



# VARIABILITY OF THE POSTERIOR CONDYLAR ANGLE

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8<sup>th</sup> International Symposium

TOTAL KNEE  
ARTHROPLASTY

Cracow 8-10 Oct 2015  
POLAND



# Introduction

Correct positioning of implants is very important factor for clinical success of TKA.

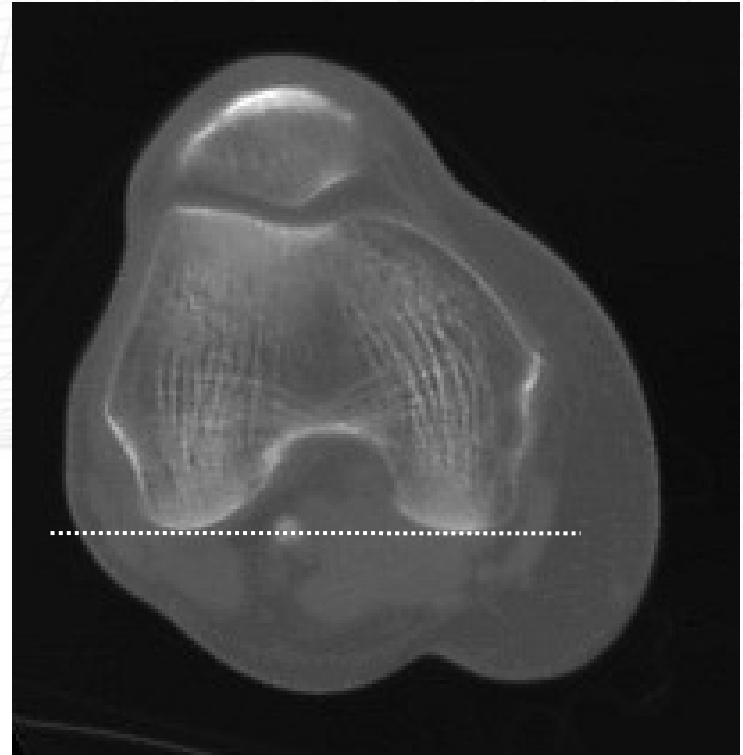
Rotational malalignment of the femoral component has been associated with:

- ❑ anterior knee pain
- ❑ abnormal patellar tracking / subluxation
- ❑ excessive pressure on the lateral femoral condyle
- ❑ increased implant wear and loosening

# Introduction

The correct rotational position of implants can be established with different techniques:

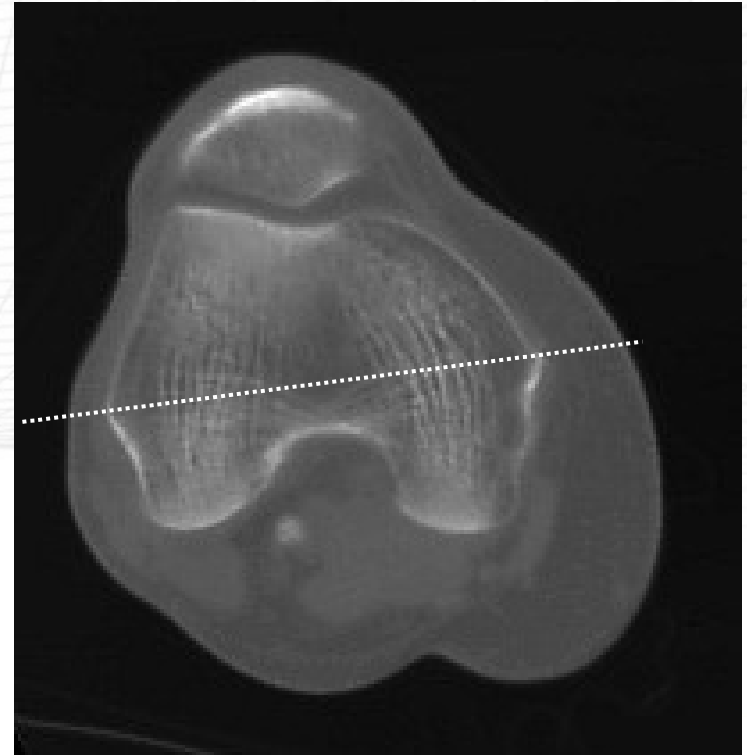
 ***Posterior Condylar Line***



# Introduction

The correct rotational position of implants can be determined with different techniques:

