VARIATIONS IN VERTEBRAL VENOUS VASCULATURE

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INTRODUCTION

Cadaveric studies have previously documented typical patterns of venous drainage within vertebral bodies (VBs) [1,2,3], comprised primarily of the basivertebral vein, a planar tree like structure at the mid-height of the VB. These studies, however, are limited in the number of samples available, and so have not examined any potential differences in this anatomy in conditions such as scoliosis.

MRI is able to create 3D images of soft tissue structures in the spine, including the basivertebral vein without the use of contrast. As a non-invasive imaging technique this opens up the possibility of examining the venous network in multiple VBs within the same subject, in healthy controls as well as in subjects with abnormal anatomy such as adolescent idiopathic scoliosis (AIS).

METHODS

Fifteen healthy adolescent controls and fifteen AIS patients were recruited (with ethics approval) to undergo 3D MRI, of the thoraco-lumbar spine. The resulting image stack had a voxel size of 0.5x0.5x0.5mm.

Using Amira Filament Editor, five transverse slices through the VB were examined simultaneously and the resulting observable vascular network traced. Each VB in the scan was assessed, and a vascular network recorded when observable. A local coordinate system was created in the centre of each VB and the vascular networks aligned to this. The length of the vascular network on the left and right sides (with a small central region) of the VB was calculated, and the spatial patterning of the networks assessed level-by-level within each subject.

RESULTS AND DISCUSSION

Vascular networks consistent with descriptions of the basivertebral vein were identifiable within each subject, most commonly between T9-L2. Significant differences were seen in the left/right distribution of vessels in both the control and AIS subjects, with both groups having greater length on the right side of the VB (Figure 1).

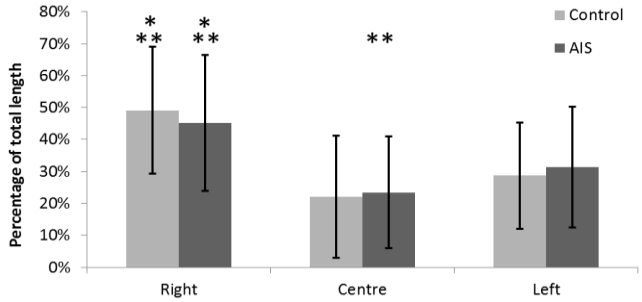

Figure 1: Overall percentage of length in each zone for AIS and control subjects * indicates a significant difference compared to Centre, ** indicates a significant difference compared to Left

Spatial patterns were assessed at each level from T9 to L2 (T11 shown in Figure 2). In both groups large individual variations in patterns were seen. While at a population level, spatial patterns that change with vertebral level appear evident in the control subjects, the large individual variability of both the control and AIS subjects is the more dominant feature.

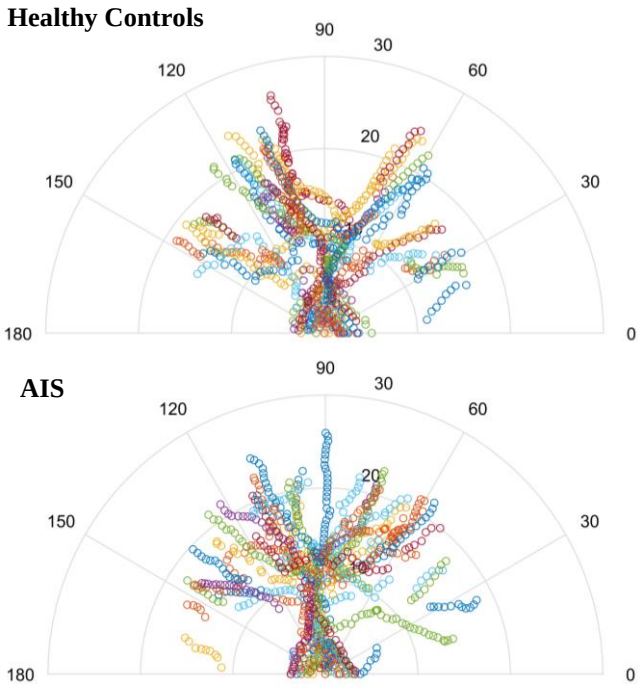

Figure 2: Cumulative polar plots for all individuals at T11 for the healthy controls (upper) and AIS (lower). Angles between 0 and 180 degrees are shown on the radials, and distances (in mm) are depicted by concentric circles out to 30mm.

CONCLUSIONS

High resolution MRI scans allow *in vivo* quantification of the vertebral venous system at multiple levels on healthy and scoliotic populations for the first time. The length of the basivertebral vein was seen to have a significant bias to the right hand side of the VB in both healthy and AIS adolescents. The spatial pattern of this vein showed large variations in branching both within and across individuals.

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