. Here $W_1 < W$ as a part of W is absorbed by the bone itself due to its flexibility and weight-bearing capacity. W_1 cannot be much intensified by the weight W of the upper part of the body as some portion of W is also absorbed by muscles, DHS etc.

So, it cannot uproot the screws attached with the DHS or it cannot even extent the plate as the plate is inextensible as well as bending of head against DHS is not possible by this force.

Resolution of transmission of body-weight [Fig.13]**:** P is the force coming from the upper part of the body due to body-weight and it is acting on the screw of DHS. P has two components (1) T is in horizontal direction and (2) C is in vertical direction where P makes an angle $\theta < 45^0$ and consequently $C > T$ for making leg in contact with earth. Otherwise, if $\theta > 45^0$ the leg will be above the ground i.e. in hanging position. For $\theta > 45^0$, the body-weight will transferred to other leg and the hanging leg will be used to balance the upper part of the body.

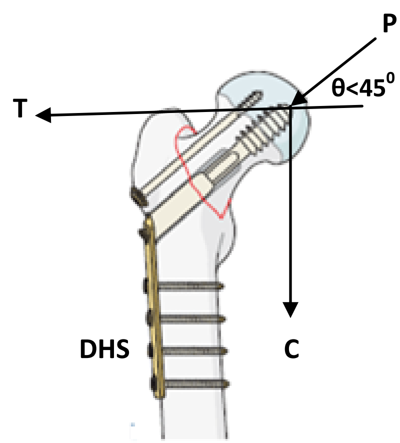

Figure.13: Showing the resolution of forces

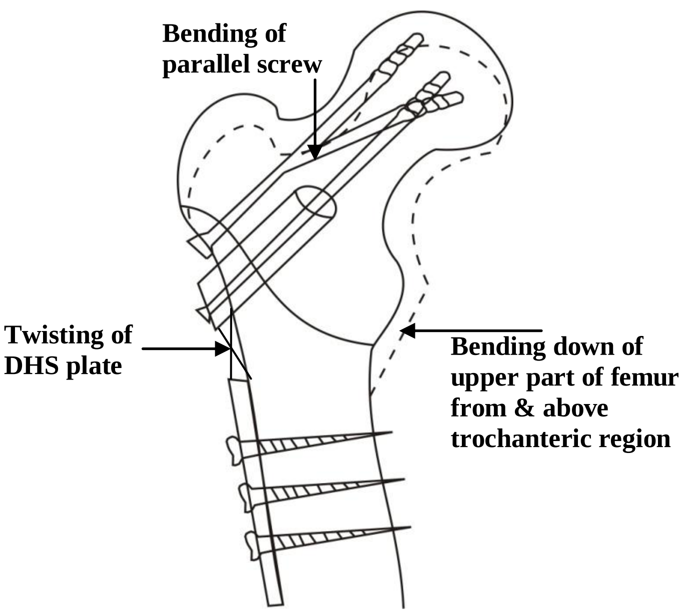

Figure 14: Bending down at trochanteric region even after insertion of parallel screw with DHS

Bending parallel screw with DHS: The only force which can deform the DHS in the management of Trochanteric Fracture is twisting force. This force is effective enough to twist the plate [Fig.14]. Screw parallel to DHS cannot resist the twist as it is in one direction i.e. the system employed in two-dimensional. But the twisting force is three-dimensional. So, twisting force can only be resisted by the three-dimensional management.

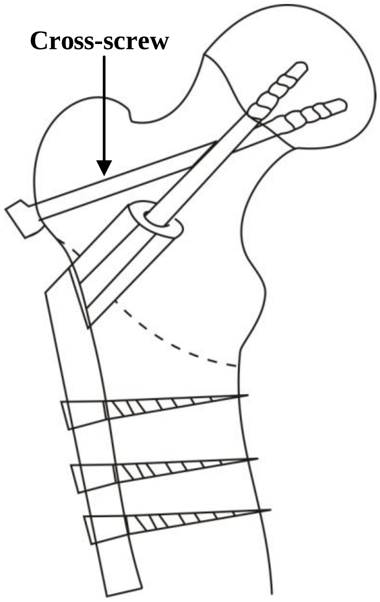

Figure 15: Insertion of cross screw in three dimensional mode along with DHS

Arrangement of cross screw along with DHS: The twisting forces are very often on the femur due to walking and movement of femur. Muscles and ligaments attached with the femur transmit forces from different angles. Even very small twisting of plate is enough for deforming the attachment of DHS with parallel screw. The net effect is lowering of the head of the femur.

The cross screw used with DHS [Fig.15] has been used for three-dimensional management of trochanteric fracture.

Mathematical appreciation of twisting of DHS plate [Fig.16]**:** Let us consider the DHS plate is in longitudinal dimension with length ‘a’ and thickness ‘t’ where a >> t and its elementary part as parallelepiped [Fig.18] with dimension dx, dy and t. Stress components perpendicular to x-axis are σ_x,τ_{xy}, τ_{xz}, where σ_x = Bending stress, τ_{xy} = Torsion stress, τ_{xz} = Transverse shearing stress. $\sigma_x \propto z$ where z is the distance of point of action of the stress from the central line of the plate.

So, Bending Moment per unit width of the plate is

$$M_x = \int_{-\frac{t}{2}}^{\frac{t}{2}} (\sigma_x . 1. dz). z = \int_{-\frac{t}{2}}^{\frac{t}{2}} z. \sigma_x . dz$$

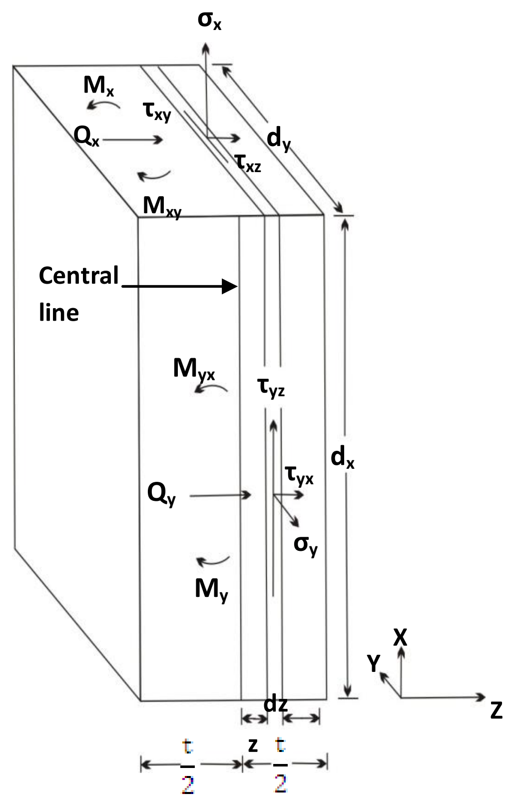

Figure.16: Geometrical structure of plate of DHS.

but $\sigma_x = -\left\{\frac{E.z}{1-\mu^2}\right\}.\left(\frac{\partial^2\omega}{\partial x^2} + \mu.\frac{\partial^2\omega}{\partial y^2}\right)$ where E = Modulus of Elasticity or Young’s Modulus of the plate = $\frac{\text{Stress}}{\text{Strain}}$ [Stress = Force per unit area; Strain = $\frac{\text{Amount of deformation}}{\text{Original length}}$; μ = Poisson’s ratio = $\frac{\text{Longitudinal stress}}{\text{Longitudinal strain}}$; ω = deflection and it is a function of x and y where $\frac{\partial^2\omega}{\partial x^2}$; $\frac{\partial^2\omega}{\partial y^2}$ are second order partial differentiation of ω with respect to x and y respectively.

