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CASE REPORT

Hypervascular cervical spine metastases: embolization by direct injection of Onyx-18

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Abstract
Purpose Spinal metastases are common in patients with cancer. Following lung and liver, spine is the most common site for cancers to metastasize. Many of them are hypervascularized. These cases are a particular challenge for the surgeon and represent a significant danger of massive blood loss during surgery. Hypervascularized metastases of the cervical spine also include the risk of postoperative bleeding with severe neurological impairment.
Case summary We report a case of a 67-year-old women with breast cancer (BC) metastasis within the vertebral bodies of C3 and C4 with nearly complete bony destruction of the ventral column and intraspinal tumor masses compressing the spinal cord at level C3 and C4. The hypervascularized tumor was supplied by multiple minor vessels from both vertebral arteries, too small to be coiled individually. Due to an allergy to aspirin, intravascular stenting of the vertebral arteries was not an option. We decided to perform a preoperative direct injection of onyx-18 for embolization of the tumor.
Conclusion Presurgical direct injection of Onyx-18 for treating hypervascular spinal metastases of breast cancer seems to be an effective and safe technique and reduces intraoperative bleeding to a minimum.

Keywords Onyx · Direct puncture · Spinal metastases · Breast cancer · Embolization

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Introduction

Vertebral lesions can severely reduce quality of life in terms of excessive pain, pathologic fractures, vertebral instability and the risk of severe neurological impairment. Metastases of well-vascularized primary tumors, such as breast carcinoma, are frequently encountered in spine [1]. The majority of these metastases are hypervascularized [2, 3]. The cervical spine is a lesser common site of metastatic disease (10 %) than thoracic or lumbar spine (70 or 20 %). Around 50 % of metastases arise from one of three primary types of cancer: breast, lung or prostate [4]. Wong et al. [5] found spinal metastases in 36 % of cancer-deceased patients by autopsy. Surgical stabilization and neural decompression belong to the standard of oncologic management. Due to hypervascularization intraoperative high risk of massive blood loss exist. The opportunity of a preoperative embolization should be considered in any patient undergoing open stabilization of spinal neoplasia.

Onyx is a nonpolymerizing liquid agent, composed of ethylene–vinyl alcohol copolymer dissolved in dimethyl sulfoxide. By creating a spongy cast an intravascular occlusion is possible. Some studies describe it as a safe and efficient technique for embolizing head and neck tumors [6, 7]. In a retrospective study Ghobrial et al. [8] presented data of patients undergoing preoperative transarterial embolization of spinal tumors. They concluded that a transarterial embolization is a safe and feasible option.

The present study reports, to our best knowledge, the first case of cervical metastasis of a breast carcinoma embolized by direct injection of Onyx-18.

Case presentation

A 67-year-old woman was referred to our department with progressive pain in the cervical spine and weakness

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of both hands. The measurement of the Oswestry Disability Index on admission to hospital with 98 % showed the serious restriction of the patient. The visual analog scale for pain of the spine and the leg was 10.0. X-Ray, CT and MRI of the spine revealed an osteolytic mass within the vertebral bodies of C3 and C4 with nearly complete bony destruction of the ventral column and intraspinal tumor masses compressing the spinal cord at level C3 and C4. The tumor masses infiltrated the posterior arch of both vertebrae and showed an additional intraspinal growth from the dorsolateral left side. Due to segmental instability she had to wear a stiff neck for stabilization.

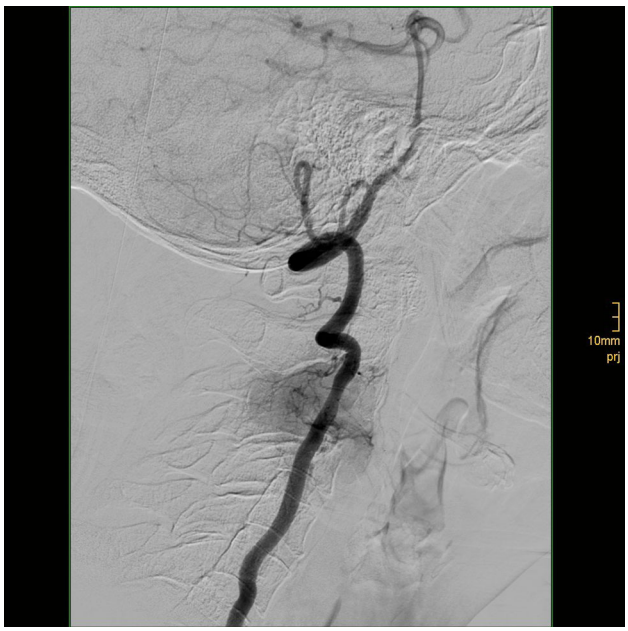

Fig. 1 Angiography (intraarterial digital subtraction angiography) over the A. vertebralis. An strong enhancement near C3–C4 vertebra is shown

