Comprehensive Assessment of Human Accessory Renal Artery Peri-Arterial Renal Sympathetic Nerve Distribution

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Disclosure Statement of Financial Interest

I, [Yu Sato] DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

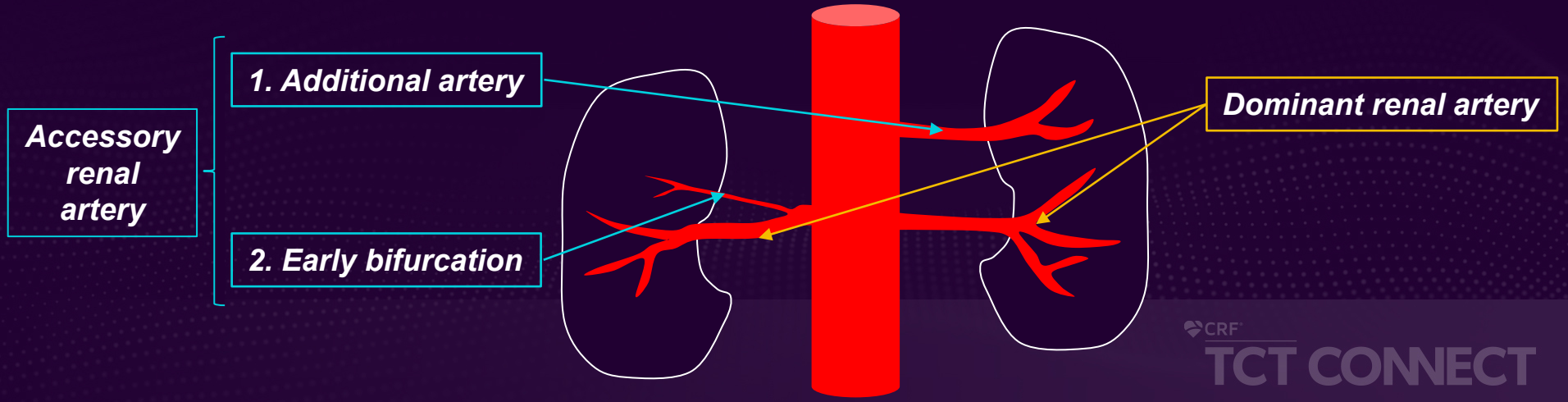
Background

- ✓ Accessory renal arteries (ARA) have been reported about 30% of patients.
- ✓ Some renal denervation (RDN) clinical trials excluded patients with ARAs, while others included such patients but excluded those with ARAs less than 3 or 4 mm in diameter.
- ✓ Some studies have suggested that RDN for ARAs may have an additional advantage of blood pressure reduction[1-3].
- ✓ The aim of this study was to evaluate the anatomic distribution of peri-arterial nerves in human ARAs.

1. Zhao XY et al. Genet Mol Res 2015.
2. Id D et al. JACC Cardiovasc Interv 2013.
3. De Jong MR et al. Hypertension 2016.
4. VonAchen P et al. Cardiovasc Rev Med 2016.

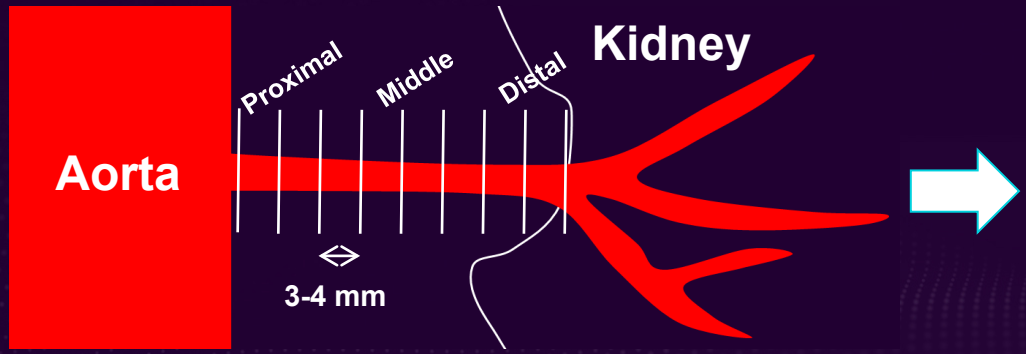
Methods: definition of renal arteries

- ✓ ***Accessory renal artery (ARA)*** **was defined as follows:**
  1. **An artery that arose from the aorta above or below the main renal artery *(additional artery)***
  2. **A renal artery that bifurcated within 20 mm of the take-off of the main renal artery *(early bifurcation)***
- ✓ ***Dominant renal artery (DRA)*** **was defined as an artery that perfused >50% of the kidney.**

