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Ender's nailing in inter trochanteric femur fracture: A retrospective analysis of 50 cases

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Abstract
Enders nailing was very popular in past but with invent of new implant it was gradually forgotten art. Although it has many advantage like short operative time, little blood loss, reduced infection risk, reduced nonunion and cheap. Major problem with Enders nailing are knee pain and stiffness and migration or nail with shortening of limb specially in unstable variety and osteoporosis. External rotation is not significant problem with technique used. In stable fracture it gives excellent result with minimum invasion. Focusing on method of doing ender nailing and selecting proper patient are key to get success with this implant with least cost.

Keywords: Ender nail, inter trochanteric femur fracture, stable inter trochanteric fracture

Introduction
Inter trochanteric fracture have one of the major fracture encountered in routine orthopedic trauma practice. Goal of treatment is to mobilize patient as early as possible with minimum operative risk. The main challenges are osteoporosis and communication with geriatric age related medical problems and anesthetic risk. Available ways to fix the fracture are lacking in one or other area. Major drawback with other fixation method than ender's nail are long operative time, wide exposure, muscle damage, blood loss, increase infection rate, increase post-operative pain, d requirement of blood transfusion, delayed morbidity, as well as major surgery for removal of implant also in case of failure or union. Enders nailing technique if properly done can be done in very less time with no blood loss, no post-operative major infection, no requirement of blood transfusion, minimal invasive so less post-operative pain, due to superior biomechanics less chance of non-union, implant brokening, very easy to remove under sedation, very cheap and significantly decrease hospital stay. The disadvantages are irritation at knee and stiffness, proximal and distal migration of nail, supra condylar fracture at insertion site and rotational deformity and shortening of limb. Here in present study we assess the overall results, particularly in relation of complication.

Material and Method
In our study we are interested in knowing outcome of ender nail in inter trochanteric fracture only. So, we analyzed data from operated case sheet record received from G.M.E.R.S. Medical College Junagadh orthopedic department operated form 1 January 2018 to 31 December 2018. All case operated in this duration for proximal femur fracture was shorted out. From those cases with examination of pre-operative x ray, we divide them in to extra capsular and intra capsular fracture. Intra capsular fracture was put aside for other parallel study and extra capsular facture was analyzed and classified using Evan's classification. Then detail of case sheet was examined and then patient having associate fracture was removed from our study. Then post-operative x ray film was assessed and pt operated with implant using other than ender nail was shorted out. Then remaining patient who are operated with ender nail are sub classified using Evans classification in type 1 to 5. then patient demographic data collected and put for statical analysis and then going through case and following point noted for study. Patient pre-operative risk, type of anesthesia, operative method, operative type, implant used and number of implant, postoperative analgesic and blood transfusion, antibiotic coverage,

total hospitalization stay, discharging condition. Then all patient were contacted called them for final follow up examination. We strictly call patient after 9 month of duration only. During follow up we check their discharge card note and follow up examination note and serial x ray and then took last final x ray and examined them using below mentioned form. Form above method we short out total 368 proximal femur about patient, out of 126 patient having associated injury like lower radius and other systemic injury. Out of 242 patient 26 patient died in hospital stay. 120 were operated by using other implant like DHS, PFN etc. Out of remaining 96 patient 9 patient could not be traced and 20 patient died before study started and 17 patient are not willing to participate in study and came for final follow up.
So finally 50 patient are enrolled in study.

Evan's classification

Type I: Fracture line extends upwards and outwards from the lesser trochanter (stable). Type I fractures can be further subdivided as:

- **Type Ia:** Un displaced two-fragment fracture
- **Type Ib:** Displaced two-fragment fracture
- **Type Ic:** Three-fragment fracture without posterolateral support, owing to displacement of greater trochanter fragment
- **Type Id:** Three-fragment fracture without medial support, owing to displaced lesser trochanter or femoral arch fragment
- **Type Ie:** Four-fragment fracture without postero-lateral and medial support (combination of Type III and Type IV)

Type II: Fracture line extends downwards and outwards from the lesser trochanter (reversed obliquity/unstable). These fractures are unstable and have a tendency to drift medially.