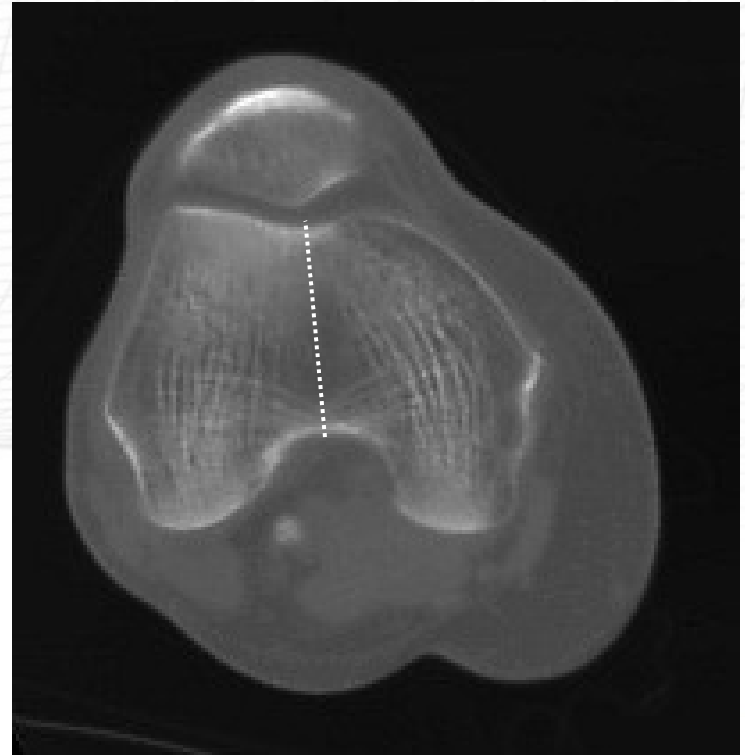
- ❑ Posterior Condylar Line
- ❑ ***Transepicondylar Line***



# Introduction

The correct rotational position of implants can be determined with different techniques:

- ❑ Posterior Condylar Line
- ❑ Transepicondylar Line
- ❑ ***Whiteside's Line***





# Introduction

The Posterior Condylar Axis is relatively easy to establish intraoperatively.

Most TKA systems include instruments with femoral resection block inserted tangentially to the posterior surface of the femoral condyles (*posterior-referencing*).



# Introduction

The anterior bone cut is usually made in 3° of external rotation relative to the posterior aspect of the femoral condyles (~ parallel to the Transepicondylar Axis and the flexion-extension axis of the knee).

The external rotation has to be increased when the lateral femoral condyle is hypoplastic or there are bone defects in the condyle.

The rotation has to be decreased when there are bone defects and/or hypoplasia of the medial condyle.



# Introduction

**The aim of our study** was to assess the variability of the Posterior Condylar Angle - i.e. how much this angle could be different from the standard  $3^\circ$  of external rotation.

We tried to identify factors which could influence this variability:

- age
- gender (sex)
- body height
- body weight (BMI)





# Material and Methods

The study was performed in cooperation with the Department of Non-Invasive Cardiovascular Diagnostic Studies, Górnośląskie Centrum Medyczne, Medical University of Silesia in Katowice.

The study group included 75 patients (24 females, 51 males), aged  $> 60$ , who underwent an Angio-CT study between Jan 2012 and Dec 2014, due to a suspected aortic disease or lower limb artery disorder.