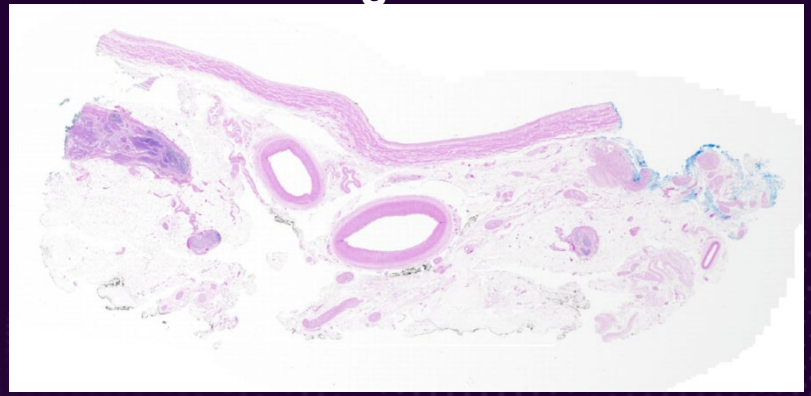


Methods: pathologic procedures

- ✓ The gross observation and post-mortem angiography (limited cases) were performed in human autopsy subjects.
- ✓ Renal arteries were perfusion-fixed under physiologic pressure with 10% buffered formalin.

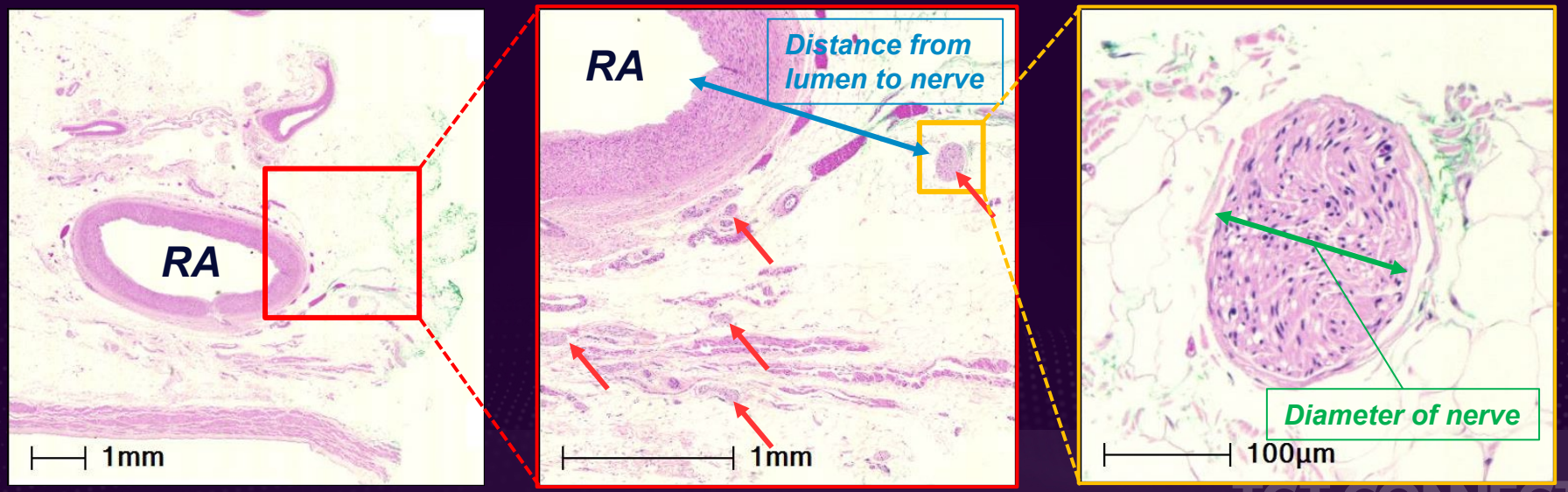


Histologic section



Methods: Morphometric assessment

- ✓ *Number of nerves*
- ✓ *Distance from lumen to nerve*
- ✓ *Diameter of nerve*



