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Case Series

Clinical, Functional and Radiological Results of Suprapatellar Nailing in Proximal Tibia Fractures: Case Series

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Abstract

Introduction:

- Proximal tibial and segmental fractures may pose technical difficulties when attempting to obtain reduction and alignment using a standard infrapatellar approach with the knee in a flexed position and there is an increased risk of a varus malunion and procarvatum in proximal tibia fractures, when a lateral parapatellar portal is used.
- Suprapatellar approach has been added to the semi-extended knee position for nailing, which has been reported to not only improve reduction during nailing, but also decrease the long-term problem of anterior knee pain after treatment and various other complications.

Aim:

- Primary aim- To evaluate the efficacy of supra patellar nailing in proximal tibia fracture by analyzing clinical (anterior knee pain and range of movement), functional and radiological outcomes (tibial alignment).
- Secondary aim- To assess intraoperative and postoperative complications of fracture treated by supra patellar nailing.

Objective

- To evaluate clinical outcomes of supra patellar nailing in proximal tibia fracture by using visual analogy scale score for anterior knee pain and range of movement of knee joint.
- To evaluate the functional outcome of supra patellar nailing in proximal tibia fracture by using Lysholm knee scoring system.
- To evaluate the radiological reduction quality of supra patellar nailing in proximal tibia fractures by assessing the tibial alignment.
- To assess complications of supra patellar nailing in proximal tibia fracture.

Method:

- In this Ambispective observational study, we included 11 patients with proximal tibia fractures who needed supra patellar nailing as per the Indications. The patients were selected according to the inclusion and exclusion criteria. The patients were operated between 2023 and 2024 at Yashoda Superspeciality Hospital, Nehru Nagar, Ghaziabad.

Result:

- 11 patients were available for follow up at a minimum of 3 months after the index procedure
- After 15 days of operation, mean VAS was 1.72. Mean Lysholm pain component was 3.6. Mean Lysholm knee score was 46.18. Mean affected side arc of motion was 8.18-86.81 . Mean normal side arc of motion was 0-133.6
- After 1 month of operation, mean VAS was 0.54. Mean Lysholm pain component was 20. Mean Lysholm knee score was 63.5. Mean affected side arc of motion was 5-115 . Mean normal side arc of motion was 0-133.

- At the end of 1 month, One patient came to us in follow up period, in which xray showed Maluniting fracture proximal tibia with tibia in 15 degrees of internal rotation (with distal shaft of femur fracture). Patient was having difficulty in walking and pain because of internal rotation of tibia for which we re-operated him and corrected the mal rotation.
- After 3 month of operation, mean VAS was 0.18. Mean Lysholm pain component was 24.1. Mean Lysholm knee score was 89.9. Mean affected side arc of motion was 0.9-130.4. Mean normal side arc of motion was 0-133. No significant complication noted at the end of 3 months
- The mean degree of angular deformation (coronal plane alignment) was 0.32° ± 0.4° valgus. The mean degree of angular deformation (sagittal plane alignment) was -1.07° ± 1.2° posterior bow.

Conclusion

- This paper critically document clinical, functional and radiographic results using the percutaneous supra patellar portal with the semiextended approach for intra medullary nailing of the tibia. Our 3 months results indicate that the procedure resulted in excellent tibial alignment and knee range of motion. Even more interesting was the absence of anterior tibial pain often found when a tibial nail is inserted in a standard fashion.

Keywords: Clinical; Radiological; Suprapatellar; Nailing; Proximal Tibia Fractures

Introduction

- Locked intramedullary nail with reamed insertion (RIMN) is the gold standard for treatment of displaced tibial shaft fractures with high rates of union, low rates of complications, and good functional results [1,2].
- In addition, proximal tibial and segmental fractures may pose technical difficulties when attempting to obtain reduction and alignment using a standard infrapatellar approach with the knee in a flexed position [3].
- For example, it is well known that there is an increased risk of a varus malunion and procarvatum in proximal tibia fractures, when a lateral parapatellar portal is used, and a common solution has been the use of blocking screws [4,5]. Recently, the use of a semiextended position for Locked intramedullary nail with reamed insertion has been advocated to minimize the technical difficulties associated with Locked intramedullary nail with reamed insertion in these fractures. Anterior knee pain, however, is the most reported complication of the standard infrapatellar approach [6-8].
- Recently, a suprapatellar (SP) approach has been added to the semi-extended knee position for nailing, which has been reported to not only improve reduction during Locked intramedullary nail with reamed insertion, but also decrease the long-term problem of anterior knee pain after treatment [9-12].

