Cardiology in the Young (2016), **26**, 143–144
doi:10.1017/S1047951115000645

Article Commentary

Anomalous origin of the left pulmonary artery from the internal carotid artery

First published online: 30 April 2015

We perused with great interest the fascinating images produced by Thankavel et al[1] to illustrate their patient with tetralogy of Fallot, in whom the left pulmonary artery arises from the internal carotid artery. Their case shows the value nowadays of CT angiography in elucidating such rare patterns of arterial supply. Although their echocardiographic images are impressive, it is questionable whether the arrangement would have been fully appreciated without the clarification provided by the reconstruction of the tomographic data set. While applauding their diagnostic skills, however, we are confused by two aspects of their description. In the first place, they describe the segmental combinations in their patient in terms of {S,D,L}. To the best of our knowledge, "L" is used to account for the arrangement in which the aorta is positioned anteriorly and to the left relative to the pulmonary trunk. Their images, nonetheless, show that in their patient with tetralogy of Fallot the aorta was positioned posteriorly and to the right. How, then, do they reach the conclusion that the arterial component of the segmental set is appropriately described by "L"?

More importantly, we would suggest that the left pulmonary artery is fed by much more than a persistent arterial duct. The arterial duct is derived from the left sixth arch artery, which during embryonic life extends from the aortic sac to the left-sided dorsal aorta. Part of the anomalous pathway in their patient is certainly derived from the left sixth arch artery, but much more of the original symmetrical arch arteries must have been retained if, as described, the left pulmonary artery originates from the internal carotid artery. It so happens that one of us (S.D.B.) has been working extensively with a mouse model in which there is abnormal re-moulding of the arteries coursing through the pharyngeal arches. The mouse is null for the *AP2a* gene.[2] The findings illustrate perfectly the anomalous arrangement described by Thankavel et al. At embryonic day (E) 11.5, the normally developing mouse has three arteries coursing bilaterally and symmetrically through the pharyngeal arches (Fig 1).

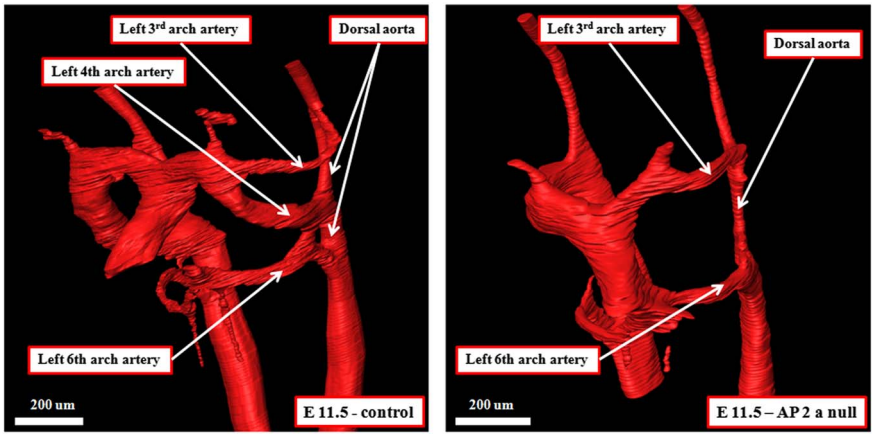

Figure 1.
The images show reconstructions of the developing pharyngeal arch arteries in the normal mouse at embryonic (E) day 11.5 (left hand panel), and the mouse null for the AP2alpha *gene (right hand panel).*

Correspondence to: Professor R. H. Anderson, 60 Earlsfield Road, London SW18 3DN, United Kingdom. Email: sejjran@ucl.ac.uk

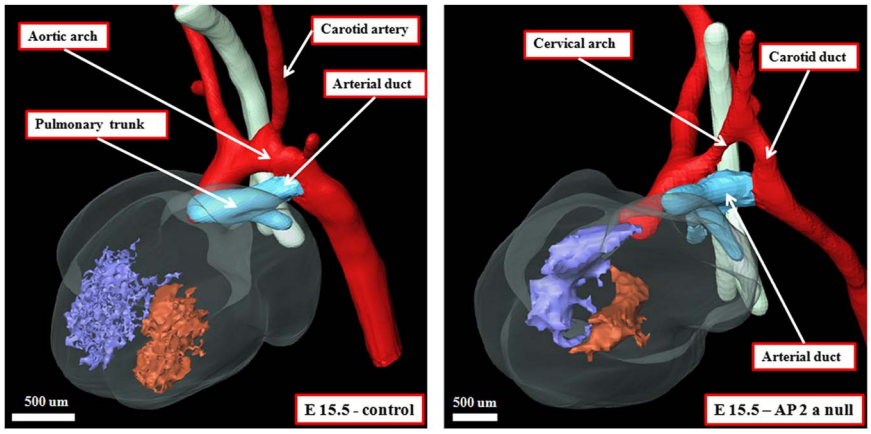

Figure 2.
The images show reconstructions of the aortic pathways in the normal mouse at embryonic (E) day 15.5 (left hand panel), and the mouse null for the AP2alpha *gene (right hand panel). Note that, in the genetically modified mouse, it is the carotid duct that feeds the arterial duct in presence of a cervical arch derived from the left third pharyngeal arch artery.*

These are the arteries of the third, fourth, and sixth arches. They join dorsally on each side with the dorsal aorta. The component of the dorsal aorta between the third and fourth arches is known as the carotid duct. In the mutant mouse (right hand panel of Fig 1), the left-sided fourth arch artery has failed to form. By E15.5, the situation can be compared with the images shown by Thankavel et al (Fig 2).

By this stage, in normal development, the third arch artery becomes the carotid artery, whereas the left sixth arch artery gets re-moulded to form the arterial duct. As is shown in the mutant mouse (right hand panel of Fig 2), in the absence of the left fourth arch artery, it is the third arch artery that persists, with the carotid duct then feeding the arterial duct. We would suggest that our findings indicate that, in the patient described by Thankavel et al, the anomalous pathway involves not only the left sixth arch artery but also the persisting left-sided carotid duct. Such a rare pathway, therefore, is surely better described on the basis of persistence of the carotid, rather than the arterial, duct.

Simon D. Bamforth, Robert H. Anderson
Institute of Genetic Medicine
Newcastle University
Newcastle, United Kingdom

References

1. Thankavel PP, Martho LC, Zeltser I. Anomalous left pulmonary artery origin from internal carotid artery: prospective echocardiographic diagnosis of a previously unknown variant. Cardiol Young 2015; doi: 1017/S1047951115000384.
2. Brewer S, Jiang X, Donaldson S, Williams T, Sucov HM. Requirement for AP-2alpha in cardiac outflow tract morphogenesis. Mech Dev 2002; 110: 139–149.