*Red arrows indicate peri-arterial nerves

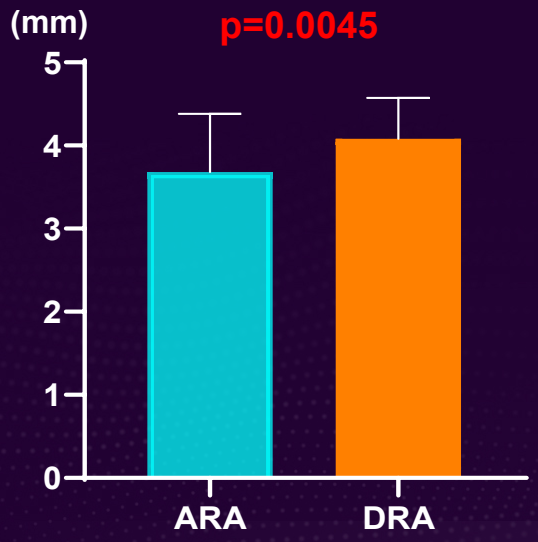
Results: Characteristics of enrolled cases and arteries

Case	N=8
Age, years	60.3 ± 14.0
Male, n (%)	6 (75)
Race (Caucasian, African American, Unknown), n (%)	6 (75) / 1 (12.5) / 1 (12.5)
Hypertension, n (%)	5 (62.5)
Sudden coronary death/non-coronary death, n (%)	5 (62.5)/ 3 (37.5)
Renal artery	**N=23 (14 ARA and 9 DRA)**
No. of ARA (additional/early bifurcation), n (%)	10 (71.4)/ 4 (28.6)
ARA in right/left, n (%)	6 (42.9)/ 8 (57.1)
ARA above/below the DRA	4 (28.6)/ 10 (71.4)
No. of DRA, n	9
DRA in right/left, n (%)	2 (28.9)/ 7 (77.8)
Median renal arterial diameter in histology, mm (IQR)	3.83 (3.24-4.43)

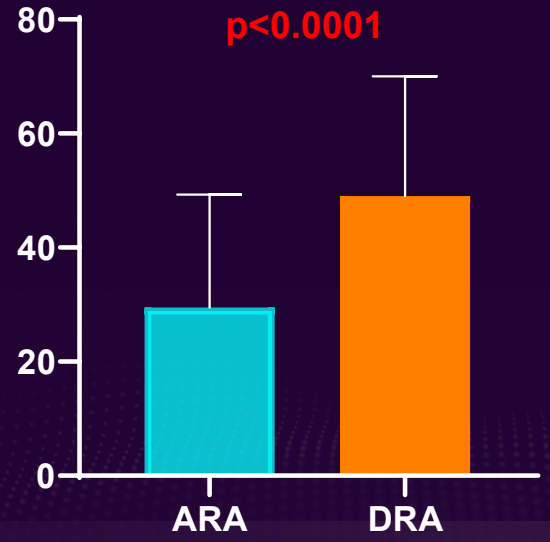
ARAs: smaller size and less nerves, but comparable size

Histologic evaluation results: ARAs vs. DRAs

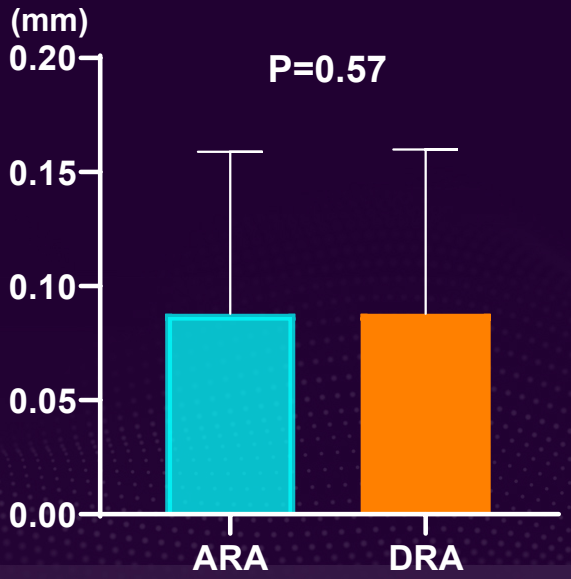
Arterial diameter (histology)