The patient was diagnosed with left-sided carcinoma of the mamma 10 years earlier. (pT1c, pN1b, M0, G1-2, R0, estrogen receptor (ER) pos., progesterone receptor pos., human epidermal growth factor receptor 2 (HER2/neu) negative). A subcutaneous mastectomy on the left side was performed and an adjuvant chemotherapy (CMF-Scheme) was applied. Additionally she underwent a hysterectomy when she was diagnosed with an uterus carcinoma 9 years ago.

The indication of an operative decompression and internal stabilization of the cervical spine was given. Permission for a case report was granted and informed consent about potential complications was obtained from the patient. The preoperative embolization was performed by the Department of Radiology. Due to the fact of the diffused blood supply of the tumor (Fig. 1), preoperative coiling was not possible. By reason of patient's aspirin allergy an implantation of a drug-eluting stent was not possible, too. We decided to use Onyx-18. Through a superselective introduced catheter a direct injection of Onyx-18 into the supplying branch of the tumor was done. The success of the injection was verified by angiography (Fig. 2).

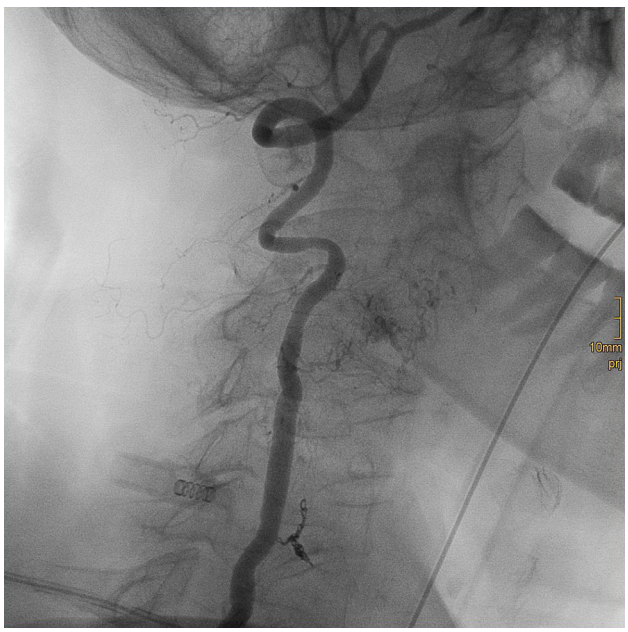

Fig. 2 Angiography after direct injection of ONYX-18 into the blood vessels supplying the metastases C3–C4

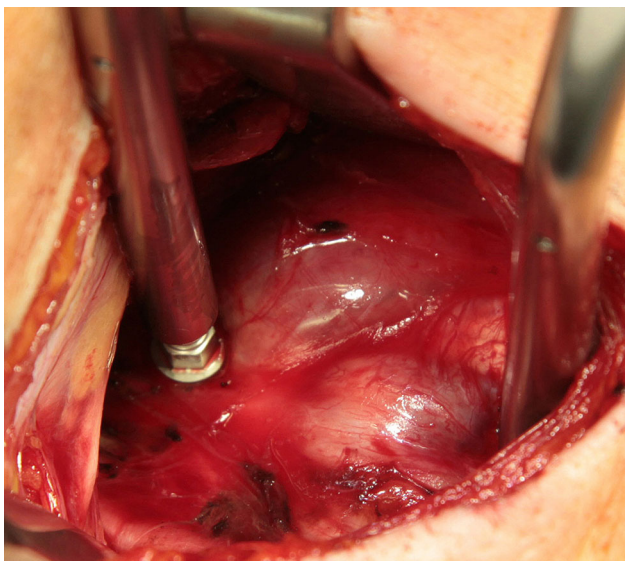

Fig. 3 View of the operational situs with the caspar distractor in place. The pins are positioned in the caudal and cephalad vertebral bodies (C2 and C5). The tumor masses at the ventral border of the cervical vertebrae C3 and C4 are clearly visible

Surgery was performed the day after direct injection of ONYX-18 into the tumor mass in a supine position and under general anesthesia using a ventral approach. After microsurgical exposure, the tumor presented at a completely extradural location (Fig. 3). Following the resection of the tumor and corporectomy (Fig. 4), the vertebral bodies C3 and C4 were replaced (Pyramesh-Cage, Medtronic) and ventral plate-stabilization (CSLP, Synthes) from C2 to C5 was performed (Fig. 5a, b). Due to the preoperative embolization, the intraoperative blood loss could be minimized to 750 ml and the surgeon obtained an optimal view on the operational site. A blood transfusion was not necessary, neither intraoperative nor postoperative.

