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Anatomical Course of the Popliteal Artery in Unicompartmental Knee Arthroplasty

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COI Disclosure

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Complication of Unicompartmental Knee Arthroplasty

- ✓ Postoperative infection
- ✓ Polyethylene wear
- ✓ Dislocation of bearing
- ✓ Fracture of medial tibial compartment
- ✓ Degenerative changes in the lateral compartment

Vascular injury

Popliteal artery injury is extremely rare but represents a serious complication.

➤ This is because the popliteal artery is known to pass laterally to the center of the tibia

However, there have been a few reports of the vascular injury occurring intra-operatively or post-operatively during UKA

Purpose

The purpose of this study was to evaluate the *position of the popliteal artery (PA) on MRI images at the level of tibial osteotomy in UKA* case



We hypothesized that there are cases in which the PA runs medial to the center of tibia



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Methods

Study period : January 2020 to March 2024

Target cases : patients who underwent medial UKA at our hospital

189 cases **213** knees

male **61** cases / female **128** cases

cases in which the PA could be visualized on axial
plain MRI images were selected

154 cases **172** knees

male **51** cases / female **103** cases



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Evaluation of alignment using X-ray images



- Hip Knee Ankle Angle(**HKAA**)
- mechanical Lateral Distal Femur Angle (**mLDFA**)
- medial Plateau Tibia Angle (**MPTA**)



