



DOES SIZE MATTERS? THE CORRELATION BETWEEN PREOPERATIVE RADIOGRAPHIC CANAL MEASUREMENTS AND ACTUAL INTRA OPERATIVE NAIL SIZE IN CASES OF FEMUR AND TIBIA SHAFT FRACTURES.

Dr Shantanu Bhardwaj

Resident, dept. of Orthopaedics, DVPMC&RC, NASHIK

Dr Satyen Joshi*

Asso Prof , Dept of Orthopedics, DVPMC&RC, NASHIK *Corresponding Author

Dr Akshay Fuse

Resident, dept. of Orthopaedics, DVPMC&RC, NASHIK

ABSTRACT The radiographic assessment of the canal diameter of the femur and tibia is frequently done in cases where intramedullary nailing is planned as the modality for fixation. In setups with limited resources and most of the Indian scenarios in rural areas where the facilities for CT scan are not available or due to financial crunch to the patients, radiographic assessment can be done with the use of an X-rays anteroposterior view. Our study focuses on the femur and tibial canal diameter measurement done preoperatively and its correlation with the size of actual intramedullary nail used intra operatively.

KEYWORDS : PACS is Picture Archiving and Communication System monitor. Used to process the X-ray images. Shows the actual size of the bone on the console for study and not affected by magnifications.

METHODS- Seventy five patients were identified and were included in this study during the year 2017 and 2018. All the patients included suffered from either femur fracture or tibia fracture at the diaphysis and were treated with intramedullary nailing. The X-rays were obtained for the fractured limb along with the full length anteroposterior view of the contralateral normal limb.

PACS system was used to measure the canal diameter.

AIM & OBJECTIVE

To study the correlation between pre-operative radiological measurement of canal and intra-operative actual interlock nail used for femur and tibia shaft fractures.

Type of study : Prospective study.

Study setting : Department of Orthopaedics, Medical college and tertiary health care centre.

Study duration : (Jan 2017 to December 2018)

Sample size : - 75 patients of fractures of tibia and femur who underwent intra medullary nailing.

INCLUSION CRITERIA-

- Patients in the age group of 20 to 70 years were considered in this study.
- Patients who had shaft fracture of tibia were considered.
- Patients with shaft femur fracture were considered.

EXCLUSION CRITERIA-

- Patients with compound fractures were excluded from the study.
- Patients with too distal or too proximal fractures in which intra medullary nailing was not possible were excluded.
- Patients with bilateral femur fractures.
- Patients with bilateral tibia fractures.
- Patients with very small canal diameters.
- Patients with severe comminuted fractures.
- Patients with neuro vascular compromise.

INTRODUCTION-

Being sub-cutaneous in location, the tibia is the commonest bone to be fractured and seen commonly in orthopedic practice. Due to its frequency, topography and mode of injury it has become a major source of temporary disability and morbidity. Also femur fractures are amongst the most common presentation to a trauma centre. Hence special care and expertise is necessary when treating such fractures. It requires the good experience, wisdom and the a greater clinical judgement in order to choose the most appropriate treatment for a particular pattern of shaft tibia or femur fracture.

The major goal for the treatment for fracture of tibia and femur is

achieving functionally active and stable limb. Yet the spectrum of injuries is so great that there is no single method of treatment, applicable to all fractures. Management of the fractures of the shaft of the femur and tibia remained a controversial subject despite all the advances in both non-operative and operative care. So intramedullary interlocking nailing is a technique which allows stable reduction, maintenance of reduction and allows early mobilization.

Intramedullary interlocking nail is advantageous over other surgical methods. The periosteum is kept intact and being a closed procedure there is no disturbance of fracture hematoma, less incidence of infection and soft tissue injury.

And long period of immobilization, incidence of muscle wasting and overlying soft tissue damage, stiffness of joint due to treatment with plaster immobilization and external fixator application is reduced with the use of intramedullary interlocking nail.

When the operating surgeon decides the plan of surgery for a particular patients he has to consider all the aspects like

- 1) implants available with him,
- 2) setup at which he is operating,
- 3) functional outcomes of the surgical procedure,
- 4) pros and cons of the surgical procedure and the implant,
- 5) and available resources.

So when planning of treating a shaft fracture of tibia or femur by intramedullary nailing, the surgeon has to take into consideration all this prospectives. A major factor is the canal diameter and the nail size. Though the sizes of the intra medullary nails used in tibia and femur is standard what changes is the intramedullary canal diameter of the patients. Knowing the intramedullary canal diameter before hand is important as it allows you to plan the various surgical steps like size of reamers to be used, size of the nail to be kept ready during the surgery or any change in operative plan or the implants if needed can be done before hand.

