

Bovine Arch Anatomy is Not Associated with Flow-Mediated Aortic Arch Hypoplasia in Infants

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ABSTRACT

OBJECTIVE: Bovine arch is the most common variation of aortic arch vessel branching and is characterized by either the left common carotid artery (LCCA) arising from the innominate artery or by the two vessels sharing a common point of origin. Although believed to be a normal variant, previous data shows children with bovine arch anatomy are at a significantly higher risk of re-coarctation following surgical repair involving extended end-to-end anastomosis. Other studies have shown blood vessels reorganize their shape to optimize flow and regress if not appropriately perfused. We propose that a bovine arch alters perfusion throughout various sections of the aortic arch and thereby impacts vessel development. This study aims to determine the association of hypoplasia in a bovine arch at various points along the aorta.

METHODS: Thirty-four chest CTAs and 15 chest CTs performed on infants (<1 year old) at a single institution from 2012 to 2017 were analyzed. Vessel diameters were obtained at the sinotubular junction (STJ), ascending and descending aorta at the level of the right pulmonary artery, proximal transverse arch, distal to the LCCA/bovine trunk, distal transverse arch, aortic isthmus, and descending aorta at the level of the diaphragm. The diameter of the innominate artery/common bovine trunk was also obtained. Data were indexed to each of the STJ diameter, weight at time of scan, and body surface area (BSA) at time of scan and analyzed separately.

RESULTS: The diameter of the common bovine trunk in patients with bovine arch anatomy was found to be significantly greater than the diameter of the innominate artery ($p < 0.05$) when indexed to STJ diameter, body weight, or BSA. However, there were no significant differences in the aortic diameters between patients with normal anatomy and patients with bovine arch anatomy at any point along the aorta ($p > 0.05$), indicating no degree of aortic hypoplasia.

CONCLUSIONS: Though previous data demonstrates higher rates of re-coarctation in patients with bovine arch, this does not appear to be due to significant aortic arch hypoplasia, compared to normal arch anatomy. Future research may involve analyzing other anatomic characteristics of bovine arch and creation of a computational fluid dynamics model of bovine arch versus normal arch anatomy to determine the true impact of bovine arch on aortic fluid dynamics.