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A Study Of Functional Outcome Of Intracapsular Fracture Neck Of FemurManaged With Dynamic Hip Screw And Derotation Screw-A Prospective Observational Study

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Abstract

Background: Intracapsular fracture neck of femur is vulnerable to the jeopardy of non-union if not fixed anatomically. The aim of this study was to assess the radiological and functional outcome of fixation of intracapsular fracture neck of femur using Dynamic Hip Screw and Derotation Screw in patients below 65 years of age.

Materials and Methods: 46 patients who underwent osteosynthesis for intracapsular fracture neck of femur between September 2018 and August 2020 at Peerless Hospital were evaluated for their clinical and radiological outcome. We used the Harris Hip Score for assessing functional outcome at final follow up (12 months) and evaluated radiographs at 3 and 9 months postoperatively for the status of union and the development of avascular necrosis respectively.

Results: All fractures were fixed within 7 days from injury, with the mean Tip Apex Distance on AP and Lateral views being (27.89±1.12)mm, using Garden Alignment Index as guide. The mean time to radiological union was 12.02±0.73 weeks. The mean amount of collapse calculated from the immediate post operative image and at subsequent follow up images till union was found to be 4.638±2.79 mm, with better functional outcomes in lesser values of collapse(P- value<0.001).

Conclusions: Intracapsular fracture neck of femur is conducive for early fixation using DHS implant in patients below 65 years of age, ensuring anatomic closed reduction and following parameters of adequate fluoroscopic alignment, however, with a low threshold for conversion to open reduction in order to achieve the same.

Keywords: DHS, Intracapsular fracture neck of femur

Introduction

The number of hip fractures worldwide is expected to increase from 1.7 million in 1990 to 6.3 million in 2050 and assuming the age-related incidence to increase by only 1% annually, the number of hip fractures in the world will reach the figure of 8.2 million in 2050[1]. The overall lifetime risk of sustaining a hip fracture, as per estimation was 23.3% for men and 11.2% for women respectively[2]. Commonly seen in the elderly after a trivial fall due to age related decrease in bone mass, intracapsular femoral neck fractures comprise only 2% in patients below 50 years of age[3] often resulting from high energy trauma. Fracture neck of femur is still an unsolved fracture[4] in modern contemporary orthopaedics and its potential complications makes it difficult to manage[5]. Reoperation and salvage procedures such as osteotomy sustain high failure rates and arthroplasty procedures are not ideal given the young age and higher levels of physical activity[6].Achieving an anatomic reduction and

stable fixation are imperative; other factors such as timing of surgery, role of capsulotomy and method of fixation remain debatable[7]. From a biomechanical point of view, the Femoral neck system is a valid alternative implant for fixation of unstable femoral neck fractures with comparable stability to the Dynamic Hip Screw[8]. Biomechanical studies have also indicated the superiority of Dynamic hip screw to multiple cannulated screws especially in femoral neck fractures of high Pauwel's angle[9,10]. A handful of literary sources established the alterations in intracapsular pressure[11, 12, 13, 14], being highest in extension and internal rotation of the fractured hip and being alleviated in flexion and external rotation of the same, thus, advocating the rationale of leaving the injured limb in the latter position whilst awaiting surgery. A low threshold for open reduction is imperative in case of a doubtful reduction[15, 16], which usually is accomplished by the Watson-Jones approach[16]. To combat the dominant shear force in Pauwel's type III fractures and prevent progression to non-union and high failure rates, the DHS implant has its merits[10, 17, 18, 19, 20, 21] . The use of a derotational screw is preferred to guard against the rotation of femoral head during insertion of compressionscrew owing to good bone density in young adults. The rate of non-union stands between 10 and 30%[22, 23], with treatment options like valgus-producing intertrochanteric osteotomy yielding consistent results, by converting the shear forces across the fracture site to compressive forces.Although initial fracture displacement and jeopardised vascular flow to femoral head are beyond a surgeon's control, the armamentarium of the surgeon's choice and quality of construct heraldsthe transcendence of successful healing.

MATERIALS AND METHODS

STUDY DESIGN: The proposed aim of this prospective observational study was to assess the functional outcome of intracapsular fracture neck of femur in 49 skeletally matured individuals who were treated operatively with osteosynthesis using Dynamic Hip Screw and Derotation Screw after closed or open reduction, in the period between September 2018 and August 2020,at our institute, out of which three patients were lost to follow up. Hence, the functional outcome assessment at 12 months were done for 46 patients. The patients were followed up at 2nd, 6th, 12th, 24th , 36th weeks and at 12 months by assessing clinical and radiological parameters using the Harris Hip Score. All Garden and Pauwel's types fractures in patients below 65 years of age were included in the study. However, patients above 65 years of age, those with pathological fractures, pre-existing hip disorders or associated neuromuscular disorders and/or ipsilateral lower limb fractures, patients with previous surgery in the ipsilateral hip and those with polytrauma were excluded from the study.

The following complications in association with the Closed/Open reduction of intracapsular fracture neck of femur and internal fixation with DHS and derotation screw, were communicated to the patients and their respective family members. Superficial and Deep wound Infection, Haematoma and Seroma formation, Thrombophlebitis and venousthromboembolism, Restriction of hip movement (periarticular ossification), Pseudoarthrosis and late incidence of femoral neck necrosis, femoral and sciatic Nerve injury (though extremely rare), Varus Collapse,Nonunion, Osteonecrosis of femoral head, Limb lengthinequality/discrepancy,Failure of Implant-Screw cut out, Screw back-out and/or hardware breakage.

Ethical approval was obtained from the Hospital Ethics Committee. All patients were informed about the study procedure, the purpose of the study and aforementioned risks. Informed Consent Form to be a part of the study was duly taken.

SURGICAL TECHNIQUE AND REHABILITATION: All patients underwent surgery under Spinal Anaesthesia along with peripheral regional nerve block. The fluoroscopy unit was placed on the contralateral side and advanced between the patient's legs for intraoperativecapturing of sagittal, coronal and 30° oblique view images. Reduction was achieved by appropriate gentle traction and internal rotation manoeuvre of the fractured extremity, under fluoroscopic guidance, in 42 of our study subjects. Appropriate antero-posterior pressure was applied to correct the retroversion and/or the posterior sag wherever, they were present. Gardenalignment index was used to assess the adequacy of reduction, by objective measurement of angulation and alignment, the same of which, were evaluated by coronal, sagittal and 30° oblique plane

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images [Figure 1]. On the AP view, it was measured by the radiographic angle between the medialcortex of femoral shaft and the central axis of the medial (primary) compressive trabeculae, measuring between 160 and 180 degrees. On the lateral radiograph, it measured approximately 180degrees and a deviation of more than 20 degrees on either side indicated excessive anteversion and retroversion respectively. An incision was given on the lateral aspect beginning a few centimeters beyond the palpable greater trochanter and extending 10cm distally, over the femoral shaft. Then, the tensor fascia lata was incised in line with the skin distal to the greater trochanter. Deep to the Tensor fascia lata, the vastus lateralis fibres were divided and reflected ventrally to expose the lateral femur. Periosteum was elevated by one or two Hohmann retractors, placed anteriorly and posteriorly, respectively.

