Vertebral Artery (VA) Anatomical Variations: Preliminary Results from a Retrospective Review Study in a WNY Academic Neurosurgical Center.

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CNS 2016 ANNUAL MEETING San Diego CALIFORNIA SEPTEMBER 24-28, 2016

Introduction

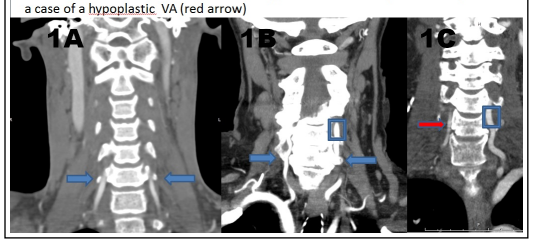
The good knowledge of VA course and its variations is of major importance in cervical spine surgery.Vertebral artery trauma during spine surgery could cause stenosis, thrombosis or occlusion of the vessel which increases dramatically the risk of stroke and subsequence mortality [1]. A numerous cadaveric and imaging studies have been conducted in the effort to recognize and record possible variation of VA segments [2-5]. In addition, a limited number of case reports in the literature already revealed unknown variations of this important vessel [6-9].

Aim of this study is to investigate the variations of VA and their prevalence in our institution based on retrospectively collected three-dimensional computed tomographic (3D CTA) angiography data.

Methods

A retrospective study (January 2014 to December 2015) was conducted in adult patients who sustained a cervical 3D CTA. The exclusion criteria were: medical history of congenital diseases (such as Klippel-Feil syndrome, Down syndrome, Marfan syndrome), cervical tumors and history of VA trauma or other acquired pathology. We recorded patients demographics (sex, race, age), origin of vertebral artery (VA) on both sides, point of entrance of V1 segment to transverse foramen in both sides (involved vertebra, dimensions of transverse foramen), VA diameter in both sides, and branches of VA in cranio-vertebral junction (Figures:1A-1C, 2A-2C, 3A-3B, 4)

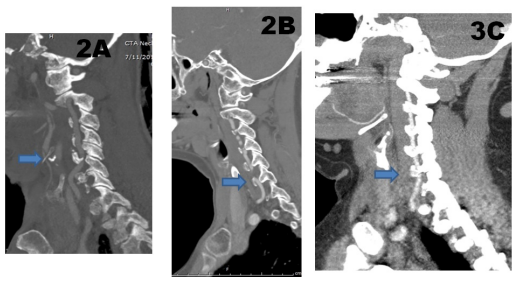
Figures 1A-1C: Coronal images of the performed CTA demonstrating the point of VA entrance in the cervical spine (blue arrows), the dominant VA (blue frames) as well as a case of a hypoplastic VA (red arrow)



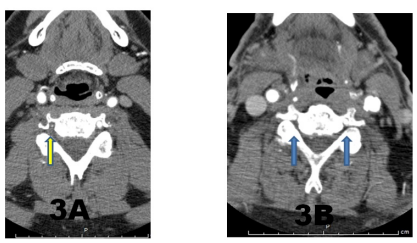
Results

136 patients (57 men and 79 women) were included with a median age of 65.88 yo (range: 21-88 yo). In regards to the vessels of origin were noted five combinations: a) bilateral subclavian artery in 111 patients (81.62%), b) left subclavian and right brachiocephalic in 21 patients (15.44%), c) left aorta and right subclavian in two patients (1.47%), d) left subclavian and right carotid in one patient (0.735%), e) absent left vertebral artery and right subclavian in one patient (0.735%) (Table 1). The entry points to the cervical spine were: C5 transverse foramen (6 VAs, 2.21%), C6 transverse foramen (247 VAs, 90.81%), C7 transverse foramen (19 VAs, 6.98%). The mean diameter of left VA was 3.514 mm (range: 0.076-5.69) and 3.216 mm in the right VA (range: 0.91-5.36). Hypolastic VAs were noted in 12 cases (4.4%). Co-dominance was recorded in 70 patients (51.47%), left dominance in 37 patients (27.21%) and right dominance in 29 patients (21.32%). In 48 patients (35.29%) were noted loops in the course of VAs. Finally, there were 5 cases of VAs final branches variations (3.6%).

Figures 2A-2C: Sagittal images of the performed CTA demonstrating the point of VA entrance in the cervical spine (blue arrows).



Figures 3A-3B: Axial images obtained from the performed CTA showing the bilateral diameter of VA in the point of entrance at the cervical spine. 3A: A left hypoplastic VA is noted (yellow arrow). 3B: Codominant VAs (blue arrows).

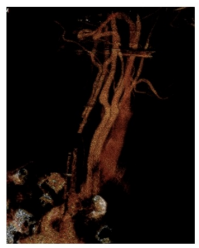


The variations regarding the vessels of origin for Vertebral Arteries (VAs) in our sample of patients.

Vessels of Origin	Number of patients	Percentage (%)
Bilateral subclavian artery	111	81.620
Left subclavian and right brachiocephalic	21	15.440
Left aorta and right subclavian	2	1.470
Left subclavian and right carotid	1	0.735
Absent left vertebral artery and right subclavian	1	0.735
Total	136	100.000

Table 1

Figure 4: 3D Reconstruction image demonstrating the vessels of the neck



Conclusions

According to our preliminary data, VAs have several variations regarding their origin, entry points to the cervical spine, course and final branches. The pre-operative evaluation of VAs with 3D CTAs could provide valuable information for the surgical planning.

References

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