

# Preoperative Measurement of Screw Nail Length to Make a Template For Surgery to Decrease Radiation Exposure and Surgical Time

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## Abstract

**Background:** Orthopaedic surgeons always stress the need for a proper implant patient match in trauma surgery. The implant incongruity causes discomfort inaccurate load sharing aseptic loosening. The present study was undertaken to get an interpretation of implant size as a template preoperatively to be used to prevent radiation during surgery decrease surgical complications by decreasing surgical time and get abundance availability of implant stock.

**Materials and Methods:** Qualitative data collection These data were collected from operated cases last 2 years of trauma cases

**Results:** The coin technique, preoperatively nail measurement, and the average length of the implant was collected to get an interpretation of implant size as template preoperatively to be used in trauma fixation abetted to decrease surgical time and radiation exposure.

**Conclusions:** Pre-operative measurement making template of intramedullary devices extramedullary devices by coin technique, preoperatively nail measurement and using mean data of operated cases reduces surgical time helped in reducing surgical complication and radiation exposure.

**Keywords:** Template, Radiation exposure, Implant measurement.

## Introduction

The most common cause of fractures is RTA, trivial trauma, malignancy metabolic disease. various methods are there to fix the fractures intramedullary nailing extramedullary plating external fixator cancellous screw.

Incidences of fractures- Fracture Percentage (%) collected from literature: Distal Radius (16.4), Proximal femur (14.7), Ankle (10.3), Proximal humerus (8.2), Metacarpal (7.2), Finger phalanx (5.7), Proximal forearm (5.2), Metatarsal 339 (4.9), Clavicle (3.6), Toe phalanx (3.0), Pelvis (2.6), Spine (2.5), Carpus (2.2), Proximal tibia (2.0), Humeral diaphysis (1.2), Patella 308 (1.1), Scapula (1.1), Tibia diaphysis (1.1), Midfoot (1.0), Calcaneus (0.9), Distal humerus (0.9), Distal tibia (0.8), Femoral diaphysis (0.8), Distal femur (0.8).

The idea is that gaining an accurate approach for preoperative nail and screw size planning is beneficial. It will assure implants possibility, limit intraoperative error margin, decrease radiation dose, preclude the unnecessary opening of numerous implants and decrease the operation time. Lengthy operative time increases the possibility of complication.

An increasing amount of evidence implies that surgical time is an independent and potentially controllable risk factor for

complications. There is a link between the length of surgical procedures and the number of problems. such as venous thromboembolism (VTE), bleeding hematoma formation, surgical site infection (SSI), sepsis, and necrosis across a variety of surgical procedures, which have been described in prospective and retrospective studies [2]. Radiation exposure to eyes, hands, and thyroid during fluoroscopy-assisted procedures has demonstrated that doses much lower than recommended annual occupational radiation exposures were investigated in clinical trials. research.

Annual dose limits recommended by the International Commission on Radiation Protection for "radiation workers "are skin/hands 500 mSv, eyes 150 mSv, and whole-body 20 mSv.

The use of radiation during surgery is now inevitable, but with appropriate measures, the level of radiation exposure of surgical personnel can be easily reduced. Despite increasing levels of exposure to ionizing radiation and growing concerns about radiation, orthopedic surgeons do not follow basic safety precautions [3,4].

For precontouring fixation plates in orthopedic surgery, 3D printed anatomical models have been reported to be used as templates for various complex fractures. clavicle, humeral shaft, acromion, pelvis, acetabulum, calcaneus.

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Submitted:13/01/2022; Reviewed: 27/02/2021; Accepted: 12/03/2021; Published: 10/6/2022

Trauma International ISSN 2455-538X | Available on [www.traumainternational.co.in](http://www.traumainternational.co.in) | DOI- 10.13107/ti.2022.v08i01.021

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Benefits such as significant reduction in operative time reduced bleeding, and a better understanding of fracture patterns have been reported. Two approaches are used for the development of 3D printed anatomical models for the precontouring of fixation plates: virtual planning, medical reconstruction, and fracture reduction followed by 3D printing of the model [5].