# Material and Methods

## Inclusion criteria:

- ❑ age > 60 years
- ❑ patient has given informed consent for the study
- ❑ aorta and arteries visualised down to the ankles

## Exclusion criteria:

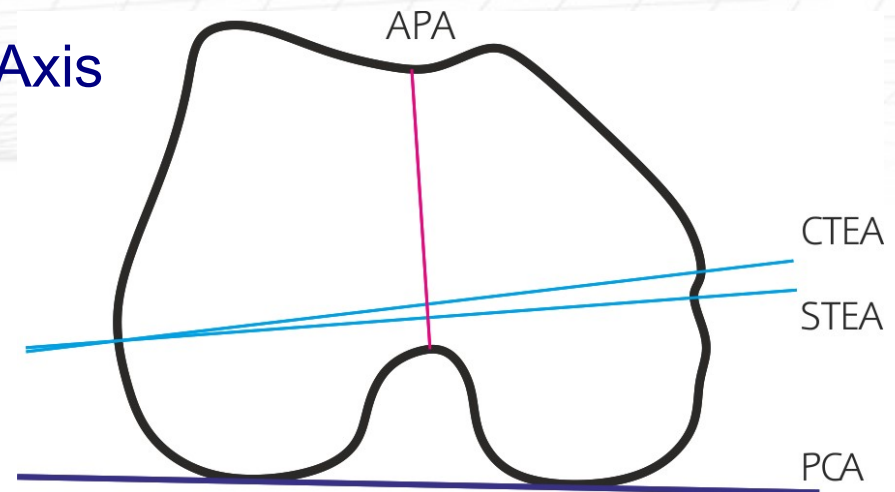
- ❑ past surgery of the knee, distal femur or proximal tibia
- ❑ severe OA of the knee (Kellgren-Lawrence grade 4)
- ❑ past vascular surgery of the aorta or lower limb vessels
- ❑ significant stenosis of any lower limb artery
- ❑ aneurysm-like widening of the popliteal artery

# Material and Methods

Scans were obtained in the transverse planes at 2 mm slices. The patients were lying supine with their hips and knees in full extension.

In each knee we identified:

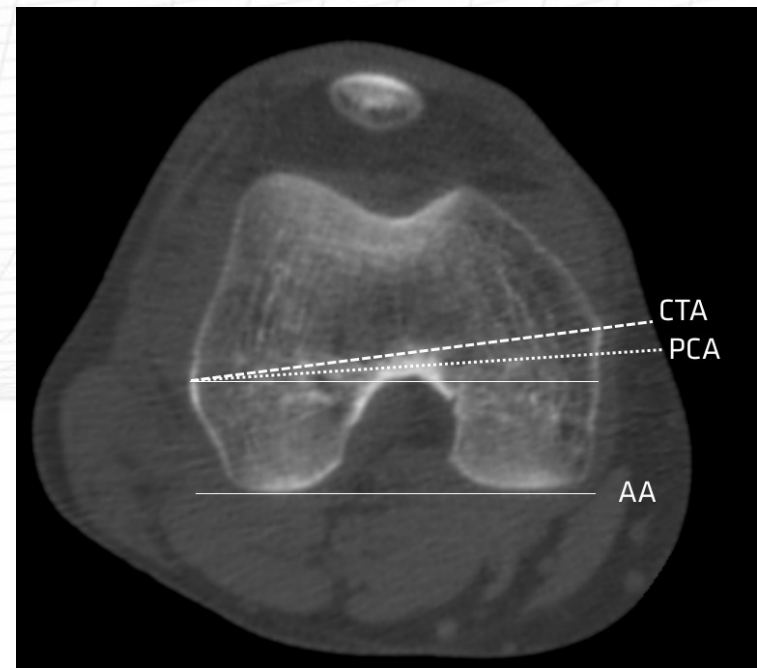
- Posterior Condylar Axis
- Surgical Transepicondylar Axis



# Material and Methods

## Radiographical Measurements

- ❏ **Posterior Condylar Angle**  
(between the surgical TEA and the Posterior Condylar Axis)





# Material and Methods

## Anthropometric Parameters:

- 📦 age
- 📦 gender (sex)
- 📦 body height
- 📦 body mass index (BMI)



# RESULTS



# Results

## The Anthropometric Parameters

Female Patients were significantly shorter (160.8 cm vs. 169.9 cm;  $p < 0.001$ ) and weighted less than men (69.5 kg vs. 79.0 kg;  $p = 0.012$ ).

No statistically significant differences were found with regard to age or the BMI.



