Is flexed knee study useful in popliteal artery angioplasty?

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Disclosure

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I have the following potential conflicts of interest to report: consulting, travel reimbursement, teaching courses, training, proctoring:

- Medtronic
- Boston Scientific
- Abbott
- LimFlow
- Terumo
- Cook
- Biotronik
- Asahi
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1. Forces acting on FEM-POP tract

2. Flexed knee patterns of POP artery

3. Is flexed knee study useful in POP-PTA?
Conclusions

Significant changes in length, curvature, and twist occur in the PA and significant but more modest changes in length and twist occur in the SFA during movement from the straight-leg and crossed-leg position.
Conclusion

3D arterial bending, torsion and compression in the flexed lower limb are highly localized and are substantially more severe than previously reported.

Cadaver study

Fig. 3. Representative measurement of 3D bending as radii of inscribed spheres.
3. Conclusion

- The popliteal artery is exposed to significant deformations during flexion of the knee joint.

- The severity of calcification directly affects curvature, but not arterial length or twisting angles.

Figure 1 ◆ Positioning of the leg during 3D rotational angiography: straight (A) and flexed (B) with the help of a cast designed to simulate the walking condition.
Conclusions

- Heterogeneous study designs that confound interpretation.
- Different physiologic settings: young/mature, with/without disease, and cadavers.
- Although this work has been valuable and significant, there are many limitations with the currently available data such that all we know about the SFA/PA environment is that we don’t know.
1. The FEM-POP segment is subject to continuous and important mechanical forces that need to be carefully considered, as they weigh heavily on the outcome of endovascular treatments.

2. With regard to what to do to control these forces, the only thing that literature can tells us is: "I know I do not know"
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Dynamic modifications of the popliteal arterial axis in the sagittal plane during flexion of the knee

P. Vernon, JF. Delattre, EJ. Johnson, JP. Palot and C. Clément

...two fixed points: a cranial fixed point, represented by the origin of the descending artery of the knee, and a caudal fixed point represented by the origin of the anterior tibial artery.

Figs. 6-7
6. The cranial fixed point: the descending genicular artery (A) marks the cranial fixed point. It stabilizes the popliteal axis at this level by perforating the aponeurosis of the adductor canal after a short course. 7. The caudal fixed point: the origin of the anterior tibial artery (B) enters the tibio-fibular space and straddles the interosseous membrane. The bifurcation acts against the free edge of this membrane and acquires connective tissue bonds with it that stabilize the arterial system at this level.
Standard AP projection: Extended knee

Latero-lateral projection: Flexed knee
Every popliteal artery is different depending on:

- Residual elastic properties
- Stiffness and calcification
- Extension of the disease
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2. Mechanical behavior of POP artery
3. Is flexed knee study useful in POP-PTA?
Never flex the knee with a wire inside!

A stiff 0.018” wire is in and the vessel is abnormally straightened

No wire: “natural” atherosclerotic upper popliteal kinking
POP-case 1

**Patient data**
- Male, 73 yy old
- Type 2 DM
- Toes gangrene
Flexed knee study
Extended knee: good result

Flexed knee: obstruction!
Stenting:

Self-expandible nitinol stent 5 x 30 mm
Stenting modified the geometry of POP artery in flexion
Patient data

• Female, 74 yy old
• Type 2 DM
• Rutherford 3, severe claudication
In our experience the latero-lateral flexed knee study of popliteal artery is very useful in testing the acute result of popliteal artery angioplasty.
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