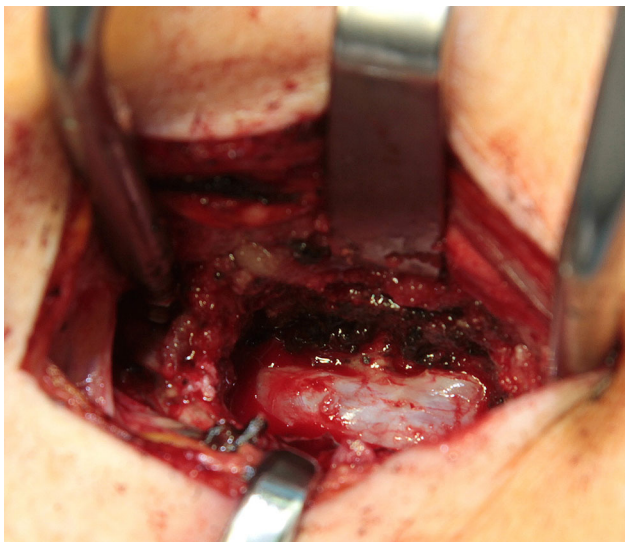

Fig. 4 The intraoperative view after corporectomy of the vertebrae C3 and C4 shows the wide decompression of the cervical myelon

Macroscopic pathological examination revealed a compact, white-brown colored tumor. The definitive histological examination of the tissue revealed tumor cells with eosinophilia staining stoma and basophilic nucleus (Fig. 6a, b). PAS-positive vacuoles are clearly recognizable. Following immunohistochemical staining, the tumor cells were positive for cytokeratin (CK) 7, CK20, P63, TTF-1 and Chromogranin A negative. 95 % were positive for ER, negative for HER2/neu and for PR. The Ki67-proliferation index was 7 %. Fluorescence in situ hybridization showed no positive signals for HER2/neu. The final histopathology report revealed the tumor as a metastatic lesion originating from the previously diagnosed breast adenocarcinoma.

Postoperatively, the patient presented an impressive pain reduction (VAS postoperative spine 3, leg 0) and a substantial increase of the Oswestry disability score up to 78 %. Walking down the hallway was now possible without the support of crutches. The patient was transferred to a

