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Evaluating the Functional Benefit of Distal Femur Fractures Treated By Closed Reduction and Internal Fixation with Retrograde Femoral Nail in Patients Coming With Fracture Femur in the Orthopedics Department of Dr.Hardas Singh Orthopedic Hospital and Superspeciality Research Centre, Circular Road, Amritsar, PUNJAB

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Abstract
Background - *Any femoral fracture of up to* ***15 cms*** *from the articular surface situated on the* ***distal end*** *has been defined as Distal femoral fractures.The condylar fractures either the Supra condylar or intercondylar are difficult to treat fractures. They are known to be complex injuries and having the possibility of causing disabilities of long term.Antegrade option for intramedullary device is used commonly for* ***proximal fracture*** *femur and in* ***type C fractures*** *of distal femur****. Retrograde*** *nailing is the choice to go in cases of Distal Femur Fracture. Evidence regarding its success in patients is negligible for the state* ***of PUNJAB****. The study intends to build on the evidence part in with certain objectives like knowing the socioeconomic status , nature of injury and overall functional gain after successful treatment .* ***Methodology A prospective study*** *was designed to be done in selected patients coming for fracture femur distal end in the****Dr.Hardas Singh orthopedic hospital and superspeciality research centre, circular road,Amritsar, PUNJAB*** *. Study was conducted* ***from Jan 2019- Feb 2020****. Strict adherence to the protocol for performing the* ***intermedullary nail*** *fixation was followed after excluding the participants not fitting the inclusion criterion.* ***Data Analysis –*** *Data was collected from patients in MS office Excel sheets and analysis was done* ***on PSPP free****software, standard measures for central tendency and statistical tests for association were used. p value <.05 was considered to be statistically significant .* ***Results*** *Out of 41 participants majority were male (58.4%) rural and Hindu . Majority had type right sided fracture . Functionality was scored using* ***the Neer's Score*** *and most of the results were* ***either excellent*** *, fair or good only 7 participants out of 41 were having poor scores .* ***Conclusion*** *retrograde intramedullary supracondylar nail is good repair technique especially* ***for extra articular*** *type distal femur fractures.*

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I. Introduction

- **(1.)**Anyfemoral fracture of up **to 15 cms** from the articular surface situated on the **distal end has been defined** as **Distal** femoral fractures. The shaft of the femur has a cylindrical shape and grows at the distal end into two curved condyles. The shape of the distal femur is **trapezoidal when viewed from** the axial plane. The slope of the lateral cortex is about **10 degrees,** and the slope of the **medial cortex is around 25 degrees.**
- **(2)**Direct damage to a flexed knee, usually seen **in dashboard injuries** during **motor vehicle collisions**, is the **most common mechanism**. Relative to the adductor tubercle, the deforming forces of distal femur fractures depend on the location of the fracture. In general, the fracture is shortened by the **hamstrings and extender system and the adductor magnus displaces thefracture into the varus**.
- **(3)**They have been globally estimated to consist of **7% of all fracture femur**. Due to these anatomical singularities the fractures poses the challenges of the complexity in the nature of injury .Usually **Orthopaedic Trauma Association(OTA)/AO classification** is used to classify **the fractures of femur** . **They are AO/OTA type 33A Extra articular , 33B Partial Articular and 33C Complete articula**r . If we exclude the hip **fractures 31% of the femoral fractures** involve the distal ends . The condylar fractures either the **Supra condylar or intercondylar are difficult** to treat fractures . They are known to be complex injuries and having the **possibility of causing disabilities of long term**. **Orthodox treatment** of the displaced supracondylar fracture of the femur followed the principles of **Watson Jones** and **JohnCharnley**.

- **(4)** This consisted **of skeletal traction,closed treatment of fractures** and **external immobilisation in** the form of **casts and cast bracings**. These techniques, however**, led to complications** such as **angular deformities, shortening of limbs, extended bed rest and complications related to immobilization, knee discomfort, joint incongruity, quadriceps wasting, knee instability and early post-traumatic osteoarthritis**.