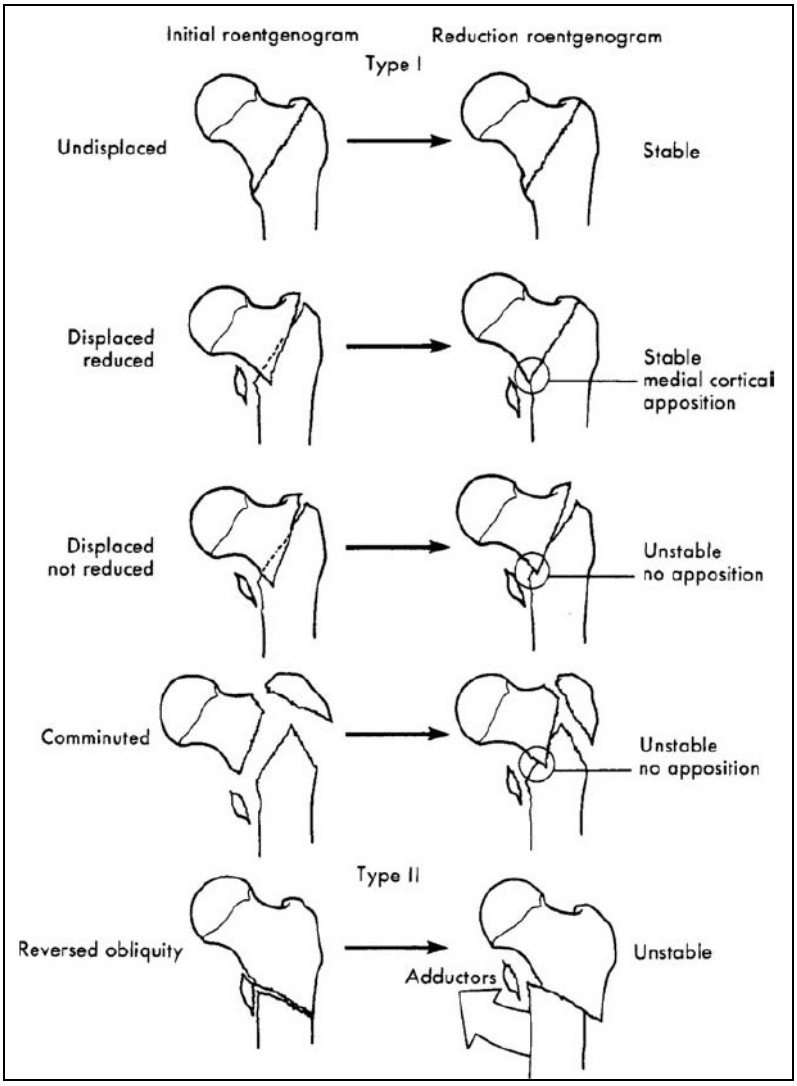

Fig 1: Evans` classification of intertrochanteric fractures

Technique used in this patient

Operative note in all cases show standard protocol of operative method described as below;
Patient was given anesthesia and shifted to fracture table, then traction and maneuver done and best possible reduction achieved and grade it as per Evans classification. Reduction usually was in natural or slightly valgus. Then after standard aseptic precaution entry taken from medial side of femoral condyle and ender nail of appropriate sized measured under IITV by putting nail on femur over drape and then ante version band given by bending of tip so this nail was positioned inferior to other subsequent nail. Length decided in such manner that proximal tip of nail on subchondral bone of head in stable fracture and slightly below at about center of head in unstable fracture. Second nail was inserted with slight bend on proximal part so that it increase rotational stability of assembly. Such 3 or 4 nail inserted and checked under IITV in both AP and lateral view and then distal end was tied with

each other with SS wire loop.

