Quantify and compare respiratory-induced renal artery deformation in patients with untreated AAA, snorkel endovascular aneurysm repair (Sn-EVAR), and snorkel endovascular aneurysm sealing (Sn-EVAS).

METHODS

- 16 patients with untreated AAA, 11 Sn-EVAR, and 10 Sn-EVAS were scanned with respiration-resolved 3D MRA and CTA at multiple institutions.
- From 3D geometric models (Fig1), centerlines were extracted and used to quantify renal artery and snorkel stent curvature and bending due to respiration (Fig2).

RESULTS

- There was dynamic renal artery branch angulation due to respiration in untreated AAA (p<0.001), but not in Sn-EVAR or Sn-EVAS (Fig3).
- Max curvature change was ~10x for Sn-EVAR and Sn-EVAS compared to untreated AAA (p<0.001) (Fig4).
- Peak curvature was more distal for Sn-EVAR and Sn-EVAS compared to untreated AAA (p<0.001).
- Bending location in the renal artery was more distal for Sn-EVAR compared to Sn-EVAS (p<0.001) even though intra-renal stent coverage was the same.

- For the snorkel stent itself, respiratory-induced bending similar for Sn-EVAR and Sn-EVAS.
- Peak curvature was located at the ostium for Sn-EVAS while ~2 cm intra-aortic for Sn-EVAR.

DISCUSSION

- Stiffness of snorkel stents damps renal branch angulation while intensifying end-stent artery bending, which can be a concern for tissue irritation, thrombosis, and end-stent stenosis.
- Snorkels do not affect static native renal artery curvature but push peak curvatures distally.
- Polymer-filled bags used for Sn-EVAS pushed the peak bend on the snorkel stent to be at the ostium, while for Sn-EVAR the peak bend was intra-aortic due to the compliance of the Nitinol main body graft.