Vertebral artery anomaly with entry at C4—avoiding a surgical pitfall: a case report

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Abstract We present a case of an unusual course of the vertebral artery (VA) with intra-foraminal entrance at C4. A patient with traumatic fracture of C3 and C4 with dislocation C3/C4, spinal cord compression and ensuing quadriplegia presented with unilateral entrance of the VA at C4 detected on preoperative magnetic resonance imaging (MRI). The patient was surgically decompressed and stabilized by an anterior-posterior approach without intra-operative complications. Apart from anatomical findings no clinical case of entrance of the VA at C4 had been described in recent clinical literature. A physiologic high entrance of the VA is very rare but must be diagnosed preoperatively to avoid potential life threatening complications.

Keywords Vertebral artery · Anomaly · Transverse foramen · Unusual course · C4 · Surgery · Cervical spine

Many variations of vertebral artery (VA) anatomy have been reported in the literature. Most commonly vertebral arteries arise from the superoposterior aspect of the first part of subclavian artery and then take a posterior cephalad course to enter the transverse foramen at C6, but other

entry levels have been described. Anomalies have been reported with an entry level of C2 [5] and C3 [7, 9]. The entry of the VA into the transverse foramen at C4 has been seen in anatomical studies with an incidence of 1–1,4% [1, 11]. To our knowledge there is no clinical case report in the literature describing the VA entry at C4.

The following case report describes a young man who suffered quadriplegia from a traumatic fracture of C3/C4 with an anomalous entry of the artery into the transverse foramen at C4 on the left in contrast to the usual entry at C6 on the right.

Case report

A 52-year-old construction worker fell from a trestle from a height of 2 meters. He was found prone with his head in antelexion. On initial examination he presented with bradycardia, somnolence and quadriplegia. During rescue he suffered from apnoea and hypotension and required intubation and cardiopulmonary resuscitation (CPR). After cardiopulmonary stabilization he was transferred to our hospital.

On initial clinical examination we found an intubated and vitally stable patient with his head still in modest antelexion. Apart from the supposed cervical lesion no other injury was detected. Initial helical (spiral) CT scan revealed a fracture of C3 including articular processes and the left vertebral arch, a dislocation between C3/C4 and a comminuted fracture of C4 with inclusion of articular processes, the vertebral arch and the left transverse foramen. Close scrutiny of the CT scans demonstrated an unusual course of the left VA. The right VA showed a normal course with entrance into the transverse foramen at C6 but the left VA entered the vertebra at C4 (Figs. 1, 2).

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Fig. 1 Sagittal reconstruction of initial helical CT scan shows a dislocation of C3/C4 with spinal compression. Note the entry of the left VA at C4

The following MRI showed extensive spinal cord oedema from C2 to C6 and epidural haematoma. After careful planning of the patients procedure with knowledge of the aberrant course of the left VA the patient was operated on immediately with anterior decompression and

partial corpectomy of C4 followed by spondylodesis of C3–C5 with an intercorporeal cage implantation, cancellous bone grafting and ventral plate osteosynthesis (DePuy Spine, Inc., Raynham, Massachusetts); operation time was 112 min.

Six days after initial decompression and spondylodesis he was stabilized additionally with a dorsal screw-rod system (internal fixator) (SummitTM, DePuy Spine, Inc., Raynham, Massachusetts) in order to gain maximum stability and allow for extensive early rehabilitation program (Fig. 3). Operation time was 90 min. Control MRI showed an extensive spinal cord myelopathy.

Postoperatively the patient was vitally stable but was left intubated due to failed ventilatory weaning attempts. The patient was referred to a paraplegic centre whilst intubated, receiving controlled ventilation together with mild sedation. On referral the patient was quadriplegic with areflexia of arms and legs and weak flaccid muscular tone, the pectoral muscle reflex was bilaterally positive.

On follow up 3 months postoperatively the patient unfortunately showed no improvement in sensomotory function and was still assistive ventilated (Fig. 3).

Discussion

Numerous anatomical variations of the VA have been described. Variations of the pretransverse segment of the VA have been described extensively, concerning origin [1, 2, 11, 13], tortuosity in its course [6, 11, 15] and entry in the transverse foramen [1, 5, 7, 9, 11]. Entry in the transverse foramen varies from C7 up to C2 [5, 7, 9].

Fig. 2 The VA is just about to enter the transverse foramen (a). The left VA has entered the transverse foramen at C4 (b). Note the reduced diameter in contrast to the right vertebral artery

Fig. 3 Postoperative lateral view radiograph shows anterior-posterior spondylodesis, the cervical spine in physiological lordosis and correct cervical alignment

Although the lateral position of VA does not hinder the anterior approach and therefore vertebral artery injury (VAI) in anterior cervical spine surgery is a rare complication with incidences of 0.3–0.5% [14], it might be an underestimated problem [8]. There have been reports of laceration due to anatomical variations [4]. Even though most VAI's will remain asymptomatic because of arterial collaterals it is decisive to know the individual specific course and anatomy of VA. When performing an anterior approach to the cervical spine it is essential for the surgeon to know what to encounter first when exposing the transverse process: bone or—as in this case—the VA. The potentially devastating complications of VAI with its supply of cerebellum, brain stem and spinal cord are well known: brain stem infarction [3, 12] or central respiratory dysfunction [10].

Careful preoperative planning is essential in cases with unusual anatomy of the VA and helps avoiding potentially life threatening complications.

Conflict of interest statement None of the authors has any potential conflict of interest.

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