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Direct emergence of the dorsospinal artery from the aorta and spinal cord blood supply

Case reports and literature review

Received: 19 October 2005
Accepted: 2 December 2005
Published online: 11 March 2006
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Abstract *Introduction:* Direct emergence of a dorsospinal artery from the aorta is a rare anatomic variant, of which a total of seven cases have been reported. This report offers an additional angiographic observation and reviews the literature. *Methods:* Two observations of common intercostal trunks documented during spinal angiography are described. *Results:* In the first observation, the common intercostal trunk provided complete blood supply to two adjacent vertebral levels (T11 and T12). In other words, the trunk included an intercostal branch and a dorsospinal branch for each level. In the second observation, the common intercostal trunk provided an intercostal branch for each level (T9 and T10), but only one dorsospinal branch

(T10). An isolated dorsospinal artery (DA) originated separately from the aorta at the T9 level, and provided a significant contribution to the anterior spinal axis. *Conclusion:* The two reported cases illustrate the concept of “complete” versus “incomplete” common intercostal trunks. In instances where an incomplete trunk is documented, a separate DA originating directly from the aorta must be looked for. A review of the literature indicates a tendency for isolated DAs to participate in the blood supply to the spinal cord.

Keywords Spinal angiography · Spinal vascular anatomy · Anterior spinal artery · Spinal cord vascularization

Introduction

Direct emergence of a dorsospinal artery (DA) from the aorta was initially described by classical anatomists [1, 2]. In 1979, Chiras and Merland [2] reported the first three angiographic observations of this rare anatomic variant, of which a total of seven cases have been reported so far [3–5]. We offer one additional angiographic observation and consider the role played by DAs originating from the aorta in relation to the vascularization of the spinal cord. A complementary observation of a common intercostal trunk providing blood supply to the spinal cord is reported as well in order to illustrate the concept of “complete” versus “incomplete” common intercostal trunks.

Case reports

Case 1

A 17-year-old man was investigated for acute paraparesis with a sensory level at T8. Magnetic resonance (MR) imaging only showed a small syringomyelic cavity (maximum diameter 3 mm) centered at T3, which was not considered to adequately explain the clinical presentation. Spinal angiography was obtained 4 days after initial presentation and documented obliteration of the right L3 segmental artery by a round intraluminal defect suggestive of embolic material. Collateral flow from right L2 was opacifying right L3 distal to the site of occlusion,