In 4 of our patients having a greater amount of comminution, open reduction had to be done bythe antero-lateral approach of Watson-Jones utilising the interval between glutei and tensor fascia lata to expose the hip joint and perform a capsulotomy followed by open reduction, because of the difficulty in accomplishing closed reduction after three repeated attempts. After closed reduction, a threaded guide wire of diameter 2.5mm was drilled onto the femoral neck through a 135° angled guide into the postero-inferioror centro-inferior position of the femoral head under image intensification till the subchondral bone just 5mm short of the articular surface. A second 2.5mm guide wire was inserted proximal and parallel to the first guide wire, to mark the position of placement of the derotation screw, and also to prevent rotation during drilling and insertion of the lag screw[Figure 2].The length of the DHS lag screw was determined using a measuring device over the distal guide wire, and a DHS cannulated triple reamer was set at 5 mm less than the above measurement, anda lag screw of the same measurement as that of the reamer was chosen, or one of not more than 5mm short of the same. A hole was drilled for the DHS lag screw and the plate sleeve and reamed subsequently[Figure 3], followed by tapping to precut the thread for the screw in good bone quality to prevent displacement of the proximal fractured fragment by twisting during forceful attempt at advancement of the lag screw. The correct lag screw was mounted on the insertion wrench and inserted over the guide wire through a centering sleeve and advanced into the bone by turning the T-handle[Figure 4]. Distally, a 2-hole, 3-holeor a 4-hole Titanium or stainless steel DHS side plate was fixed to the femur with two or three 3.2mm bicortical or a proximal-most cortical screw and distal 5mm locking screws through 4.3mm drilled holes, respectively. Traction was slightly released and a compression screw was inserted in all of our patients. Thereafter, adjunctively, a cannulated cancellous screw of 6.5mm diameter with 16mm thread length, of appropriate total length was placed cranially to provide rotational stability, and confirmed fluoroscopically in both AP and lateral planes[Figure 4], as being parallel to the DHS lagscrew. Care was taken to prevent fracture distraction during insertion of the anti-rotation screw. Primary Compression of the fracture was achieved by sequential tightening of the cannulated cancellous screw and the DHS compression screw.

All patients were encouraged active toe and ankle dorsiflexion movements from the immediate post-operative period. Static quadriceps strengthening exercises, knee bending exercises and bedside leg dangling were initiated from the first post-operative day. Weight bearing was prohibited on the operated lower limb for the subsequent 3 weeks. Thereafter, toe touch-down and non-weight bearing was instructed till the end of 3 months. Thenceforth, gradual weight bearing was started after assessing status of union.

CLINICAL EVALUATION: All patients were assessed for functional outcome by the Harris Hip Score and evidence of collapse was assessed by sequential radiographs at stipulated follow up period[Figures 5 A through K and Figures 6 A through L]

CALCULATION OF THE AMOUNT OF COLLAPSE

a1/b1=a2/b2, b1=b2×F, F=b1/b2, a1=a2×F. The extended length of the sliding hip screw a2 can be identified and measured consistently onthe radiograph. However, because image of thescrew is a projection in the plane of the radiograph, a2 is proportional, but not equal to the actual length a1. Barrel length b1 is known and does not change. Barrel length on the radiograph was measured between a point given by the cut point of a line along

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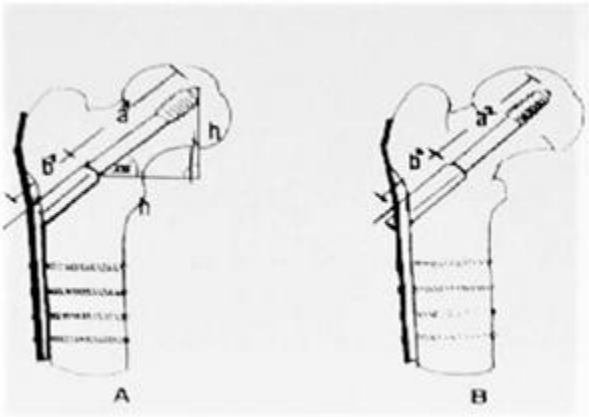
the superior border of the barrel and the derotation screw and the medial step-off, where the sliding screw extends the barrel. The projected barrel length b2 can provide the factor (F) required to calculate the actual length of the screw from measurement of the projected length b2. Radiographs were taken with the hip in a neutral position. Collapse s of the fracture was calculated using the difference in millimetres of the DHS lag screw protruding from the barrel in the peri-operativeradiograph and comparing that difference with the length of the DHS screw protruding from thebarrel after a 12 week period of full weight bearing.



STATISTICAL ANALYSIS

Categorical variables are expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate. Continuous variables are expressed as Mean, Median and Standard Deviation and compared across the groups using Kruskal Wallis Test. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant.

RESULTS AND ANALYSIS:

In our study, 49 patients, presenting with intracapsular fracture neck of femur, were treated in the period between September 2018 and August 2020, with osteosynthesis using a dynamic hip screw with an additional derotation screw. However, three patients were lost to follow-up prior to fracture union. Hence, 46 patients were ultimately available for the final assessment. Four patients required open reduction via the Watson-Jone's approach, rest of them were treated by closed reduction. The functional outcome was assessed using the Harris Hip Score, with an average follow-up period of 12months, ranging from 9-16 months.

The maximum number of patients in our study group was between the ages 41 to 50 years (52.17%) with the mean age being 46.67 years and the standard deviation 7.61. The median age was 48 years. The mean age of patients having excellent functional outcome according to the Harris Hip Score was 46.22 years. 66.67% of female patients and 70.97% of male patients respectively had excellent functional outcomes. 67.4% of patients sustained injuries due to road traffic accidents, while 32.6% of patients had domestic fall, signifying the predominance of motor vehicular accidents in such fractures of physiological age group of less than 60 years. In this series of study, two patients had maxillofacial injuries and two patients had ipsilateral distal end of radius fractures, while one patient each had ipsilateral clavicular and scapular fractures respectively. Four patients were diabetic (8.7%), four were hypothyroid (8.7%) and ten of them were hypertensive (21.74%) while one patient had COPD (2.2%) and the rest 67.4% had no pre- existing co-morbidities[Table 1]. 83.87% of patients with no associated co-morbidities were having excellent outcomes, while only 40% of patients with associated co-morbidities were having excellent functional outcome. A statistically significant relationship was established between the presence of associated co-morbidities and the functional outcome of patients (P- Value=0.002), concluding that the presence of co-morbidities affected the functional outcome scores[Chart 1]. Both the patients with poor functional outcomes had co-morbid conditions, i,e. COPD in the patient with screw cut-out and hypertension and type-2 Diabetes Mellitus in the patient with non-union. Both these patients were osteoporotic too.

All patients were operated latest within 7days from the date of injury. The mean length of time lapse between the injury and surgery was 2.37 days, ranging from 1 to 5 days. The mean pre- operative delay in the excellent functional outcome group was 1.91 days, while that in the poor functional outcome group was 4.5 days, suggesting a statistically significant relationship between the pre-operative delay and the functional outcome (P-Value<0.001). The earlier a surgery was performed, the better was the functional outcome[Chart 2].

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In this series of study, the mean Tip-Apex distance in both AP and Lateral views was (27.89±1.12) mm, ranging from 25mm to 30mm. The large TAD value was due to the inferior placement of the DHS lag screw in order to place the proximal cervical screw superiorly. However, the proximal screw back-out was noted in all cases to commensurate with the collapse. The proper placement of the tip of the lag screw inside the femoral head was assessed by two 45 degree oblique intra-operative fluoroscopic views to confirm the confinement of the same within 10mm of subchondral location[Table 2]. However, there was no statistical significance between the Tip-Apex distance and the functional outcome (P-Value: 0.121), implying no bearing of a larger TAD value on the rendering of a poor functional outcome. There was one case of screw cut-out, in a patient with COPD on inhalational corticosteroids in a background of osteoporosis. The fracture configuration had severe comminution posteriorly, prompting the imperative of an open reduction via the Watson Jones approach, which, thereby, resulted in a Garden Alignment index of 155° of trabecular angle in the AP fluoroscopic image. 23.9 % of the study population had Singh's index VI, while 32.6 % had Singh's index V and 32.6 % had Singh's index IV respectively. The least among the study population was Singh's indexing III, constituting about

10.87 %.

