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Case Report

Venous structures can mimic masses in the foramen magnum

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ABSTRACT

Benign enhancing lesions at the foramen magnum is a recently described entity and believed to represent a varix or ganglion. These lesions are typically described as being single, located posterior to the intradural vertebral artery, and not attached to the dura. These 2 cases demonstrate previously undescribed variations in appearance of these lesions including contacting the posterior inferior cerebellar artery and lateral epidural plexus/dura, segmental dilatations, transverse and linear configuration, and visualization on an unenhanced CT head. These lesions most likely reflect bridging veins and are structures that clinicians should be aware of to avoid unnecessary follow-up or surgical intervention.

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Introduction

Enhancing masses in the foramen magnum and craniocervical junction (CCJ) can be malignant or benign in etiology and often require serial imaging follow-up and if needed, surgical resection. A new entity termed “benign enhancing foramen magnum lesions” has been described as single lesions which either represent a varix or ganglion [1]. These 2 cases demonstrate variants of these enhancing lesions and have characteristics that are similar to cases described by others [1,2], but also important differences that have not been described. We also provide evidence that these structures are venous in etiology.

Case reports

Case 1

A 66-year-old female with a history of sinonasal melanoma diagnosed in 2014 underwent extensive craniofacial surgery for removal of tumor and flap reconstruction in 2014 and 2015 and for resection of progressive tumor in 2019. Serial pre- and postoperative CT or MRI of the head and neck performed between 2014 and 2019 (63 months) demonstrated 3 sub-cm contiguous enhancing structures in the left spinal canal and one sub 5 mm enhancing structure in the right spinal canal at the level of the CCJ which remained unchanged in appearance,

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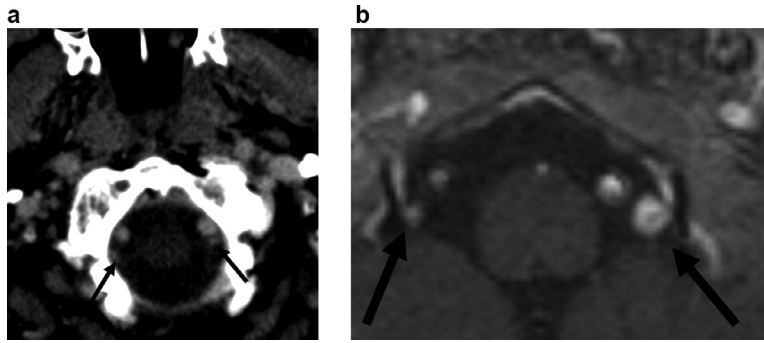


Fig. 1 – Focal dilatation(s) in the venous structure in the periphery of the spinal canal at the CCJ on CT neck with IV contrast (A) and MRI sinus T1 SE postcontrast (B) obtained in 2014 (black arrows). The Hounsfield unit on CT of both venous structures was approximately 85.