Form used to assess in follow up final visit

NAME
AGE/SEX
IPD NO
Date of admission
Date of operation
Date of discharge
Date of final follow up
Duration since discharge to follow up in months
Partial wt bearing time since operation as per follow up card sheet
Full weight bearing since operation as per follow up card sheet
Assessment of results using modified shepherd's criteria

1. Pain

a. No pain
b. Slight pain – not interfere with daily activity
c. Moderate pain – interfere with daily activity
d. Severe crippling pain

2. Limb length discrepancy

a. None
b. Up to 1 cm
c. 1-2 cm
d. > 2 cm

3. Gade's mobility index

Point are given according to usefulness of that range of motion in different movement

Flexion (in degrees)	0-45 * 0.6 45-90 * 0.4 90-150 * 0.1
Adbuction (in degrees)	0-15 * 0.6 15-30*0.4 30-60*0.1

Abduction, medial rotation, extension (in degrees)*0.2

4. Functional activities

Limp	yes	1
	No	0
Trendelenburg	positive	2
	Negative	0

Mark shift

a. Without aid 0
b. With one stick 1
c. With two stick 3
d. With crutches 4
e. Bed ridden 10

Walking ability

A less than 100 mt 4
100mt - 1km 3
1 km to 5 km 2
More than 5 km 0

Sitting cross legged

A. Possible 0
B. Difficult 1
C. Not possible 3

Squatting

A. Possible 0
B. Difficult 1
C. Not possible 3

Muscle wasting

A. None 0
B. Slightly atrophic 1
C. Strongly atrophic 3

Use of limb

A. Normal 0
B. Half than normal 1
C. Less than half 2

Table 1: The Mobility index functional activity

grade		Pain	Mobility index	Functional activity	Ll discrepancy
I	Excellent	None	>80	0-4	None
II	Good	Slight	50-79	5-9	Upto 1 cm,
III	Fair	Moderate	20-49	10-13	Upto 2 cm
IV	Poor	severe	<19	>40	2 cm

Observation and Discussion

Our retrospective analysis of patient admitted in orthopedic department in January to December 2018 was suggest following observation

Table 2: Age incidence

AGE	Male	Female
40-49	3	1
50-59	1	5
60-69	7	9
70-79	8	10
80 and above	4	2

Incidence of fracture increase with age due to osteoporosis and low bone mass as well decrease balance and eye sight will also lead to trivial trauma. So it is primarily a low velocity injury

Table 3: Mode of injury

Mode of injury	Household fall	RTA
Patient	45	5
percentage	90	10

Table 4: Sex incidence

Sex	No of patient	percentage
Male	23	46
female	27	54

Female are e more prone to this fracture mostly due to osteoporosis and low bone quality

Table 5: Side of limb

	Right	Left
Male	11	12
Female	12	15
Total	23	27
Mode of injury	Household fall	RTA
Patient	45	5
percentage	90	10

Table 6: Classification as per type of fracture

Classification	No of patient	percentage
Stable and un displaced	12	24
Stable but displaced and reducible	10	20
Unstable and not reducible	15	30
comminuted	8	16
Reverse oblique	5	10

Here study criteria are designed to select case done by ender nailing also, so more than 70 percent case are of stable variety or two part fracture. It clearly show the implant selection done by surgeons in favour of good outcome with minimum damaging to patient and cost effective also

Table 7: Type of reduction in post of x ray

	Stable un displaced	Sable displaced	Unstable two part	communized	Reverse oblique
Perfect	12	8	4	0	0
Near perfect	0	2	7	3	1
Varus	0	0	2	4	4
Valgus	0	0	2	1	0
total	12	10	15	8	5

Table 8: Grade of anesthesia

Grade	No. of patient	Percentage
I	0	0
II	3	6
III	32	64
IV	15	30

Table 9: Type of anesthesia

type	
Spinal	30
Epidural	8
General	3
Local + sedation	10

Most of patients were operated under grade 3 in spinal anesthesia, though some was operated under local anesthesia with sedation show simplicity of procedure and important in high risk patient who otherwise can't be operated leads to morbidity.