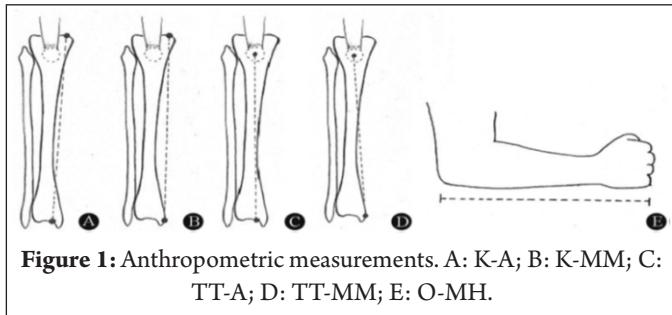
### Coin Technique

The magnification of the coin will match the magnification of the bone, depending on the distance between the source and the patient. If the distance between the bone and the X-ray is increased from 90 to 170 cm, the magnification will double from 10% to 20%. Coin of known diameter was placed on the plate on the same side of the hip to be operated. Radiographs are scaled by applying a known diameter of the prosthetic head. The coin's diameter was then measured and compared to a known size, yielding the rate of magnification for all patients using this procedure [6, 7, 8].

### Anthropometric Parameters

To improve the accuracy of nail size prediction, different TT-MM, TT-A, K-A, K-MM measurements are taken simultaneously for the tibial length. This method of preoperative planning before tibia nailing is simple, quick, and accurate. The femoral nail length is measured from the forearm to the little finger and from the greater trochanter tip to the upper pole of the patella.

The standardization of nail dimensions should help to avoid future surgical issues. Time spent in surgery and radiation exposure. This strategy could be used for surgical debriefing as well [9, 10, 11, 12].



**Figure 1:** Anthropometric measurements. A: K-A; B: K-MM; C: TT-A; D: TT-MM; E: O-MH.

### Materials and Method

Patients were enlisted regardless of sex, age, and region.

### Inclusion criteria

Age 22-60 years, common trauma cases predominantly males, number 1020 cases.

### Exclusion criteria

Dwarf, long stature, severe osteoporosis, infection, LLD, congenital disorder bowing, pelvic fractures.

### Uses

Ready-made template of size of implant screw nail prepared preoperative decreases time for measurement so it decreases the duration of surgery with less radiation exposure.

Before surgery can check measurement assures any shortage If technical issues c arm fluoroscopy failure ready-made template useful.  
In pregnancy when fluoroscopy contraindicated.  
In Life-saving surgery to do fast surgery.

### Methods

By three methods 1. Coin method 2. Nail length measurement femur tibia humerus preoperatively 3. Qualitative data collection from trauma operated cases last 2 years the mean of the data used. In this study in plating proximal and distal lengths of the screw were taken in data and in nailing the proximal and distal locking bolt data was collected. The mean of all cases was used as a reference.

The purpose of the study is to make a template of the screw, locking bolt, and nail length preoperatively so that before surgery can check the availability of implant. The study also helps in reducing surgery time in emergency surgeries lifesaving, in Pregnancy, failure of C arm. This study decreases radiation exposure.

### Results

**Table 1: Measurement of studied parameters Average Mean of each implant used**

<b>PLATING</b>				
PROCEDURE	CASES	PROXIMAL SCREW	SHAFT SCREW	DISTAL SCREW
CLAVICLE 3.5	30		14-16	
PHILOS	50	44-50		26-28
SCAPULA 3.5	5		12-14	
DISTAL HUMERUS 3.5	45	18	22	50-60 Oblique 34±2 Oblique 18±2
Near joint Medial Lateral				
SHAFT 4.5	50		24-28	
OLECRANON3.5	30	20		16 – 18
BBFA PLATING	50		12-16	
DER PLATING	100	16-18		20-24
METACARPAL	10	11		
DHS	70	85-95		38-42
PATELLA	40	24-22		12
PROXIMAL TIBIA	50	75-80	50-60	30-36
TIBIA SHAFT	50		30-36	
DISTAL TIBIA PLATING	40	28-30		40-50
LATERAL MALLEOLUS	30	16		20
<b>CANCELLOUS SCREW</b>				
PROCEDURE	CASES	PROXIMAL SCREW	SHAFT SCREW	DISTAL SCREW
NOF CCS	50		90±5	
MEDIAL MALLEOLUS	50			60
PATELLA	40		35±5	
TALUS	20	30±5	45±5	
CALCANEUM	20	Medial to lateral process 40±5; Tuberosity to facet of cuboid 75±5; Tuberosity to posterior facet 45±5		
<b>NAILING</b>				
PROCEDURE	CASES	PROXIMAL LOCKING BOLT	DISTAL LOCKING BOLT	NAIL LENGTH
HUMERUS NAIL	20	28-30	22	24
FEMUR NAILING	20	38-40	42-48	38-40
PFN	100	90-100	36-34	170
TIBIA NAILING	50	34-36	34-40 Anterior to posterior 36-34	32-36