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So,

$$M_x = -\frac{E}{1-\mu^2}.\left(\frac{\partial^2\omega}{\partial x^2}+\frac{\partial^2\omega}{\partial y^2}\right).\int_{-\frac{t}{2}}^{\frac{t}{2}} z^2.dz = -\frac{E.t^3}{12(1-\mu^2)}.\left(\frac{\partial^2\omega}{\partial x^2}+\frac{\partial^2\omega}{\partial y^2}\right)$$

Similarly, torsion stress $\tau_{xy} \propto z$, then twisting moment per unit width of the plate is

$$M_{xy} = \int_{-\frac{t}{2}}^{\frac{t}{2}} z.\tau_{xy}.dz = -\frac{E}{1+\mu}.\frac{\partial^2\omega}{\partial x\,\partial y}.\int_{-\frac{t}{2}}^{\frac{t}{2}} z^2.dz = -\frac{E.t^3}{12(1+\mu)}.\frac{\partial^2\omega}{\partial x\,\partial y}$$

$$\left[\text{since } \tau_{xy} = -\frac{Ez}{1+\mu}.\frac{\partial^2\omega}{\partial x\,\partial y}\right]$$

Transverse shearing stresses per unit width of the plate are τ_{xz}, τ_{zx} and $\tau_{xz} = \tau_{zx}$
So, Transverse Shearing Stress moment is

$$Q_x = \int_{-\frac{t}{2}}^{\frac{t}{2}} \tau_{xz}.dz = -\frac{E}{2(1-\mu^2)}.\frac{\partial}{\partial x}\left(\frac{\partial^2\omega}{\partial x^2}+\frac{\partial^2\omega}{\partial y^2}\right).\int_{-\frac{t}{2}}^{\frac{t}{2}}\left(z^2-\frac{t^2}{4}\right).dz$$

$$= -\frac{E.t^3}{12(1-\mu^2)}.\frac{\partial}{\partial x}\left(\frac{\partial^2\omega}{\partial x^2}+\frac{\partial^2\omega}{\partial y^2}\right)$$

$$\left[\text{where } \tau_{xz} = -\frac{E}{2(1-\mu^2)}\left(z^2-\frac{t^2}{4}\right).\frac{\partial}{\partial x}\left(\frac{\partial^2\omega}{\partial x^2}+\frac{\partial^2\omega}{\partial y^2}\right)\right]$$

In the same way Stress components on the normal to the y-axis are σ_y, τ_{yx} and τ_{yz} which are symbolic as the same way before and respective moments of twisting and shearing forces are

$$M_y = \int_{-\frac{t}{2}}^{\frac{t}{2}} z.\sigma_y.dz = -\frac{E.t^3}{12(1-\mu^2)}.\left(\frac{\partial^2\omega}{\partial y^2}+\mu.\frac{\partial^2\omega}{\partial x^2}\right)$$

$$M_{yx} = \int_{-\frac{t}{2}}^{\frac{t}{2}} z.\tau_{yz}.dz = -\frac{E.t^3}{12(1+\mu)}.\frac{\partial^2\omega}{\partial x\,\partial y} = M_{xy}$$

$$Q_y = \int_{-\frac{t}{2}}^{\frac{t}{2}} \tau_{yz}.dz = -\frac{E.t^3}{12(1-\mu^2)}.\frac{\partial}{\partial y}\left(\frac{\partial^2\omega}{\partial x^2}+\frac{\partial^2\omega}{\partial y^2}\right)$$

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Now, $\sigma_x = \frac{12M_x.z}{t^3}, \sigma_y = \frac{12M_y.z}{t^3}, \tau_{xy} = \tau_{yx} = \frac{12M_{xy}.z}{t^3}, \tau_{xz} = \frac{\frac{6Q_x}{t^3}}{\frac{t^2}{4}-z^2} = \tau_{zx}, \tau_{yz} = \frac{\frac{6Q_y}{t^3}}{\frac{t^2}{4}-z^2} = \tau_{zy}, \sigma_z = -\left\{2q\left(\frac{1}{2}-\frac{z}{t^3}\right)^2\right\}.\left(1+\frac{z}{t}\right)$ where q = total transverse load per unit area of the plate, including the surface forces and body forces in the z-direction. Considering the surface component z′ on the lower face of the plate and the body force component z along their lines of action to the upper face of the plate the total surface component on the upper face becomes

$$q = (z')_{z=-\frac{t}{2}} + (z')_{z=\frac{t}{2}} + \int_{-\frac{t}{2}}^{\frac{t}{2}} z.dz$$

It is the total transverse load per unit area of the plate. This force or load is considered to be positive when it acts in the positive direction oz. The transmission of forces will cause some error only in the unimportant Stress component σ_x and does not affect the other Stress component at all.

$$q = \frac{Et^3}{12(1-\mu^2)}.\left(\frac{\partial^4\omega}{\partial x^4} + \frac{\partial^4\omega}{\partial y^4}\right)$$

The dimension of moments is considered as Force or Load for all practical purposes. Similarly, the dimension of shearing force is considered as Force or Load / Length.

So, the stresses on a thin plate under bending / twisting can be grouped into three classes according to the order of magnitude are (1) The transverse normal stress σ_z is of order of magnitude of q; (2) The transverse shearing stresses τ_{xz} and τ_{yx} are of order of $q\frac{a}{t}$; (3) The bending stresses σ_x and σ_y as well as the torsion stress τ_{xy} are of order $q.\frac{a^2}{t^2}$.

As for thin plate ‘t’ is small in comparison with ‘a’ then ‘a/t’ is a large number. Therefore, we see that σ_x, σ_y and τ_{xy} are much greater than τ_{xz} and τ_{yz} and still much greater than σ_z.

So, we see the bending stress and torsion stress are acting on the thin plate. Then there is every possibility of twisting as well as bending of the plate but due to bending or shearing forces the DHS plate is uprooted along with the screw as plate is strong enough against twisting. To resist it we fix upper part of the trochanteric fracture with the lower part (i.e. to the shaft of the femur in sub-trochanteric region) in three dimensional ways i.e. by additional cross screw along the conventional DHS and by replacing additional parallel screw as this cross screw will connect head of the femur to the lower part of the fracture in angular direction and it will be very much rigid because of the curved intrinsic trabecular structure of the head of the femur to fix the lower part in angular direction which will resist tendency of bending of the plate and it will be very much effective to keep the parts of the femur singly as solid one as it is a three dimensional management of fixation.

STATISTICAL DATA

Table 1: Distribution of cases according to age-group

Age-group in years	Number of patients	Percentage
< 40	06	5.36
41 – 50	13	11.61
51 – 60	22	19.65
61 – 70	53	47.32
71 – 80	11	9.82
> 80	07	6.25
Total	**112**	**100**