Aim

- Primary aim- To evaluate the efficacy of supra patellar nailing in proximal tibia fracture by analyzing clinical (anterior knee pain and range of movement), functional and radiological outcomes (tibial alignment).
- Secondary aim- To assess intraoperative and postoperative complications of fracture treated by supra patellar nailing.
- Objective
- To evaluate clinical outcomes of supra patellar nailing in proximal tibia fracture by using visual analogy scale score for anterior knee pain and range of movement of knee joint.
- To evaluate the functional outcome of supra patellar nailing in proximal tibia fracture by using Lysholm knee scoring system.
- To evaluate the radiological reduction quality of supra patellar nailing in proximal tibia fractures by assessing the tibial alignment.
- To assess complications of supra patellar nailing in proximal tibia fracture.

Method and Materials

- TYPE OF STUDY: Ambispective observational study.
- PLACE OF STUDY: Study was done at Yashoda hospital and Research centre, Nehru Nagar Ghaziabad, Uttar Pradesh.
- PERIOD OF STUDY: From 2023 till 2024
- INVESTIGATIONS –
- Xray Leg – AP and Lateral
- NCCT leg

Inclusion criteria

- Extra-articular fractures of the proximal tibia (AO type 41A)
- Simple and comminuted fractures of the tibia diaphysis (AO type 42A–C)
- Segmental diaphyseal fractures of the tibia (AO Type 42C)
- Extra-articular fractures of the distal tibia and fractures with simple intra-
- articular distal extension (AO type 43A and C1)
- Floating knee injuries
- Patella bacha, ossifications of the patella tendon
- Contaminated wounds at the level of the patella tendon
- Fracture with a skin lesion or severe soft tissue damage in the infrapatellar region

Exclusion criteria

- Gustilo grade 3C open fractures of the tibia because of an increased risk of joint infection, although an increased joint infection risk in open fractures has not been reported.
- Severe soft tissue laceration, contamination, or infection in the suprapatellar area
- Ipsilateral knee joint prosthesis
- Knee arthrodesis
- Extension deficit of the knee joint >20°
- Fractures of the ipsilateral tibia plateau involving the nail entry point
- Implants blocking the nail entry point.
- Ipsilateral fracture of the patella.

Figure 1: Case 1 Xray suggestive of Severely comminuted Proximal shaft of tibia fracture with segmental fibula fracture.

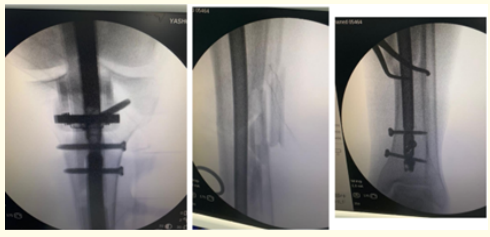


Figure 2: Intra op c-arm images.

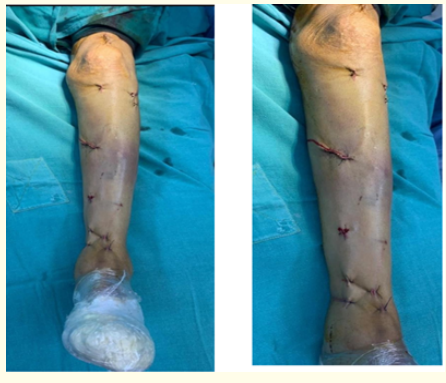


Figure 3: Intra op clinical images.

Figure 4: Case 2: xray suggestive of proximal shaft of tibia fracture with head of fibula fracture.

