CASE REPORT

Renal cell carcinoma metastasis to the cerebellopontine cistern: intraoperative Onyx embolization via direct needle puncture

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SUMMARY

We report a rare case of a renal cell carcinoma (RCC) metastasis occupying the cerebellopontine and cerebellomedullary cisterns, and describe an alternative strategy for embolizing hypervascular intracranial tumors. A middle aged patient with a distant history of RCC presented with headaches, nausea, and vomiting, and was found to have an enhancing mass in the left cerebellopontine and cerebellopontine cisterns. The initial surgical resection was aborted due to excessive bleeding. After an unsuccessful attempt at intra-arterial embolization, the patient returned to the operating room and the tumor was devascularized by direct needle puncture Onyx embolization under biplane fluoroscopy. The devascularized tumor was then successfully dissected from the brainstem and adherent lower cranial nerves. In properly selected cases, open surgical direct needle puncture embolization of intracranial vascular tumors under biplane fluoroscopy is a viable alternative devascularization method.

BACKGROUND

The cerebellopontine angle (CPA) is a common location for intracranial tumors but is a rare site for tumor metastasis. Metastasis to the CPA represents between 0.2% and 2% of all reported brain metastases.¹ Of patients with renal cell carcinoma (RCC), 10–11% will ultimately develop brain metastases.² Although RCC are vascular tumors, cerebral RCC metastases are generally not associated with excessive operative blood loss, but when closely associated with critical structures, embolization can be important for safe dissection. We report a rare case of an RCC metastasis in the CPA and cerebellomedullary cistern that was embolized in the operating room via direct needle tumor puncture with Onyx. To our knowledge, this represents the third reported case of an RCC metastasis to the CPA region and the first described case of an intradural tumor embolized via direct needle puncture.

CASE PRESENTATION

A middle aged patient presented with a history of clear cell RCC treated with a nephrectomy 8 years previously and was without interval recurrence until presenting with occipital headaches and nausea.

INVESTIGATIONS

An MRI demonstrated a heterogeneously enhancing extra-axial lesion occupying the caudal CPA and

cerebellomedullary cistern (figure 1A, B). An octreotide scan showed uptake in the left CPA (figure 1C). Interestingly, there was evidence of chronic low-grade subarachnoid hemorrhage on gradient echo MRI sequences (figure 1D). This tumor was felt to most likely represent an extra-axial RCC metastasis. The patient was neurologically intact and no systemic disease was found on metastatic workup. A preoperative diagnostic angiogram was performed (figure 2). Due to moderate tumor blush, lack of large feeding arteries, shared blood supply with the brainstem, and the surgeon's feeling that critical arterial feeders could be controlled intraoperatively, embolization was not performed.

TREATMENT

A retrosigmoid craniotomy was performed, and the mass was found extending from just inferior to cranial nerves (CN) VII/VIII to near the foramen magnum with the rootlets of CN IX and X draped over the dorsal surface of the tumor. The anterior inferior cerebellar artery–posterior inferior cerebellar artery feeders were ventral to the tumor and could not be accessed. The safe surgical zones between CN were small and resection attempts resulted in immediate profuse bleeding. The surgery was aborted, and the following day transarterial embolization was attempted. However, tortuous anatomy prevented catheterization of the left anterior inferior cerebellar artery–posterior inferior cerebellar artery complex and its distal tumor feeders, and embolization was not performed.

The following morning, the patient returned to the operating room for open direct puncture tumor embolization followed by tumor resection. After femoral artery access was obtained and the lesion was again exposed, two C arms were positioned for biplane fluoroscopy (figure 3A). A diagnostic catheter was navigated into the left vertebral artery. Under direct vision, a 20 gauge spinal needle (Portex Inc, Keene, New Hampshire, USA) was inserted to the center of the tumor under fluoroscopic roadmap guidance. The stylet was removed and blood return was seen (figure 3B). The hub of the spinal needle was then connected to a 20 cm luer lock extension tubing (B Braun, Melsungen, Germany). An intralesional angiogram was performed through the needle to confirm an appropriate position within the tumor (figure 3C). The spinal needle and tubing were flushed with 0.3 mL

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Figure 1 (A) Axial with gadolinium and (B) coronal T2 views of preoperative MRI showing the 2.0 cm×2.5 cm extra-axial enhancing mass in the left cerebellopontine angle and cerebellomedullary cistern. (C) Transversal (upper) and coronal (lower) views of the preoperative octreotide scan showing radiotracer accumulation within the lesion. (D) Preoperative gradient echo axial MRI sequence showing susceptibility artifact in the cerebellar folia suggestive of blood breakdown products, possibly from chronic low grade subarachnoid hemorrhage.

of dimethyl sulfoxide followed by injection of Onyx 18 (ev3 Microtherapeutics Inc, Irvine, California, USA) into the tumor under negative subtracted roadmap. During embolization, intermittent angiograms were performed to assess the remaining vascularity. After embolization, microsurgical resection of the lesion was performed with minimal tumor bleeding (figure 3D, E). The CN were preserved, with the exception of a single rootlet of CN X that was adherent to the tumor capsule.

