Abstract: Transvascular pace-capture of aorticorenal ganglia provides a testable procedural endpoint for transcatheter renal artery denervation and identifies a novel therapeutic ablation target for denervation

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Background: Transcatheter renal denervation procedures often produces incomplete renal denervation and inconsistent antihypertensive effect. The lack of an intraprocedural method for renal sympathetic nerve function assessment has precluded a rational and physiologically based approach to ensure adequate denervation has been achieved at the time of the procedure.

Purpose: To demonstrate that it is possible to localise aorticorenal ganglia via transvascular pacing to provide: 1) a testable procedural endpoint for transcatheter renal denervation and, 2) a novel ablation target for renal denervation.

Methods: High frequency pacing in the inferior vena cava and aorta, invasive blood pressure measurements and renal angiography was performed in sheep (N=19) to identify ARG pace-capture sites by concurrent hypertensive and renal vasoconstrictive responses. Group A (N=5) underwent ink injection labelling at the ARG pace-capture site for histological verification; Group B (N=6) received unilateral irrigated radiofrequency ablation of ARG pace-capture sites and assessment of renal innervation at 1 week post-procedure; and Group C (N=8) had ARG pacing performed prior to and 2-3 weeks after unilateral transcatheter microwave renal denervation.

Results: ARG pace-capture responses were observed at paired discrete sites in the posterior IVC and anterolateral aorta approximately 40mm above the ipsilateral renal artery. Pacing elicited a mean arterial blood pressure change of 22.2[IQR 15.5-34.3]mmHg, p<0.001, together with ipsilateral renal vasoconstriction with main renal artery calibre change of -0.42mm [IQR -0.64mm to -0.24mm] measured with quantitative coronary analysis (QCA), p<0.001, and branch renal artery median pixel density index change -10.4[IQR -22.7% to -3.0%], p=0.003. Contralateral renal arterial vasoconstriction was not observed consistently at either the main or branch renal artery level. Sympathetic ganglionic tissue was observed at ARG pace-capture sites, and ganglion ablation caused significant ipsilateral renal denervation with a median hilar functional sympathetic nerve area reduction of 51% [IQR24%-52%), p=0.043, and renal cortical norepinephrine reduction of 54% [IQR 36%-59%], p=0.043. Circumferential renal denervation resulted in immediate and sustained abolition of ARP pacing induced renal vasoconstriction and significant ipsilateral renal denervation.

Conclusion: Localisation of ARG using transvascular pacing is feasible with pace-capture demonstrated by concurrent hypertensive and ipsilateral renal arterial vasoconstrictive responses. Abolition of ARG pacing
induced renal arterial vasoconstriction may indicate successful renal sympathetic denervation, providing a physiological procedural endpoint to guide transcatheter renal denervation. Additionally, ablation of ARG could provide an alternative or adjunctive method for renal denervation.