**Table 2: NAILING Radiation exposure**

Preoperative Nail measurement by three methods	Radiation exposure TLD	Radiation exposure Time
1 min	0	0
C arm Measurement	Radiation exposure TLD	Radiation exposure Time
3 min	Hand - .27 mSv Eyes - .09mSv	3.89 min

**Table 3: PLATING Radiation exposure**

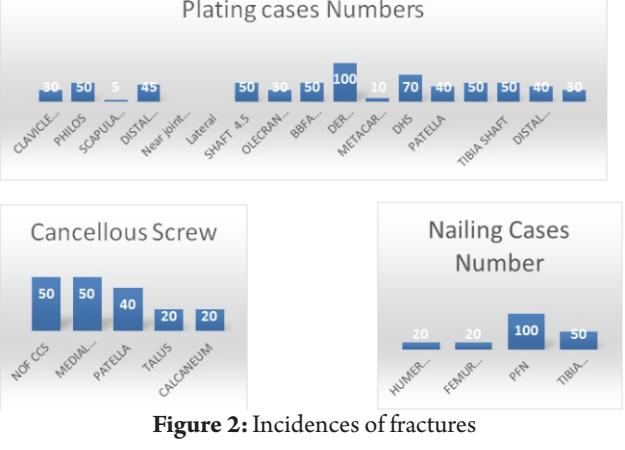
Preoperative Measurement by Two methods time	Radiation exposure TLD	Radiation exposure Time
3 min	0	0
C arm Measurement	Radiation exposure TLD	Radiation exposure Time
10 min	Hand - .37 mSv Eyes - .11mSv	8.89 min

**Table 4: NAILING Surgical time**

Procedure	Surgical Time Minutes
Preoperative Nail Bolt measurement by three methods	50
Nailing under Fluoroscopy	71

**Table 5: PLATING Surgical time**

Procedure	Surgical Time Minutes
Preoperative Plate screw measurement by three methods	59
Plating under Fluoroscopy	84

**Figure 2: Incidences of fractures****1. Preoperative Nail Bolt measurement by three methods  
2.Nailing under Fluoroscopy**

■ Procedure ■ Surgical Time Minutes

**Surgical Time Minutes**

■ Preoperative Nail Bolt measurement by three methods  
■ Nailing under Fluoroscopy

**Figure 3: NAILING Surgical time****1. Preoperative Plate screw measurement by three methods  
2.Plating under Fluoroscopy**

■ Procedure ■ Surgical Time Minutes

**Surgical Time Minutes**

■ Preoperative Plate screw measurement by three methods time  
■ Plating under C arm

**Figure 4: PLATING Surgical time****Figure 6: Coin Measurement**

### Discussion

Proper sizing and placement of the implant nail plate screw are crucial to the success of fracture union. Studies of various fracture fixation were done to study surgical time radiation exposure time and various surgical-related complications. Our study is to plan preoperative measurement of the implant to be used we studied three methods for Screw Plate Nail length measurement. First Coin method - On the same side of the hip to be operated on, a coin of known diameter was placed on the plate. The coin's diameter was then measured and compared to a known size, yielding the rate of magnification for all patients using this procedure. Second, the data was collected for all diaphyseal metaphyseal fractures fixed with extramedullary and intramedullary devices and an average of all the Nail, screw length data was collected used in the various surgery.