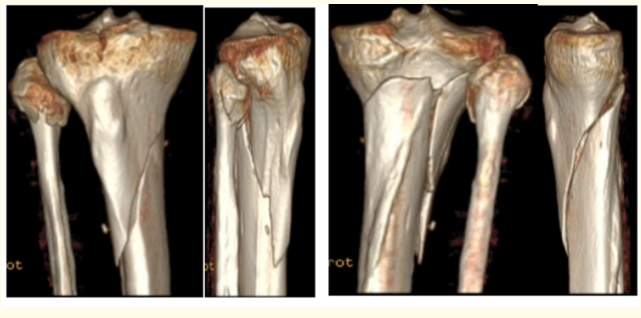


Figure 5: CT scan images.

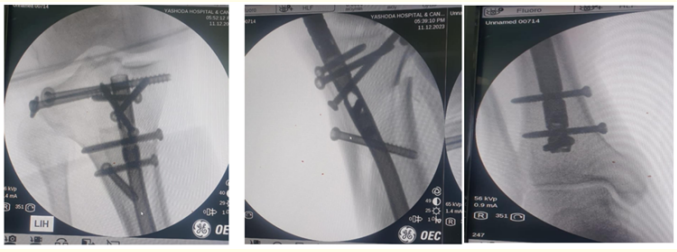


Figure 6: Intra op c-arm images.

Clinical evaluation

- 11 patients were available for follow up at a minimum of 3 months after the index procedure
- After 15 days of operation, mean VAS was 1.72. Mean Lysholm pain component was 3.6. Mean Lysholm knee score was 46.18. Mean affected side arc of motion was 8.18-86.81 . Mean normal side arc of motion was 0-133.6
- The mean degree of angular deformation (coronal plane alignment) was 0.32° ± 0.4° valgus. The mean degree of angular

Serial No.	Sex	Age	Side	OTA class	Open?	Fracture level
1.	M	45	Right	42C2.2	No	Proximal + Middle
2.	M	24	Right	42B3	Yes	Proximal
3.	F	67	Left	42A2.3	No	Proximal
4.	M	57	Left	42B3.3	No	Proximal
5.	F	35	Left	42C2.3	Yes	Proximal + Middle
6.	M	53	Left	42A3.3	No	Proximal
7.	M	61	Right	42C2	No	Proximal + Middle
8.	F	44	Right	42B2.3	Yes	Proximal
9.	M	70	Left	43A2.2	Yes	Proximal
10.	M	34	Right	42B1.2	No	Proximal
11.	M	68	Right	42C2	No	Proximal + Middle (includingmid femur)

Table 1: Demographic characteristics.

Figure 7: Intra Op clinical images.

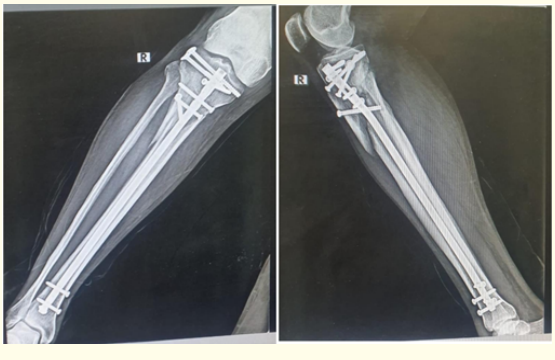


Figure 8: Immediate post op X-rays.

Serial No.	Follow up day	VAS	Lysholm pain component	Lysholm knee scoring scale	Affected side ROM	Normal side ROM	Tibial alignment-valgus (Coronal plane)	Tibial alignment- posterior bow (sagittal plane)	Complications, if any
1.	15	0	0	38	0-80	0-140	0.32	+0.8	No
2.	15	0	5	60	0-100	0-135	0.36	-2.07	No
3.	15	2	5	43	25-95	0-125	0.29	-1.05	No
4.	15	3	5	38	20-80	0-130	0.35	-1.1	No
5.	15	3	0	57	0-85	0-145	0.28	-1.07	No
6.	15	1	10	63	10-70	0-120	0.30	+0.13	No
7.	15	2	5	35	0-90	0-130	0.32	+1.2	No
8.	15	0	0	57	30-95	0-140	0.35	+1.13	No
9.	15	4	5	63	0-90	0-135	0.31	-2.27	No
10.	15	0	5	38	5-100	0-130	0.29	-1.2	No
11.	15	4	0	16	0-70	0- 140	0.28	-1.1	No

Table 2: Evaluationafter 15 daysof operation.

deformation (sagittal plane alignment) was -1.07° ± 1.2° posterior bow.

