CASE REPORT

Renal cell carcinoma metastasis involving vertebral hemangioma: dual percutaneous treatment by navigational bipolar radiofrequency ablation and high viscosity cement vertebroplasty

Jean-Baptiste Zerlauth, Reto Meuli, Vincent Dunet

Diagnostic and Interventional Radiology, Lausanne University Hospital, Lausanne, Vaud, Switzerland

Correspondence to

Dr Vincent Dunet, Lausanne University Hospital, Diagnostic and Interventional Radiology, Lausanne, Vaud 1011, Switzerland; vincent.dunet@chuv.ch

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SUMMARY

The case of a 70-year-old woman with progressive renal cell carcinoma (RCC) metastatic invasion of a L3 vertebral hemangioma treated by dual percutaneous radiofrequency ablation (RFA) and vertebroplasty is reported. The patient was surgically treated for RCC in 2001. Chemotherapy and immunotherapy were introduced in 2013 for ovarian, bladder and cerebral metastatic disease. An asymptomatic L3 benign hemangioma was noticed at this time. One-year CT and MRI follow-up studies demonstrated a nodular isolated soft tissue lesion involving the anterior edge of the hemangioma. Percutaneous treatment consisted of a L3 vertebral body unipedicular approach to perform a biopsy, RFA with a navigational bipolar RFA device and vertebroplasty using high viscosity cement. Histopathological examination confirmed metastasis of RCC. The 5-month spinal MRI and CT examinations demonstrated complete disappearance of the tumor.

BACKGROUND

Vertebral hemangiomas are the most common benign vascular neoplasms in the spine. We report the first case of a typical vertebral hemangioma that displayed progressive aggressive morphological changes due to renal cell carcinoma (RCC) metastatic graft, which was treated by dual percutaneous radiofrequency ablation (RFA) with a navigational bipolar RFA device and vertebroplasty.

CASE PRESENTATION

A 70-year-old woman was treated in May 2001 with right nephroureterectomy for RCC. In September 2013, chemotherapy and immunotherapy were introduced for multiple abdominal and cerebral metastases of RCC. On restaging studies, an asymptomatic L3 fatty lesion with a 'polka dot' appearance on CT and no fluorodeoxyglucose uptake on PET-CT was seen ([figure 1](#)), which was consistent with a typical benign hemangioma. No treatment was considered.

INVESTIGATIONS

In September 2014, focal ground glass opacity on the anterior edge of the hemangioma was seen on follow-up CT ([figure 2A, B](#)). Spinal MRI demonstrated a focal isolated soft tissue L3 lesion with strong enhancement on T1-weighted images after intravenous gadolinium injection ([figure 2C, D](#)).

A solitary L3 bone metastasis was suspected. Due to known multiple metastases in this patient, combined immunochemotherapy was continued. One year later, follow-up studies demonstrated a lesion growing with almost complete replacement of the fatty content of the hemangioma ([figure 2E, F](#)). Whole spinal MRI showed that the lesion was still isolated without extension into the epidural, foraminal or paravertebral spaces ([figure 2G, H](#)). The lesion was asymptomatic and other metastases were considered as stable under immunochemotherapy. Percutaneous therapy was therefore planned.