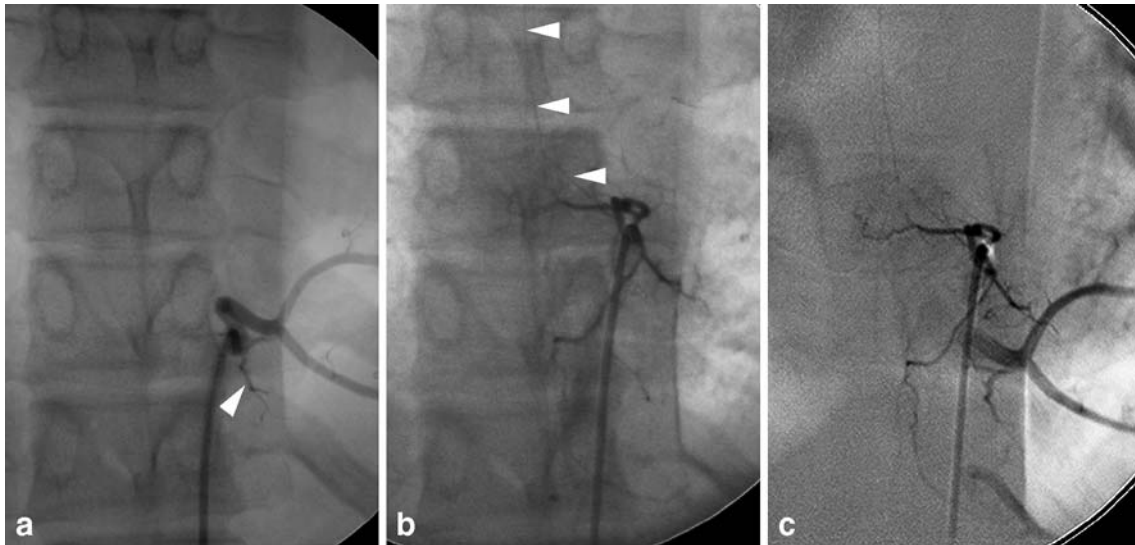


Fig. 1 A 17-year-old man with direct emergence of the T9 dorsospinal artery. **a** Digital subtraction angiography (DSA), selective left T10 injection, non-subtracted anteroposterior view, showing a common origin for the left T10 and T9 intercostal arteries. Note that a dorsospinal branch is opacified at T10 (*arrowhead*), but absent at T9. **b** DSA, selective left T9 injection, non-subtracted anteroposterior view, documenting the direct emer-

gence of the left T9 dorsospinal artery from the thoracic aorta. Note the opacification of an anterior radiculomedullary branch (*arrowheads*). **c** DSA, selective left T9 injection, subtracted anteroposterior view. Contrast reflux into the thoracic aorta provides simultaneous opacification of the T9 dorsospinal artery and of the T9/T10 trunk, clarifying their topographic relationship

including a major anterior spinal artery contributor. Incidentally, a common trunk supplying both left T9 and T10 was observed (Fig. 1a). There was no blush in the T9 left hemivertebra, and the T9 component of the trunk did not have a DA, which was ultimately found at the left T9 level. This direct DA provided a significant anterior spinal branch (Fig. 1b,c).

Case 2

A 26-year-old man with a history of cerebral vasculitis was investigated for new onset of rapidly progressive paraparesis. MR imaging documented an extensive abnormal signal within the spinal cord at the thoracic level. Spinal angiography was unremarkable. Incidental observation was made of a common trunk for left T12 and T11 (Fig. 2). The DA for both levels was opacified by the injection of the trunk, and a hemivertebral blush was observed at both levels.

Discussion

The segmental anatomy of the spine and spinal cord vascularization is relatively simple. A pair of arterial trunks originates from the aorta at most of the thoracic and lumbar vertebral levels. Each of these trunks courses posteriorly along the lateral aspect of the corresponding vertebral body before bifurcating into an anterior branch, the intercostal or

lumbar artery per se and a posterior branch, the DA. The DA itself divides into a dorsal branch that ends within the posterolateral spinal musculature and a smaller radicular branch that courses medially along the corresponding nerve

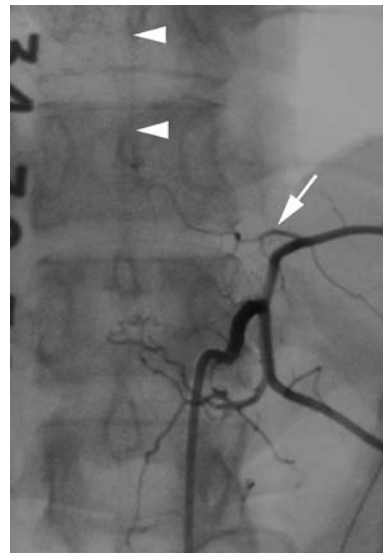


Fig. 2 A 26-year-old man with a “complete” form of common intercostal trunk. Selective injection at T12 opacifies both the T12 and T11 intercostal arteries, both of which have a corresponding dorsospinal branch. Note that the dorsospinal artery at T11 (*arrow*) provides a small anterior radiculomedullary branch (*arrowheads*)