- No significant complication noted at the end of 15 days (Table 3)
- 11 patients were available for follow up at a minimum of 3 months after the index
- procedure.
- After 1 month of operation, mean VAS was 0.54. Mean Lysholm pain component was 20. Mean Lysholm knee score was 63.5. Mean affected side arc of motion was 5-115 . Mean normal side arc of motion was 0-133.
- The mean degree of angular deformation (coronal plane alignment) was 0.32° ± 0.4° valgus. The mean degree of angular deformation (sagittal plane alignment) was -1.07° ± 1.2° posterior bow.
- One patient came to us in follow up period, in which xray showed Maluniting fracture proximal tibia with tibia in 15 degrees of internal rotation (with distal shaft of femur fracture). Patient was having difficulty in walking and pain because of internal rotation of tibia for which we re-operated him and corrected the mal rotation. Clinical and radiological Images of the patient are attached herewith, (Figure 9-17, Table 4)
- 11 patients were available for follow up at a minimum of 3 months after the index procedure.
- After 3 month of operation, mean VAS was 0.18. Mean Lysholm pain component was 24.1. Mean Lysholm knee score was 89.9. Mean affected side arc of motion was 0.9-130.4. Mean normal side arc of motion was 0-133.
- The mean degree of angular deformation (coronal plane alignment) was 0.32° ± 0.4° valgus. The mean degree of angular deformation (sagittal plane alignment) was -1.07° ± 1.2° posterior bow.
- No significant complication noted at the end of 3 months.

Figure 9: 3 months post op xray image.

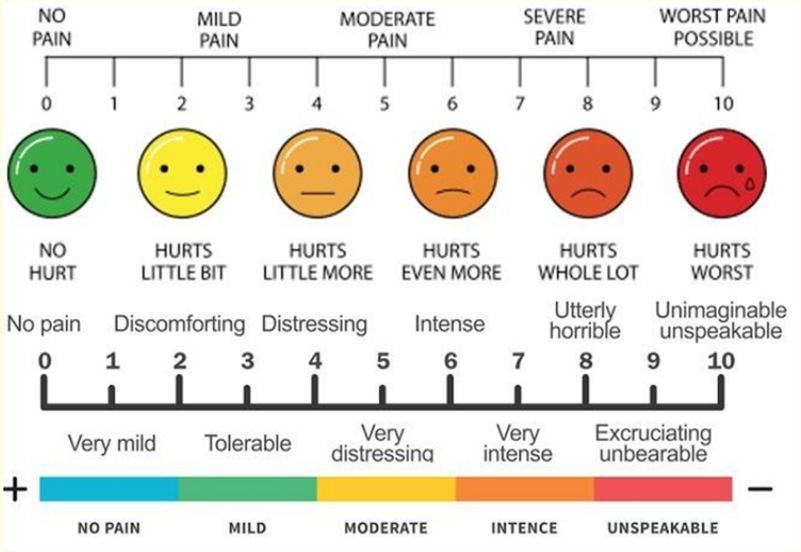
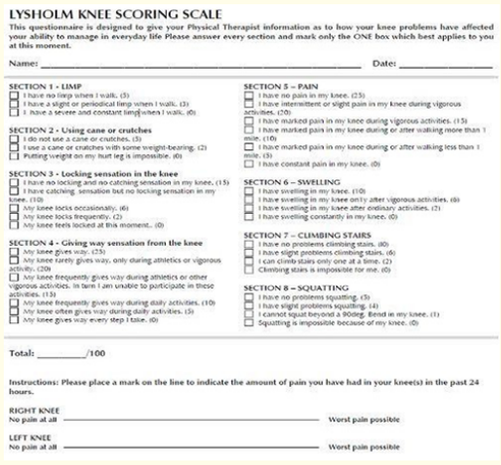


Figure 10: Anterior knee pain using visual analogue scale score.



