CASE REPORT

Preoperative Embolization of Cervical Spine Osteoblastomas: Report of Three Cases

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SUMMARY: Our aim was to describe the technique and clinical results of preoperative embolization of cervical spine osteoblastomas. We treated 3 patients with these tumors with transarterial embolization and subsequent surgical excision. In all 3 patients, distal access to the tumor-supplying vessels was gained with a microcatheter and embolization was performed with polyvinyl alcohol particles. No complications occurred. Surgical resection was performed in all patients without relevant bleeding. The postoperative course was uneventful in all patients. Preoperative embolization is a valuable adjunct to the surgical treatment of osteoblastomas of the cervical spine.

Osteoblastoma is a rare benign primary bone tumor, histologically similar to osteoid osteoma, but one fourth as common. These tumors account for approximately 3% of benign and 1% of all primary bone tumors.[1,2] "Osteoblastoma" is defined as a vascular, osteoid, and bone-forming tumor containing numerous benign-appearing osteoblasts. Between 32% and 46% of all osteoblastomas involve the spinal column, including the sacrum.[3,4] Of all spinal osteoblastomas, 9%–39% are found in the cervical spine.[1,5] Radical surgical excision is the treatment of choice for osteoblastoma.[6] The use of modern imaging techniques allows precise surgical planning. In some cases, however, intraoperative complete resection of the tumor may be impeded by excessive bleeding. Especially, osteoblastomas in the cervical spine, localized in close proximity to the vertebral artery, require complex therapeutic solutions.[7]

We report our experience in 3 patients with cervical spine osteoblastomas who were treated with transarterial embolization and subsequent surgical excision. The management, technique, and advantages of this 2-step approach are presented.

Patients and Methods

We treated 3 patients, 2 men (19 and 21 years) and 1 woman (57 years) diagnosed as having a cervical spine osteoblastoma. All patients underwent diagnostic imaging with native (non-enhanced)/contrast-enhanced spiral CT before angiography.

Angiography and embolization were performed with the patient under general anesthesia and intravenous heparinization, with monitoring of the activated clotting time. The degree of tumor vascularization and the feeding vessels were determined by diagnostic angiography of the subclavian arteries and their branches, the vertebral and external carotid arteries, with a 4F diagnostic catheter. In 2 patients with osteoblastomas at the upper cervical spine, access to the tumor vessels was achieved by placement of a 6F guiding catheter into the vertebral artery via a transfemoral approach. In 1 patient with tumor localization at C6–7, embolization of feeding branches of the ascending cervical artery was performed via the transbrachial route with a 4F catheter. In all patients, distal access to the tumor-supplying vessels was gained with a microcatheter, and embolization of the tumor vascular bed was performed with polyvinyl alcohol (PVA) particles (150–250 μm, CONTOUR Emboli; Boston Scientific, Natick, Mass). No complications occurred. Subsequently, surgical resection was performed the next day without relevant bleeding as a result of preoperative embolization. The postoperative course was uneventful in all patients.

Case 1

A 19-year-old man presented with a right cervical mass, moderate pain, and right C7 root syndrome. A spiral CT scan showed an expansile lytic lesion (15 mm in diameter) in the right pedicle of C7 with extension to the right neuroforamen of C6–7 and the vertebral body. Because the etiology of this lesion was unclear, tumor biopsy and nerve root decompression were performed via a dorsal approach. After the histopathologic diagnosis of osteoblastoma was confirmed, angiography and embolization were initiated. Injection of the right thyrocervical trunk revealed a hypervascular lesion, which was fed mainly by multiple dilated branches of the right ascending cervical artery. After superselective catheterization of these branches via a transbrachial approach, the tumor was embolized by injecting calibrated particles (150–250 μm) until the tumor vessels were completely occluded. Eighteen hours after embolization, radical resection was performed via an anterior approach, with minimal blood loss. Follow-up examinations showed no signs of recurrence 2 years after therapy.