Number of nerves/section

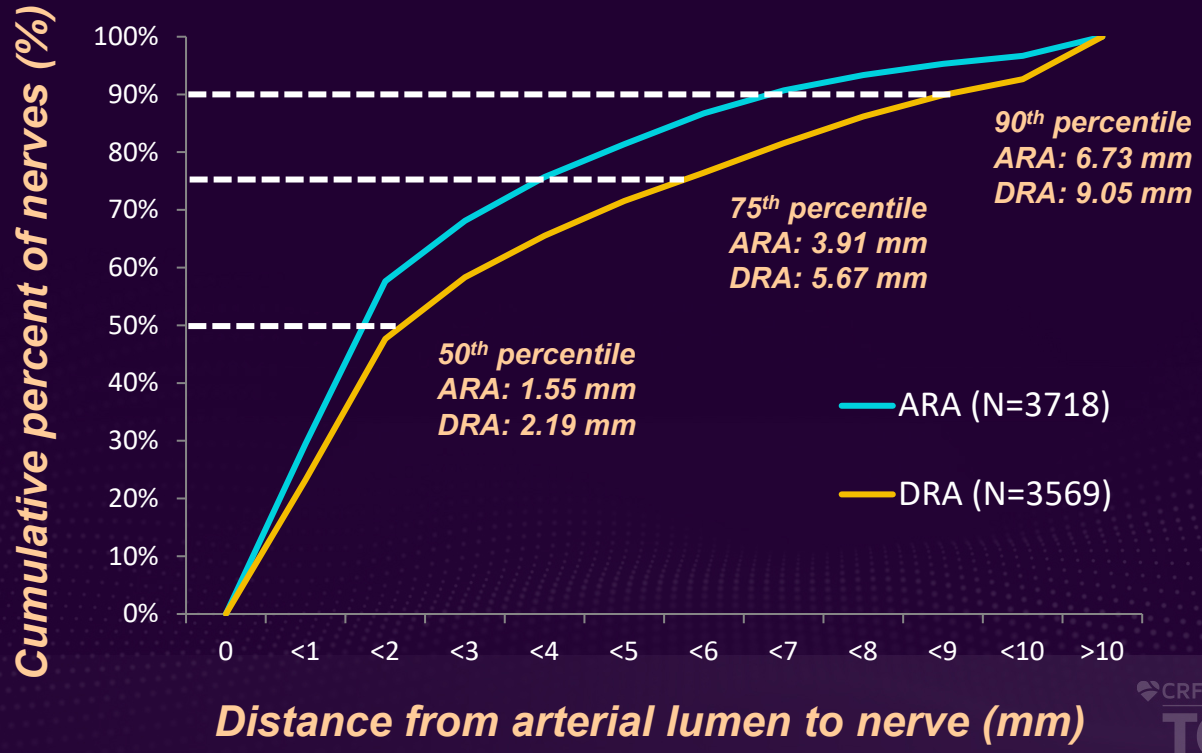


Nerve size (diameter)