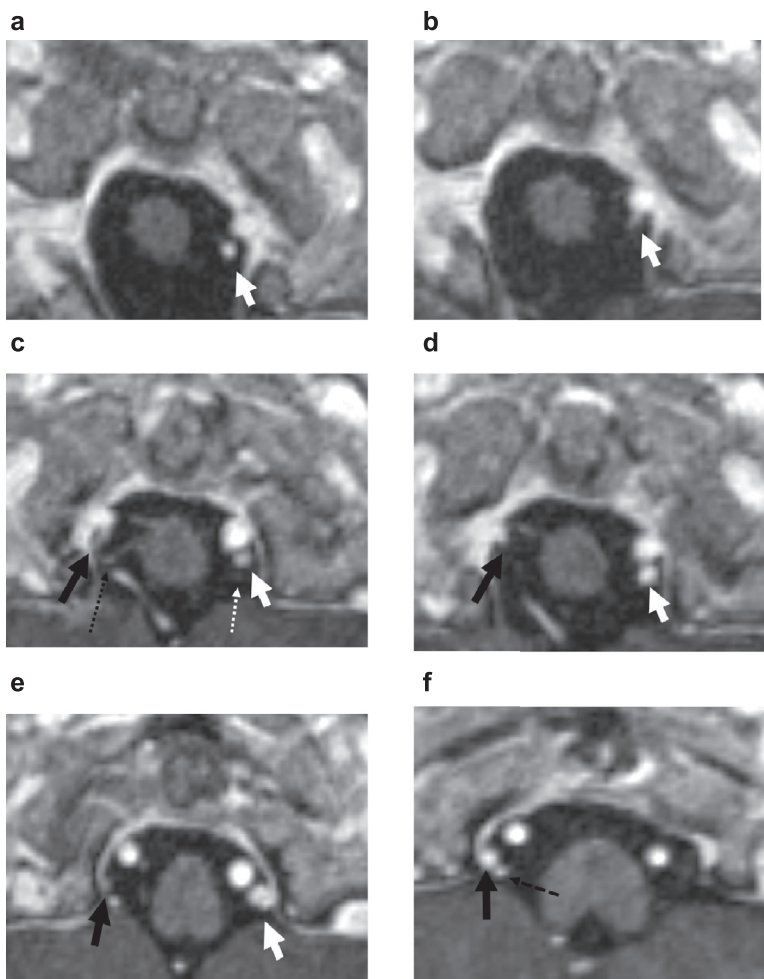


Fig. 2 – MRI obtained in 2019. T1 volumetric postcontrast sequence. (A-F) demonstrate the venous structure in the left lateral (white arrow) and right lateral (black arrow) periphery of the spinal canal and the images are from caudal to rostral at the CCJ. (B) demonstrates connection of the venous structure with the left vertebral artery venous plexus (white arrow). (C) demonstrates the venous structure on the right communicating with the right vertebral artery venous plexus (black arrow) and a vein from the right C1 dorsal nerve root draining into the adjacent venous structure (dotted black arrow). The left C1 dorsal nerve root is located posterior to but not directly contacting the venous structure (dotted white arrow). (E) and (F) demonstrate the venous structures draining into the bilateral marginal sinuses (black and white arrows). (F) shows the right venous structure contacting the right PICA (dotted black arrow).

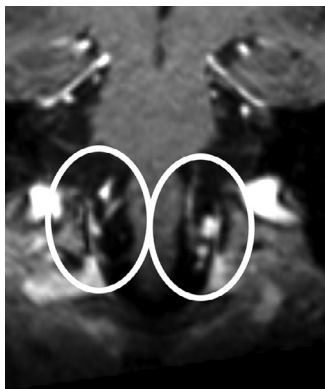


Fig. 3 – Reformatted coronal T1 volumetric postcontrast sequence obtained in 2019. White circles show both venous structures.

orientation, and shape. These structures extended from the level of the vertebral artery plexus to the lateral marginal sinus (Figs. 1-4) and remained posterior to the vertebral arteries. The venous structure on the right is seen in continuity from its origination at the right vertebral artery venous plexus to its termination into the right lateral marginal sinus and contacts the right lateral epidural venous plexus. While the venous structure on the left demonstrates continuity with the left vertebral artery venous plexus and the lateral marginal sinus, but multiple portions remain separate from the adjacent left lateral epidural venous plexus.

The Hounsfield unit of these structures was around 85 on CT neck with IV contrast (Fig. 1A) which is similar to the adjacent epidural venous plexus and MRV head (Fig. 4B) demonstrates that the structure has similar signal characteristic as the adjacent epidural plexus. Therefore, these structures are venous in etiology. In addition, a vein from the right C1 dorsal nerve root drains into the venous structure in the right spinal canal, while the left C1 dorsal nerve root is located posterior to but not directly contacting the venous plexus (Fig. 2C). The venous structure on the right contacts the right posterior inferior cerebellar artery but is not contiguous with it (Fig. 2F).