TREATMENT

After obtaining written informed consent, the procedure was performed under general anesthesia with the patient lying in the ventral recumbent position. A unilateral right transpedicular approach was undertaken with a 10-gauge bevelled cannula under real-time biplane fluoroscopic guidance (Philips Healthcare, Best, The Netherlands). Both biopsy and aspiration were performed through a 13 gauge needle. The distal tip of the working cannula was placed at the posterior rim of the osteolytic lesion involving the L3 vertebral body. The SpineSTAR Tumour Ablation System 10–15 mm (DFINE, San Jose, California, USA) was chosen to ablate as much volume of osteolysis as possible. The navigational bipolar RFA probe was placed within the lesion under real-time fluoroscopic guidance ([figure 3A, B](#)). A total of four cycles of thermoablation running over 23 min were applied over the right half of the L3 body. Temperatures were monitored at the distal and proximal edges of the ablation zone by two inner thermocouples, the generator being set to automatically stop when the proximal thermocouple reached 50°C to avoid damage to posterior neurological structures. After 15 min of passive cooling, 6 mL of ultra-high viscosity PMMA StabiliT VP (DFINE) were injected through the same working cannula under real-time biplane fluoroscopic guidance. The final X-ray successfully demonstrated complete filling of the lesion with cement without any paravertebral or discal leakage ([figure 3C, D](#)). Following a smooth postoperative recovery, the patient was discharged home early in the evening without any pain medication.

OUTCOME AND FOLLOW-UP

Histopathological examination confirmed RCC metastasis. Clinical examination, CT and MRI scans

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Figure 1 Images of the L3 lesion in 2013. Axial CT images of (A) bone and (B) soft tissue showing an osteolytic lesion with fatty content and polka dot appearance consistent with a benign hemangioma. The lesion showed no fluorodeoxyglucose uptake on axial fusion PET-CT image (C).

were performed at 1 and 5 months after the procedure. The CT scan showed complete disappearance of the osteolytic lesion, which was filled with cement. Whole spine MRI showed no residual tumor tissue (figure 3E, F). This imaging appearance was strictly superimposable on both the 1-month and 5-month CT and MRI examinations.

DISCUSSION

Vertebral hemangiomas are the most common benign vertebral tumors and are found in about 10% of autopsy series. They are mostly asymptomatic¹ and incidentally discovered on multislice imaging with the classic 'polka dot' appearance on CT and nodular T1- and T2-hyperintensity on MRI. Fewer than 1% of vertebral hemangiomas have an aggressive behavior and produce symptoms due to vertebral body collapse or cord compression secondary to epidural extension or posterior cortical bulging. Only two cases of metastatic involvement of a vertebral hemangioma

have been reported in patients with colon adenocarcinoma² and choriocarcinoma.³ Overall, this suggests that benign vascular tumors may be invaded by metastases in cases of synchronous second malignant tumors via hematogenous spread. Since malignant transformation has not been reported, the appearance of an aggressive pattern in a previously known typical vertebral hemangioma should raise concern for metastatic graft.

RCC is the most common malignancy of the kidney, and about 40% of patients will relapse with disseminated disease after initial surgery,⁴ the spine being the most common site of osseous involvement. Although RCC has traditionally been considered as a relatively radioresistant tumor, external targeted radiation is a very common therapeutic modality and emergency spinal radiosurgery can now deliver a single-fraction tumor dose while sparing adjacent spinal cord and nerve roots.⁵ Greenwood *et al*⁶ reported a local tumor control rate of 100% when combining radiation therapy and RFA.

Figure 2 Images of the L3 lesion in 2014 (top line) and 2015 (bottom line). Axial CT slices show that the hemangioma was progressively invaded by tumorous tissue starting from the anterior edge of the L3 lesion. The tumor had a ground glass appearance on the bone images (A, E) and progressively replaced the fatty content of the hemangioma on the soft tissue images (B, F). On MRI the tumor initially appeared as an anterior hypointense nodule on the sagittal unenhanced T1-weighted image (C) with strong enhancement on the axial post-gadolinium T1-weighted image (D). It grew back and forth and progressively replaced the T2-weighted hyperintense fatty component of the hemangioma (G, H).

Figure 3 Dual percutaneous treatment. (A) Right transpedicular approach enabled the navigational bipolar radiofrequency ablation (RFA) device to be positioned in the L3 lesion (B) under real-time fluoroscopy guidance. After RFA, vertebroplasty was performed to stabilize the cavity. The same cannula was used for vertebral augmentation by injection of high viscosity cement with no leakage visible on the final X-ray (C and D, coronal and sagittal views). MRI at 5-month follow-up showed only peripheral rim enhancement due to post-RFA scar tissue with no residual nodule, which confirmed complete local control of the metastasis on axial (E) and sagittal (F) views.

