Phenol-Based Denervation Induces Sustained Abdominal Aortic Remodeling

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Introduction

- Previous studies have identified sympathetic nervous system (SNS) signaling as a critical regulator of arterial wall homeostasis with potent effects on inflammation and vascular remodeling. [1]
- Our prior investigation of denervated aortic conduits was marked by significant pathologic remodeling, perhaps underpinned by lack of innervation. [2] Sympathetic dysfunction may contribute to the pathogenesis of aortic diseases, including occlusive disease, aneurysms, and related vascular complications.

HYPOTHESIS:
Dysfunction of aortic sympathetic innervation is a critical contributor to pathologic remodeling and aortic morphology on extended follow-up.

Methods

- Aortas were divided into four segments from lowest renal artery to iliac bifurcation (a-d).
- Tissue analysis conducted encompassing morphology, histology, & immunohistochemistry.

Results

Denervated aortas exhibited variations in intima-media thickness with b-segment exhibiting the lowest intima-media thickness.

Denervated aortas demonstrated significantly increased elastin breakage scores versus sham controls.

Adventitial and medial collagen content of aortas was similar between groups. Sex stratification indicated denervated females exhibited increased collagen content versus sham control.

Denervated aortas revealed a significant decrease in nerve fiber density and medial alpha smooth muscle actin (α-SMA).

Elastin Breakage

Collagen Content

Nerve Fiber Density

Significant aortic adventitial angiogenesis is observed after phenol denervation versus sham control.

Conclusions

1. Extracellular Matrix Remodeling: Topical phenol-based denervation results in loss of elastin morphology with increased elastin breakage scores
2. Nerve Fiber Density: Denervated aortas demonstrate significant loss of sympathetic nerve fiber density on extended follow-up
3. Loss of Vascular Smooth Muscle Cells: Significant loss of α-SMA and medial cellular density are observed after phenol denervation
4. Adventitial Angiogenesis: Marked angiogenesis is observed within the adventitia after phenol-based denervation
5. Sexual Dimorphism: Dimorphic response to phenol-based denervation include collagen content, baseline nerve fiber density, and medial vascular smooth muscle cell loss

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