ORIGINAL ARTICLE

Correlation Between the Forearm Plus Little Finger Length and The Actual Femoral Length

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ABSTRACT

Objective: To determine the correlation between forearm plus little finger length and the actual femoral length in orthopedic patients presenting with femoral shaft fractures at a teaching hospital in Punjab.
Design: Descriptive cross-sectional study.
Place and Duration of Study: This study was conducted in the department of Orthopedic Surgery, Sir Ganga Ram Hospital, Lahore from November 2014 to June 2015.
Patients and Methods: 30 patients of both genders, aged between 18-70 years having femoral shaft fractures undergoing intramedullary nail fixation at Department of Orthopedic Surgery, Sir Ganga Ram Hospital, Lahore were included in this study. A written informed consent was obtained from every patient.
Results: The age of the patients ranged from 26 years to 59 years with a mean of 42.10±9.79 years. There were 27 (90%) male and 3 (10%) female patients in the study group. The forearm plus little finger length ranged from 38 cm to 44 cm with a mean of 40.97±2.28 cm. The actual femoral length ranged from 38 cm to 45 cm with a mean of 40.93±2.29 cm. The forearm plus little finger length correlated well (r=.970; p=.01) with the actual femoral length with a mean difference of .036. This correlation was unaffected by patient age (r=0.13, p=.183) and gender (*t*=-1.87, p=.096).
Conclusion: Forearm plus little finger length strongly correlates (r=.970; p=.01) with the actual femoral length and can be used for pre-operative determination of femoral length in the management of patients with femoral shaft fractures.

Keywords: Femoral Shaft Fracture, Intramedullary Nail, Forearm plus Little Finger Length, Actual Femoral Length, Correlation

INTRODUCTION

The worldwide annual incidence of femoral shaft fracture from road traffic collisions has been reported between 1.0 and 2.9 million being higher in low and middle income countries where it has been reported as high as 45.5 per 100,000 people per year[1].

Most common surgical option adopted in femoral shaft fractures in adults is the intramedullary nailing[2]. It offers the benefits of indirect reduction with less stripping of periosteal blood supply and preservation of soft tissues and the fracture hematoma with its bone-forming cells and factors thus enabling early mobilization, excellent fracture healing and decreased risk of infection[2,3,4].

It however requires proper preoperative evaluation of the fracture pattern, morphology, fracture comminution, extension and femoral length. Numerous direct and indirect methods for the estimation of femoral nail length have been described[5]. Direct measurement of the intact femur (from the tip of the greater trochanter to the proximal pole of patella) on the opposite side can function as a rough guide, but may be inaccurate in obese patients. The use of radiographs can resolve this issue, but implicates radiation exposure, and radiological magnification may lead to inaccuracy. Other methods comprise the use of a nail template, radio-opaque ruler, or Kuntscher ossimeter. All these methods necessitate an intact contralateral femur[5,6,7].

Lakhey et al. in 2006 described the use of pre-operative forearm plus little finger length measurement as reference for per-operative femoral length[8]. Naik et al. in 2013 showed that the forearm plus little finger length correlated well (r=0.861) with the actual femoral length[9]. Similar correlation was observed previously by Nazir et al. in 2009 (r=1)[10].

This method of pre-operative femoral length estimation is simple, radiation free, and can be applied in day-to-day practice. However, the above evidence was limited (only 2 international papers)

and there was no study in local population. Considering the limited evidence and skeletal differences among various populations[11,12], the purpose of the current study was to determine how strongly the forearm plus little finger length correlates with the actual femoral length in local population with a hope that the results of this study may thus provide a simple, easy to perform and safe method for pre-operative determination of femoral length in future patients requiring intramedullary nail fixation for femur shaft fractures.

PATIENTS AND METHODS

30 patients of both genders, aged between 18-70 years having femoral shaft fractures (5cm distal to lesser trochanter to supracondylar region) undergoing intramedullary nail fixation at Department of Orthopedic Surgery, Sir Ganga Ram Hospital, Lahore were included in this study.

Sample size was calculated with 80% power of test, 5% significance level and taking expected correlation between the forearm plus little finger length and the actual femoral length to be r=0.861[9]. Patients with congenital or acquired deformity of the limbs and those with comminuted fractures where loss of bone length was suspected were excluded from the study.

A single resident doctor measured both the lengths. Actual femoral length was measured in centimetres from the tip of the greater trochanter to the level of proximal pole of the patella over the outer aspect of thigh while the thigh was slightly flexed and adducted to make the greater trochanter more prominent. Forearm plus little finger length was measured in centimetres from the tip of the olecranon to the tip of the little finger while the elbow was flexed to 90º and the wrist and fingers were in a neutral position.