In our study, the mean time to radiological union was 12.02±0.73 weeks, ranging from 11 to 14weeks. It was seen that fractures which were early in uniting had a better functional outcome as per the Harris Hip Scores. The mean time to radiological union in the excellent functional outcome was 11.75 weeks[Table 3]. The collapse at the fracture site was calculated from the immediate post-operative view and subsequently at each follow up visits till radiological union. In our study, the mean collapse was 4.638±2.79 mm, ranging from 1.53mm to 16mm. It was seen that, with greater amount of collapse, the functional outcome was grimmer. Statistical significance was also established between the amount of collapse and the functional outcome (P-Value<0.001)[Table 4].

Garden alignment index was used to measure the femoral neck alignment. The trabecular alignment pattern was evaluated with both the AP and Lateral radiographs. On the AP view, it measured between 160 and 180 degrees. An angle of less than 160degrees indicated varus and an angle of more than 180 degrees indicates excessive valgus. On the lateral radiograph, it measured approximately 180degrees and a deviation of more than 20 degrees on either side indicates excessive anteversion and retroversion respectively. In 54.3% of the study subjects, the radiographic angle in AP view measured between 170°-174°, while it measured between 175°- 179° in 26.1% of patients. The mean AP angle was 171.76°[Chart 3(a)]. The lateral radiographic view revealed 50% of patients having a measured angle between 175°-179°, whereas 34.8% of study subjects had a measured angle ranging between 170°-174°, with the mean value being 174.48°[Chart 3(b)]. Only one case was reduced in varus where the AP angle measured 155° and the lateral angle measured 160°. Another case had to undergo open reduction, where the AP and lateral radiographic angles measured 160° and 166° respectively. None of the cases were reduced in excessive anteversion and/or retroversion. Statistical significance existed between the trabecular angles in AP and Lateral radiographs and the amount of collapse as shown above[Charts 3(a) and 3(b)], signifying that more a fracture was reduced towards varus and/or excessive anteversion, as was assessed using the Garden Alignment Index, the more was the amount of collapse[Table 5], respectively, thereby, affecting the functional outcome. One patient with a collapse of 16mm having a poor functional outcome with a complication of screw cut-out, had a measured AP and Lateral trabecular angles of 155° and 160° respectively. Another patient with measured AP and Lateral trabecular angles of 160° and 166° respectively, had a collapse of 15mm and later developed non-union with fixed adduction deformity and limb shortening by>3.2cm as compared to the contralateral limb. She also had a poor functional outcome. Statistical significance was established between the Garden Alignment Index and the functional outcome, with respect to trabecular angles in both the AP and Lateral radiographic views, as shown above. (P-Value<0.001).

In this series of study, there were two complications (4.4%). One 52 years old lady with Chronic Obstructive Pulmonary Disease, on inhalational corticosteroids, with GARDEN type IV fracture had

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screw cut-out secondary to non-union, probably multifactorial in causation; the fracture was reduced in varus with trabecular angle in AP view as less as 155°, after addressing it by open reduction. Patient had Singh's index III (osteoporotic) with a history of intake of inhalational corticosteroids for COPD. The amount of collapse obtained was also 16mm, which was on the higher side, heralding poor outcome. Another hypertensive and diabetic lady with osteoporosis had Non-union, but without implant failure. The trabecular angles in AP and Lateral views after open reduction were 160° and 166° respectively. There was a great bit of collapse as well,

measuring 15mm. Both these patients had poor functional outcome with total Harris Hip Scores of 20 and 40 respectively. Statistically significant relationship was also established with a P- Value of 0.001), seconding the association between presence of complications and poor functional outcome[Chart 4]. Both these patients underwent necessary revision surgeries to address the complication of non-union.

In our study, 73.92% and 89.1% of patients were without pain and limp respectively, and mostly had excellent functional outcomes. 43.5% of patients required no aid during ambulation, while 45.6% of patients required canes for long walks only. Majority of patients(52.1%) could walk without any discomfort for 30 minutes and ascend staircases without holding the railing(54.3%). 73.9% of patients could put on shoes and socks with ease, while 78.3% of patients could sit comfortably in an ordinary chair for an hour. One patient in our study had fixed flexion contracture of >30° at the ipsilateral hip along with fixed adduction deformity of >10°, fixed internal rotation of >10° in extension and limb length inequality, with resultant shortening of than 3.2cm from the normal contralateral limb. Her Garden Type IV fracture in a background of Singh's Grade III osteoporosis was approached by open reduction and internal fixation, wherein, the trabecular angles in AP and Lateral views for assessing Garden Alignment Index were 155° and 160° respectively. The collapse obtained was also on the higher side, i,e. 16mm. Another patient developed a fixed adduction deformity of >10° on the affected side along with limb length inequality by a margin of >3.2cm, who later went onto develop the complication of non-union. The calculated collapse in her case was 15mm. For assessing her Garden Alignment Index, the trabecular angles in AP and Lateral views were 160° and 166° respectively.

Thirty patients had good overall range of motion ranging from 211° to 300° while fourteen patients had range of motion ranging from 161° to 210°. Our patient with a complication of non- union had a range of motion between 101° to 160° whereas, another of our patient in this study, who had a screw cut-out secondary to non-union had a range of motion of 61°-100°. In our study, the mean total Harris Hip Score was 87.72[Chart 5(a)] with a standard deviation of 14.28 and ranging from 20 in the patient with screw cut out to 100 in one of the patients in the excellent functional outcome group. 69.6% of patients (32 patients) had excellent functional outcomes according to the Harris Hip Score, while 17.4% of the patients (8 patients) had good outcomes. 4 patients (8.7%) and 2 patients (4.4%) were having fair and poor functional outcomes respectively[Chart 5(b)].

PARAMETERS OF HARRIS HIP SCORE:

PARAMETERS	MEAN SCORE	STANDARD DEVIATION	MEDIAN
PAIN(44)	41.87	6.12	44
LIMP(11)	10.54	1.41	11
USE OF SUPPORT(11)	8.35	2.68	7
DISTANCE WALKED(11)	7.43	2.43	8

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STAIRS' CLIMBING(4)	3.02	1.12	4
PUTTING ON SHOES AND SOCKS(4)	3.43	1.00	4
MANNER OF SITTING(5)	4.56	0.83	5
ABSENCE OF DEFORMITIES' SCORE(4)	3.83	0.82	4
ENTERING PUBLIC TRANSPORTATION(1)	0.09	0.28	0
RANGE OF MOTION SCORE(5)	4.59	0.65	5
TOTAL HARRIS HIP SCORE(100)	87.72	14.28	92

DISCUSSION:

The dilemma in treatment of fracture neck of femur below the physiological age of 65 years transcends into a real challenge, so as to evade complication rates of osteonecrosis of femoral head, non-union and/or hardware failure when fixing such fractures with fortitude of restoring vascular supply and enabling patients to early mobilisation. Keeping in mind the pre-existing co- morbidites and pre-injury activity level of the individual, the goal of restoring functionality of an young adult to one's pre-injury level provokes the impetus for achieving a stable construct after ensuring anatomic reduction thereby, attempting to mitigate the possibilities of osteonecrosis of femoral head and hasten union by preserving bone stock and accomplishing compression at the fracture site. Many methods of fixation have been described in literature with the advent of novel implants such as the Femoral Neck System[8] which is established to be biomechanically as stable as the DHS implant. Implants allowing sliding permit dynamic compression at the fracture site during axial loading, but at the expense of some amount of shortening of the femoral neck, thereby, impacting the biomechanics, which is, ironically accepted or overlooked. Adjunction of a permanent derotation screw proximal to the DHS lag screw accounts for rendering some protection against the fate of revision arthroplasties[24]. The femoral neck being intracapsular with want of a periosteal cambium layer, and bathed in synovial fluid, heals intra-osseously without the formation of callus. From a structural point of view, the interface of bone and screw remains the strongest immediately after surgery and gradually the strength diminishes over time. In this study, 49 subjects with intracapsular fracture neck of femur were duly operated with osteosynthesis using Dynamic Hip Screw along with a cervical derotation screw. However, three patients were lost to follow-up before fracture union and as such 46 patients were evaluated and followed up for functional assessment and radiological outcome. The data obtained in our study has been analysed, assessed and compared with the existing data of other studies, with respect to the following parameters.