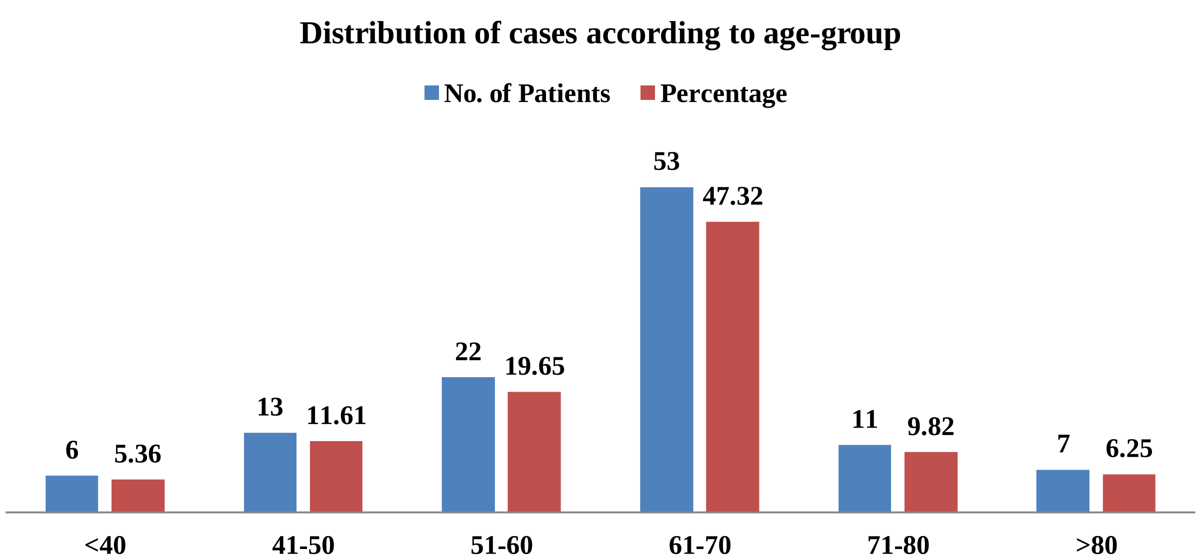

Chart-1: Representing Table-1

Table 2: Showing distribution patients with percentage according sex and side affection

Sex	Number of patients	Percentage	Side affection	Number of patients	Percentage
Male	73	65.12	Right	60	53.57
Female	39	34.88	Left	52	34.83
Total	**112**	**100**	**Total**	**112**	**100**

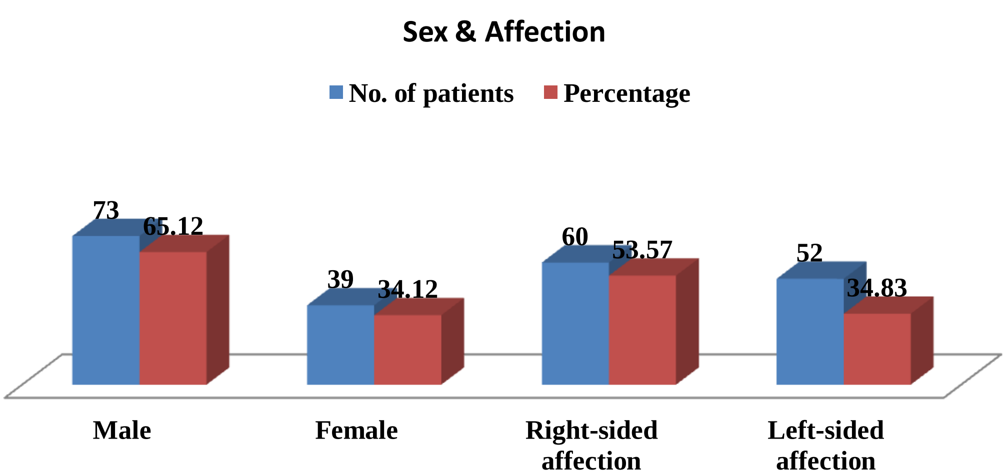

Chart-2: Representing Table-2

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Table 3: Distribution of patients with percentage according to associate injuries with trochanteric fracture

Associated Fractures	Number of patients out of 112	Percentage	Causes of injuries	Number of patients	Percentage
Collis fracture	06	5.36	Road traffic accident	31	27.68
Intercondylar humeral fracture	02	1.79	Severe fall on ground	39	34.82
Proximal humeral fracture	03	2.68	Fall from height	26	23.22
Spinal fracture	02	1.79	Slip on floor	16	14.28
Total	**13**	**11.62**	**Total**	**112**	**100**

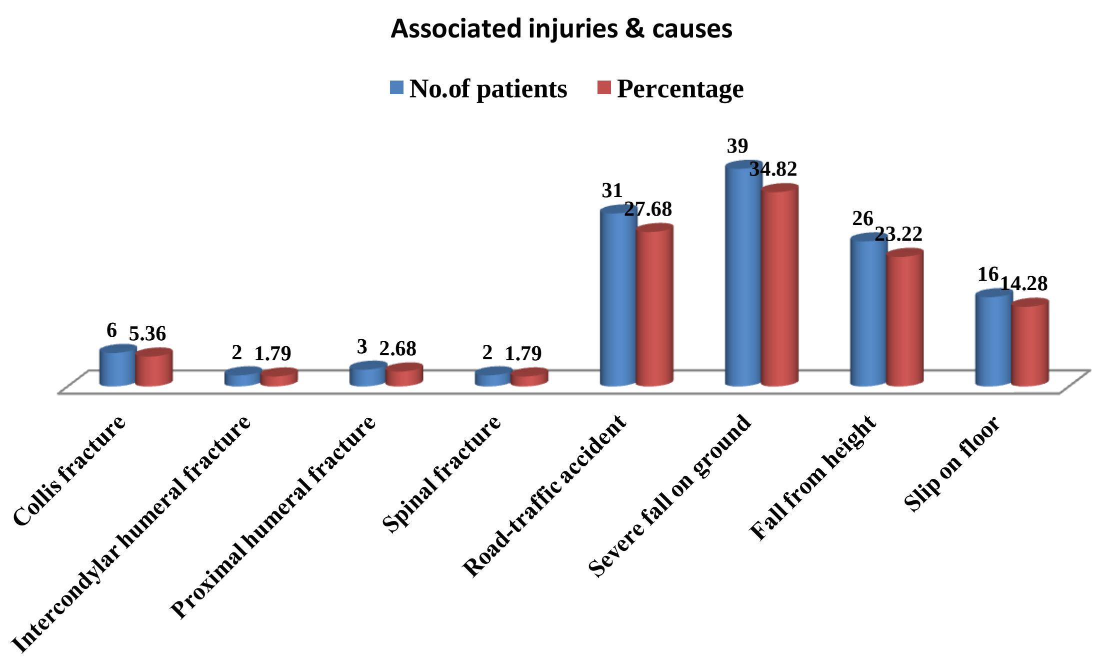

Chart-3: Representing Table-3

Table 4: Showing duration of injuries before admission

Duration in weeks	Number of cases	Percentage
0 – 1 weeks	83	74.12
2 – 3 weeks	15	13.39
3 – 4 weeks	10	8.92
More than 4 weeks	04	3.57
Total	**112**	**100**

Late comer patients suffer from decay of bones at the points of injuries due to contact of internal bone structure with different types of fluids flowing within the body i.e. osteoporosis at the fracture portion causing problems in proper union. Most of the late comer patients go under unstable fracture pattern.

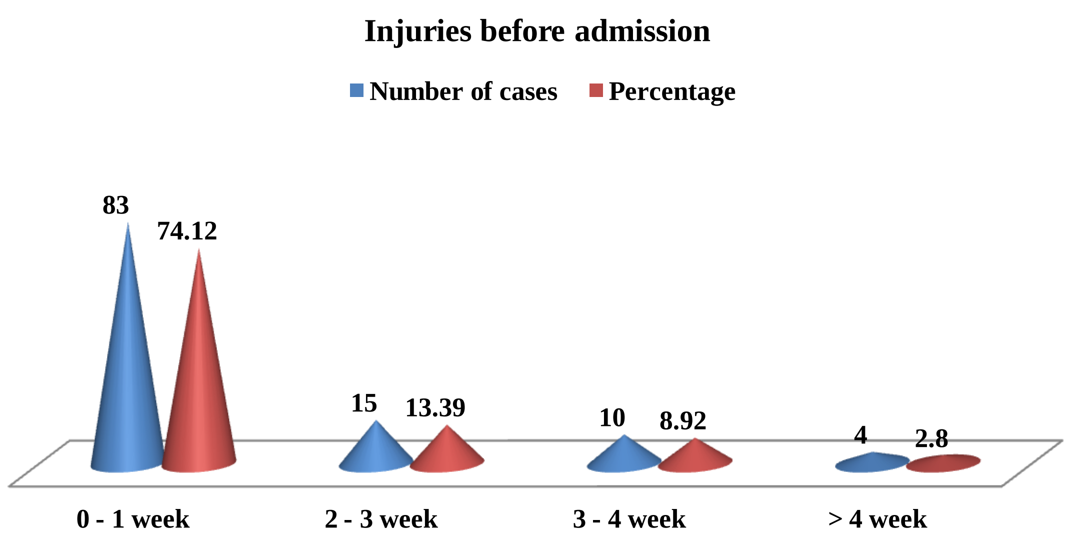

Chart-4: Representing Table-4

Table 5: Showing fracture pattern

Stability	Number of cases	Percentage
Stable	53	47.32
Unstable	59	52.68
Total	**112**	**100**