RESULTS

The age of the patients ranged from 26 years to 59 years with a mean of 42.10±9.79 years as shown in Table 1. There were 27 (90%) male and 3 (10%) female patients in the study group as shown in Table 2.

Table 1: Descriptive statistics for age (in years)

	n	Minimum	Maximum	Mean	Std. Deviation
Age	30	26	59	42.10	9.792
Valid n (listwise)	30				

Table 2: Frequency table for gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	27	90.0	90.0	90.0
	Female	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

Figure 1: Linear correlation between the forearm plus little finger length and the femoral length

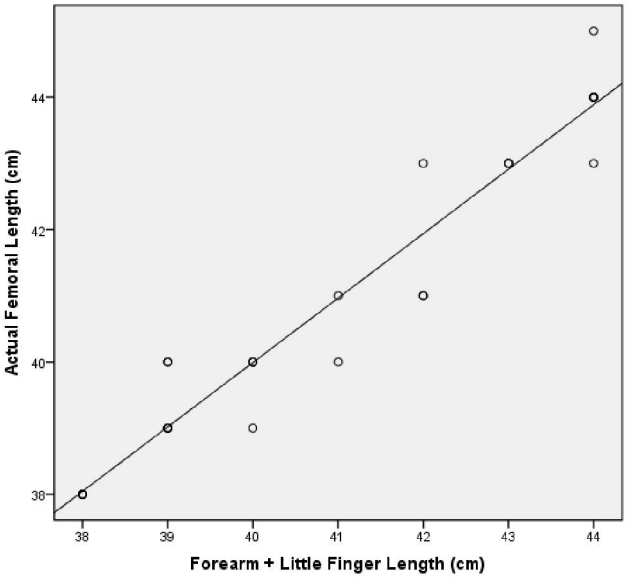

Table 3: Descriptive statistics and correlation between forearm plus little finger length and actual femoral length

	n	Minimum	Maximum	Mean	Std. Deviation	Mean Difference	Sig. (2-tailed)	Pearson Correlation
Forearm + Little Finger Length (cm)	30	38	44	40.97	2.282	.036	.01	.970**
Actual Femoral Length (cm)	30	38	45	40.93	2.288			
Valid n (listwise)	30							

**Correlation is significant at the 0.01 level (2-tailed).

The forearm plus little finger length ranged from 38 cm to 44 cm with a mean of 40.97±2.28 cm. The actual femoral length ranged from 38 cm to 45 cm with a mean of 40.93±2.29 cm as shown in Table 3. The forearm plus little finger length correlated well (r=.970; p=.01) with the actual femoral length with a mean difference of .036 (-.174 to .241) as shown in Table 3 and Figure 1.

This correlation between forearm plus little finger length and actual femoral length was not affected by patient age (r=0.13, p=.183) and gender (*t*=-1.87, p=.096) as shown in Table 4.

Table 4: Effect of age and gender on correlation between forearm plus little finger length and actual femoral length

Variable	Analysis
Age	r=0.13, p=.183
Gender (Male/ Female)	*t*=-1.87, p=.096

DISCUSSION

Determination and placement of properly sized intramedullary nail is of crucial importance as a longer nail will protrude out and will impinge on the soft tissue causing pain, bursitis and restriction of normal movement where as a shorter nail will not provide adequate stability and may lead to stress fracture[13,14]. Forearm plus little finger length is a simple, radiation free, and easy to apply method for pre-operative estimation of proper nail length[8,9,10]. In the present study, the mean forearm plus little finger length was 40.97±2.28 cm while Naik et al. (2013)[9] reported it to be 39.87±2.73 cm in Indian population. Mean actual femoral length in the present study was 40.93±2.29 cm while Naik et al.[9] observed it to be 39.85±2.44 cm. The forearm plus little finger length correlated well (r=.970; p=.01) with the actual femoral length with a mean difference of .036 (-.174 to .241). Similar correlation was observed previously by Naik et al. in 2013 (mean difference=0.028; r=0.861)[9] and Nazir et al. in 2009 (mean difference=0.16; r=1)[10]. This correlation was unaffected by patient age (r=0.13, p=.183) and gender (*t*=-1.87, p=.096) making it method of choice in all ages and both genders.

Thus forearm plus little finger length is an effective method for pre-operative determination of femoral length. It is easy to perform and safe. However, a very important limitation to our study was the limited sample size of 30 cases. There is need to repeat this study with larger sample size to further confirm the results.

CONCLUSION

Forearm plus little finger length strongly correlates (r=.970; p=.01) with the actual femoral length and can be used for pre-operative determination of femoral length in the management of patients with femoral shaft fractures.

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