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Feasibility of Fluoroscopy-Free Endovascular Navigation in Subjects of Different Ages

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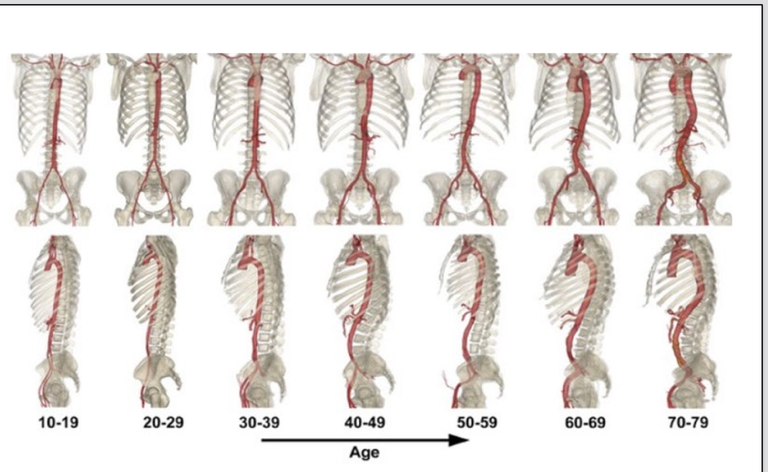
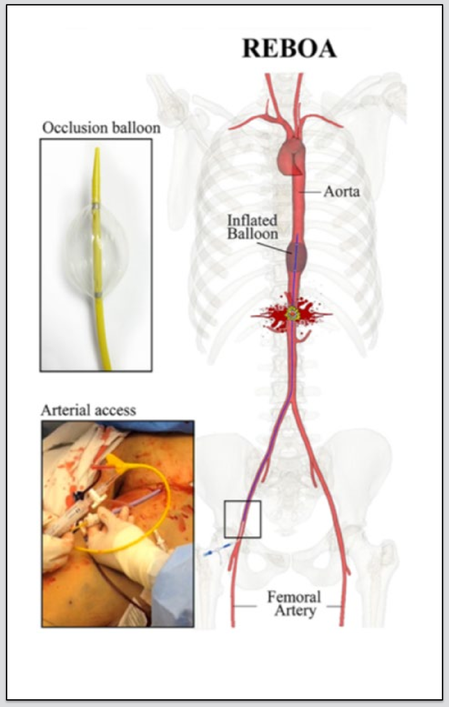
INTRODUCTION

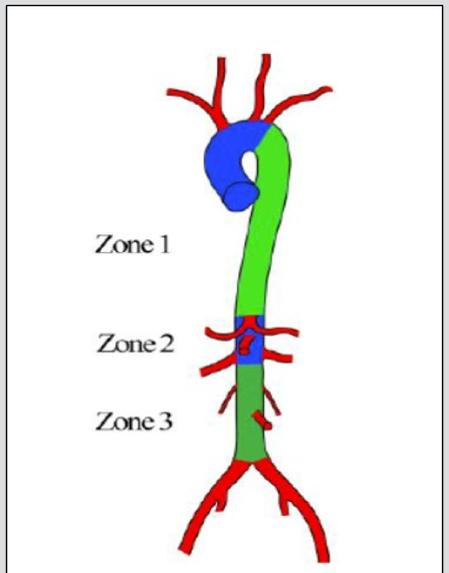
Fluoroscopy-free endovascular navigation has received significant attention due to its utility for controlling hemorrhage in pre-hospital settings. Morphometric vascular maps have been proposed to accurately calculate catheter and wire lengths to reach specific aortic zones without the need for fluoroscopy. It remains unclear whether certain anatomical characteristics, such as wide bifurcation angles or vessel tortuosity that are particularly prevalent in older subjects, may prevent fluoroscopy-free navigation. Our goal was to test the ability to blindly navigate the aorta with a stiff 0.035" and J-curve wires using electronic simulator.



METHODS

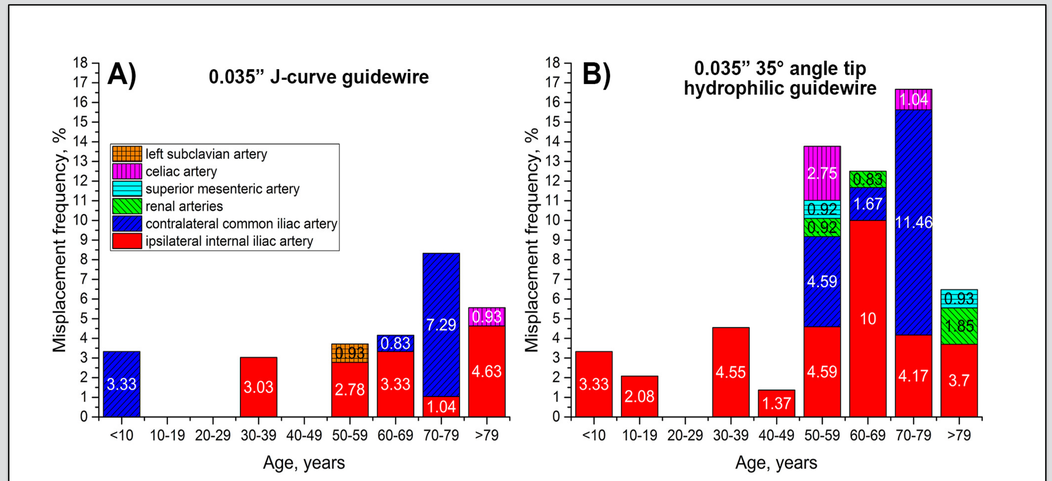
A total of n=86 CTAs from trauma patients 5-93 years old (average age 53±2 years) were used to build 3D models of the aorta and its branches using Mimics software. The models were exported into Mentice VIST G5 simulator through the Case-IT capability. An electric wire-feeding mechanism was built to advance J-curve and 0.035" 35deg wires at a consistent speed, and a total of 6 trials were performed in each anatomy and with each of the wires. Final location of the wire was recorded and percentage of unsuccessful attempts to advance the wire from the femoral access site to Zone 1 was calculated.





RESULTS

In majority of cases both wires stayed in the aorta as they were blindly advanced towards the heart. The overall frequency of misplacements increased with age for both wires (P=0.04 for J-curve and P=0.04 for 0.035"wire respectively, Figure 1). With J-curve misplacements occurred in <9year-old-group (contralateral common iliac artery [cCIA], 3%), in 30-39-year-old group (ipsilateral internal iliac artery [iIIA], 3%) and in >50-year-old groups (cCIA, iIIA, subclavian, celiac arteries, with up to 7%, 5%, 1%, and 1% respectively). With 0.035" wire misplacements occurred in all age groups except 20-29-year-old. In subjects <50-years-old misplacements occurred in iIIA (1-5%), while in older subjects misplacements were most common in cCIA (up to 11%), followed by iIIA (10%), celiac (3%), renal (2%), and superior mesenteric artery (1%).



DISCUSSION

Aging is associated with increased wire misplacements across all the major aortic branches. The most common misplacement locations are iIIA and cCIA. No misplacements were observed in 20-29-year-old anatomies for either of the wires. After the age of 50 years, misplacements become more common, particularly when using the 0.035" 35deg wire, most likely due to increased aortic tortuosity and widening of the aortoiliac bifurcation with age. Presented results suggest that fluoroscopy-free endovascular navigation may be feasible in subjects younger than 50-years-of-age (<5% misplacements), but the risk more than doubles in older subjects.