Case 2

A 21-year-old man presented with a 2-year history of suboccipital pain and restricted movement of the head. A spiral CT scan showed an expansive large (50 mm in diameter) lesion with subtotal destruction of the posterior arch of the atlas and extension into the spinal canal. The thin sclerotic peripheral shell surrounding the lesion and several punctuate calcifications within the tumor matrix were demonstrated in the native spiral CT scan. The lesion showed strong enhancement after administration of contrast media. Diagnostic angiography revealed a hypervascular lesion displacing the atlantal segment of the right vertebral artery. The tumor derived 90% of its blood supply from feeding vessels of the right vertebral artery and the right external occipital artery and 10% from branches of the hypoplastic left vertebral artery (Fig 1). The embolization of the tumor vascular bed was performed via the dilated branches of the right vertebral artery, with particles in the range of 150–250 μm. Because of deep penetration into the tumor bed, this embolization also obliterated the collateral supply from the external occipital artery. Considering the hypoplastic nature of the left vertebral artery, we did not perform an embolization

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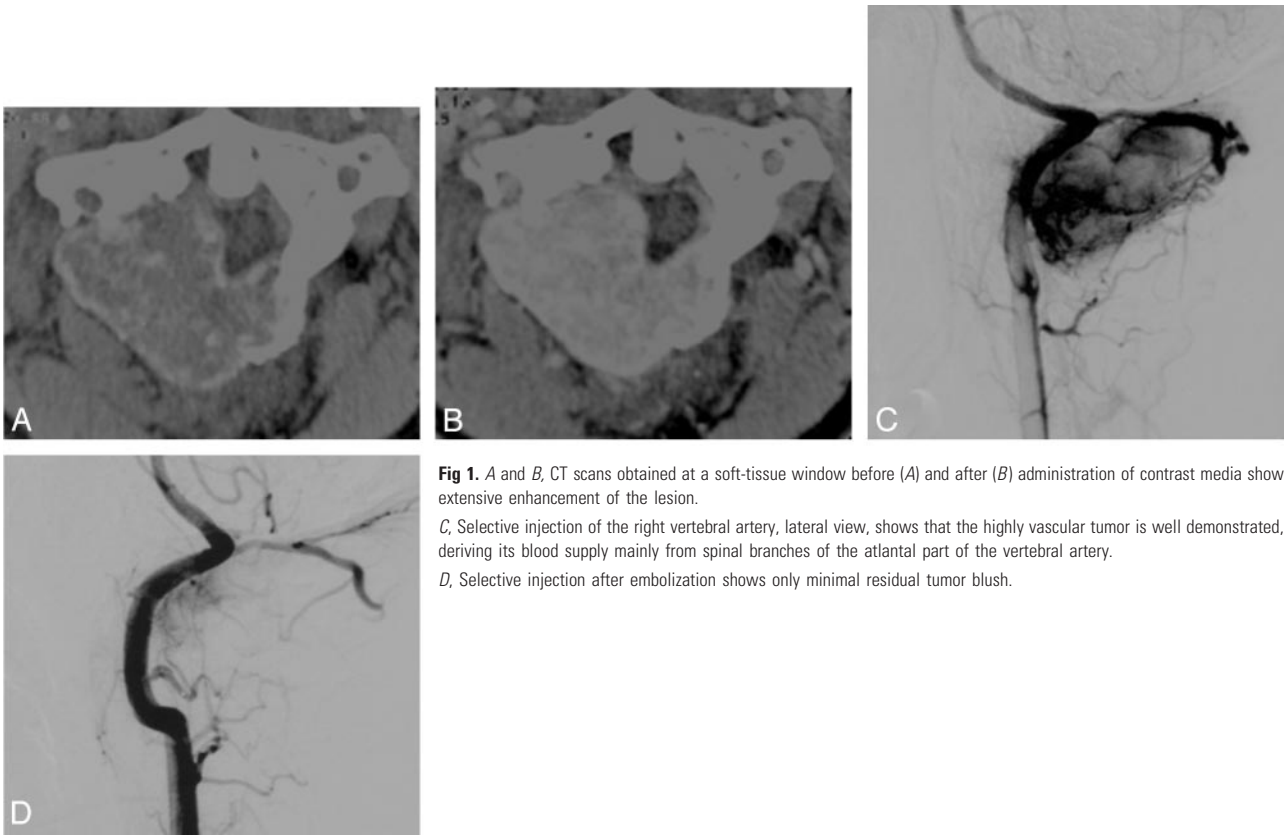