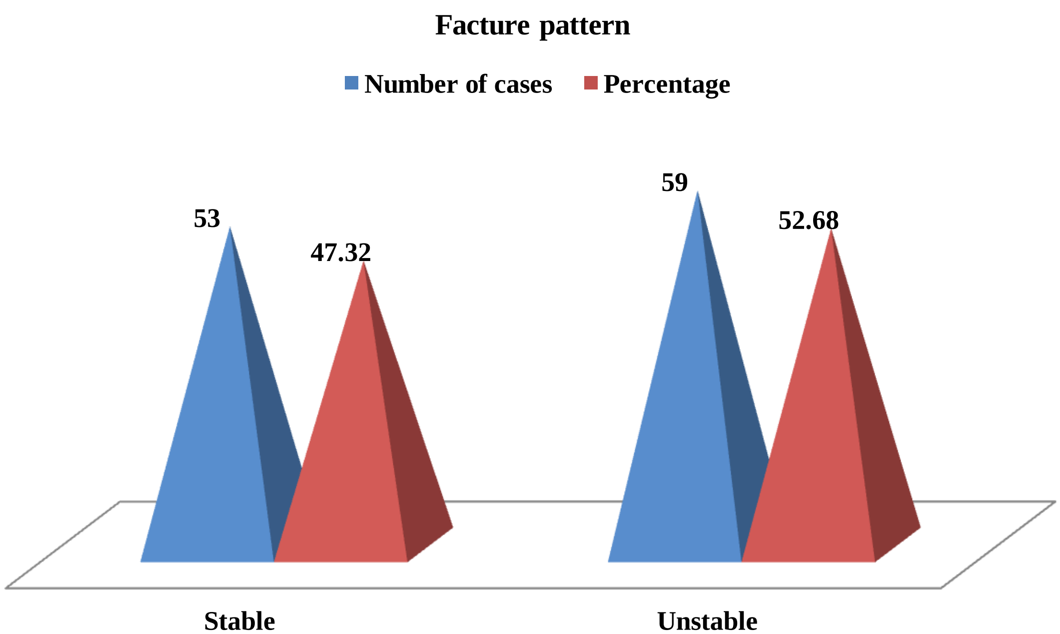

Chart-5: Representing Table-5

All patients are allowed to sit on the bed from next week of operation. Static quadriceps drill and knee bending exercises started thereafter. Patients' non weight-bearing crutch walking stared after 2 weeks. By 6 – 8 weeks most of the patients were walking with partial weight-bearing and weight- bearing by 8 – 10 weeks.

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Table 6: Period necessary for partial and full weight-bearing

Duration	Partial weight-bearing		Full weight-bearing	
	Number of cases	Percentage	Number of cases	Percentage
0 – 2 weeks	00	0.00	00	0.00
2 – 4 weeks	08	7.62	00	0.00
4 – 6 weeks	28	26.67	10	9.53
6 – 8 weeks	64	60.95	18	17.14
8 – 10 weeks	05	4.75	58	55.24
10 – 12 weeks	00	0.00	19	18.10

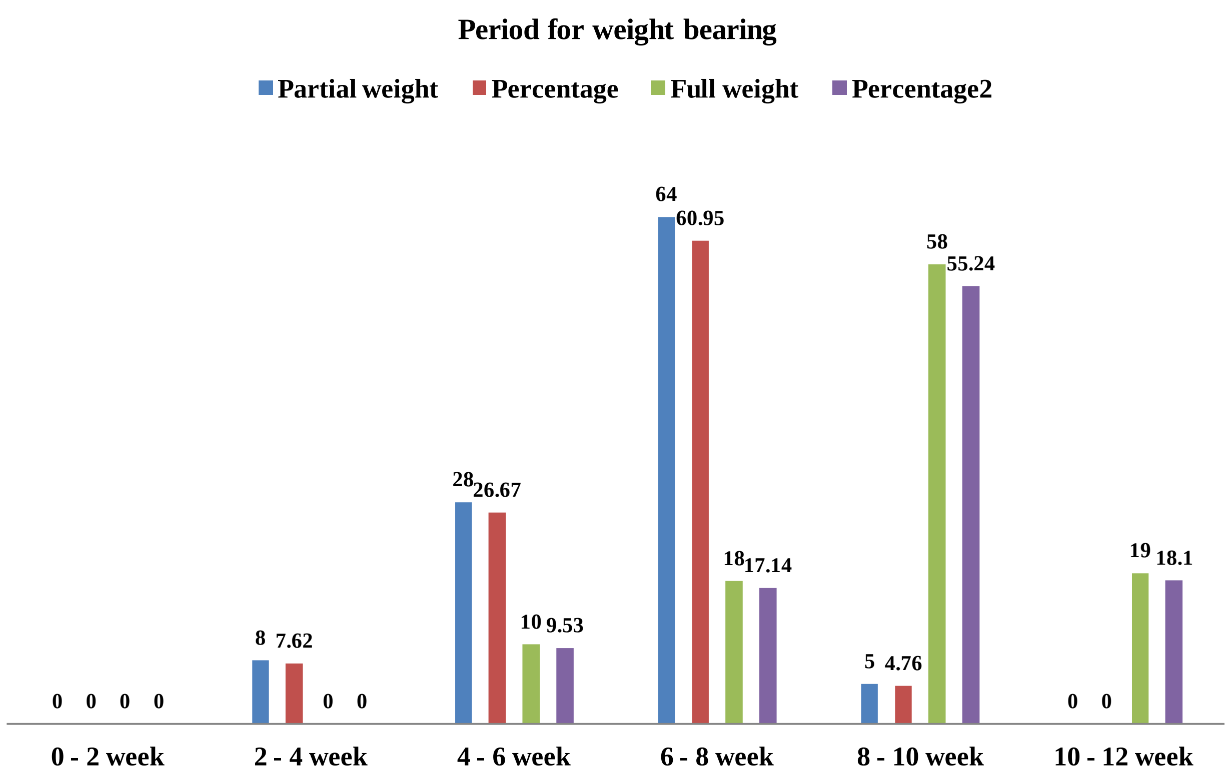

Chart-6: Representing Table-6

Table 7: Showing complications arising on patients after operation

Complications	Number of patients	Percentage
Superficial wound infection	06	5.36
Deep wound infection	04	3.57
Over penetration of lag screw	01	0.89
Urinary tract infection	02	1.79
Chest infection	00	0.00
Deep vein thrombosis	02	1.79
Bed sore	03	2.68
Total	**18**	**16.08**