Table 10: No of ender nail used

Number of ender nail	Number of patient	percentage
1	1	2
2	13	26
3	30	60
4	6	12

Table 11: Blood transfusion due to blood loss intra operative

Blood transfusion	No of patient	percentage
0	45	90
1	4	8
2	1	2

This shows significant less blood loss intra operatively

Table 12: Duration of hospitalization

No of days	No of patient	percentage
0-3	20	40
4-6	25	50
7-10	5	10

Most of patient can be discharged within 5 day show less hospitalization and reduced cost and complications

Table 13: Patient re assessment timing since operation

Time since operation	No of patient	percentage
9 month	2	4
10 month	25	50
11 month	13	26
12 month	10	20

In this study we do last assessment between 9 to 12 month since operation because it is maximum time to heal fracture

Table 13: Timing of partial wt bearing

Weeks	No of patient	Percentage
<1 week	3	6
2-4 week	20	40
5-8 weeks	17	34
>8 week	10	20

Most of patient able to do partial wt bearing at about 4-6 week which correlate with fracture pattern and post reduction stability of fracture

Table 14: Timing of full weight bearing

Weeks	No. of patient	Percentage
<4 wks	2	4
5-8 wks	14	28
9 to 12 wks	32	64
>12weeks	12	24

Most of patient able to do full wt bearing between 6 to 10 weeks which directly correlate with no of patient with stable reduction

Table 15: Supportive aid on follow up

Supportive AID	No. of patient	percentage
None	32	64
With cane	14	28
With walker	4	8

Most of patient able to walk without support or with cane direcely proportional to stable post reduction fracture pattern

Table 16: Pain at final follow up

Pain severity	No of patient	percentage
None	20	40
Slight	12	24
mild	10	20
moderate	6	12
marked	2	4

Most patients at final follow up show minimal pain and also that is related to implant impingement

Table 17: Cross leg at final follow up

Sitting cross legged	No of patient	percentage
Without difficulty	35	70
With difficulty	12	24
unable	3	6

Most patients able to sit cross leg proportionate to stable fracture reduction and good anatomical healing

Table 18: Squatting at final follow up

Squatting	No. of patient	Percentage
Possible	28	56
Squatting with difficulty	17	34
Not possible	5	10

Squatting is difficult for most of patient correlate with change in version of neck to shaft which happened in most of inter trochanteric fracture

Table 19: External rotation deformity

Rotational deformity	No of patient	Percentage
Absent	32	64
Mild	12	24
severe	6	12

In our series rotational stability is less due to improved technique of 3 nail fixation

Table 20: Limb length discrepancy (LLD)

L.L.D.	No of patient	
No L.L.D (<cm)	35	70
1-2cm	10	20
>2cm	5	10

Limb length discrepancy directly correlate to communiation at fracture site and in our series most of fractures are stable after reduction

Table 21: Implant position at final follow up

Implant position	No of patient	percentage
Not present	8	16
In situ but Mild impingement	30	60
Significant impingement	10	20
Cut through proximally	2	4

Table 22: Gades mobility index

Grades index	Stable un displaced	Stable displaced	Unstable Not reduced to stable	comminuted	Reverse oblique	Total
Excellent	10	9	10	3		32
Good	2	1	3	2	1	9
Fair			2	2	3	7
poor				1	1	2

Table 23: Functional activity at final follow up

grade	Stable un displaced	Stable displaced	Unstable Not reduced to stable	comminuted	Reverse oblique	Total
Excellent	9	8	7	2	0	26
Good	3	2	5	3	2	15
Fair			3	2	1	6
poor				1	2	3

Table 24: Radiological union as per serial x rays

grade	Stable un displaced	Stable displaced	Unstable Not reduced to stable	communited	Reverse oblique	total
10-15 weeks	9	7	3	0	0	19
16-20 weeks	3	3	10	2	1	19
20-25 weeks			2	5	3	10
>25 week				1	1	2

Summary and conclusion

After analysis of date we came to conclude that ender nailing in inter trochanteric fracture is safe, cost effective, easy method especially in stable or post reduction stable fracture pattern. There is significant less chance of blood loss and infection rate as well as shortening and rotational deformity especially with technique suggested here of putting 3 nail in head in different directions as far as possible. Only disadvantage are nail impingement and knee stiffness which are more related to unstably reduced fracture. One of the drawback of our study is analyzing data of institute where surgeon choose appropriate implant as per fracture pattern so, we get good outcome with this implant, there is scope to study and compare result with other implant as well as within different fracture pattern to prove or disprove superiority of ender to other implant So we conclude that ender nail is best option in stable or stably reduced inter trochanteric fracture with significant less cost and risk with minimum complication and better outcome. Superiority in unstable or communicated fracture is still questionable.

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