In our study, the mean age of study subjects was 46.67 years with a standard deviation of 7.61 years and 52.1% of patients belonging to the age group of 41-50 years. To our knowledge, the low threshold for fixation of intracapsular fracture neck of femur in lower age groups is suggested by the studies of Mehmet Gem et al[25], where the mean age of study subjects was 37.13 years, ranging from 17 to 65 years, Vijayvargiya et al[26]with the mean age of patients at presentation being 37.5 years, ranging from 20 to 65 years and Jaiveer et al[27] having mean age group of patients treated with a DHS and derotation screw to be 40±11.08 years with 40% of those belonging to the age group of 31-40 years. Bhati et al[28], in his study, compared patients who were treated with DHS and derotation screw with those treated with multiple cannulated cancellous hip screws. The mean age of patients who were treated by the former modality was 52.66 years. The mean age of patients in our study are comparable with those of the aforementioned studies, justifying the treatment modality, i,e. internal fixation with plate

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osteosynthesis, since the age group is on the lower side.

In our study, 67.4% of the study subjects were males, while 32.6% of the study subjects were females. Nitharwal et al[29], in his study, showed that 65% of the study subjects were males and Vijaygarviya et al[26] showed that 64.9% of his study subjects were males. Similar proportion of sex distribution were observed in studies of both Frank et al[30] and Bhati et al[28], where 66.67% of the patients were males and 33.33% were females in both the studies, respectively. In the study by Mandeep Singh et al[31], the proportion of males and females presenting with intracapsular fracture neck of femur were 79.1% and 20.9% respectively. Vijaykumar et al[32], in his study showed that the percentages of male and female study subjects were 62.8% and 37.2% respectively. In our study, the major mode of injury was road traffic accidents, amounting to 67.4% of the study subjects, which closely resembled the data with previous studies. The percentage of road traffic accidents in causation of fracture neck of femur in this age group reflects the etiological predominance over senility fractures, and is corroborated in our study as well.

Since there is more of male preponderance and mostly associated with motor vehicular accidents, this suggests that intracapsular fracture neck of femur in the age group of our study has not much association with osteoporosis, unlike in older age group, whereby, there is usually more of female preponderance. Also, the distribution of Singh's index in our study population reflects the absence of senility fractures as most of them belonged to Singh's index of Grade IV and V respectively.

In our study, the mean duration of delay between the injury and surgical intervention was 2.37 days ranging from 1 to 5 days, with a standard deviation of 1.04 days, which were comparable with those of Lee Yih-Shiunn et al[33], having a mean pre-operative delay of 33.8 hours. Our study values show that all surgeries were promptly done without any injury being operated beyond the first week, having a bearing on the excellent functional outcome in 69.6% of study subjects, thereby, with an established statistically significant relationship.

In this study, the mean TAD value in both AP and Lateral fluoroscopic images was 27.89, ranging from 25mm to 30mm. The large value of TAD was due to the placement of the DHS lag screw, a bit caudally in the inferior/posterior quadrant of femoral head to facilitate the placement of a cervical derotation screw.

Adequacy of closed reduction was achieved in 91.3% of the study subjects and the Garden Alignment Index was used to assess the adequacy of reduction similar to the previous literature. Frank et al[30]. in his study, quantified adequate reduction as a trabecular angle measuring between 160° to 170° in AP radiographic view and between 170° to 190° in lateral radiographic view, respectively. Jaiveer Yadav et al[27] in his study also used Garden Alignment Index as a parameter of assessing the adequacy of reduction, whereby, none of the patients required an open reduction and internal fixation. Massoud et al[34]. in his study, achieved adequate fixation in 92.86% of his study subjects and inadequate in 7.14% of patients, the former being quantified as<10° varus angulation difference between the affected hip and the contralateral hip, or <15° of valgus angulation difference between the same. Inadequacy of reduction was due to placement of the lag screw in the anterior and/or superior quadrant. Bhati et al[28] , in his study, aimed to achieve adequate reduction by quantifying the Garden alignment index within 160° of trabecular angle in AP view and about 180° of trabecular angle in the Lateral view, respectively. Vijayvargiya et al[26] in his study, achieved adequate fixation in 83.8% patients whereas, inadequate fixation in 16.3% of his patients, due to, either placement of lag screws in the anterior and/or superior quadrants of femoral head, or in case of a TAD value of > 25mm.

In our study, the mean time to radiological bone union was 12.02 weeks with a standard deviation of 0.73 weeks, which closely resembled the values in the former studies.

In our study, there were two complications (4.4%). One of the patients had a screw cut-out secondary to non-union, after open reduction and internal fixation, wherein, the fracture was reduced in varus, in a background of Singh's index indicating grade III osteoporosis, and a calculated collapse of 16mm. Another hypertensive and diabetic patient with Singh's index of grade III osteoporosis had non-union having a calculated collapse of 15mm. This

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suggests that fractures if not reduced adequately, as determined by the trabecular indices, and inclines more into varus malposition, then the resultant amount of collapse increases and predisposes to failure of fixation, more so, if augmented by the risk factors of co-morbidities and osteoporosis. Nitharwal et al[29] in his study, showed that DHS with derotation screw fixation yielded lower complication rates (13.33%) than that of multiple cannulated cancellous screws, i,e. 33.33%. In patients treated with DHS and derotation screw, there were no cases of non-union, while there were two cases of screw backout and one case each of screw penetration and osteonecrosis respectively, as opposed to cancellous hip screws, where three non-union, four screw backouts and one case of osteonecrosis and two cases of screw penetration of femoral head were seen. In the study conducted by Mandeep Singh et al[31] there was 9.5% incidence of non-union in DHS group against 13.6% in the Cannulated Cancellous Hip Screws group, while the rates of complication of osteonecrosis of femoral head in the DHS and Cannulated Cancellous screws groups were 4.8% and 13.6% respectively.

In our study, there were 69.6% patients with excellent functional outcome, with total Harris Hip Scores above 90, followed by 17.4% of patients with good functional outcome (Harris Hip Scores between 80-90. 8.7% of patients were having fair functional outcome with scores between 70 and 80, while 4.3% of patients were having poor functional outcome. Our values are comparable with the values in the study of Vijaykumar et al[32], where 70% of patients were having excellent functional outcome, followed by 11.4% with good functional outcome, 5.7% with fair functional outcome and only 2.8% with poor functional outcome. Frank et al[30], in his study, showed that 73.33% of patients were having excellent functional outcome, followed by 16.67% with good functional outcome and 10% with poor functional outcome.

There were limitations in this study. Firstly, our study had a shorter period of follow up, insufficient for evaluation of development of long term complications such as osteonecrosis of femoral head and late onset secondary arthritis. Moreover, this being an exclusively prospective study, with comparatively less number of patients, the assessment of outcome and complications had been wanting in being extensive.

In conclusion, intracapsular fracture neck of femur in young adults due to high energy trauma is most amenable to closed or open reduction and internal fixation by preserving bone stock.

