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Quantitative analysis of unusual entrance of vertebral artery into the Cervical Foramen (V2 Segment) and its Clinical Implications

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Purpose: Because unusual entrance of vertebral artery into the cervical transverse foramen (UE-V2S) is relatively common anomaly in clinical field, therefore spine surgeon always have one's eye to understand its anatomical characteristics and clinical implications. The aim of this study is to assess the above task with a very large number of UE-V2S anomaly cases.

Methods: Retrospectively, the authors analyzed 2207 three-dimensional head and neck computed tomographic angiograms (CTA) without a specific vascular abnormalities. After confirming the unusual entrance of the vertebral artery (VA) into the transverse foramen (TF), we measured its vertebral artery diameter (VAD), transverse foramen area (TFA) and pedicle width (PW) from C3 to C7, bilaterally. The shortest horizontal distance from the vertical line in the medial margin of the TF to VA (D-TFVA) were measured in extra-osseous region to estimate the exact location of extra-osseous VA, excepting C7 level.

Results: The unusual V2 entrance was observed in 11.4 % (252 patients) of all 2207 consecutive patients and 6.5 % (268 courses) of all 4414 courses. The prevalence of unilateral UE-V2S level was followed as below: E5 > E4 > E7 > E3 and prevalence of bilateral UE-V2S were ordered as below: E5 (bilateral) was most prominent and E4 (right) / E5 (left) and E4 (bilateral) was followed. Generally, the VAD of the anomaly side was statistically smaller than the normal contra-lateral side, which can induce small value of TFA in all sub-axial level. Although UE-V2S can assure larger PW dimension in below adjacent level of UE-V2S, the difference value of PW between anomaly and normal side was not much in it, or insignificant in some types of UE-V2S (E4-Right and E7-both). The least value of D-TFVA was -3.8 mm in this study, which means that we should take a care not to pass exceeding 3.8mm medial to the vertical line of medial wall of TF during dissection in anterior cervical approach.

Conclusions: For avoiding unexpected VA injury or improving efficiency of cervical operation, spine surgeon should know the possible presence of UE-V2S in a routine cervical operation and understand its clinical characteristics in advance.

Keywords: Cervical spine, Vertebral artery, V2 segment, Anomalous course, CT angiography

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