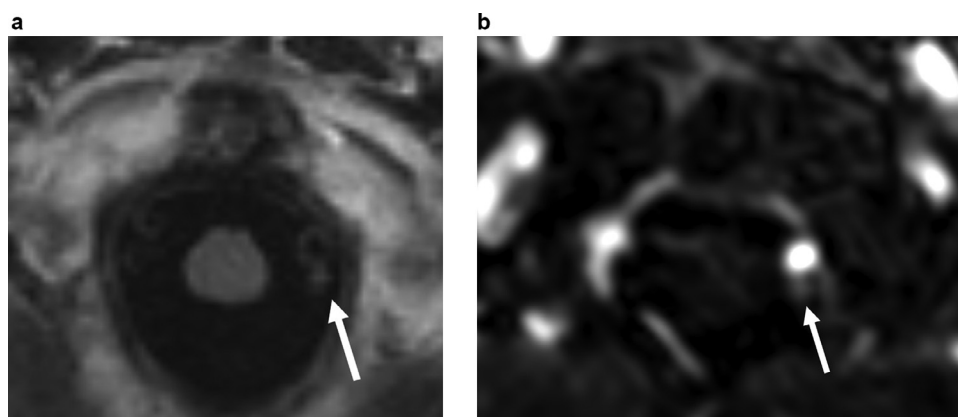


Fig. 4 – Axial FLAIR and MRV head with IV contrast obtained in 2019 show the venous structures in the left spinal canal (white arrows).

Case 2

A 63-year-old male patient with parkinsonism obtained a MRI brain with IV contrast in 2020. The volumetric axial T1 post-contrast sequence demonstrates a 7 mm enhancing lesion in the right spinal canal at the level of C1-C2 which is congruent with the dorsal nerve root and adjacent right internal vertebral venous plexus (Fig. 5A) and therefore is most likely venous in etiology. This structure was unchanged in size compared to an unenhanced CT head from 2009 and demonstrated an internal Hounsfield of around 25 (Fig. 5B).

Discussion

Careful evaluation of the foramen magnum and CCJ is critical as masses in this region could potentially impact important structures such as the brain stem and upper cervical cord. The differential considerations for intradural extramedullary enhancing lesions in the region of the foramen magnum/CCJ include meningioma, schwannoma, aneurysm, or malignancy/inflammatory disease of the meninges [1]. A recent case series highlighted that benign lesions can be present in the foramen magnum and were thought to represent varix or ganglion [1].

On the prior case series, these lesions were described as being single, demonstrating hyperintense signal on FLAIR and enhancement on T1-weighted postcontrast imaging on MRI, located posterior to the vertebral artery, and not abutting the dura or the posterior inferior cerebellar artery (PICA) [1]. A prior case report described the appearance of these lesions on CT neck with intravenous contrast and labeled them as probably venous in etiology [2]. The 2 cases presented here show some similarities with the prior case series and case report but important differences that highlight the variability of these lesions on imaging.

The structures described in the first case had Hounsfield units on CT with IV contrast which are similar to that of earlier case report (around 80-90 HU) [2] and appearance on MRV suggestive of a venous structure. Both venous structures showed