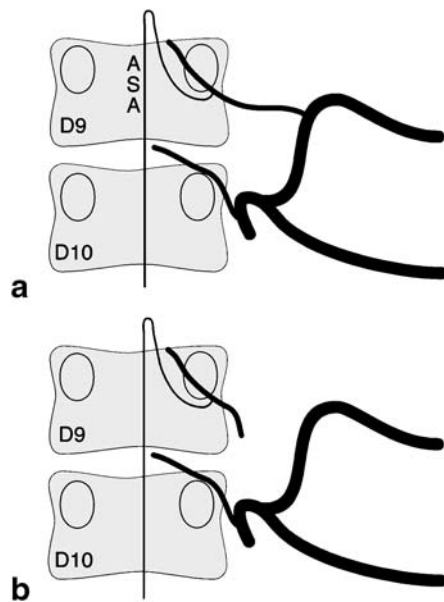


Fig. 3 Schematic representation of complete and incomplete common intercostal trunks. **a** Common trunk of left T9 and T10, “complete type”. Despite its origin from T10, the T9 intercostal trunk normally bifurcates into an anterior intercostal branch and a DA. The injection of the T9/T10 trunk would result in a hemivertebral blush at T9. **b** Common trunk of left T9 and T10, “incomplete type”. The common trunk for T9 and T10 provides an anterior intercostal branch for T9, but the dorsospinal branch originates separately from the thoracic aorta. The injection of the T9/T10 trunk would not result in a hemivertebral blush at T9

root to enter the spinal canal through the neural foramen [6]. The functional importance of the radicular branch of the DA lies in its possible contribution to the spinal cord vascularization via small anterior and/or posterior radicular branches supplying the anterior and/or posterior spinal axes, respectively (in which case the radicular artery is classically called a radiculomedullary artery [7]).

The common origin of two (or more) segmental arteries via a single trunk is a variant frequently observed during spinal angiography. In such cases, each segmental vessel must have its own DA in order to be considered complete (Figs. 2 and 3). If a DA is missing, a separate origin of the DA from the aorta must be suspected [2]. The presence or absence of a hemivertebral blush can help distinguish these

Table 1 Summary of seven published cases of DAs arising from the aorta

| Case | Gender | Age (years) | Level | Side | Spinal cord blood supply | Reference |
|------|----------------|----------------|-------|------|--------------------------------|--------------|
| 1 | Female | 19 | T9 | R | None detected | [2] |
| 2 | Male | 37 | T9 | R | Normal posterior spinal branch | [2] |
| 3 | Female | ? ^a | T9 | R | None detected | [2] |
| 4 | Male | 32 | T10 | L | Normal anterior spinal branch | [3] |
| 5 | ? ^a | ? ^a | T8 | R | None detected | [5] |
| 6 | Female | 36 | T9 | L | Normal anterior spinal branch | [4] |
| 7 | Male | 50 | T9 | L | Normal anterior spinal branch | [4] |
| 8 | Male | 17 | T9 | L | Normal anterior spinal branch | Present case |

^aInformation not provided in the original report

“complete” and “incomplete” forms of common intercostal trunks. At this point, it should be noted that a thromboembolic occlusion of a normal DA sparing the corresponding anterior branch could in theory result in a similar angiographic appearance: that is, non-opacification of the DA and absence of the corresponding hemivertebral blush.

The seven angiographic observations of direct emergence of the DA from the aorta reported to date (including the present case) are summarized in Table 1. It is interesting to note that all eight reported instances of direct DA were located at low thoracic levels (T8 to T10), most often at T9 (75% of cases). In four cases, the variant was on the right side and showed either no contribution to the spinal cord vascularization (three cases) or a minor contribution to the posterior spinal axis (one case). On the other hand, all four variants located on the left side were branching off a major anterior spinal branch. Although these numbers remain too small to provide conclusive evidence, we noted a tendency for a left-sided direct DA to carry a major spinal cord feeder. This tendency emphasizes the need for neuroangiographers to be familiar with this anatomic variant in order to avoid overlooking a potentially significant anterior or posterior spinal axis contributor during spinal angiography.

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