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Intra-arterial Onyx Embolization of Vertebral Body Lesions

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While Onyx embolization of cerebrospinal arteriovenous shunts is well-established, clinical researchers continue to broaden applications to other vascular lesions of the neuraxis. This report illustrates the application of Onyx (eV3, Plymouth, MN) embolization to vertebral body lesions, specifically, a vertebral hemangioma and renal cell carcinoma vertebral body metastatic lesion.

INTRODUCTION

Hypervascular bone metastases and vascular spinal tumors can cause high volume blood loss during open surgery. Presurgical embolization of these lesions decreases intraoperative blood loss and facilitates subsequent surgical resection. Agents used for embolization of tumors include polyvinyl alcohol (PVA), gelfoam powder, fibrin glue, gelatin microspheres, liquid adhesives, alcohol and coils. Until recently, PVA particle embolization has served as the mainstay of embolization. Onyx (eV3, Plymouth, MN, USA) is a nonpolymerizing liquid agent composed of ethylene-vinyl alcohol copolymer dissolved in dimethyl sulfoxide. When injected, Onyx precipitates within vessels forming a spongy cast. We report the use of Onyx in the embolization of vertebral body lesions, including a renal cell carcinoma vertebral body metastatic lesion and a vertebral hemangioma.

CASE REPORTS

Case 1

A 74-year-old male patient with ongoing persistent lower lumbar spine pain, shortness of breath, and cough was initially treated symptomatically for his pain and for presumed pneumonia. Computed tomography (CT) demonstrated an 11 mm right middle lobe lesion and an indeterminate 13 mm right adrenal lesion, prompting further evaluation with positron emission tomography (PET)-CT. A PET-CT demonstrated a fluorodeoxyglucose (FDG)-avid left renal mass suggestive of malignancy with an associated L2 vertebral body and left humeral head destructive lesion. He underwent total spine magnetic resonance imaging (MRI) and lumbar spine CT imaging, revealing a large destructive L2 vertebral body lesion with a pathologic fracture and 4-mm soft tissue extension into the ventral spinal canal, resulting in moderate left-sided spinal canal narrowing (Fig. 1). Significant
A 52-year-old male patient presented with six months of progressive bilateral lower extremity weak-
ness and worsening sensory function, leading to multiple falls. There were also spasms and spasticity of the lower extremities bilaterally, and several episodes of fecal and urinary incontinence. A CT and total spine MRI revealed multiple lesions with coarse trabeculae in the thoracic (T1, T3 and T11) and lumbar spine (L1), most severe within the T3 vertebral body. These lesions extended to the posterior elements and soft tissues in the surrounding paravertebral and epidural space, causing significant anterior cord compression (Fig. 4).

An open biopsy confirmed an intraosseous hemangioma, and the patient was referred for embolization prior to anticipated surgical resection. The patient was placed under general anesthesia and standard access with a 5 French sheath in the common femoral artery was achieved. The right T4 segmental artery was selectively catheterized with a Cobra catheter (Terumo, Somerset, NJ, USA). Angiography demonstrated a large pathologic blush in the region of the T3 vertebral body, corresponding to the known hemangioma (Fig. 5A). Opacification of a spinal pial artery was not seen. An Echelon microcatheter was advanced into the segmental artery and the vascular supply to the hemangioma was embolized with a total of 0.24 mL of Onyx-18 (Fig. 5B). The procedural total fluoroscopy time was 27 minutes, and procedural duration was 2.5 hours. Post-embolization angiography via the Cobra catheter confirmed no further pathologic blush (Fig. 5C, Fig. 6). The patient recovered uneventfully from the embolization and surgical resection, the latter with 300 cc of estimated blood loss.

**DISCUSSION**

Metastatic disease occurs in approximately 30% to 50% of patients with renal cell carcinoma at the time
A hypodense lesion with coarse trabeculae within the T3 vertebral body with extensive soft tissue in the surrounding paravertebral and epidural space causing significant anterior cord compression (A). Sagittal T2-weighted (B) and Short T1 Inversion Recovery (STIR) (C) magnetic resonance images of thoracic spine demonstrate a heterogeneous lesion at the T3 vertebral body extending laterally and posteriorly through the vertebral body and causing severe central canal compression.

Fig. 4. Axial computed tomography demonstrates a hypodense lesion with coarse trabeculae within the T3 vertebral body with extensive soft tissue in the surrounding paravertebral and epidural space causing significant anterior cord compression (A). Sagittal T2-weighted (B) and Short T1 Inversion Recovery (STIR) (C) magnetic resonance images of thoracic spine demonstrate a heterogeneous lesion at the T3 vertebral body extending laterally and posteriorly through the vertebral body and causing severe central canal compression.

Fig. 5. Selective angiography of the right T4 segmental artery demonstrates a pathologic blush in the region of the T3 vertebral body (A). Intraprocedural unsubtracted antero-posterior radiograph demonstrates Onyx distributed through the known T3 hemangio- ma (B). Post-embolization selective injection of the right T4 segmental artery demonstrates no residual opacification of the pathologic vascular blush (C).
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Fig. 6. Postembolization axial noncontrast computed tomography (A) and coronal reformat (B) show penetration of Onyx through tumor vessels within the T3 vertebral body.

peroperative hemorrhage prior to corporectomy in hypervascular spinal tumors. Smith et al. demonstrated the safety and effectiveness of transarterial embolization of symptomatic vertebral hemangiomas in eight cases using PVA. In 2013, Yao et al. described four cases of transpedicular n-butyl cyanoacrylate (NBCA) direct-puncture embolization of spinal hemangiomas as a preoperative adjunct, facilitating resection of these high vascular tumors.

Cases reporting the use of Onyx for preoperative embolization of spinal tumors are limited. Hurley et al. were the first to document the use of Onyx, transarterially, in the treatment of two cases of aggressive vertebral hemangiomas. Additional studies report use of Onyx via an arterial route and by direct puncture in the treatment of hypervascular head, neck and spinal tumors. Advantages of Onyx embolization include a more controlled injection due to gradual precipitation in a centripetal fashion, allowing for slower and more accurate injections as well as penetration of very small caliber vessels. In addition, it can be easily visualized during surgery via intraoperative X-rays and directly visualized, serving as a roadmap for the surgeon.

As is done during particulate embolization, careful attention must be paid to the initial diagnostic angiographic run prior to embolization to ensure occlusion of a spinal pial artery such as the artery of Adamkiewicz is not seen. In both of our illustrative cases, this was not seen and embolization proceeded uneventfully without complication. Notably, as is illustrated in Fig. 3, reflux of Onyx into the epidural venous plexus may occur without resultant morbidity. Our results further the growing body of literature confirming the safety and efficacy of Onyx embolization of vertebral body lesions.

REFERENCES