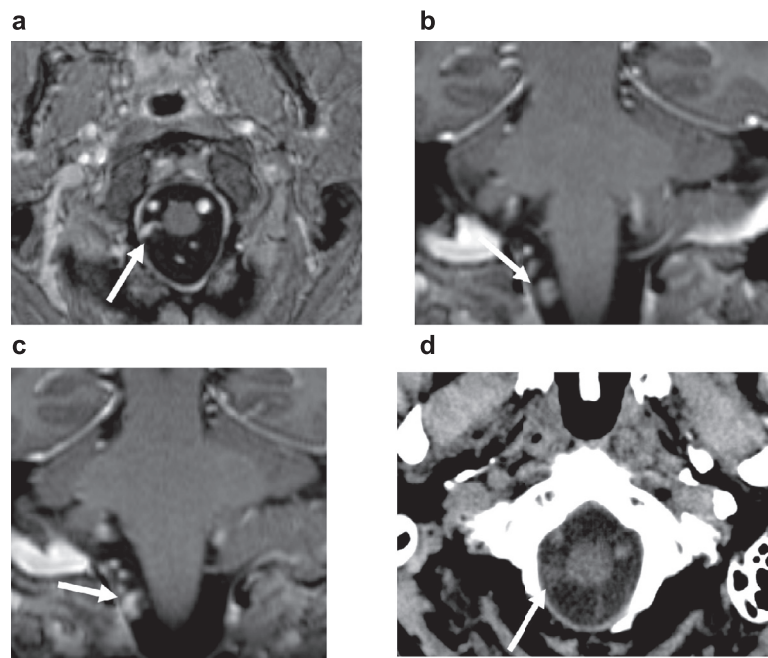


Fig. 5 – Axial T1 volumetric postcontrast sequences (A) and Coronal T1 volumetric postcontrast sequences (B and C) obtained in 2020 demonstrate transverse linear venous structures in the right spinal canal at the CCJ extending from the C1 dorsal nerve root to the right lateral epidural venous plexus (white arrows). CT head unenhanced from 2009 (D) demonstrates the hypodense venous structure in the right spinal canal at the CCJ.

similar pathways as described on the prior case series including extending from the vertebral artery venous plexus to the marginal sinus/anterior condylar venous confluence, locating posterior to the vertebral arteries, and receiving veins from the dorsal C1 nerve root [1]. However, this case demonstrates that these venous structures can show multiple segmental dilations and contact the PICA and the adjacent internal vertebral epidural venous plexus.

The venous structure in the second case is also located in the spinal canal posterior to the right vertebral artery with similar signal characteristics described on the prior case series [1], but demonstrates notable variations including a transverse linear configuration, as opposed to round or ovoid configuration as described on the prior cases series [1], with veins extending along the dorsal nerve root at C1 to the lateral epidural venous plexus. In addition, this lesion was seen on an unenhanced CT head approximately 10.5 years prior to the MRI as a hypodense lesion and was unchanged in size.

Given appearance and location, these structures are most consistent with bridging veins which approximate the dorsal cervical nerve roots as described on a prior cadaveric dissection study [3]. The incidence of visualization of these venous structures on MRI brain with IV contrast is unknown but is suspected to be low. McGuinness et al. analyzed MRI brain studies over 5 years at their institution and netted a total of 14 patients with these lesions. However, the total number of studies the authors analyzed to acquire the 14 patients was not provided. The overall low incidence of visualizing these structures could be related to normal variation in venous anatomy at the CCJ that is seen in the human population [4]. Interestingly, these venous structures presented in this case series are adjacent

to the expected course of a recently described venous structure termed the lateral internal vertebral venous plexus. This plexus is located in the lateral epidural space between the lateral masses of C1 and the base of the skull and was seen in 33% of their sample size [5]. The venous structures in both of the cases presented here contact the adjacent epidural venous plexus and may communicate with the lateral internal vertebral venous plexus. Therefore, the lack of visualization of these venous structures in all patients could be related to the variability of presence of lateral internal vertebral venous plexus in patients. However to prove this, patients with these venous structures will require postmortem autopsy evaluation of the CCJ.

Conclusion

These 2 cases demonstrate the presence of structures in the lateral periphery of the spinal canal at the CCJ and foramen magnum on CT and MRI which likely represent bridging veins. These cases also demonstrate previously undescribed variations in these venous structures including contacting the PICA and lateral epidural venous plexus, demonstrating segmental dilations, and transverse orientation and linear shape. Furthermore, these structures can be seen on unenhanced CT head but require MRI with IV contrast for further evaluation. Knowledge of the presence and variability in appearance of these venous structures is important for physicians to avoid mislabeling them as masses or vascular malformations and to avoid potential surgical mishaps.

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