Fracture displacement and morphology indicate the ease and adequacy of closed reduction, with more likelihood of conversion to an open reduction, in case of increased fracture comminution. The grade of osteoporosis has no role in adequacy of reduction. Meticulous anatomic reduction is imperative without much delay pre-operatively, for obtaining a better functional outcome.

Garden Alignment Index is of paramount importance for assessing the quality of reduction, with the goal of optimum reconstruction of neck shaft angle, preferably in slight valgus, assessed by the Antero-Posterior trabecular angle on fluoroscopic image. The derotation screw provides rotational stability in adjunct to a biomechanically strong Dynamic Hip Screw in stable fixation of intracapsular fracture neck of femur. Greater amount of collapse heralds poorer functional outcomes.

TABLES AND FIGURES:

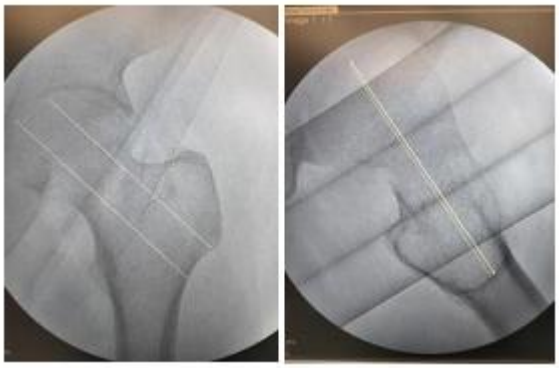

Figure 1: DHS Lag screw and Derotation screw vectors drawn pre-operatively in AP and Lateral ImageIntensification

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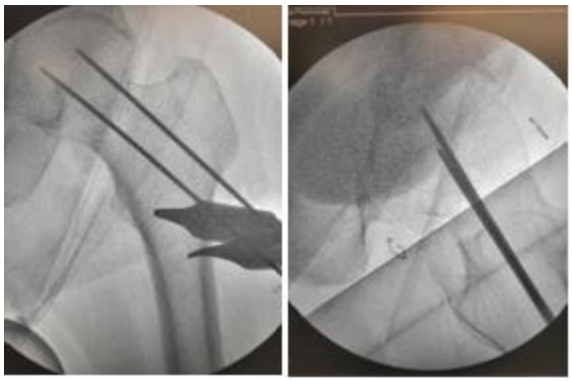

Figure 2: Position of guide wires onAP and Lateral projections

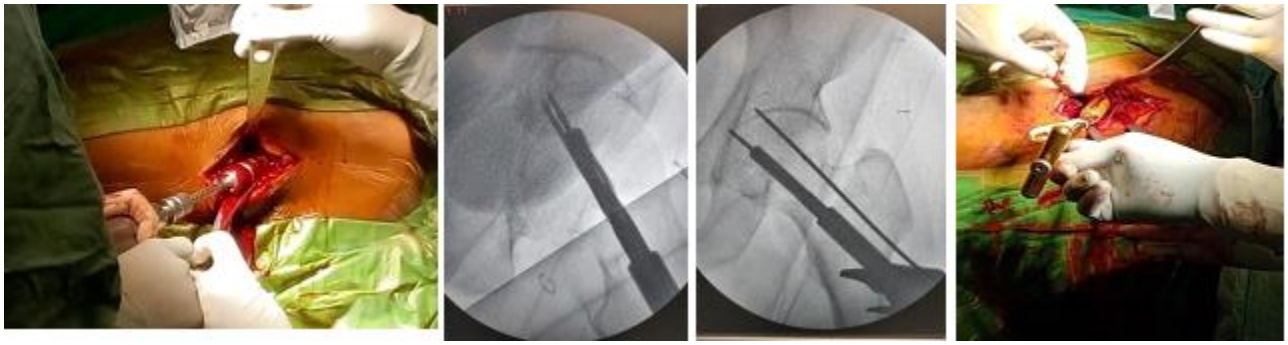

Figure 3: Triple Reaming for insertion of Lag Screw

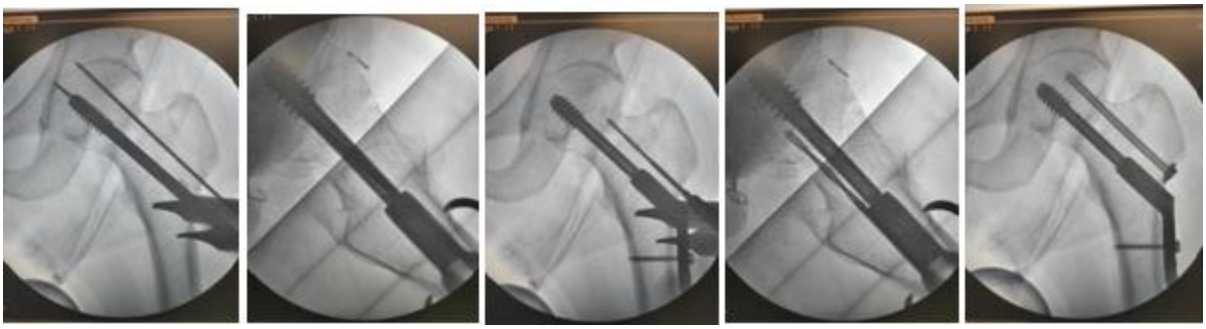

Figure 4: Advancement of Lag screw and insertion of Derotation Screw depictedfluoroscopically

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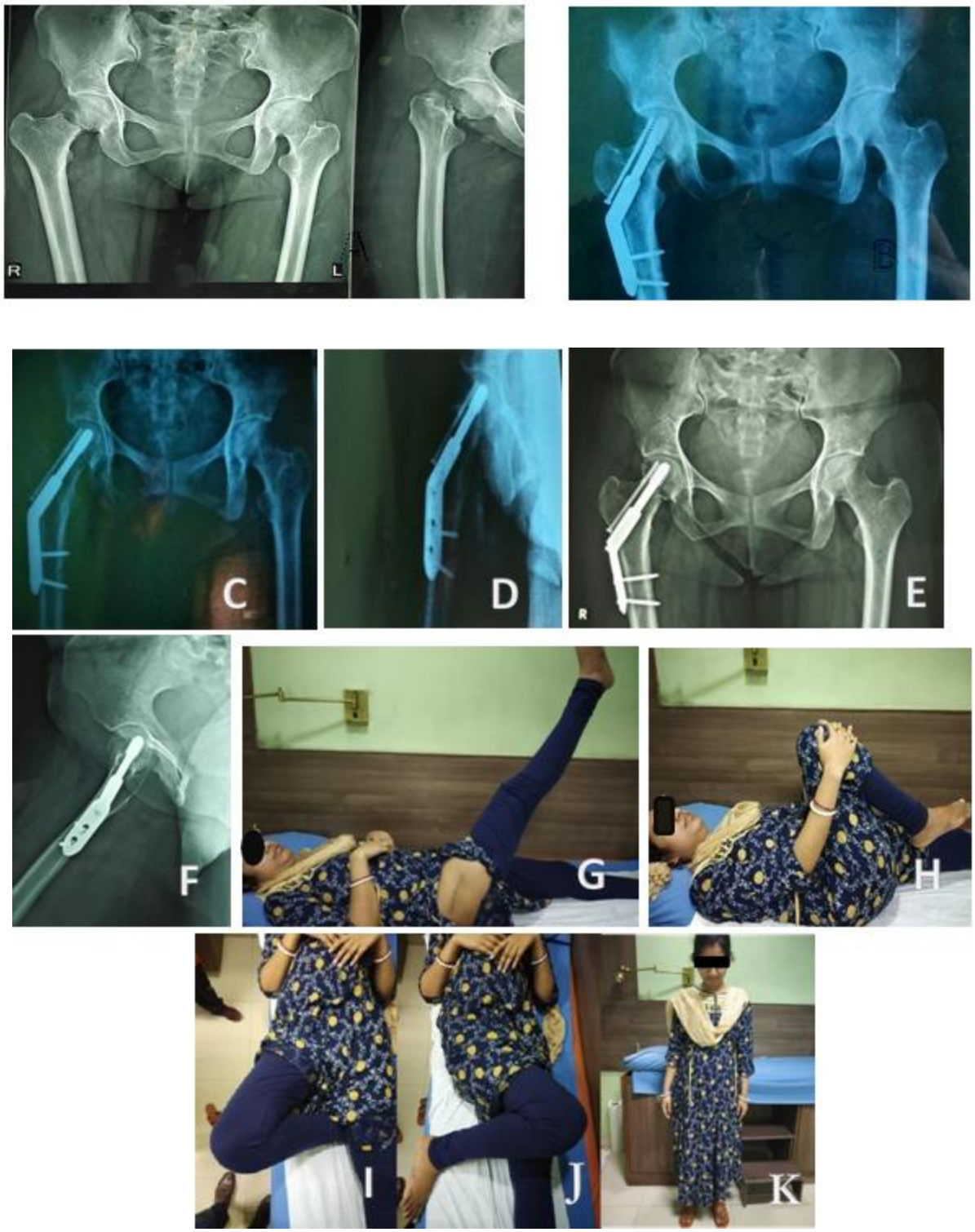