Fig 1. *A* and *B,* CT scans obtained at a soft-tissue window before (*A*) and after (*B*) administration of contrast media show extensive enhancement of the lesion.

C, Selective injection of the right vertebral artery, lateral view, shows that the highly vascular tumor is well demonstrated, deriving its blood supply mainly from spinal branches of the atlantal part of the vertebral artery.

D, Selective injection after embolization shows only minimal residual tumor blush.

via this vessel. Surgery took place 17 hours after embolization with moderate bleeding. Close outpatient follow-up was initiated, showing no signs of recurrence 1 year after treatment.

Case 3

A 57-year-old woman presented with cervical pain. A native spiral CT scan showed an expansile calcified lesion of the left vertebral arch of C2, with extension into the spinal canal. The maximal diameter of the lesion was 32 mm. Angiography was performed through the femoral route, and the left and right vertebral arteries were injected. Injection of the left vertebral artery revealed a hypervascular lesion, which was fed by an elongated spinal branch. The tumor was embolized via this branch with particles in the range of 150–250 μm. Surgery took place 16 hours after embolization without relevant bleeding. Spiral CT performed 6 months after therapy revealed local recurrence of the lesion. Angiography demonstrated a hypervascular tumor deriving its blood supply from the right and left ascending cervical arteries. A re-embolization was not performed because of spontaneous anastomoses between the tumor-feeding vessels and both vertebral arteries, increasing the risk of cerebral ischemic complications. After a second resection followed by percutaneous radiation therapy, no signs of progressive disease were evident in a 10-month interval.

Discussion

Osteoblastoma is a benign hypervascular tumor, which is often located in the spinal column.[3,4] Like osteoid osteomas, osteoblastomas tend to involve the posterior component of the spine.[5] They predominantly affect adolescents and young adults in the second and third decades of life.[8] Patients usually have a dull localized pain for more than a year before diagnosis.[1] Although osteoblastoma represents a nonmalignant tumor, spinal lesions may cause serious neurologic impairment due to their expansile growth. Furthermore, osteoblastomas rarely undergo malignant transformation, most commonly with a histologic appearance reminiscent of osteosarcoma.[1-6,8-12] The curative approach is radical surgical resection. Nevertheless, complete resection is often impeded by extensive intraoperative bleeding.

Superselective angiography has a major role not only as a diagnostic tool but also as a therapeutic procedure before surgery.[13] Preoperative embolization reduces intraoperative bleeding, can make a complete resection more feasible, reduces postoperative complications, and has the potential to improve patients' outcomes.[3,11] Surgical resection of osteoblastomas is greatly facilitated by preoperative embolization if surgery is performed within 24 hours after devascularization of the tumor bed. Longer intervals increase the risk of reconstitution of the collateral vascular supply, thus endangering the success of embolization.[10]

Precise analysis of the vascular pattern, with identification of the vessels feeding the tumor and their relationship with those supplying the spinal cord, is highly important for good results without complications.[13] The goal of preoperative embolization is devascularization of the tumor with preservation of the feeding vessels. The use of calibrated particles in the range of 150–250 μm allows a deep penetration into the vascular bed of the tumor with a low risk of ischemic damage to the spinal cord, which is supplied by vessels of a smaller diameter.

In our experience, preoperative embolization was a valuable adjunct to the surgical treatment of these lesions.

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