# Results

The mean ***Posterior Condylar Angle*** was  $2.7 \pm 2.1^\circ$  (F:  $3.0 \pm 2.1^\circ$  M:  $2.6 \pm 2.0^\circ$ , differences not statistically significant).

The measurements were highly symmetrical (no statistically significant differences between the right and the left knees).





# Results

## The Correlations

There were no statistically significant correlations in the male subgroup.

In the female subgroup we found some correlations between height/weight the Posterior Condylar Angle

**height vs. PCA (left)  $r= 0.3779$   $p= 0.0343$**

**weight vs. PCA (left)  $r= 0.3489$   $p= 0.0474$**



# DISCUSSION



# Discussion

Our Results (avg.  $2.7 \pm 2.1^\circ$ ; F:  $3.0 \pm 2.1^\circ$  M:  $2.6 \pm 2.0^\circ$ )  
compared to previous studies

Values of the Posterior Condylar Angle reported in previous studies			
Author and year of publication	Women	Men	Overall
Berger R, 1993	$0.3 \pm 1.2^\circ$	$3.5 \pm 1.2^\circ$	N/A
Poivache P, 1996	$3.6 \pm 1.9^\circ$	$3.6 \pm 2.2^\circ$	$3.6 \pm 2.0^\circ$
Griffin F, 1998	$3.7 \pm 2.6^\circ$	$3.6 \pm 1.8^\circ$	$3.7 \pm 2.2^\circ$
Yoshino N, 2001	N/A	N/A	$3.0 \pm 1.6^\circ$
Akagi M, 2005	N/A	N/A	$4.2 \pm 2.2^\circ$
Asano T, 2005	N/A	N/A	$3.1 \pm 1.7^\circ$
Aglietti P, 2008	$2.8 \pm 1.7^\circ$	$2.1 \pm 1.6^\circ$	N/A



# Discussion

The average values of the Posterior Condylar Angle were consistent with previous studies.

The standard deviation was relatively high compared to the arithmetic mean.

Posterior Condylar Angle ranged from  $3.6^\circ$  of internal rotation to  $9.0^\circ$  of external rotation.

In two-thirds of the knees the Posterior Condylar Angle would fall between  $0.6^\circ$  and  $4.8^\circ$  of external rotation.



# Discussion

The values of the Posterior Condylar Angle reveal a high degree of symmetry between the left and the right side.

Previous studies have not investigated this in detail.

This near-perfect symmetry may suggest that dispersion of the measured values is mostly caused by anatomical variations between individuals.

The revealed symmetry of measurements could be used for preoperative planning.



# Discussion

Most of the published studies have not investigated the correlation between the Posterior Condylar Angle and anthropometric factors (body height, weight, BMI).

We found no such correlations in the male subgroup. The female subgroup revealed a medium-strength correlation between height and body weight and Posterior Condylar Angle. These correlations were rather inconsistent and usually noted only for one side of the body, despite high level of symmetry of the measurements.

# CONCLUSIONS



# Conclusions

1. Positioning of the femoral component parallel to the transepicondylar line (flexion-extension axis) requires resecting the femur at  $\sim 3^\circ$  of external rotation relative to the line tangential to the posterior surface of the femoral condyles.

This angle, however, may vary from  $3.6^\circ$  of internal rotation to  $9.0^\circ$  of external rotation. Femoral resection guides should allow for adjustment in that range.





# Conclusions

2. The Posterior Condylar Angle shows a near-perfect symmetry between the limbs, which could be used in pre-operative planning when the operated limb is markedly deformed.



# Conclusions

3. In female patients, height and body weight may influence the Posterior Condylar Angle, but these correlations would require further studies on larger groups of patients.



# THE END

Thank You  
for Your Attention

See You  
in Katowice !

   KATOWICE, 04 grudnia 2015

POLISH SHOULDER CLUB MEETING  
**15 LAT KATEDRY I KLINIKI**  
ORTOPEDII I TRAUMATOLOGII NARZĄDU RUCHU SUM  
oraz POLSKO-FRANCUSKIE SYMPOZJUM  
**CHIRURGIA BARKU**

od artroskopii do endoprotezoplastyki pierwotnej i rewizyjnej