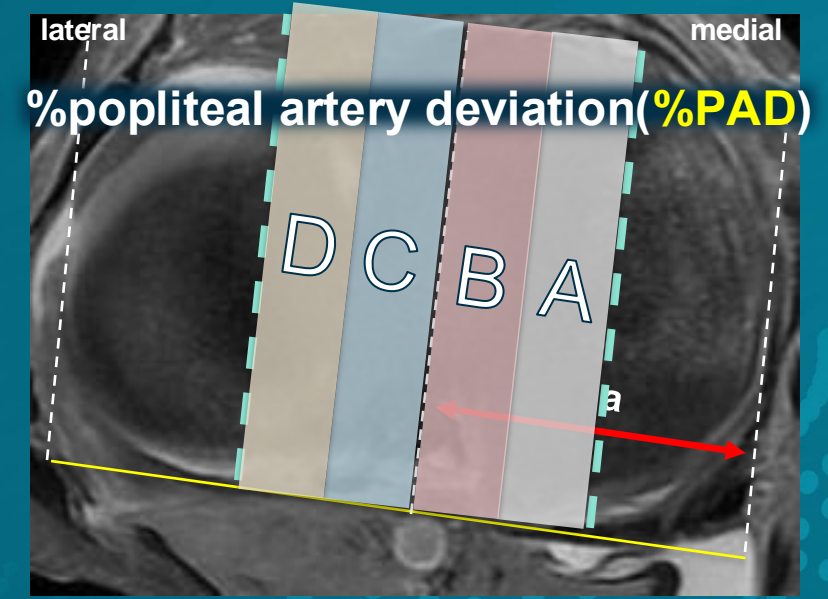
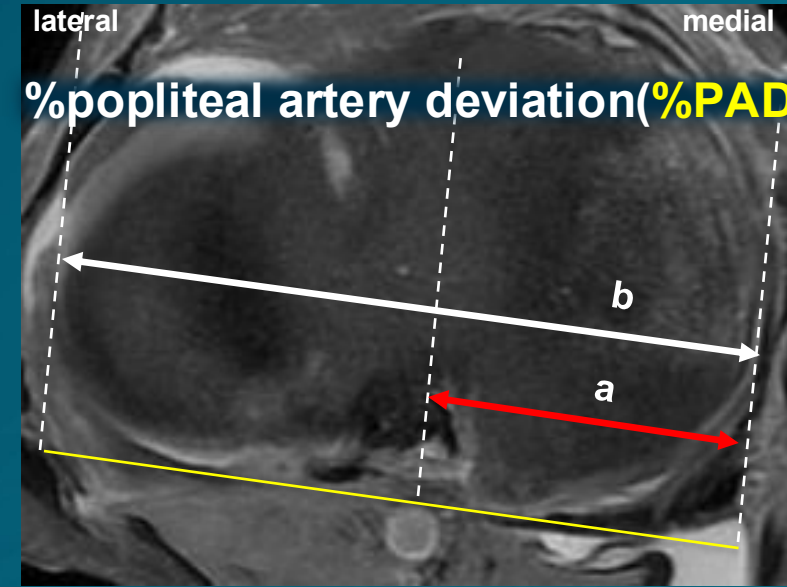
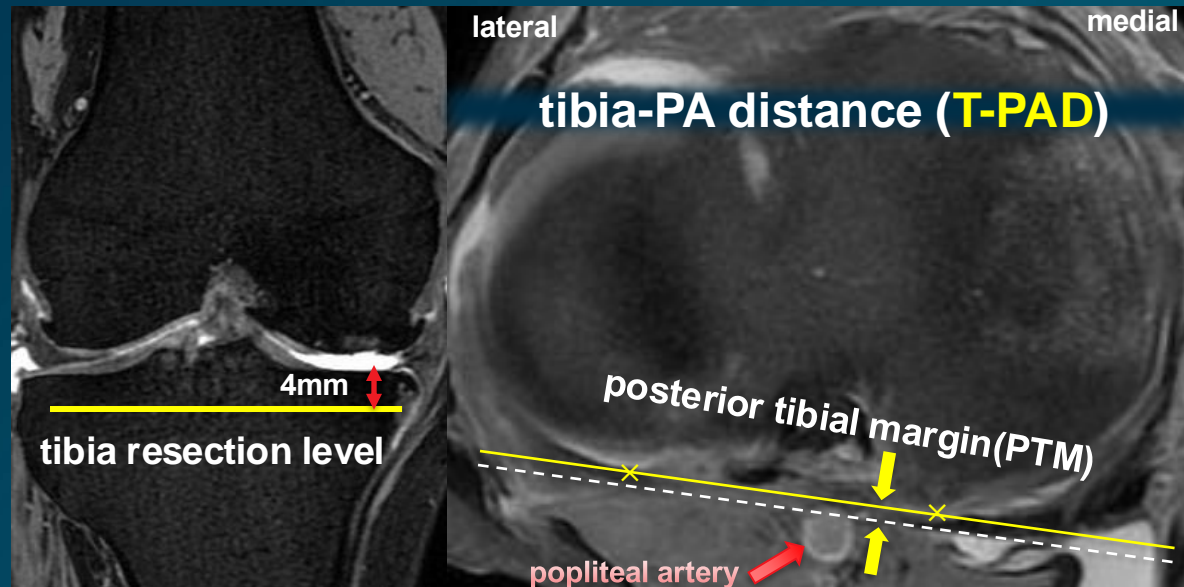
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Evaluation of the popliteal artery (PA) position using MRI



PTM : Medial and lateral posterior tibial tangents at the UKA resection level

T-PAD : Distance from the PTM to the anterior wall of the popliteal artery

%PAD : The popliteal artery position was expressed as a percentage from the medial (0%) to lateral malleolus (100%) based on a perpendicular from the PTM.

Zone classification

zone	
A	25-37.5%
B	37.5-50%
C	50-62.5%
D	62.5-70%

%PAD was divided into zones as shown in the figure, with zone **A** and **B** defined as “**medial**”

Popliteal artery position and limb alignment

MRI evaluation

- ☐ T-PAD
- ☐ %PAD

Statistical analysis

Radiographic evaluation

- ☐ HKAA
- ☐ mLDFA
- ☐ MPTA

- ☐ Mann Whitney U test
- ☐ Spearmans's correlation coefficient

Statistical significance was set at <0.05 .