LYSHOLM KNEE SCORING SCALE

This questionnaire is designed to give your Physical Therapist information as to how your knee problems have affected your ability to manage in everyday life Please answer every section and mark only the ONE box which best applies to you at this moment.

Name: _____ Date: _____

SECTION 1 - LIMP
- I have no limp when I walk. (5)
- I have a slight or periodical limp when I walk. (2)
- I have a severe and constant limp when I walk. (0)

SECTION 2 - Using cane or crutches
- I do not use a cane or crutches. (5)
- I use a cane or crutches with some weight-bearing. (2)
- Putting weight on my hurt leg is impossible. (0)

SECTION 3 - Locking sensation in the knee
- I have no locking and no catching sensation in my knee. (15)
- I have catching sensation but no locking sensation in my knee. (10)
- My knee locks occasionally. (6)
- My knee locks frequently. (2)
- My knee feels locked at this moment.. (0)

SECTION 4 - Giving way sensation from the knee
- My knee gives way. (25)
- My knee rarely gives way, only during athletics or vigorous activity. (20)
- My knee frequently gives way during athletics or other vigorous activities. In turn I am unable to participate in these activities. (13)
- My knee frequently gives way during daily activities. (10)
- My knee often gives way during daily activities. (5)
- My knee gives way every step I take. (0)

SECTION 5 – PAIN
- I have no pain in my knee. (25)
- I have intermittent or slight pain in my knee during vigorous activities. (20)
- I have marked pain in my knee during vigorous activities. (15)
- I have marked pain in my knee during or after walking more than 1 mile. (10)
- I have marked pain in my knee during or after walking less than 1 mile. (5)
- I have constant pain in my knee. (0)

SECTION 6 – SWELLING
- I have swelling in my knee. (10)
- I have swelling in my knee only after vigorous activities. (6)
- I have swelling in my knee after ordinary activities. (2)
- I have swelling constantly in my knee. (0)

SECTION 7 – CLIMBING STAIRS
- I have no problems climbing stairs. (10)
- I have slight problems climbing stairs. (6)
- I can climb stairs only one at a time. (2)
- Climbing stairs is impossible for me. (0)

SECTION 8 – SQUATTING
- I have no problems squatting. (5)
- I have slight problems squatting. (4)
- I cannot squat beyond a 90deg. Bend in my knee. (1)
- Squatting is impossible because of my knee. (0)

Total: _____/100

Instructions: Please place a mark on the line to indicate the amount of pain you have had in your knee(s) in the past 24 hours.

RIGHT KNEE
No pain at all _____ Worst pain possible

LEFT KNEE
No pain at all _____ Worst pain possible

Figure 11: Functional evaluation using Lysholm knee scoring scale.

Figure 12: X-ray images showing severely comminuted segmental tibia fracture with distal shaft ipsilateral femur fracture

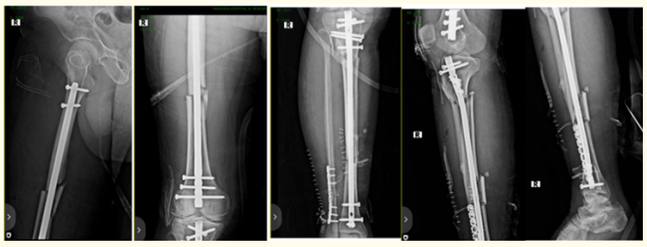


Figure 13: Immediate post op x-ray images.