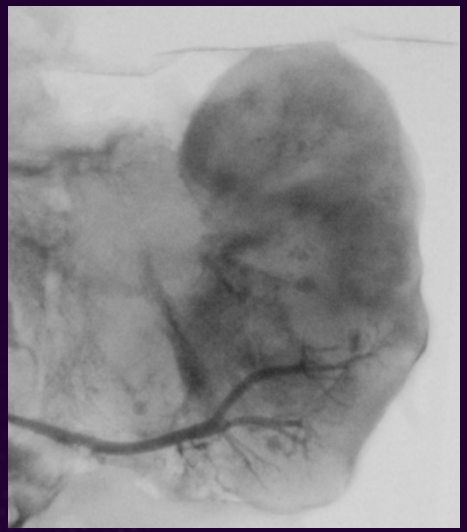
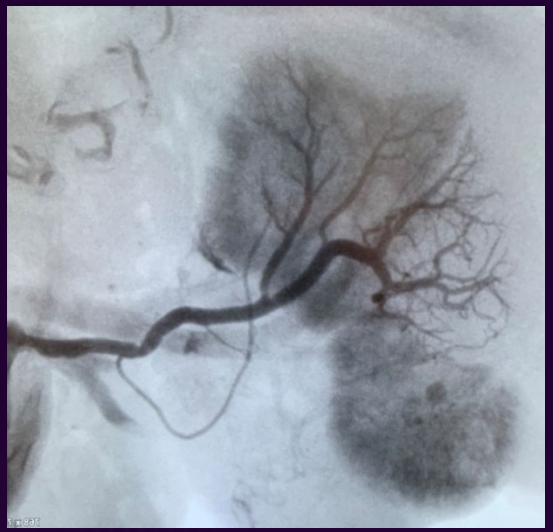
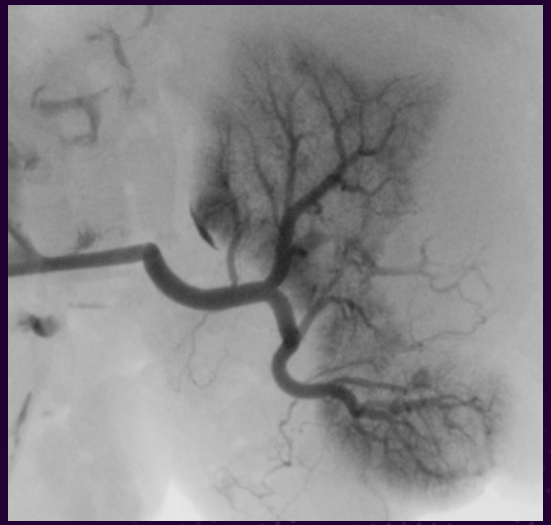


Peri-arterial nerves in ARA is closer to the arterial lumen than DRA

Cumulative distribution of nerves at distance from the lumen in ARA and DRA



Post-mortem angiography based analysis

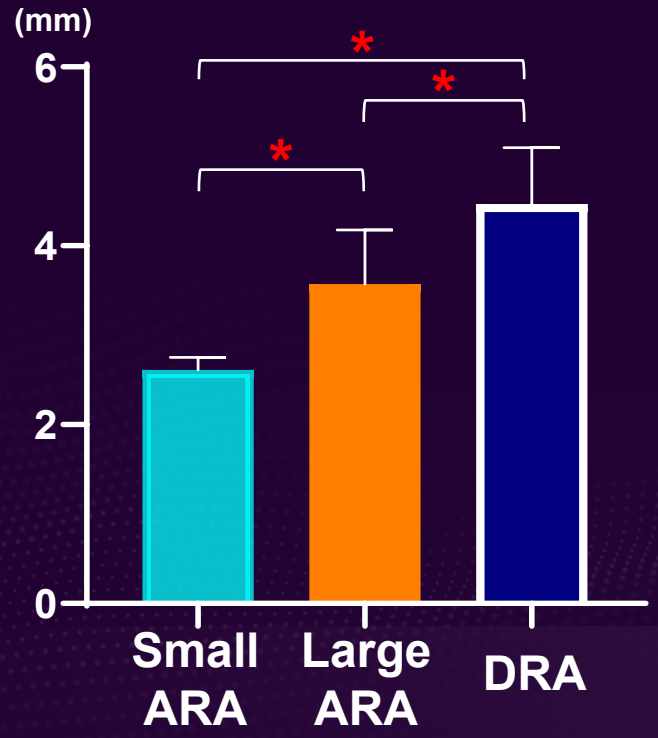
	Small ARA <3 mm	*Large ARA ≥3 mm*	*DRA*
			
Findings in angiography	**30 sections (N=4)**	**53 sections (N=6)**	**39 sections (N=5)**
Arterial diameter	**2.61 ± 0.14 mm**	**3.57 ± 0.61 mm**	**4.47 ± 0.63 mm**
Perfused area	**20.1 ± 5.4%**	**36.5 ± 7.5%**	**60.2 ± 4.0%**