Measuring canal diameter is done using radiological techniques like CT scans. But its availability in rural areas of India is a question? Also taking into consideration the financial aspects of the patients, doing CT scan just for evaluation of canal diameter would not be acceptable to many of the poverty prone areas of India where such fractures are very commonly seen. Also exposure to radiations cannot be justified.

Using antero-posterior X-ray views of the contralateral limb is a technique we used in this method to calculate the canal diameter pre-operatively and then correlated this with the intra-op nail size used to understand the relation of canal diameter with nail size and its accuracy during surgical procedures.

Various researchers have focused on calculating the intramedullary canal diameter using high end radiological techniques like CT scans but

we have used the basic a very easily available and comparatively cheaper modality like AP view X-ray.

METHODOLOGY

For our study we included 75 patients with shaft tibia and femur fractures . Plain X-rays in AP view of the contralateral limb was obtained . The X-ray film had to focus on the entire length of femur from the tip of greater trochanter to the distal femoral condyles and for tibia from tibial spines to the ankle joint. We used the PACS system for processing the X-rays where in the actual size of the femur was displayed and the measurements were not affected by magnifications or minification of the image.

MEASURING THE LENGTH AND DIAMETERS- 1) FEMUR

For measurements of the femur a straight vertical line was drawn from the tip of greater trochanter passing through the diaphysis till the superior pole of patella. This gave us the idea about the length of the nail to be used during the surgical procedure. For the diameter the isthmus , the narrowest point of the femoral canal at the diaphysis was identified and a horizontal connecting the inner boundaries of the cortex was drawn . this line gave us the measurements for the diameter of the nail to be used. (fig 4)

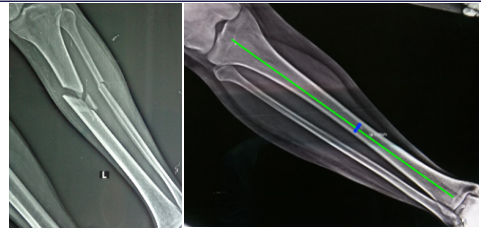


Figure 1 Figure 2)

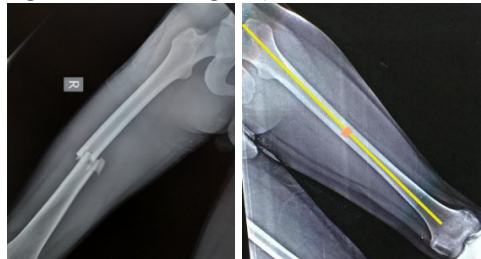


Figure 1 Figure 2)

2) TIBIA -For measurements of the tibia a similar vertical line is drawn from the tibial spikes or 2 cm below the joint line passing through the diaphysis till 2cm above the ankle joint. For the diameter isthmus was marked and a horizontal was drawn along the inner cortices . (Fig 2

RESULT-

The correlation between pre-op canal diameter and actual intra-op nail was highly significant with p<0.001 for the length as well as diameter for both tibia and femur.

Variable	Sex	n - Sample size	Mean	Std. Deviation	T	Sig. (2-tailed)	Significance
Tibial length (cm)	Pre-op	50	35.87	2.202	0.86	0.001	Highly significant
	intra-op	50	35.96	1.960			
tibial canal diameter (mm)	Pre-op	50	9.04	0.525	0.53	0.001	Highly significant
	intra-op	50	9.44	0.705			
femoral length (cm)	Pre-op	26	38.82	2.358	0.960	0.001	Highly significant
	intra-op	26	39.12	2.405			
Femoral canal diameter (mm)	Pre-op	26	9.77	0.815	0.83	0.001	Highly significant
	intra-op	26	9.37	0.697			

DISCUSSION

The first important step in the accurate measurement of the canal diameter is determining the exact location of the isthmus . If the isthmus is chosen incorrectly , the canal measurements will be prone to error.

When compared to the gold standard isthmus position obtained by CT scan, the isthmus position obtained by AP radiographs was most accurate, whereas the Lateral view x-rays were the least accurate in determining the isthmus.

In our study we found that the length when measured was more Accurate then diameter. Also reaming didn't affect the nails length but did affect the diameter in some cases where the bone was osteoporotic. The nails available come with a size difference of 2 cm and even number sizes. Therefore whenever the size was in odd numbers the larger size was preferred as it gave a better reduction compared to smaller nail as it affected the working length.

The diameter was also found to be highly significant as it gave us the orientation of the quality of the bone. In patients more then 50 yrs where the bone was osteoporotic especially in females the size

obtained pre-op was comparatively smaller than the actual nail used by about 1-1.5mm as more reaming was done in them.