(5) .The pattern of **open reduction and internal focus** has become visible in recent years. The numerous implants used include **the AO blade plate**, the **dynamic condylar screw, the intramedullary interlocking of the supracondylar nails** and the **plate compression lock**.**Varus** is more common with supracondylar fractures as it **collapses**. During the application of the **AO blade plate or dynamic condylar screw, the shaft of the femur is often pushed laterally,displacing the weight bearing line laterally to the anatomical axis of the femoral shaft. Fatigue fractures of the plate are result of this commonly**. As most of these fractures are common in adults in many cases **osteoporosis is an accentuating factor** leading to **failure of fixation** of the screws and plates.

(6)An intramedullary device is often the treatment which is preferred over other methods ,asit provides a stable construct along with **minimal soft tissue injury and minimal disruption of theperiosteum** . This invariably **reduces the varusfailure** at the fracture site . Also on **top of this benefit, furthermore, when the bending movement of the intramedullary device is greatly decreased, there is also less failure of the fixation of the osteoporotic bone. Depending on the fracture characteristics Antegradeand Retrograde options** are used .

(7). Antegradeoption for i**ntramedullarydevice is used** commonly Antegrade nailing is useful commonly for the **treatment of proximal femoral fractures** in some cases of distal **femoral fracture type C.**

(8). For **distal femur** fractures the **retrograde nailing** is the option of choice and **viability** .

(9). The **benefits of retrograde** nailing include: the intramedullary nail is a **load-sharing system compared to plating**, **the nail can be inserted by smaller incisions that cause less soft tissue disturbance, and allows for the treatment of ipsilateral hip and ipsilateral tibia fractures in the poly trauma patient**. In addition, the retrograde intramedullary supracondylar nail has major advantages **in preserving fracture hematoma**, **reduced blood loss, minimal soft tissue dissection, reduced operating time, reduced infection incidence and reduced hospital stay. Early weight bearing can be started on the basis of the load-sharing property of the intramedullary implant**.

(**10).**Other newer techniques are there like Distal **femoral locking plates but these have certain risks despite** giving in some cases good to near **complete recovery**. In this method **weight bearing is also delayed** as plates are bearing the load instead of the intramedullary device.

. Till date we don't have published data on the efficacy of intramedullary implant being used as **the retrograde nail and its effects on the patients**. Also we don't have data on the reasons of fracture femur and the age group which is coming with **such injuries in our hospital**. With a view to generate evidence and formulate appropriate measures this study was planned with objectives of

1) To **understand the various** traits of the patients coming with fracture femur distal end.

2**) To understand the post-operative effects** after using the retrograde nailing in fracture femur cases.

II. Methodology

After the IEC approval this study was carried out on patients attending the **Orthopedics OPD /Emergency** with **fracture femur**.

Study Type– A longitudinal cross sectional observational study where patients which satisfied the criterion **of Distal femur** fracture and other inclusion criterion were picked for their record evaluation after giving the treatment as per the routine procedure of the Institute.

Study Setting- Hospital based, All patients who were enrolled in the study were followed as per the protocols after their consent on mobile number provided by them .

Study duration and Sample size – Based on available hospital records it was observed that **a duration of 18 months** will be ample to have **a sample size close** to **100-150**. The study started to enroll patients in **Jan 2019** and continued with till **Feb 2020**. During this period a total of **119 patients** were enrolled for the study after all study criterion were satisfied.

Study inclusion criterion- All patients who were willing to be included in this **study were included in this study. Distal fracture femur** was identified in all **fracture femur cases** and only those cases who fulfilled the definition were included . Age group included **was 18 completed years to 60 years** .**Gustillo – Anderson type 1, and 2 distal femoral fractures were included in this study** . All such cases were observed closely and only those who were given **the treatment of closed reduction and internal fixation with retrograde femoral nailing were selected in this study.**

Study Exclusion Criterion– Patients not willing to be a part of the study were excluded while those **with polytrauma, neurological injuries, vascular trauma and pathological fractures** were **categorically excluded**.

Description of the process for treatment of Distal Femur Fracture cases consisting **of closed reduction and internal fixation with retrograde femoral nailing followed**.

