Case Report

Successful technical note—Identification of the Adamkiewicz artery with 1.5 Tesla MR angiography in a 14-month-old child

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Abstract

Posterior mediastinal tumors surgery may be complicated by their proximity to the artery of Adamkiewicz (AKA) and its segmental supplier, increasing the risk of ischemia of the spinal cord. We describe a case of preoperative identification of the AKA with magnetic resonance angiography (MRA) in a 14-month-old boy diagnosed with a thoracic neuroblastoma, thus allowing an accurate surgical planning in order to avoid injury to those vessels. Given the relatively high incidence of posterior mediastinal tumors in the pediatric age, MRA may establish itself as a viable alternative for this purpose, even in young children.

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Introduction

Posterior mediastinal tumors in children account for approximately one third of all tumors in the mediastinum and comprise a variety of types; approximately 90% of them are neurogenic and neuroblastoma is the most common subtype, being often located paravertebrally near the vascular system that supplies the spinal cord [1].

In order to assess tumor's resectability and surgical risks, an expert consensus established image-defined risk factors of neuroblastomas which presence may dictate preoperative chemotherapy [2]. One of those factors is a lower mediastinal tumor between T9 and T12, concerning the possibility of the artery of Adamkiewicz (AKA) segmental supplier involvement. Injury to the AKA and potential spinal cord ischemia during tumor surgery is a main concern and vascular anatomical variations also contribute to the risk of an iatrogenic injury.

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Therefore, preoperative AKA identification has been stressed in preoperative setting [3–5].

Case report

We describe a case of preoperative identification of the AKA with magnetic resonance angiography (MRA) in a 14-month-old boy diagnosed with a thoracic neuroblastoma. The tumor was located on the left posterior mediastinum with extension between T6 and T12, involving the circumference of the descending aorta. After partial response to preoperative chemotherapy, molecular study for segmental changes was required in order to decide further management and no sufficient sample was obtained with previous fine needle biopsy. A video-assisted thoracic procedure was planned in order to obtain more specimen material and, owing to the high-risk location of the tumor, a MRA was performed to depict the segmental supplier of AKA in order to avoid surgical complications, particularly spinal cord ischemia.

Imaging was performed under general anesthesia on a 1.5 Tesla MRI using head and neck, spine and body arrays (with 12, 4, 24, and 6 element coils, respectively). The MRA protocol consisted of 2 consecutive dynamic phases performed with a 3-dimensional gradient echo using gadoteric acid at a dose of 0.2 mmol per kilogram of body weight as contrast agent (field of view 249 × 399 mm; matrix size 216 × 384 pixels; slice thickness 1 mm; number of slices 80).

The 2 dynamic phases allowed differentiation based on temporal intensity changes between the AKA and the Great Anterior Radiculomedullary Vein, which have a similar spatial configuration. In the arterial phase, it was detected a vessel compatible with the AKA, that ascended from left dorsal plans at the level D12-L1 to the midsagittal surface of the spinal cord, joining to the anterior spinal artery at the level T10, after its characteristic “hairpin” turn. The vessel reaches its upper limit, at the level of D12 segmental artery, that is in close relationship with the inferior limit of the thoracic expansive lesion (Figs. 1 and 2). Therefore, the video-assisted biopsy targeted the most superior and anterior faces of the tumor, being performed without complications and the child was discharged the following day.

Discussion

The AKA, or the great anterior radiculomedullary artery, provides the major blood supply to the anterior thoracolumbar spinal cord in the vast majority of the population (approximately 85%) [3]. Its origin is highly variable, extending from T3 to L5, and most often it arises as a single vessel from an intercostal or a lumbar artery between T8 and L1 (in almost 90% of the patients) on the left side (in nearly three quarters of the patients). The AKA has a diameter of 0.8–1.3 mm and typically traverses the upper third of the intervertebral foramen, coursing cephalad before joining the anterior spinal artery in a characteristic “hairpin” curve [1,5,6].

![Fig. 1 – Artery of Adamkiewicz—coronal. Coronal contrast-enhanced MR angiography (CE-MRA) in the arterial phase depicts artery of Adamkiewicz (arrowhead), ascending from left dorsal plans to the midsagittal surface of the spinal cord, joining to the anterior spinal artery (arrow), after its characteristic “hairpin” turn.](image)

Although the description of postoperative spinal cord ischemia in children is limited to case reports, preoperative identification of the AKA and its segmental supplier allows a more accurate surgical planning and a consequent decrease in postoperative complications [6,7] This can be done through digital subtraction angiography (DSA; the gold standard), computed tomography angiography (CTA) or MRA [3,5,7].

The experience in this context is scarce, especially in children. Boglino et al. and Nordin et al. described 3 pediatric cases of a neurologic deficit after posterior mediastinal tumors surgery; barely twelve cases of presurgical spinal DSA are described in this age group and only 3 of them were performed in patients younger than 2 years old [1,4,5]. Furthermore, spinal DSA application should be carefully assessed, once it is an invasive method with radiation exposure, and its indication has been limited to cases of increased risk of AKA injury, as tumors located centrally and/or to the left, especially between T8 and L1 [1,4].

Other authors have analyzed the use of noninvasive methods for AKA identification, with reported detection rates of...
Fig. 2 – Artery of Adamkiewicz—axial. CE-MRA in the arterial phase—axial images show the artery of Adamkiewicz pathway (arrowhead) from dural plans at the level T12-L1 (A) to its junction with the anterior spinal artery at the level T10 (E).

68%-95% for CTA and 67%-100% for MRA [7–10]. These techniques developed in adults may be applicable in children, but to date they have not been validated. Only one study has proven the ability of 64-section CT for assessing the AKA with a high degree of sensitivity in the pediatric context, including patients as young as 5 years old; however, high radiation dose has to be taken in account, particularly in this population [5]. As far as we know, AKA identification with MRA has been reported exclusively in adults, namely in cases of pre-surgical evaluation of thoracoabdominal aortic abnormalities or suspected spinal cord vascular pathology [6–8].

Presurgical identification of the AKA is of great interest in cases of posterior mediastinal tumors, especially in inferiorly located and left-sided lesions, even without foraminal or intracanal extension, as documented in the presented case. The localization of the level and the side of the feeding intercostal and/or lumbar artery allows the surgeon to avoid its lesion. Studies have validated MRA as a technique able to consistently localize the AKA, but not in children [4,5]. However, given the relatively high incidence of posterior mediastinal tumors in the pediatric age, MRA may establish itself as a viable alternative to DSA and CTA for this purpose, even in young children.

**Patient consent**

Informed consent for publication of the case “Successful technical note—Identification of the Adamkiewicz artery with 1.5 Tesla MR angiography in a 14-month-old child” was obtained from the patient.

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