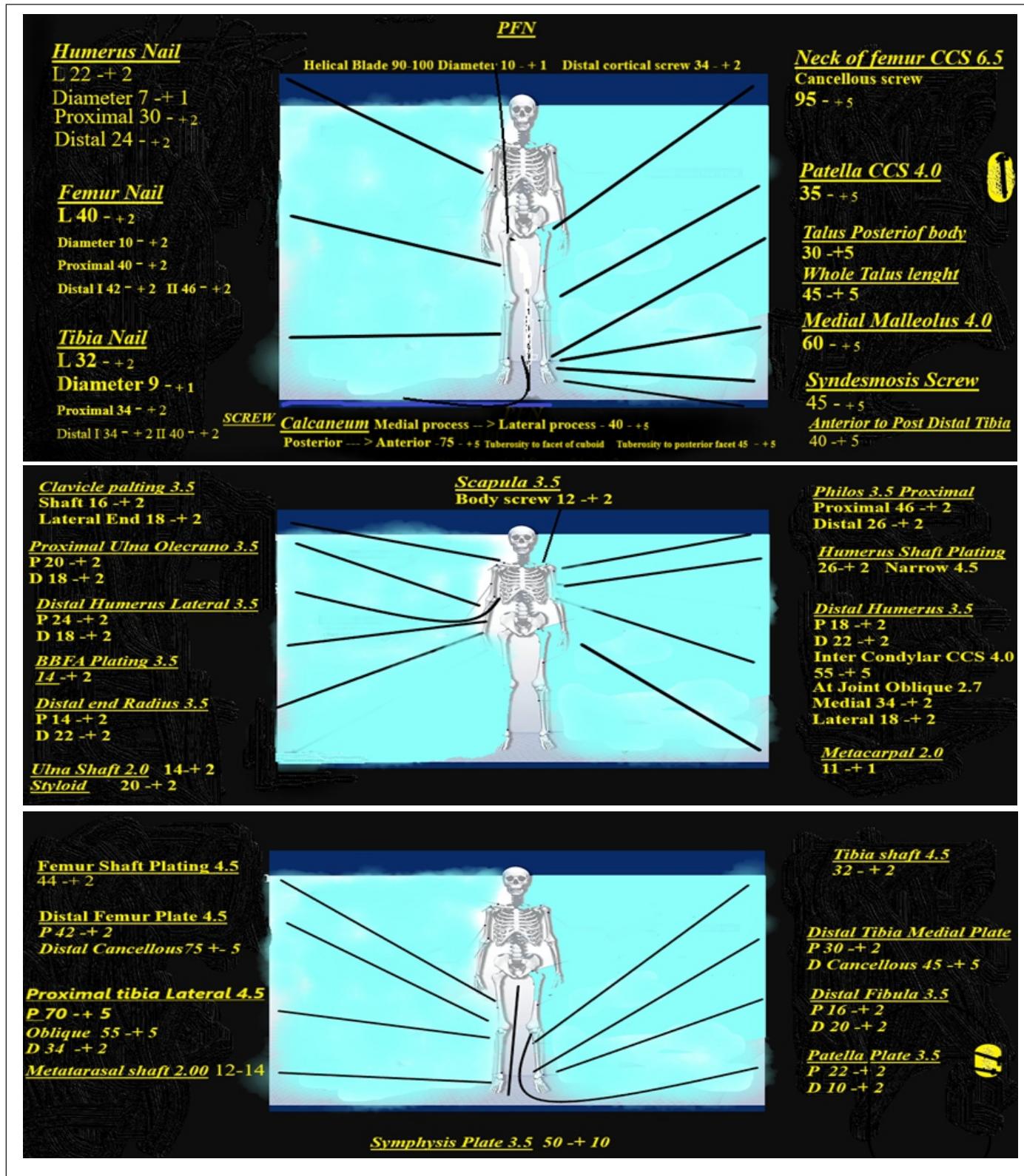


Figure 5: Summary of the average length of trauma implants Nail Screw size

Third To improve the accuracy of nail size prediction, different TT-MM, TT-A, K-A, K-MM measurements are taken simultaneously for the tibial length. Femur Humerus was also measured preoperatively. The purpose of the study to make template screw nail length preoperatively so before surgery checks the availability of the implant. The study also helps in reducing surgery time in emergency lifesaving cases pregnancy where fluoroscopy contraindicated, failure of fluoroscopy.

The advantages of using the method used to decrease the surgery time decrease the radiation exposure Assure the availability of the implant before the surgery in reciprocation it helps in a decrease rate of infection DVT and other prolonged surgery-related complications.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed

**Conflict of interest:** Nil **Source of support:** None

## Conclusion

Pre-operative measurement intramedullary and extramedullary devices by coin technique Anthropometric measurements nail measurement and using mean data of operated cases reduces surgical time and radiation exposure.

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## How to Cite this Article

Chhawra S, Jain R, Singh G, Kumar A | Preoperative Measurement of Screw Nail Length to Make Template for Surgery to Decrease Radiation Exposure and Surgical Time | January-June 2022; 8(1):01-05.