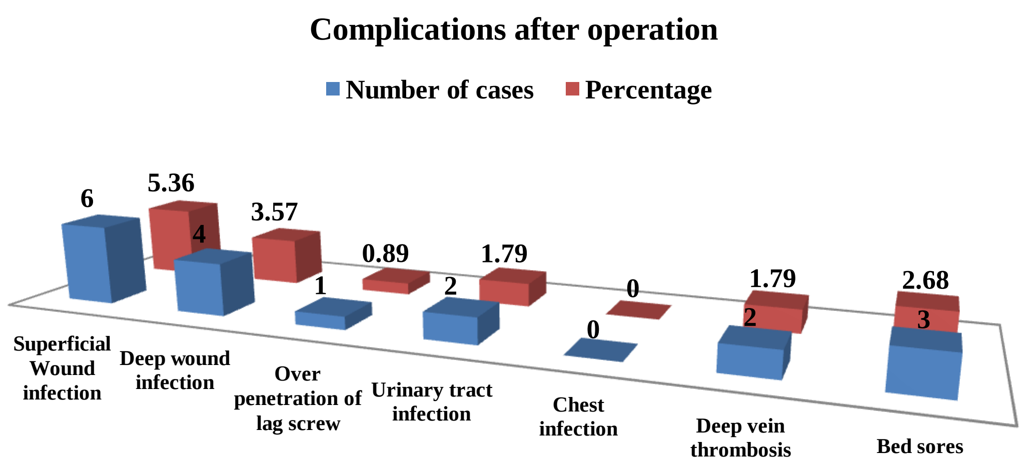

Chart-7: Representing Table-7

Table 8: Actual number of cases followed up

Description of cases	Number of cases	Percentage
Number of cases at the start of study	112	100
Cases expired during study	04	3.57
Cases lost to follow up	03	2.68
Total number of cases followed for study	**105**	**93.75**

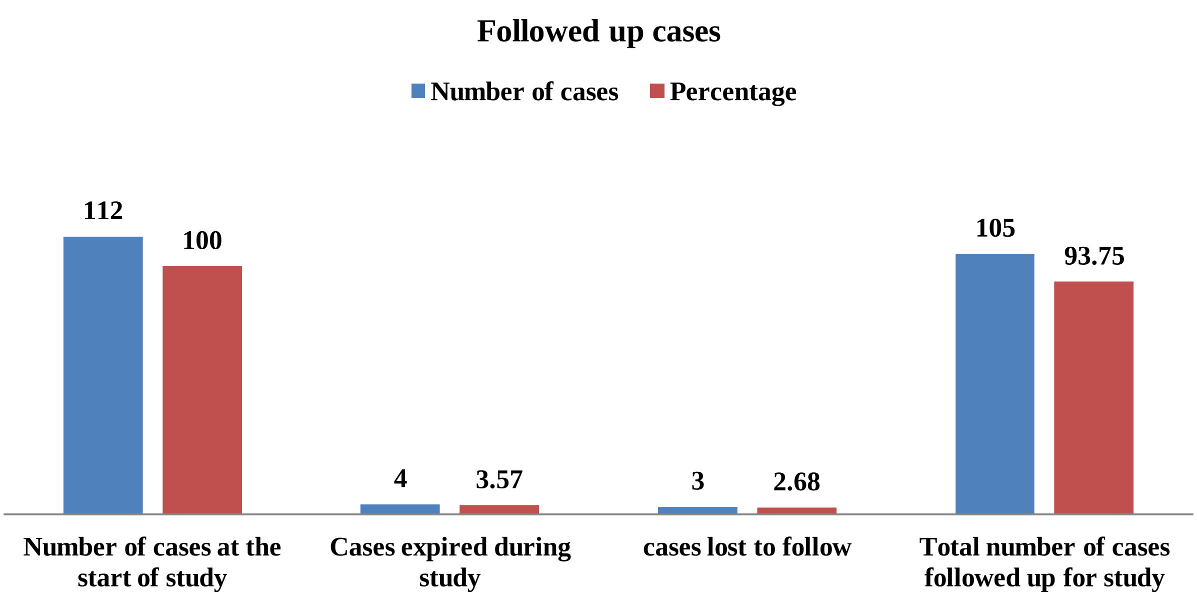

Chart-8: Representing Table-8

Table 9: Showing the limb shortening

Amount of shortening	Number of cases	Percentage
None	89	84.76
0 – 1 cm	14	13.33
1 – 2.5 cm	02	1.91
More than 2.5 cm,	00	0.00
Total	**105**	**100**

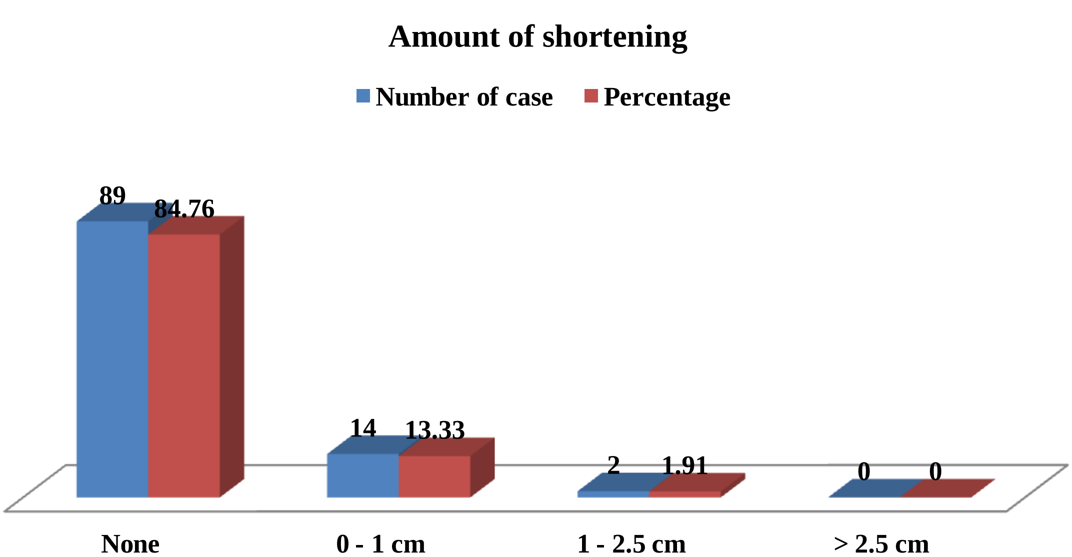

Chart-9: Representing Table-9

Table 10: Showing time taken for Radiological union

Time has elapsed	Number of cases	Percentage
8 – 12 weeks	99	94.28
12 – 16 weeks	05	4.76
16 – 20 weeks	01	0.96
Total	**105**	**100**

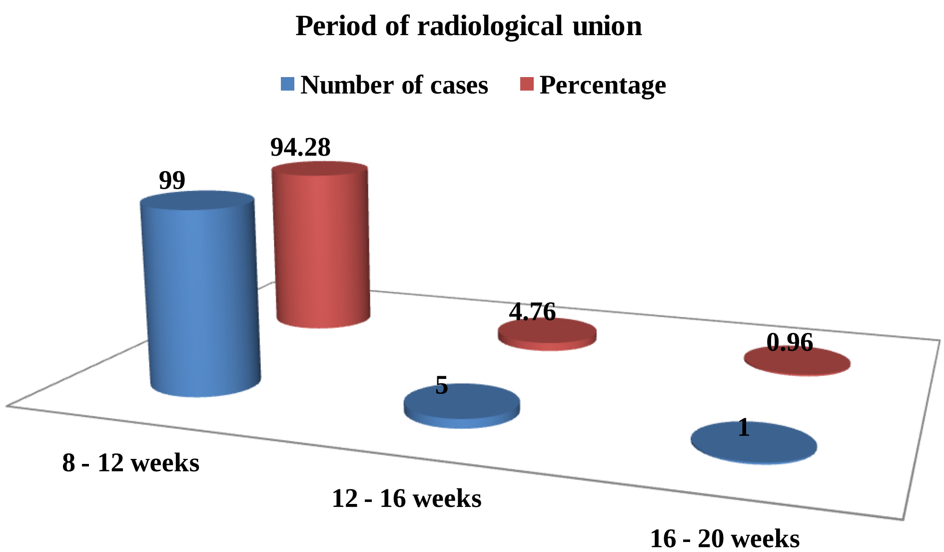

Chart-10: Representing Table-10

Table 11: stay of the patient in hospital

Duration	Number of cases	Percentage
0 – 1 week	29	27 62
1 – 2 weeks	63	60.00
2 – 3 weeks	12	11.42
3 – 4 weeks	01	0.96