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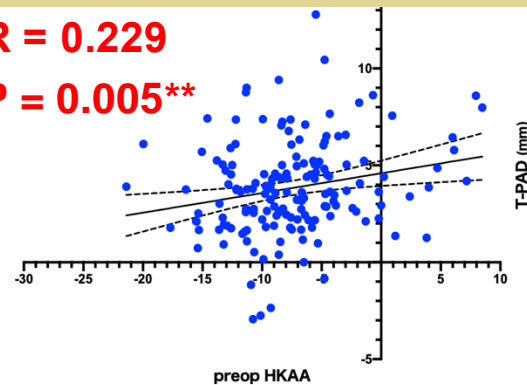
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Results

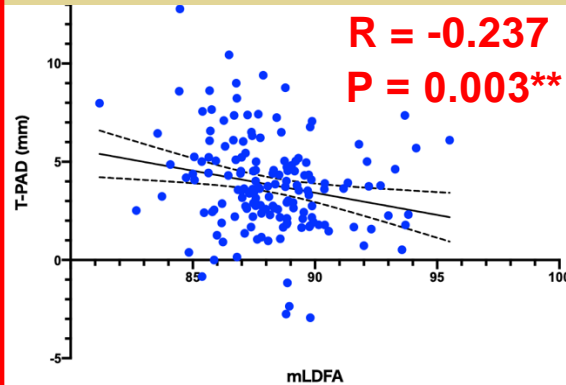
HKAA vs T-PAD

$R = 0.229$
 $P = 0.005^{**}$



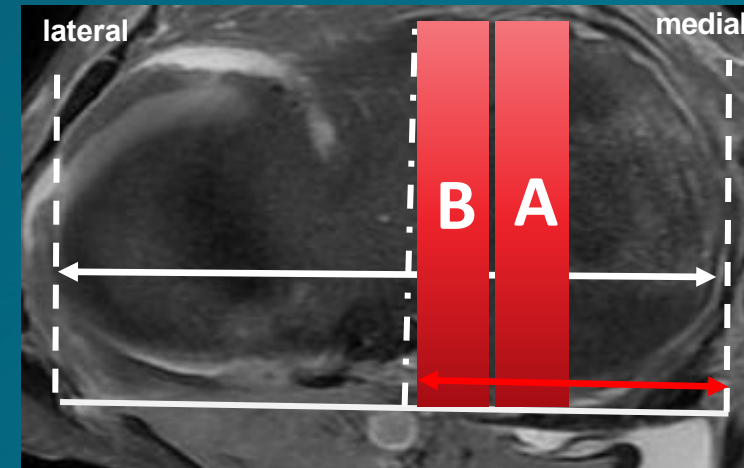
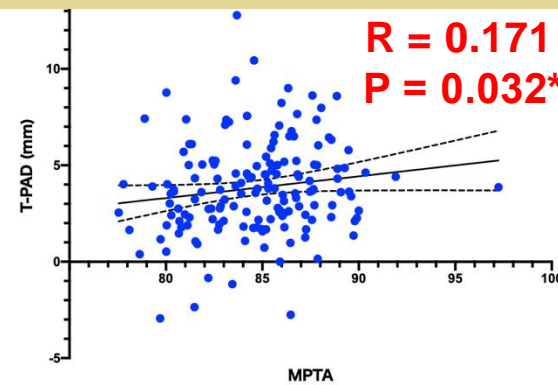
mLDFA vs T-PAD

$R = -0.237$
 $P = 0.003^{**}$



MPTA vs T-PAD

$R = 0.171$
 $P = 0.032^{*}$



Knee

n=172

ZoneA

6 (3.4%)

ZoneB

73 (42.4%)

ZoneC

82 (47.7%)

ZoneD

11 (6.72%)