*** Post-mortem angiography was available in 5 cases**

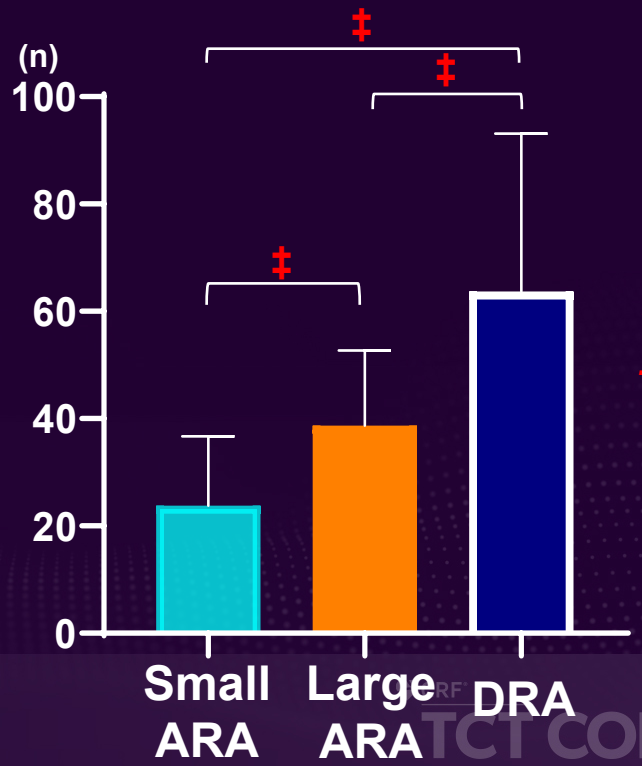
Greater number of nerves was seen in the larger artery

Post-mortem angiography based analysis

Diameter of arteries



Number of nerves/section



*: P<0.05
†: P<0.01
‡: P<0.005

Summary of the results

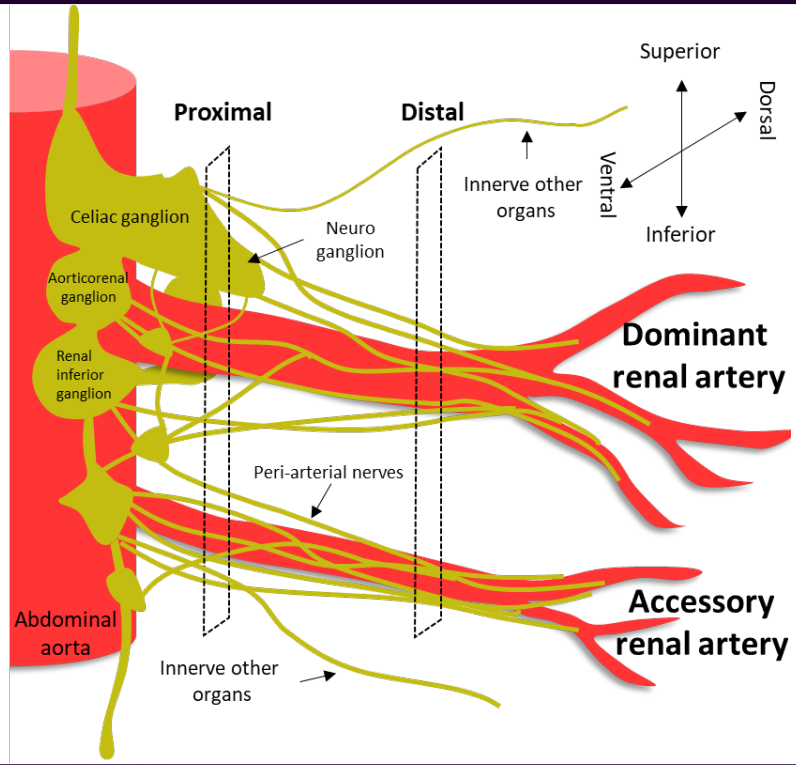
Accessory renal artery vs. Dominant renal artery

Renal artery

- ✓ *Arterial diameter: ARA < DRA*

Peri-arterial nerves

- ✓ *Number: ARA < DRA*
- ✓ *Distance from lumen: ARA < DRA*
- ✓ *Nerve Size: ARA = DRA*



Conclusions

- ✓ ARAs have two-thirds the number of nerves as compared to DRAs.
- ✓ The number of nerves around the ARAs is depending on the size of renal arteries.
- ✓ Our results suggest that ablation of peri-arterial nerves in ARA should result in an additional blood pressure reduction.
- ✓ Future RDN clinical trials should consider including ablation of peri-arterial nerves in ARAs.