OUTCOME AND FOLLOW-UP

The patient had transient hoarseness and mild swallowing difficulties but was able to eat a regular diet. Postoperative MRI

showed a gross total resection (figure 4A). Final pathology confirmed a clear cell RCC with Onyx material in the vascular bed (figure 4B). The patient was doing well at the 1 month follow-up, only complaining of occasional dizziness and mild difficulty in swallowing.

DISCUSSION

RCC represents 70–80% of renal cancers and they commonly metastasize.³ Between 7% and 11% of RCC patients develop cerebral metastases.² RCC is considered to be resistant to fractionated radiation; therefore, patients with controlled systemic disease and accessible cerebral lesions are often treated with

Figure 2 (A) Anteroposterior and (B) lateral angiographic views of the left vertebral artery showing the tumor blush and the tortuous course of the vertebral and basilar arteries.

Figure 3 (A) A photograph of the biplane fluoroscopy setup for the intraoperative embolization. (B) A photograph of the direct needle puncture of the tumor, with blood return through the needle. (C) Anteroposterior fluoroscopic view of the intraslesional angiogram performed by injecting contrast into the tumor parenchyma via the needle. Of note, this image illustrates dangerous early filling of deep cerebral veins; therefore, before embolization was begun, the needle was repositioned and the intratumoral angiogram repeated until no early venous drainage was seen. (D) A post-embolization intraoperative photograph of extruded Onyx material layered on the tumor. Cranial nerves IX (upper arrow) and X (lower arrow) can be seen draped on the tumor surface. (E) A post-resection intraoperative photograph showing the empty tumor cavity.

open surgery. However, standalone treatment of RCC brain metastases with stereotactic radiosurgery has also yielded high rates of tumor control.⁴ The tumor described in this report was closely associated with the brainstem and lower CN, putting these adjacent critical structures at risk for delayed adverse effects after radiosurgery or requiring suboptimal radiation doses to be given at the tumor margin to spare the brainstem and CN.⁵

Although RCC tumors commonly metastasize to the brain parenchyma, discrete lesions in the extra-axial subarachnoid space are rare. A literature search yielded only two previously reported RCC metastases in the CPA and one report of a RCC tumor arising in the perimedullary region.^{6–8} Metastases of other cancers have been reported in the CPA, including the following: lung, breast, melanoma, prostate, gastrointestinal, nasopharyngeal, parotid, and lymphoma.¹

Direct puncture embolization has been reported for vascular head and neck tumors; however, reports of direct puncture embolization for intracranial masses are limited to a few intrasellar and dural based lesions.^{9–10} Superficial cerebral tumors may be candidates for open direct needle tumor puncture embolization. However, similar to intra-arterial cerebral tumor embolization procedures, it is critically important to perform direct puncture embolization of cerebral tumors under biplane fluoroscopy to avoid unintentional egress of embolic material into surrounding vascular structures.¹⁰ To our knowledge, the current case represents the first reported direct puncture embolization of a tumor deep to the dura.

CONCLUSION

We have reported a rare case of renal cell metastasis to the CPA and cerebellomedullary cistern that was unable to be embolized

Figure 4 (A) Postoperative MRI showing gross total resection. (B) A hematoxylin and eosin pathology micrograph demonstrating Onyx inside the blood vessels within the clear cell renal carcinoma tumor stroma.

transarterially but was successfully devascularized via open direct puncture embolization. In properly selected superficial vascular tumors, open surgical direct puncture embolization under biplane fluoroscopy may be a viable alternative devascularization method.

Learning points

- Renal cell carcinoma metastasis to the cerebral cisterns are rare, and only three cases have been previously reported in the cerebellopontine and cerebellomedullary cisterns.
- In properly selected superficial vascular tumors, open surgical direct puncture embolization under biplane fluoroscopy may be a viable alternative devascularization method.

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