The advantages of calculating the canal diameter pre-op -

- it reduced the operating time as the surgeon already has an idea which nail size to use and this avoided any additional time wasted in trying out other nail sizes.
- as the operating time was reduced complication related were also significantly reduced . There was significant reduction in infection post operatively as well as reduction in blood loss intra-operatively.
- Adequate sized implants were kept ready during the surgery and the surgeon did not have to compromise due to limited resources.
- Canal diameter calculated using X-rays is comparatively easy , inexpensive, fast and less hazardous way as well as equally useful way for small setups and in rural areas .

CONCLUSION-

We strongly suggest the use of pre-operative radiographic canal diameter calculation using x-rays as it had more advantages and made the surgery quick and better for both the surgeon as well as the patient.

Sr NO	AGE/SEX	MRD NO	LENGTH(CM)	DIAMETER(MM)	LENGTH (CM)	DIAMETER(MM)
1	40/M	782243	33.3	9.3	34	10
2	19/M	776037	32.1	8.8	32	9
3	20/M	773913	35.6	8.3	36	9
4	70/M	935638	33	9.3	34	10
5	21/M	700656	32.01	8.9	32	10
6	33/F	120151	31.4	8	32	9
7	65/F	708500	34.4	9.6	34	10
8	65/M	868647	34.6	9.5	36	10
9	25/M	738216	35.8	8.01	36	9
10	28/M	891411	36	9	36	9
11	65/M	890878	35.7	9.4	36	10
12	32/M	748339	33.02	9	34	10
13	35/M	555641	34.8	9.01	32	7
14	21/M	776037	35.1	8	36	8
15	76/M	673460	32.92	9.1	34	10

16	32/F	679293	30.12	9	30	9
17	25/M	685546	34.7	8.3	36	9
18	42/F	964310	32	9	32	10
19	55/M	966317	35.8	9.3	36	10
20	58/M	1076251	37.5	9.2	38	10
21	22/M	1126307	34.9	8.1	36	9
22	20/M	1133083	39.11	9.01	38	9
23	25/M	11323661	35.5	8.6	36	10
24	18/F	743884	34	8.7	34	9
25	50/F	748823	29.2	9	28	10
26	75/M	935638	34	9.3	34	10
27	25/M	934589	35.6	8.9	36	9
28	50/M	884203	36	9.6	36	10
29	60/M	789342	38	9	38	10
30	30/M	892231	36	8.9	36	9
31	21/M	1050831	35.4	8.2	36	9
32	42/M	1018441	34	9.4	34	10
33	50/M	1021930	35.3	9.4	36	10
34	22/M	992979	32.7	9	32	10
35	46/M	999718	34	9	34	10
36	65/M	999649	35.5	10	36	10
37	55/M	1079666	36	10	36	10
38	22/M	1080439	34.2	9.5	34	10
39	35/M	1082779	35.8	9.8	30	9
40	20/M	1082892	34	9.1	34	9
41	30/F	1001129	32.3	9.4	32	9
42	24/M	1001448	35.7	9.4	36	10
43	21/M	1003584	34	8.5	34	8
44	45/M	983863	35	9	34	9
45	54/M	1008627	36	9.4	36	10
46	32/M	1134241	35.6	9.1	36	9
47	62/M	3777418	34	10	34	10
48	29/M	119567	35.1	8.01	34	8
49	60/M	1106973	30	9.6	30	10
50	42/M	1123052	32.2	9.1	32	9
51	21/M	789086	39	8.6	40	9
52	15/M	787868	36.1	8.3	36	9
53	65/F	915999	36	9.8	38	10
54	20/M	689289	42	9.2	42	10
55	56/M	855553	40	10	40	10
56	24/M	824203	41	8.9	42	9
57	25/M	833982	42.01	8.6	42	9
58	20/F	840390	37.8	8.7	38	9
59	30/M	737249	38	9.5	40	10
60	47/M	746254	42	9.7	42	10
61	25/M	758126	42.2	9.8	42	10
62	18/F	672251	37.8	8.6	38	9
63	18/M	1071806	38	8.8	38	9
64	40/M	1078812	39.4	10	40	10
65	20/M	998912	40	9.03	40	10
66	30/M	1021002	40	9.7	40	10
67	30/M	1134900	41.5	8.7	42	9
68	25/M	1082738	42	9.7	42	10
69	60/M	1134783	37.6	9.5	38	10
70	65/M	1132968	38	10	38	11
71	50/M	1021830	35.4	10.3	36	11
72	75/F	1020987	34	10.7	34	11
73	26/M	1049947	38.3	9.7	39	9
74	23/F	985424	35.2	7.9	34	8
75	60/M	1015970	38	10	38	11

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