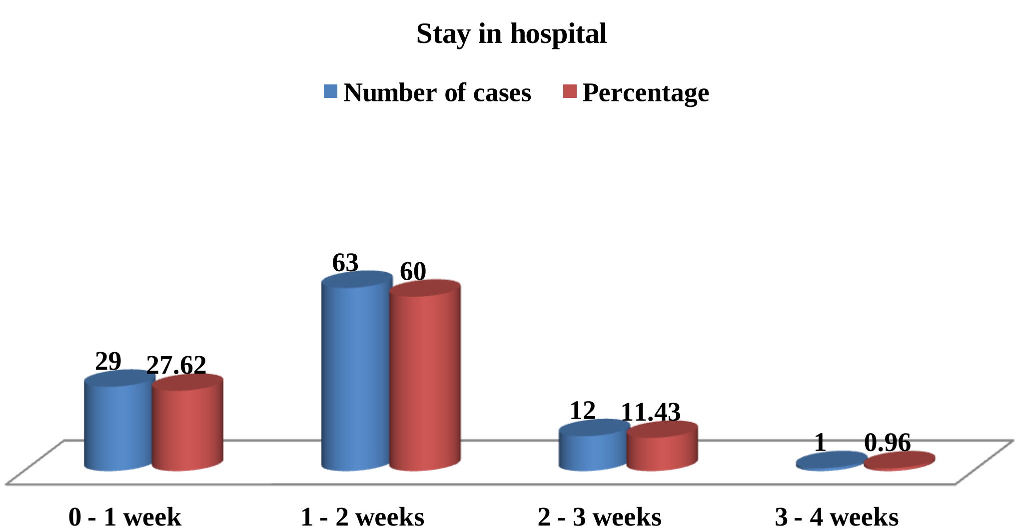

Chart-11: Representing Table-11

Table 12: Range of hip movement after 6 months

Range of movements	Number of cases	Percentage
Full range	97	92.37
Flexion $80^0 – 110^0$	06	5.72
Flexion < 80^0	02	1.91
Total	**105**	**100**

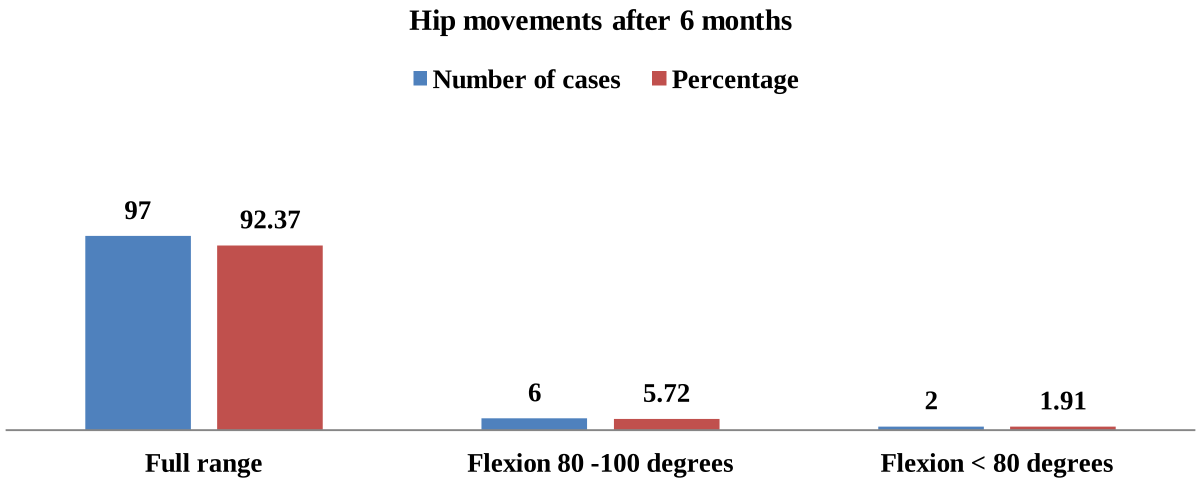

Chart-12: Representing Table-12

Table-13: Range of knee movement after 6 months

Range of movements	Number of cases	Percentage
Full range	102	97.13
Flexion $90^0 – 110^0$	02	1.91
Flexion < 90^0	01	0.96
Total	**105**	**100**

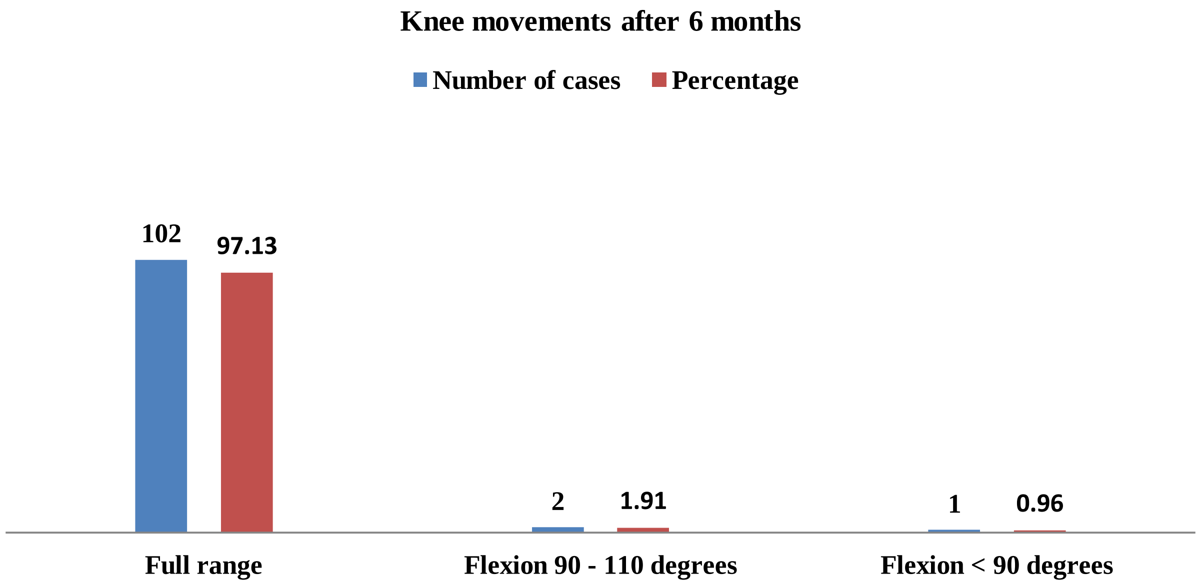

Chart-13: Representing Table-13

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Table 14: Various deformities after 6 months

Deformities	Number of cases	Percentage
External rotation	05	4.77
Adduction	03	2.85
Adduction & external rotation	02	1.91
Flexion	00	0.00
Total	**10**	**9.53**