Percutaneous RFA has increasingly been used for minimally invasive treatment of vertebral metastases. However, it does not prevent pathological compression fractures in cases of a potentially unstable neoplastic lesion and even increases the risk of fracture when used alone. A combination of RFA with a monopolar probe and vertebroplasty⁷ or kyphoplasty⁸ has thus been reported in cases of spinal oligometastases with significant pain reduction⁸ and no local tumor recurrence after 3 months.^{7, 8} Because the use of monopolar RFA electrodes may be limited by thermal injury of the adjacent spine and nerves, bipolar RFA electrodes have been developed and have demonstrated a more favorable temperature distribution.⁹

To control tumor growth and stabilize the vertebral body, we performed dual modality percutaneous treatment by combining RFA with a navigational bipolar device and vertebroplasty. Complete local control of the tumor was shown at 5-month follow-up with no neurological complications. Wallace *et al*¹⁰ recently published local control rates of 70% at 1 year using the same technique on 55 patients with spinal oligometastases. The rate decreased to 67% in cases of simultaneous systemic metastatic progression.

A large prospective study with long-term follow-up should now be carried out to confirm these promising results, especially in patients with painful spinal oligometastatic disease.^{8, 10}

Contributors JBZ and VD were involved in case design, data collection, first draft writing and manuscript editing. RM was involved in data collection and manuscript editing. JBZ, RM and VD gave their consent before submission.

Competing interests None declared.

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REFERENCES

- 1 Fox MW, Onofrio BM. The natural history and management of symptomatic and asymptomatic vertebral hemangiomas. *J Neurosurg* 1993;78:36–45.
- 2 Zapałowicz K, Bierzyńska-Macyszyn G, Stasiów B, *et al*. Vertebral hemangioma coincident with metastasis of colon adenocarcinoma. *J Neurosurg Spine* 2016;24:506–9.
- 3 Lee JH, Park CW, Chung DH, *et al*. A case of lumbar metastasis of choriocarcinoma masquerading as an extraosseous extension of vertebral hemangioma. *J Korean Neurosurg Soc* 2010;47:143–7.
- 4 Motzer RJ, Bander NH, Nanus DM. Renal-cell carcinoma. *N Engl J Med* 1996;335:865–75.
- 5 Gerszten PC, Burton SA, Welch WC, *et al*. Single-fraction radiosurgery for the treatment of spinal breast metastases. *Cancer* 2005;104:2244–54.
- 6 Greenwood TJ, Wallace A, Friedman MV, *et al*. Combined ablation and radiation therapy of spinal metastases: a novel multimodality treatment approach. *Pain Physician* 2015;18:573–81.
- 7 Schaefer O, Lohrmann C, Markmiller M, *et al*. Technical innovation. Combined treatment of a spinal metastasis with radiofrequency heat ablation and vertebroplasty. *AJR Am J Roentgenol* 2003;180:1075–7.
- 8 Zheng L, Chen Z, Sun M, *et al*. A preliminary study of the safety and efficacy of radiofrequency ablation with percutaneous kyphoplasty for thoracolumbar vertebral metastatic tumor treatment. *Med Sci Monit* 2014;20:556–63.
- 9 Bornemann R, Pflugmacher R, Frey SP, *et al*. Temperature distribution during radiofrequency ablation of spinal metastases in a human cadaver model: comparison of three electrodes. *Technol Health Care* 2016;24(5):647–53.
- 10 Wallace AN, Tomasian A, Vaswani D, *et al*. Radiographic local control of spinal metastases with percutaneous radiofrequency ablation and vertebral augmentation. *AJNR Am J Neuroradiol* 2016;37:759–65.

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