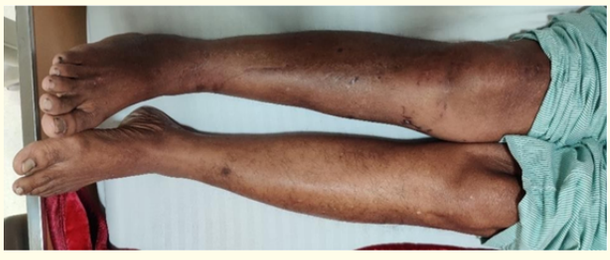


Figure 14: Clinical image of the same patient 1 month post op, showing 15 degrees of internal rotation of right tibia.

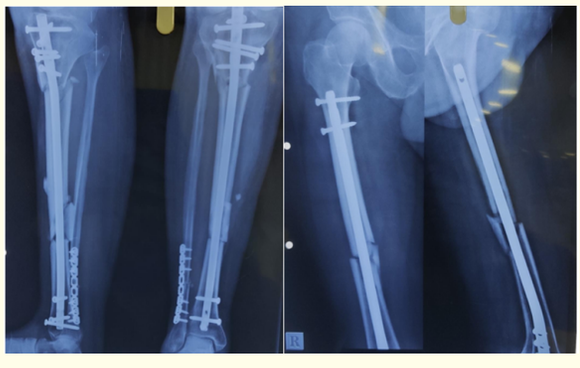


Figure 15: Post operative xray images of patient showing 15 degrees of internal rotation of right tibia.

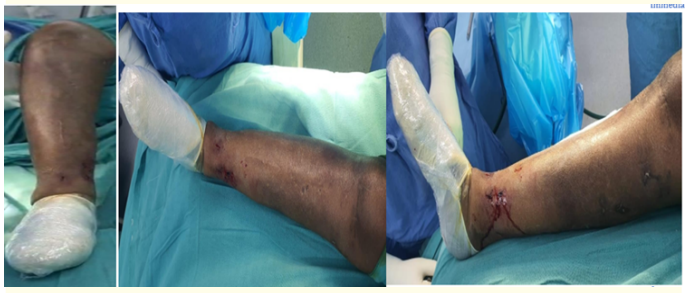


Figure 16: Immediate post operative clinical images after correction of malrotation of right tibia.

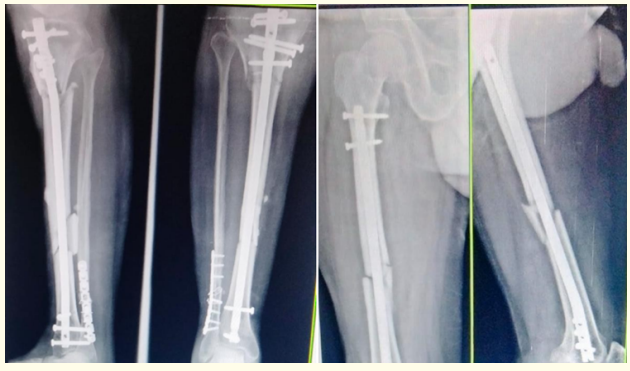


Figure 17: Months Post operative Xray images of patient showing correction of malrotation of right tibia.

Serial No.	Follow up month	VAS	Lysholm pain component	Lysholm knee scoring scale	Affected side ROM	Normal side ROM	Tibial alignment - valgus (Coronal plane)	Tibial alignment-posterior bow (sagittal plane)	Complications, if any
1.	1	0	25	73	0-120	0-140	0.32	+0.8	No
2.	1	0	25	72	0-135	0-135	0.36	-2.07	No
3.	1	2	20	60	20-110	0-125	0.29	-1.05	No
4.	1	0	25	73	10-120	0-130	0.35	-1.1	No
5.	1	0	25	60	0-130	0-145	0.28	-1.07	No
6.	1	0	10	65	10-100	0-120	0.30	+0.13	No
7.	1	1	25	73	0-130	0-130	0.32	+1.2	No
8.	1	0	15	79	10-100	0-140	0.35	+1.13	No
9.	1	0	25	63	0-120	0-135	0.31	-2.27	No
10.	1	0	25	65	5-120	0-130	0.29	-1.2	No
11.	1	3	0	16	0- 80	0-140	0.28	-1.1	Yes (Mal-uniting fracture proximal tibia with tibia in 15 de-grees of internal rotation)

Table 3: Evaluation after 1 month of operation.