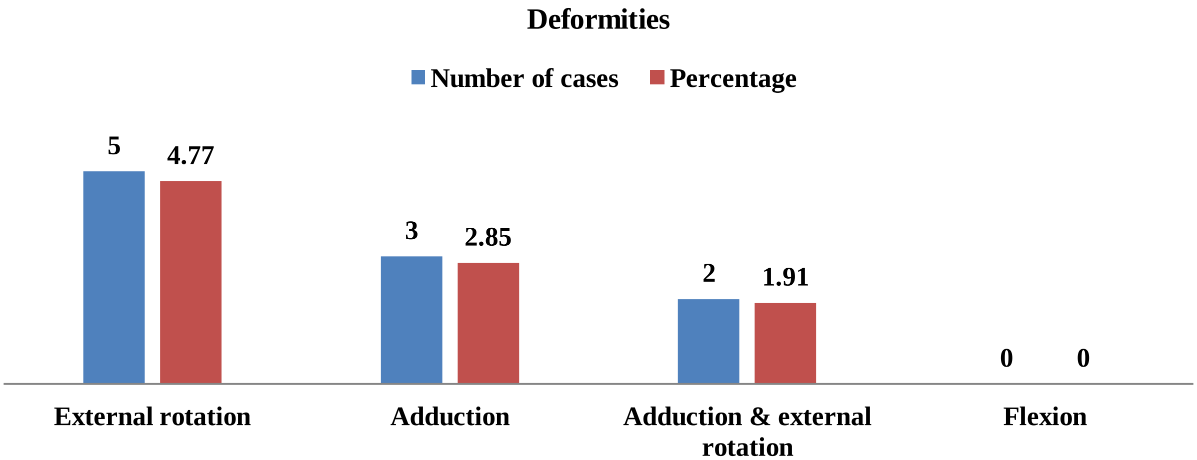


Chart-14: Representing Table-14

Table 15: Showing femoral neck-shaft angle

Femoral neck-shaft angle	Normal or within ± 10^0 of normal		Within ± 10^0 – 20^0 of normal	
Duration	Number of cases	Percentage	Number of cases	Percentage
Immediate post operative	101	96.20	04	3.81
After partial weight bearing	101	96.20	04	3.81
A radiological union	99	94.29	06	5.72
At 6 months	99	94.29	06	5.72

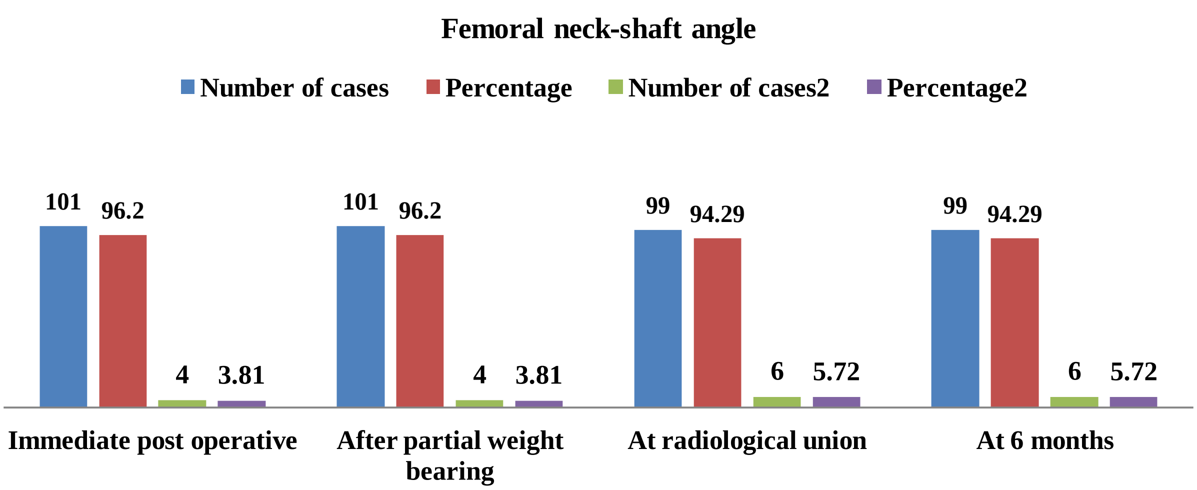


Chart-15: Representing Table-15

Table 16: Showing evaluation of result as per Harris Hip Score

Hip score points	Categories	Number of cases	Percentage
100 – 90	Excellent	86	81.90
80 – 89	Good	12	11.43
70 – 79	Fair	05	4.76
60 – 69	Poor	02	1.91
Less than 60	Failure	00	0.00

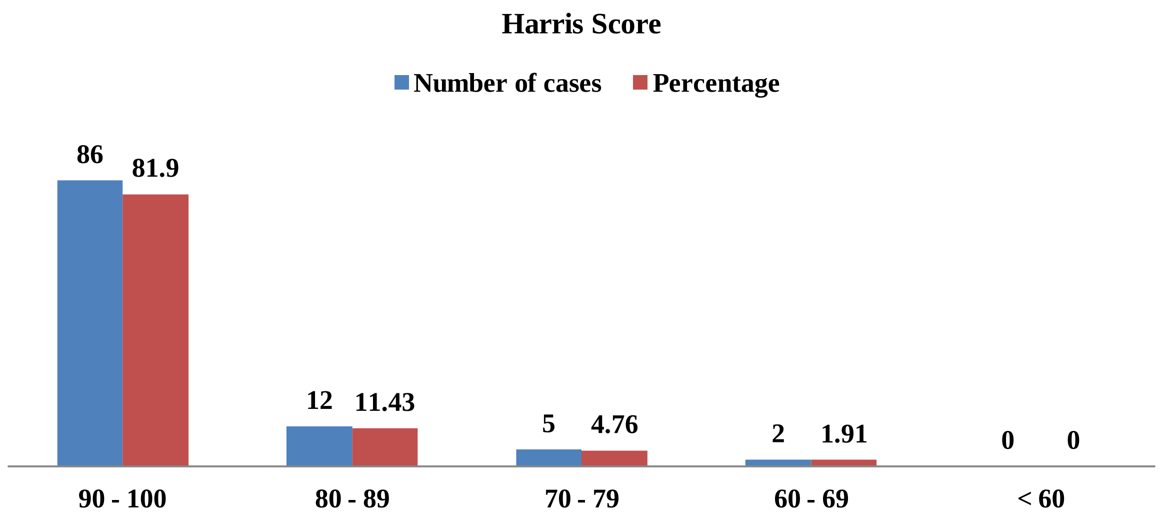
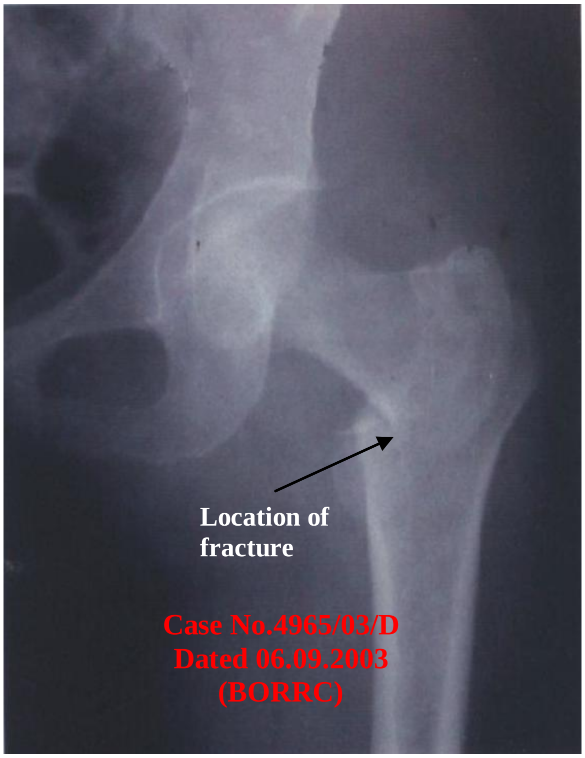
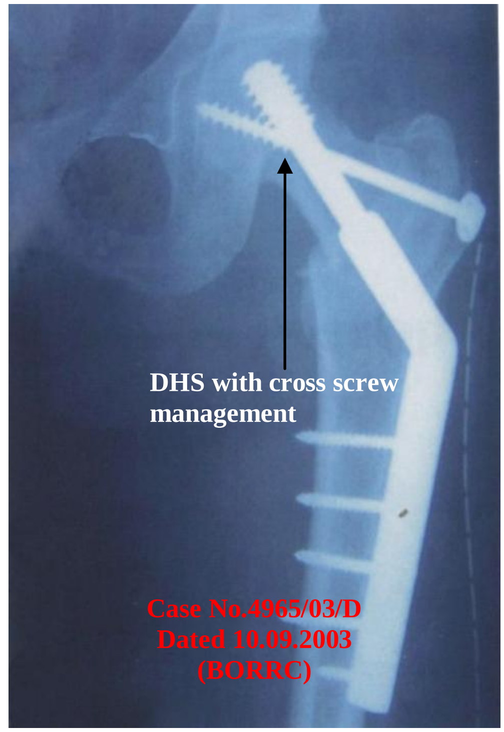