Once a femoral fracture was identified and **admitted ,proper investigations like X ray and CT** if needed were done **after putting the lower limb in Thomas splintfor stabilization with a cotton pad below the distal portion. Assessment to rule out neurovascular injuries , polytrauma and other associated fractures** are carried out . Stabilization before investigation is done **with intravenous fluids , oxygen and blood transfusion** . **X rays were done in AP views and true lateral views of the complete knee joint and distal femu**r . In cases of need to view the **coronal plane fractures oblique views were taken** . Compound wounds were taken care **by Irrigation , lavage and meticulous and thorough debridement** . **Proper antibiotics and immunization with tetanus toxoid** were given to all . All fractures thus identified were **classified according to AO classification** of distal femur . Once the per operative management was completed and **reports of X rays and other investigations** cleared they were posted for operatives in the OT after **anesthetic clearance** . The operation and plate insertions were done strictly under the aseptic environment and proceeding as described in the seminal paper **by Ingman A.M in 1992** which was further published in 2002 with bigger sample size .(10)

Post operatively treated individuals were encouraged to mobilize after one day of rest using **a crutch or walking frames** . After few more days they were counselled about the need **to start walking , weight bearing etc**. Except in cases of articular fracture **gentle weight bearing was encouraged** . Patients on their own after six weeks **. After six weeks or three months patients were called back** for review **after being discharged post operatively 15 to 20 days depending on their stability and viability** . There on patients were called for follow **up on 3rd week** postop **, 6th week post op ,3 months ,6 months and 12 months** . They were assessed at each follow up for the development of complications if any , **NEER's Score and functional rating was thus decided as Excellent (>85) , Good (70-84), Fair (50-69) and Poor (<50).**(11)

Data Analysis – Standard measures of central tendency were used to analyze the data which was meticulously recorded and entered **on MS Office Excel sheets**. While tests of associations were used as **the Chi square test with taking p values <.05 as of statistical significance. PSPP the free online software was** used to analyze the data thus compiled .

III. Results

- During the study period we had a **total of 41 patients** who **were fit for our inclusion criterion**. Out of these majority were **(n=24 ,58.5%) male while rest were female** .
- The mean age of the participants **were 36.48 ±13.59**. Majority were from **rural background** while most were followers of **Hindu religion (68.5%).**

- **Table 1** It was also noted that most of the study participants were from BPL but not all participants. **Age category and SES** were found to **be statistically significan**t .

- Out of a total of **41 cases**, **27 were extra-articular** and **14 were intra-articula**r. In **addition, the AO classification of fractures was used in our research**.

- Most of the incidents**, 32 out of a total of 41(78% per cent) were of type A**. **(Table 2) Right side fracture was more (n=21 ,51%) while closed fractures were common** (Table 2) . **Neer's Score** was also checked for association with various types of fractures depending on its type , and trauma type .Based on **Neer 's guidelines**, which included pain assessment, range of **motion, walking and work ability, anatomy and X-ray findings were measured at 6 months and used to evaluate the outcomes between open** and closed fractures. Trauma types were seen to be of high statistical significance when compared for **the Neer's score** which was excellent in **majority of cases (n=17 ,41%), while it was good in (n=15,36%)** .

- **Only seven outcomes were poor** . (Table 3) A figure is also inserted to illustrate the pre operative fracture site and **immediate post operative effect** after the fracture has been fixed at the distal femoral end with **retrograde intramedullary nail** . All cases **developed bridging callous which was visualized as radiological reunion** . Mean time in attaining that was **18.54 weeks** . Good fracture union was described as complete bridging of **the callus in 3 cortices along** with painless full weight bearing by the patients .

- There were **3 patients (8.57%) with superficial wound infections**. Infections subsided with regular adjustments in **dressing and necessary antibiotics**. There was **no varus collapse or malfunction of the implant**.

Different SES factors		Male	Female	Total	
Age in years Mean age 36.48 ±13.59	**18-25**	5	7	12	**P <.05**
		41.7%	58.3%	100.0%	
	25-35	4	4	8	
		50.0%	50.0%	100.0%	
	35-55	11	5	16	
		68.8%	31.3%	100.0%	
	>55	4	1	5	
		80.0%	20.0%	100.0%	
Religion	**Hindu**	15	11	26	
		62.5%	64.7%	63.4%	
	Muslim	8	5	13	
		33.3%	29.4%	31.7%	
	Christian	1	1	2	
		4.2%	5.9%	4.9%	**p>.05**
	Others	0	0	0	
		0	0	0	
SES	**APL**	8	7	15	
		53.3%	46.7%	100.0%	
	BPL	16	10	26	**p<.05**
		61.5%	38.5%	100.0%	
Total		24	17	41	
		58.5%	41.5%	100.0%	

Table 1 . Sociodemographic traits of the Study participants
15 out of 41 were from urban area while rest were from rural areas .