Serial No.	Follow up month	VAS	Lysholm pain component	Lysholm knee scoring scale	Affected side ROM	Normal side ROM	Tibial alignment- valgus (Coronal plane)	Tibial alignment- posterior bow (sagittal plane)	Complications, if any
1.	3	0	25	83	0-140	0-140	0.32	+0.8	No
2.	3	0	25	95	0-135	0-135	0.36	-2.07	No
3.	3	0	25	98	5-125	0-125	0.29	-1.05	No
4.	3	0	25	88	0-130	0-130	0.35	-1.1	No
5.	3	0	25	89	0-140	0-145	0.28	-1.07	No
6.	3	0	20	96	0-120	0-120	0.30	+0.13	No
7.	3	1	25	86	0-130	0-130	0.32	+1.2	No
8.	3	0	25	100	5-130	0-140	0.35	+1.13	No
9.	3	0	25	90	0-135	0-135	0.31	-2.27	No
10.	3	0	25	95	0-130	0-130	0.29	-1.2	No
11.	3	1	20	69	0-120	0-140	0.28	-1.1	No

Table 4: Evaluation after 3 months of operation.

Discussion

- The semi-extended approach for Intra medullary nailing of the tibia was originally described by Tornetta et al. This technique requires a large parapatellar incision to reflect the patella to place the Intra medullar nailing in the trochlea groove.
- The technique is particularly useful when treating difficult metaphyseal and meta- diaphyseal proximal and distal tibia fractures, where the amount of knee flexion required in traditional approaches causes much difficulty in obtaining and maintaining an acceptable reduction.
- The use of a Supra patellar portal adds a novel percutaneous component to the semi-extended approach. It is our understanding that Dr Dean Cole originally developed and used this approach in a large series of patients with proximal tibial fractures. To our knowledge, how- ever, there have been no published reports on the clinical use of this portal, despite much anecdotal and cadaveric evidence that it is safe and useful. Knee Range of movement was painless and functional in all the patients.
- Clearly, these patients will need to be followed at a minimum of 2-5 years to document any late effects that may occur, but the 3 months outcomes seem promising in this regard. It is even more remarkable that none of our Supra patellar portal patients complained of any anterior knee pain whatsoever. The reasons are unknown, but in patients with traditional nail insertion techniques, it may be that the patella tendon and the soft tissue surrounding that tendon simply do not respond well to open manipulation. Vaisto et al noted that differing the traditional approach (paratendinous vs. transtendinous) made no difference when evaluating the cause of anterior knee pain after intra medullary nailing. Interestingly, retrograde femoral Intramedullary nailing patients do not seem to complain about knee pain using essentially the same standard inferior patella tendon approach, but a different bone window. Furthermore, because the bone window for tibial nail insertion remains the same whether a standard or Supra patellar portal is used, the difference may simply be the prolonged knee flexion associated with tibial nail insertion in contrast to both the semi-extended tibial and retrograde femoral nail insertion method, where the knee is largely in extension. It is possible that using a percutaneous portal proximal to the patella avoids the patella tendon altogether and therefore, the associated pain.
- When comparing our study to other reports that describe pain in the leg after injury and Intramedullary nailing insertion, it must be stated that our evaluation was specifically focused on whether the portal and/or the technique caused knee pain and not generalized leg pain, which in the trauma patient, and in our patients, is multifactorial. Whatever the reason, the fact that none of the patients experienced any anterior knee pain at all is remarkable. A larger study population will be necessary, however, before definitive comments about lack of knee pain can be stated with certainty.

Conclusion

In conclusion, this paper critically documents clinical, functional and radiographic results using the percutaneous Supra patellar portal for the semi extended approach for Intramedullary nailing of

the tibia. Our 3 months results indicate that the procedure resulted in excellent tibial alignment and knee Range of movement. Even more interesting was the absence of anterior tibial pain typically found in up to 25%- 60% of cases where a tibial nail is inserted in a standard fashion.

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