Figures 5:A through K: Clinical and radiological follow up of a patient treated with DHS and Derotation Screw for Intracapsular Fracture Neck of Femur: Fig A Pre- operative X-Ray showing Garden Type IV fracture. Fig B Post operative X- Ray at 6 weeks with progressive collapse. Fig C-D Follow up X-ray at 3 months showing evidence of union. Fig E-F Follow up X-Ray at 9 months with no signs of Avascular Necrosis. Fig (G-K) Range of Motion and clinical function at 12 months.

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Figures 6: A through L: Clinical and radiological follow up of a patient treated with DHS and Derotation Screw:Fig A Pre-operative X-Ray. Fig B-C Post operative X-Ray at 6 weeks with progressive collapse. Fig D Follow up X-ray at 3 months showing evidence of union. Fig E-F Follow up X-Ray at 9 months with

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no signs of Avascular Necrosis. Fig (G-I) Range of Motion and clinical function at 3 months. Fig (J-L) Clinical Function at 9 months.

TABLES:

TABLE 1: RELATIONSHIP OF CO-MORBID CONDITIONS WITH FUNCTIONAL OUTCOME

		ASSOCIATED CO-MORBID CONDITIONS		TOTAL		
		NIL	YES		P VALUE	SIGNIFICANCE
FUNCTIONAL OUTCOME	POOR	0(0)	2(13.33)	2(4.35)	0.002	Significant
	FAIR	3(9.68)	1(6.67)	4(8.7)		
	GOOD	2(6.45)	6(40)	8(17.39)		
	EXCELLENT	26(83.87)	6(40)	32(69.57)		
Total		31(100)	15(100)	46(100)		

Table 1: Establishing the statistical relationship between co-morbidities and functionaloutcome of patients

TABLE 2: TIP-APEX DISTANCE in AP and LATERAL VIEWS

DESCRIPTIVE STATISTICS	TIP-APEX DISTANCE IN AP and LATERAL VIEWS (mm)
Mean±SD	27.89±1.12
Median	28
Range	25-30

Table 2: Depicting the Mean Tip-Apex Distance

TABLE 3: RELATIONSHIP BETWEEN FUNCTIONAL OUTCOME AND TIME TO RADIOLOGICAL BONE UNION

	FUNCTIONAL OUTCOME													
	POOR			FAIR			GOOD			EXCELLENT				
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	p Value	Significance
Time to Radiolo	-	-	-	13.25	13.00	0.50	12.50	12.50	0.53	11.75	12.00	0.57	<0.001	Significant

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gical Union														

Table 3: Establishing the statistical relationship between time to radiological union andfunctional outcome

TABLE 4: RELATIONSHIP BETWEEN FUNCTIONAL OUTCOME AND COLLAPSE

	FUNCTIONAL OUTCOME													
	POOR			FAIR			GOOD			EXCELLENT				
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	p Value	Significance
Collapse	15.50	15.50	0.71	7.00	7.00	0.82	5.00	5.00	1.31	3.59	4.00	1.10	<0.001	Significant

Table 4: Establishing that lesser amount of collapse heralds better functional outcome

RADIOGRAPHIC ANGLE IN AP VIEW		COLLAPSE
155-159	Mean	16.00
	Median	16.00
	Std. Deviation	
160-164	Mean	11.50
	Median	11.50
	Std. Deviation	4.95
165-169	Mean	6.33
	Median	6.50
	Std. Deviation	0.82
170-174	Mean	3.88
	Median	4.00
	Std. Deviation	1.13
175-179	Mean	3.33
	Median	4.00
	Std. Deviation	1.07
	p Value	<0.001
	Significance	Significant

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RADIOGRAPHIC ANGLE IN LATERAL VIEW		COLLAPSE
160-164	Mean	16.00
	Median	16.00
	Std. Deviation	
165-169	Mean	15.00
	Median	15.00
	Std. Deviation	
170-174	Mean	5.00
	Median	4.50
	Std. Deviation	1.79
175-179	Mean	3.61
	Median	4.00
	Std. Deviation	1.12
180	Mean	4.00
	Median	4.00
	Std. Deviation	1.22
	p Value	0.020
	Significance	Significant

Table 5: Depicting the statistical relationship between AP and Lateral trabecular angles with theamount of collapse, indicating varus reduction leading to a greater amount of collapse, and the latter remains low when reduction is achieved more towards valgus and neutral version

CHARTS:

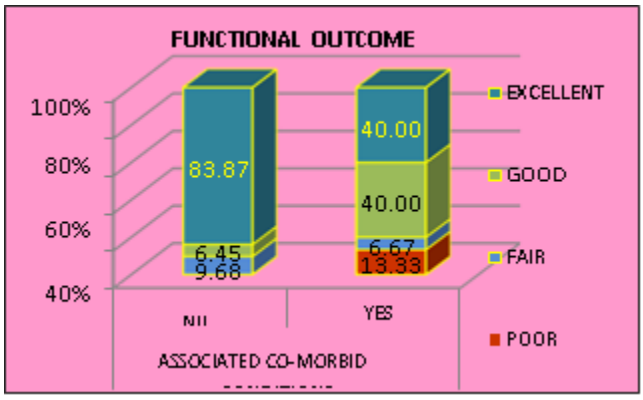

Chart 1: Illustrating that all patients with poor outcomes had associated co-morbid conditions

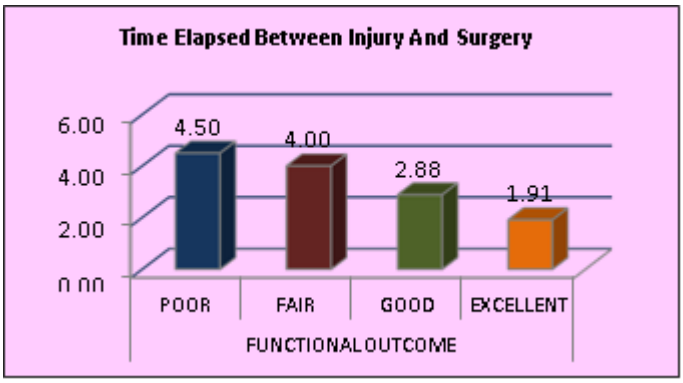

Chart 2: Illustrating that the mean pre-operative delay in excellent functional outcome group was 1.91 days