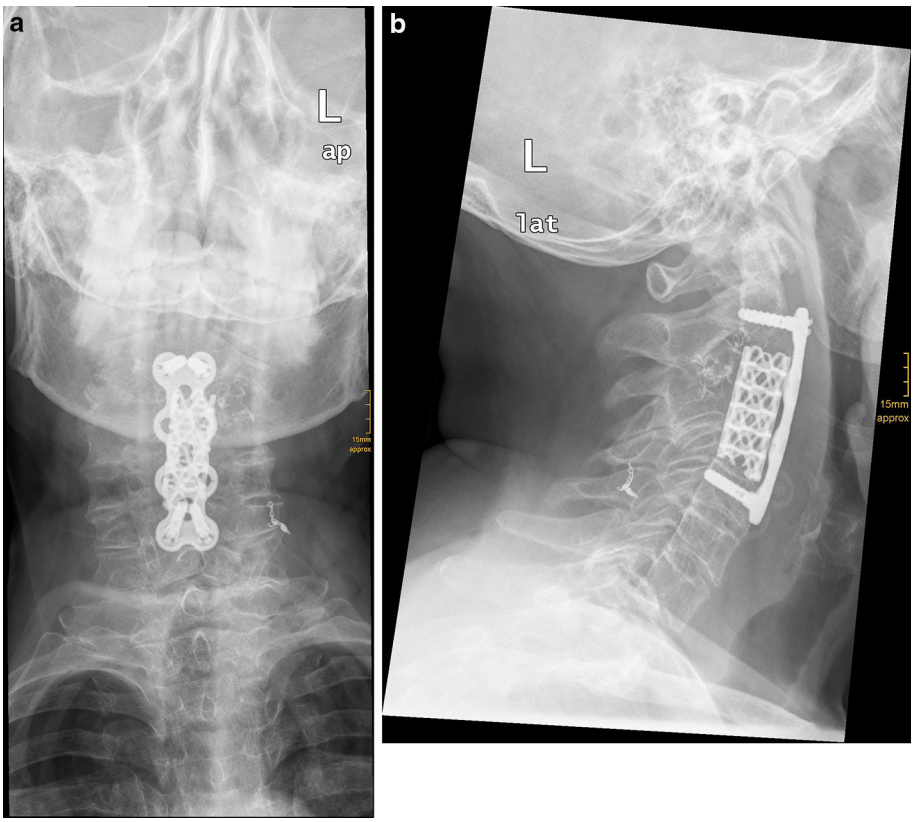

Fig. 5 **a**, **b** Postoperative X-Ray of the cervical spine. The vertebral bodies C3 and C4 were replaced (Pyramesh-Cage) and ventral plate-stabilization (CSLP, Synthes) from C2 to C5 was performed

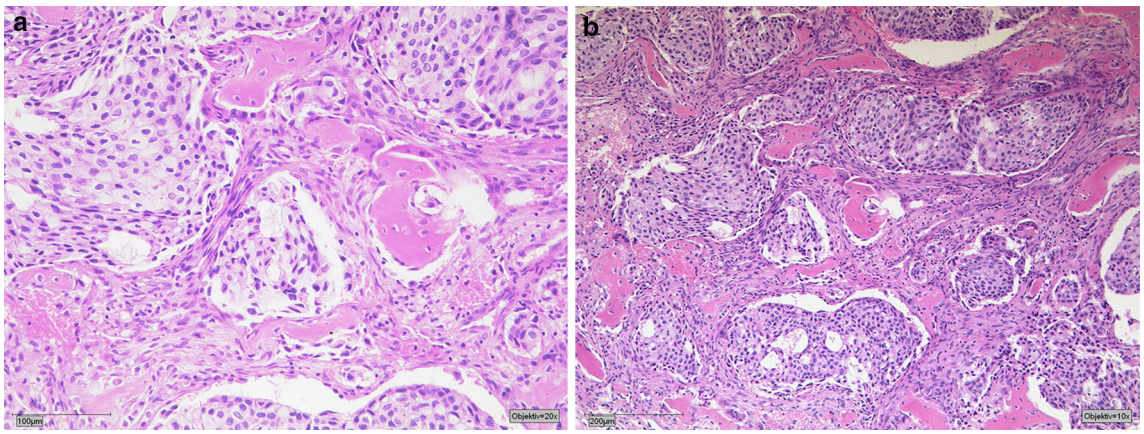

Fig. 6 **a**, **b** Histopathology of the removed tumor mass and vertebrae C3–4. Bony and cartilage fragments with tumor infiltration of the medullary canal. Medium-sized tumor cells with eosinophilia cytoplasm and basophilic cell nucleus can be identified. PAS-positive vacuoles can be found

medical oncologic service and received combined radiochemotherapy.

Discussion

The spinal column is the most common location among osseous sites for metastatic deposits. Spinal involvement may occur in up to 40 % of patients with cancer and most of them are hypervascularized. The presurgical embolization of hypervascular bone metastases has been shown to be effective in reducing blood loss during surgery and creating an excellent view of the site during the operation [9].

Aggressive spinal hemangioma has already been treated successfully with the use of Onyx [10]. Additionally the effectiveness and safety of an Onyx injection has been shown in some head and neck tumors, like paragangliomas, by several reports [6, 11]. Besides the use in tumors, successful application into cervical arteriovenous fistulas has been described [12, 13].

Clarençon et al. [14] reported two cases of presurgical devascularization by direct puncture and injection of Onyx-18 to treat hypervascular spinal metastases close to the anterior spinal artery. The primary tumor was a renal adenocarcinoma in one case and a thyroid cancer in the other case.

To the best of our knowledge our case represents the first description of the use of Onyx-18 in a patient with spinal metastases of a BC and an allergy to aspirin.

Conclusion

Presurgical direct injection of Onyx-18 for treating hypervascular spinal metastases of breast cancer seems to be an effective and safe technique and reduces intraoperative bleeding to a minimum.

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Conflict of interest The authors declare that they have no competing interests. We have no personal or financial conflicts of interest related to the preparation and publication of this manuscript.

Informed consent Written informed consent for the publication of clinical data was obtained from the patient.

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