



# Reamer Irrigator Aspirator Intraoperative Ruler Accuracy of Femoral Isthmus Diameter

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## Introduction

Over the past two decades, bone graft harvest with the Reamer Irrigator Aspirator (RIA) from the femoral canal has grown in popularity. Intra-operative measurement of the femoral canal is taken with a metallic ruler (RIA ruler) in conjunction with C-arm fluoroscopy.

## Purpose

- Our study aims to evaluate the accuracy of the RIA ruler in judging the femoral canal diameter compared to two other measurements.

## Methods

Utilizing 6 fresh frozen human cadavers, each cadaveric femur is imaged in the operative suite in the supine position with C-Arm fluoroscopy. The femoral diameter is then measured with the RIA ruler in AP and lateral plane at all three reference points by multiple surgeons. CT scans of each individual femur were then performed. The cadaveric femurs were then transected at all the guide pins and direct caliper measurements were taken in the AP and Lateral plane.

## Results

There was no significant difference in mean AP diameter measured by CT canal measurement and Canal Caliper measurement ( $p=0.6276$ ) (Table 1). However, the lateral differed significantly between the CT canal and canal caliper measurements (14.606mm vs 11.947mm) respectively. Our AP measurements using the RIA ruler were similar to those of both the CT canal and canal caliper (13.000mm vs 12.167mm vs 12.439mm) respectively. Additionally, our lateral measurements were very similar between the RIA ruler and CT canal (14.644mm vs 14.606mm), however lateral RIA ruler measurements were significantly different than the canal caliper method (14.644mm vs 11.947mm) (Table 1). Only the fellow's RIA measurements were significantly different from CT or canal caliper measurements ( $p=0.0090$  and  $p=0.0392$ ) (Table 2). We accurately predicted the canal size using the RIA ruler 89.99% of the time in the AP plane, and 87.78% in the lateral plane.

Femoral isthmus diameter measured by different measurement systems			
Type of Measurement	Location Mean $\pm$ SD		
	AP	Lateral	Mean (AP & Lateral)
RIA	13.000 $\pm$ 1.649	14.644 $\pm$ 1.456	13.817 $\pm$ 1.391
CT Canal	12.167 $\pm$ 1.619	14.606 $\pm$ 1.533	13.386 $\pm$ 1.323
Canal Caliper	12.439 $\pm$ 1.722	11.947 $\pm$ 1.777	12.193 $\pm$ 1.561

  

Percentage of correct measurement ( $\pm 2.5$ mm) by surgeons (RIA measurement) according to CT canal measurement			
Observer	CT Canal Measurement n (%)		
	AP	Lateral	Mean
<b>Senior Attending</b>			
Yes	17 (94.44)	14 (77.78)	17 (94.44)
No	1 (5.56)	4 (22.22)	1 (5.56)
<b>Junior Attending1</b>			
Yes	17 (94.44)	16 (88.89)	17 (94.44)
No	1 (5.56)	2 (11.11)	1 (5.56)
<b>Junior Attending2</b>			
Yes	16 (88.89)	16 (88.89)	17 (94.44)
No	2 (11.11)	2 (11.11)	1 (5.56)
<b>Fellow</b>			
Yes	15 (83.33)	17 (94.44)	16 (100.00)
No	3 (16.67)	1 (5.56)	-
<b>Resident</b>			
Yes	16 (88.89)	16 (88.89)	16 (88.89)
No	2 (11.11)	2 (11.11)	2 (11.11)

**Figure 1.** Tables demonstrating femoral isthmus diameter measured by different measurement systems and the percentage of correct measurements by surgeons.

## Discussion

Our findings suggest measurements (and subsequent reamer head selection 1.5 mm over the measurement) fall within the manufacturers upper limit of 2.5mm and can be consistently made using the RIA ruler. However these measurements approach the upper end of this threshold, therefore a more robust, accurate method of measuring femoral canal width is needed. By drawing attention to the inadequacies of the current measurement system, our hope is a new effective measurement tool will decrease the risk of femur fracture, decrease blood loss and help eliminate excess cost related to multiple reamer head use due to incorrect initial reamer head choice.

## Conclusion

- Our results suggest we are able to reliably estimate the femoral canal size near the isthmus with the RIA ruler on both the AP and Lateral images compared to the CT scan measurement