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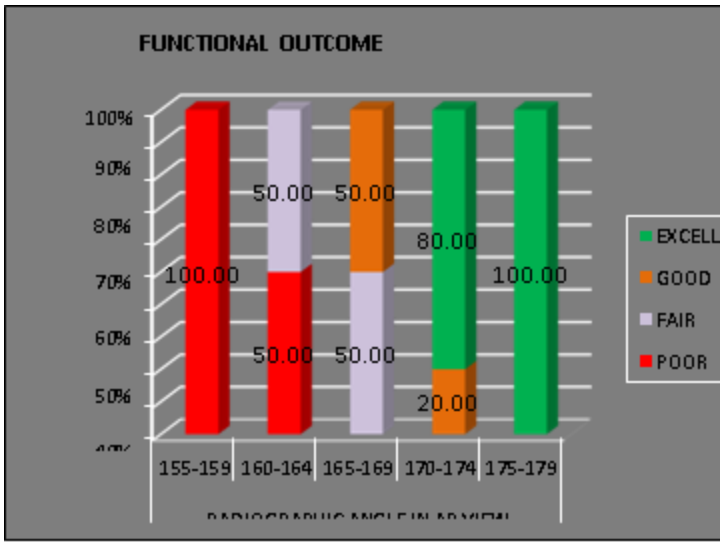

Chart 3(a): Relationship between Garden Alignment Index and Functional outcome with respect to AP trabecular angle, demonstrating cent percent excellent outcome in valgus reduction

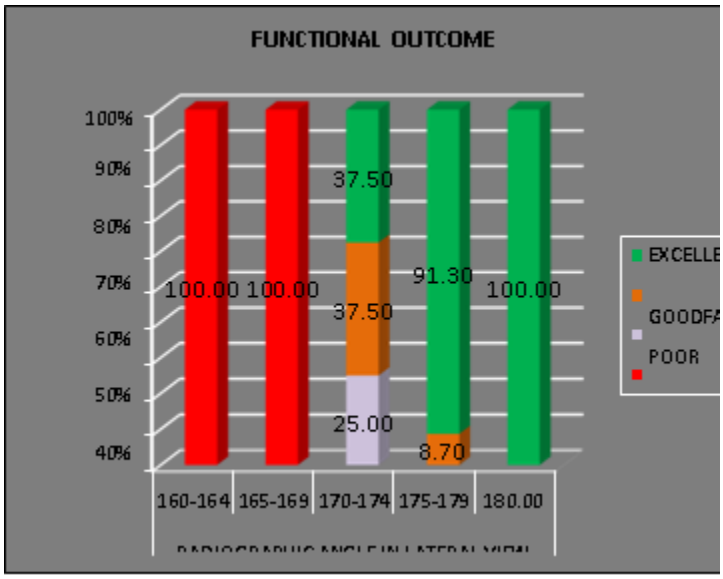

Chart 3(b): Relationship between Garden Alignment Index and Functional outcome with respect to Lateral Trabecular angle, demonstrating cent percent excellent outcome in an angle of 180°.

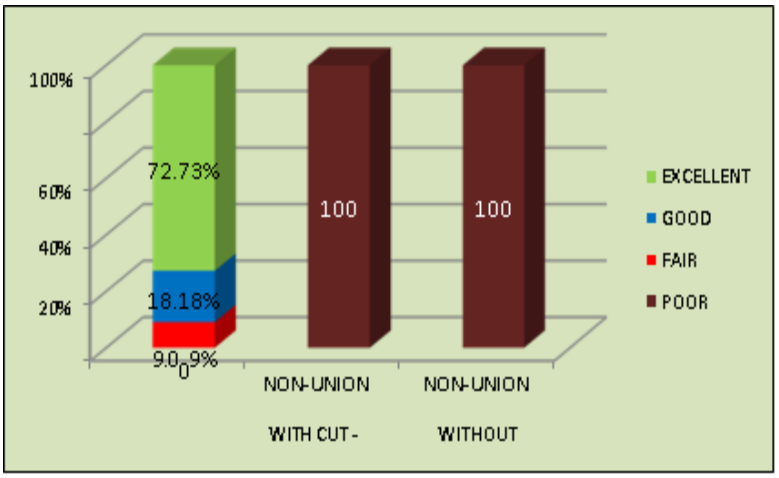

Chart 4: Demonstrating that each of the complication led to poor functional outcome, whereas, 72.73% of the patients without any complications had excellent functional outcomes

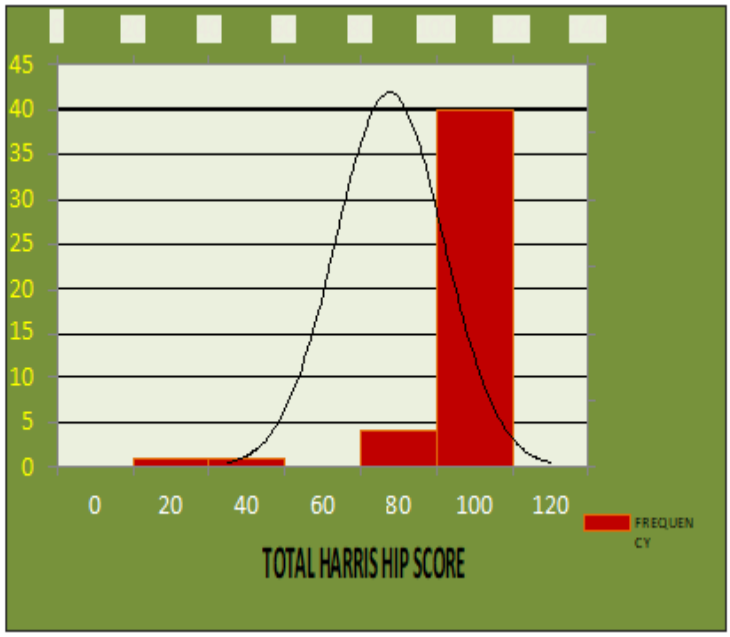

Chart 5(a): Demonstrating the normal distribution curve of The Total Harris Hip Scores with a mean value of 87.72/100

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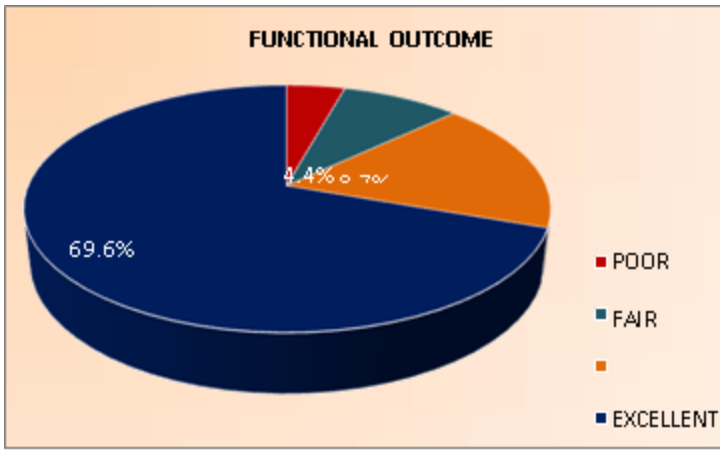

Chart 5(b): Illustrating Excellent Functional outcomes in 69.6% of patients and Poor Functional outcomes in 4.4% of patients

REFERENCES:

1. Ahlborg HG, Rosengren BE, Järvinen TL, Rogmark C, Nilsson JÅ, Sernbo I, Karlsson MK. Prevalence of osteoporosis and incidence of hip fracture in women-secular trends over 30 years. BMC musculoskeletal disorders. 2010 Dec 1;11(1):48.
2. Kanis JA, Johnell O, Oden A, Sernbo I, Redlund-Johnell I, Dawson A, De Laet C, Jonsson B. Long-term risk of osteoporotic fracture in Malmö. Osteoporosis international. 2000 Sep 1;11(8):669-74.
3. Berglund-Rödén M, Swierstra BA, Wingstrand H, Thorngren KG. Prospective comparison of hip fracture treatment: 856 cases followed for 4 months in The Netherlands and Sweden. Acta Orthopaedica Scandinavica. 1994 Jan 1;65(3):287-94.
4. SPEED K. The Classic The Unsolved Fracture. Clinical Orthopaedics and Related Research (1976-2007). 1980 Oct 1;152:3-9.
5. Bachiller FG, Caballer AP, Portal LF. Avascular necrosis of the femoral head after femoral neck fracture. Clinical Orthopaedics and Related Research®. 2002 Jun 1;399:87-109.
6. Kim YH, Kook HK, Kim JS. Total hip replacement with a cementless acetabular component and a cemented femoral component in patients younger than fifty years of age. JBJS. 2002 May 1;84(5):770-4.
7. Pauyo T, Drager J, Albers A, Harvey EJ. Management of femoral neck fractures in the young patient: A critical analysis review. World journal of orthopedics. 2014 Jul 18;5(3):204.
8. Stoffel K, Zderic I, Gras F, Sommer C, Eberli U, Mueller D, Oswald M, Gueorguiev B. Biomechanical evaluation of the femoral neck system in unstable Pauwels III femoral neck fractures: a comparison with the dynamic hip screw and cannulated screws. Journal of orthopaedic trauma. 2017 Mar 1;31(3):131-7.
9. Aminian A, Gao F, Fedoriw WW, Zhang LQ, Kalainov DM, Merk BR. Vertically oriented femoral neck fractures: mechanical analysis of four fixation techniques. Journal of orthopaedic trauma. 2007 Sep 1;21(8):544-8.
10. Baitner AC, Maurer SG, Hickey DG, Jazrawi LM, Kummer FJ, Jamal J, Goldman S, Koval KJ. Vertical shear fractures of the femoral neck. A biomechanical study. Clinical orthopaedics and related research. 1999 Oct(367):300-5.
11. Maruenda JI, Barrios C, Gomar-Sancho F. Intracapsular hip pressure after femoral neck fracture. Clinical Orthopaedics and Related Research®. 1997 Jul 1;340:172-80.
12. Bonnaire F, Schaefer DJ, Kuner EH. Hemarthrosis and hip joint pressure in femoral neck fractures. Clinical Orthopaedics and Related Research (1976-2007). 1998 Aug 1;353:148-55.
13. Stromqvist BJ, Nilsson LT, Egund NI, Thorngren KG, Wingstrand HA. Intracapsular pressures in undisplaced fractures of the femoral neck. The Journal of bone and joint surgery. British volume. 1988 Mar;70(2):192-4.
14. SOTO-HALL RA, JOHNSON LH, JOHNSON RA. Variations in the intra-articular pressure of the hip joint in injury and disease: a probable factor in avascular necrosis. JBJS. 1964 Apr 1;46(3):509-16.

Volume 5, Issue 4; July-August 2022; Page No 853-871

15. KELLER CS, LAROS GS. Indications for open reduction of femoral neck fractures. Clinical Orthopaedics and Related Research®. 1980 Oct 1;152:131-7.

16. Swiontkowski MF. Intracapsular fractures of the hip. Orthopedic Trauma Directions. 2009 Jan;7(01):31-3.

17. Blair B, Koval KJ, Kummer F, Zuckerman JD. Basicervical fractures of the proximal femur. A biomechanical study of 3 internal fixation techniques. Clinical orthopaedics and related research. 1994 Sep(306):256-63.

18. Bonnaire FA, Weber AT. Analysis of fracture gap changes, dynamic and static stability of different osteosynthetic procedures in the femoral neck. Injury. 2002 Dec 1;33:24-32.

19. Bartonícek J. Pauwels' classification of femoral neck fractures: correct interpretation of the original. Journal of orthopaedic trauma. 2001 Jun 1;15(5):358-60.

20. Broos PL, Vercruysse R, Fourneau I, Driesen R, Stappaerts KH. Unstable femoral neck fractures in young adults: treatment with the AO 130-degree blade plate. Journal of orthopaedic trauma. 1998 May 1;12(4):235-9.

21. Weinrobe M, Stankewich CJ, Mueller B, Tencer AF. Predicting the mechanical outcome of femoral neck fractures fixed with cancellous screws: an in vivo study. Journal of orthopaedic trauma. 1998 Jan 1;12(1):27-36.

22. Protzman RR, Burkhalter WE. Femoral-neck fractures in young adults. JBJS. 1976 Jul 1;58(5):689-95.

23. Dedrick DK, Mackenzie JR, Burney RE. Complications of femoral neck fracture in young adults. The Journal of trauma. 1986 Oct;26(10):932-7.

24. Woods S, Pilling R, Vidakovic I, Al-Mothenna A, Mayahi R. To derotate or not? The impact of a permanent derotation screw on the revision rate of dynamic hip screw fixation for intracapsular neck of femur fractures. F1000Research. 2017 May 15;6.

25. Gem M, Özkul E, Alemdar C, Kapukaya A, Arslan H, Atiç R. Femur boyun kırıklarının tedavisinde kanüllü vida ile dinamik kalça vidasının karşılaştırılması. J Clin Exp Invest www. jceionline. org Vol. 2015 Sep 1;6(3)

26. Vijayvargiya M. OUTCOME ANALYSIS OF DYNAMIC HIP SCREW FIXATION IN FEMORAL NECK FRACTURES

27. Yadav J, Arora VK, Sharma SK. A comparative analysis of outcomes of treatment of fracture neck of femur with 9.5 mm sliding hip screw and plate with an additional derotation screw versus three parallel cannulated hip screws. International Journal of Orthopaedics. 2017;3(2):558-66.

28. Bhati LS, Assat RP, Rathore DD. Comparative Study Of Fixation Of Basicervical Fracture Neck Of Femur Using Fixed Angle Device [Dhs] Withderotation Screw Versus Three Cannulatedcancellous Screws.

29. Nitharwal ML, Kumar S, Harshwal RK, Jain MP, Mehra AK. A Prospective Comparative Study of Outcome of Surgical Management of Basicervical Fractures of Femur with Dynamic Hip Screw (DHS) with Derotation Screw and Multiple Cannulated Cancellous (CC) Screw.

30. Frank HC, Agarwal B, Bhatacharyya TD, Choudhury FA, Roy R. Basicervical Fracture of Neck Femur Treated With DHS And Derotation Screw-A Prospective Study of 30 Cases.

31. Singh M, Sonkar D, Verma R, Shukla J, Gaur S. Comparison of the functional outcome of DHS versus cannulated cancellous screws in pauwels type II and III fracture neck femur in young adults. International Journal of Orthopaedics Science s. 2017;3(2):745-9.

32. Kulambi VS, Satish AS, Rangaraja P. Surgical management of basicervical fracture neck of femur with dynamic hip screw and de-rotation screw: a prospective study. International Journal of Research in Orthopaedics. 2019 Jul;5(4):712.

Volume 5, Issue 4; July-August 2022; Page No 853-871

33. Yih-Shiunn L, Chien-Rae H, Wen-Yun L. Surgical treatment of undisplaced femoral neck fractures in the elderly. International Orthopaedics. 2007 Oct 1;31(5):677-82.

34. Massoud EI. Fixation of basicervical and related fractures. International orthopaedics. 2010 Apr 1;34(4):577-82.

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