Gender		Fracture Type		p	Side Involved		p	Trauma type		p	Total
		Type A	Type C1		Right	Left		Closed	Open		
	Male	20	4	<.05	14	10	>.05	16	8	<.05	24
		62.5%	44.4%		66.7%	50.0%		57.1%	58.3%		58.5%
	Female	12	5		7	10		12	5		17
		37.5%	55.6%		33.3%	50.0%		42.9%	41.7%		41.5%
Total		32	9		21	20		28	13		41
		100.0%	100.0%		100.0%	100.0%		100.0 %	100.0%		100.0%

Table 2 . Relationship of the Gender and Types of Fracture , Trauma Type and Age Category

		Neer's Score				Total	p value
		Excellent	**Good**	**Poor**	**Fair**		
Fracture Type	Type A	12	15	5	0	32	>.05
		37.5%	46.9%	15.6%	0.0%	100.0%	
	Type C1	5	0	2	2	9	
		55.6%	0.0%	22.2%	22.2%	100.0%	
Trauma type	Closed	17	11	0	0	28	<.00
		100.0%	73.3%	0.0%	0.0%	68.3%	
	Open	0	4	7	2	13	
		0.0%	26.7%	85.7%	100.0%	29.3%	
Total		17	15	7	2	41	
		100.0%	100.0%	100.0%	100.0%	100.0%	

Table 3 . Neer's Score and its relationship with Fracture Type and Trauma Type

Figure 1.A X ray of the right distal femur with fracture followed by intramedullary nailing

IV. Discussion

- **Supracondylar femur** fractures are **inherently difficult** and they are **extremely fragile**. Due to **heavy muscular attachments,** it is harder to **manage proper alignment without fixation**. Often due to its close proximity to the knee, **regaining full motion of the knee is typically more difficult**.
- In our study our age **group our mean age group was 36.48** while in other studies like that **of Gils et al had more in** the mean **age group of 50s** while **Siliski et al had mean age more than** our research . Similar studies done in **India have reported similar mean age group. (14, 15, 16)**.
- In our study we found **males to be more involved in the femur fracture**. Similar findings were from other **Indian sites (15, 16) in our cases**, the implant material was **stainless steel**, **with a decent amount of callus being** achieved by union**. Neer's Score were used to evaluate the post- operative success in other quoted studies as well to evaluate the effectiveness**.
- In **1995**, **a retrospective study conducted byKrickler and Butt MS et al.** examined **42 supracondylar and intercondylar fractures** of the femur in elderly patients.
- **Twenty** patients underwent **AO DCS surgery** and **side plate assembly**, **while 22 underwent skeletal traction** followed by **cast bracing.(17) Good to** excellent outcomes **were achieved in 53 per cent of patients** treated with surgery, **while only 31 per cent of patients** reported good results in the conservative community.
- **Kumar A et al.** published the findings of **18 distal femoral** fractures (all **type-A, AO classification)** in **elderly patients** treated with **retrograde titanium supracondylar nails**. In the **research, 15 fractures (93.7%) were consolidated in an average period of 3.6 month**s. **The total range ofmotion reached in the knee was100.6 degrees**. There was no malfunction of the implant. (18)
- In our study we had **good success** as **majority of results were evaluate**d as **either Excellent, Fair, or Good**. Similar success stories were reported by **authors quoted in India and across the globe**. X ray imaging on cases showed **excellent results** post operatively **(Fig 1)**

V. Conclusions

- We can **safely** conclude as others quoted above that in cases of distal **femoral fractures** ,**retrograde intramedullary supracondylar nail** is **good** repair technique especially **for extra articular type fractures** .
- As there is **no bone graft** involved owing to the preserved **hematoma** and **vasculature morbidities** following **repair are negligible**. With careful **selection of cases this method can be said to be followed across the state** . Our research is **an opening for framing a guideline** for the state to follow in cases of **coming distal femoral fractures** .

Limitations

A small sample size as has been noted by researchers across the globe from **Griffin et al to Jagandeepsinghvirk et al in**India . (15,19) **We hope one daymore sites can partner** and in the state we can have **a Multicentric study where** stringently protocols are adhered to .

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