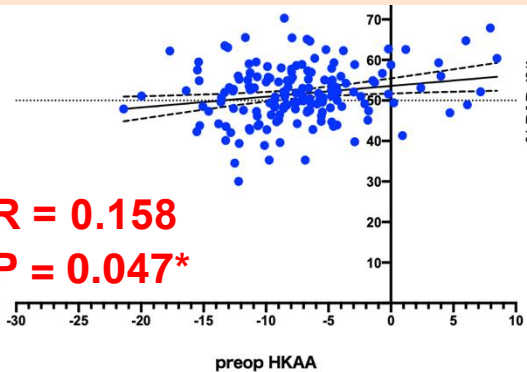
45%

medial

lateral

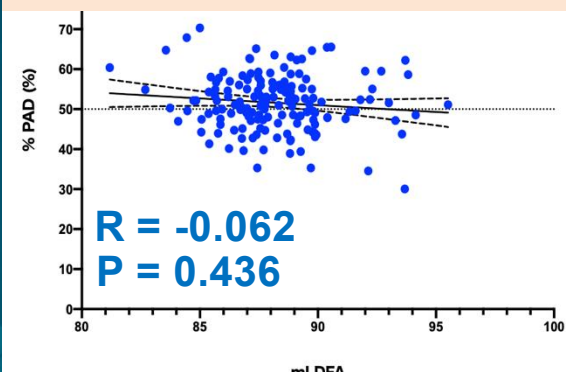
HKAA vs %PAD

$R = 0.158$
 $P = 0.047^{*}$



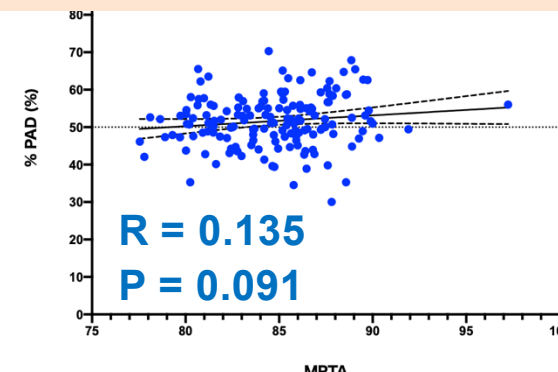
mLDFA vs %PAD

$R = -0.062$
 $P = 0.436$



MPTA vs %PAD

$R = 0.135$
 $P = 0.091$



Statistical significance was set at <0.05 .

□ T-PAD was correlated with HKAA, mLDFA, MPTA.

□ %PAD was correlated with HKAA.

□ Approximately **45%** of the cases showed a **medially positioned** course of the popliteal artery.

Discussion

- Yang D et al. found that the neurovascular bundle runs lateral to the tibial posterior midline with major branches located 5.5-6.0cm distal to the joint line, indicating a safe zone in the posterior medial tibia.
- Ninomiya et al. also reported, based on MR angiography of 50 cadaveric knees, that the popliteal artery is positioned laterally.

However, these studies were limited to healthy subjects and excluded osteoarthritic cases.

This study focused on patients with ***medial knee osteoarthritis*** and found ***positive correlation*** between ***HKA*** and the ***distance to the popliteal artery***.



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Discussion

□ Hamashima et al. investigated the course of the popliteal artery in patients undergoing total knee arthroplasty and high tibial osteotomy, and reported that the artery is *closer to the tibia at the joint level* with a higher risk of injury in *females* than in males.

This study

- In this study, no significant differences in T-PAD or %PAD were found between males and females .
- However, zone analysis showed a tendency for the popliteal artery to run more medially in males than females.

Knee All n=172			men group n=56	female group n=116
<i>medial</i>				
ZoneA	3 (5.9%)	50%	3 (2.6%)	44%
ZoneB	25 (44.6%)		48 (41.4%)	
<hr/>				
<i>lateral</i>				
ZoneC	26 (46.4%)		56 (48.3%)	
ZoneD	2 (3.6%)		9 (7.8%)	
T-PAD	3.73±2.66		3.88±2.30	
%PAD	51.21±5.89		51.81±7.41	

Conclusion

- The relationship between the position of the popliteal artery and lower limb alignment as investigated in 172 knees.
- As the lower limb alignment became more varus, the popliteal artery was located closer to the posterior surface of the tibia
- In approximately 45% of cases, the popliteal artery ran medially relative to the tibia.



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