Chart-16: Represent Table-15

Follow-up X-ray (Prognosis) at *Bhattacharya Orthopædics and Related Research Centre, Narayanpur, Kolkata – 700136 (BORRC) headed by Dr. Sailendra Bhattacharya, FRCS.*



Picture-1: Pre-operative trochanteric fracture

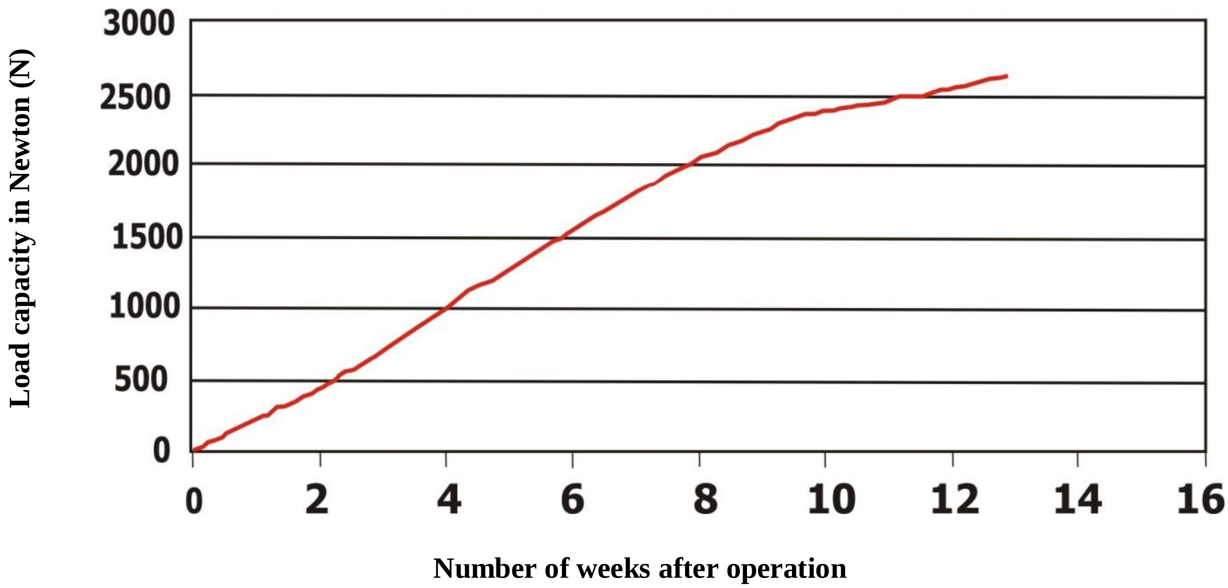


Picture-2: Post-operative management

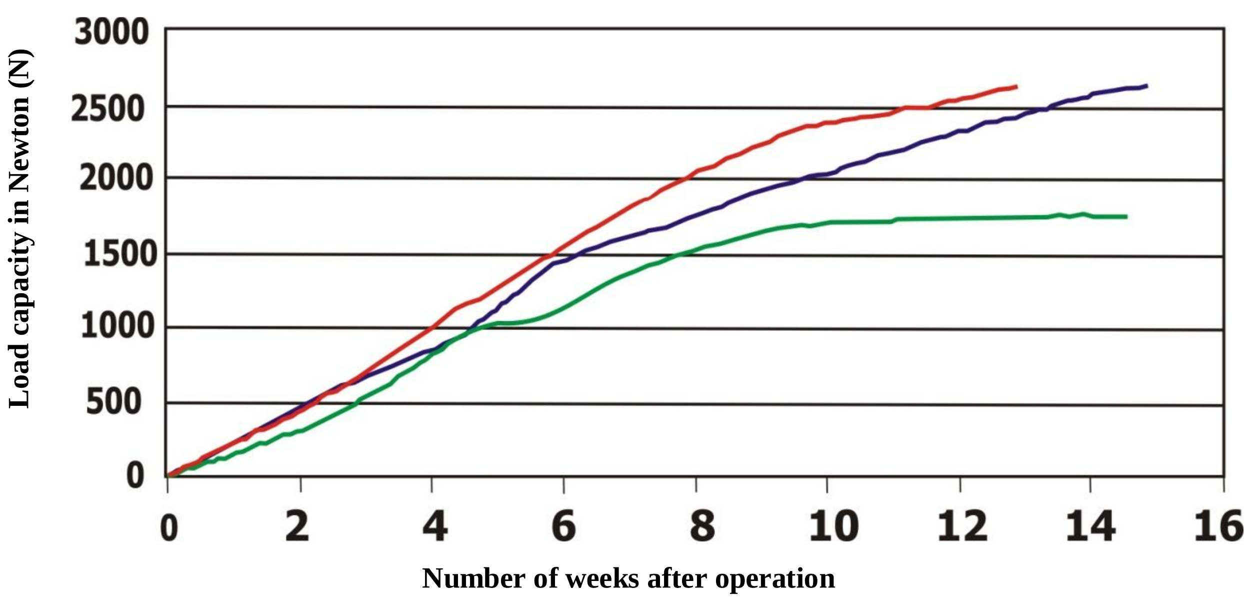
Picture-3: Antero Posterior-View after 1.5 months

Picture-4: Antero-posterior view after 6 months

Picture-5: Antero-posterior view after 10 months



Graph-3: Curve on load capacity against time on application of DHS + Cross screw in trochanteric fracture



Graph-4: Comparison of curves on load capacity against time on application of DHS; DHS + parallel screw; DHS + Cross screw in trochanteric fracture.

Above graphs [Graphs-3 & 4] shows that load bearing capacity in trochanteric fracture management is going better as:
Load bearing capacity with only DHS < with DHS + parallel screw < with DHS + cross screw. Moreover time healing is going less.

CONCLUSION

- It has been deduced mathematically that the system of using cross-screw along with conventional DHS is appropriate against bending of plate with DHS.
- It gives better fixation with mobility as well as stability (Its mechanical stability is superior).
- The stability of the construction has also been proved by mathematical calculations and deductions.
- Complications of shortening and deformity, which were obvious problems, are minimized due to consideration of three-dimensional methods of fixation of trochanteric fracture in place of two-dimensional method by DHS or by DHS with parallel screw.
- This construction provides good rotational bindings, providing stability, as well as early union for weight-bearing where neck-shaft angular relation is retained having a minimum deformity and limping is reduced thereby.
- A good fixation for osteoporotic bones also.
- As the construction is stable and rigid, we can provide early mobilization which allows early return to work.

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