Preoperative Embolization of Primary Spinal Aneurysmal Bone Cysts by Direct Percutaneous Intralesional Injection of *n*-Butyl-2-Cyanoacrylate

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ABSTRACT

Aneurysmal bone cysts (ABCs) are highly vascular lesions often referred for preoperative transarterial embolization. However, accessible arterial pedicles do not always exist. Two cases are presented of pediatric patients with spinal ABCs in which preoperative embolization was performed by percutaneous injection of up to 31 mL of liquid embolic agent (1:7 ratio, *n*-butyl-2-cyanoacrylate [*n*-BCA] to ethiodized oil). Total estimated surgical blood loss was 1,000 mL in one case and 3,650 mL in the other case, which occurred during the extensive anterior and posterior approaches required to remove the massive ABCs. Direct percutaneous injection of *n*-BCA is a technically simple and efficient adjunct to surgical resection with the aim to reduce intraoperative blood loss.

ABBREVIATIONS

ABC = aneurysmal bone cyst, EBL = estimated blood loss, n-BCA = n-butyl-2-cyanoacrylate

Transarterial embolization is a well-established technique for reducing intraoperative bleeding associated with resection of aneurysmal bone cyst (ABC) (1–3). It may be performed in high-flow ABCs with a prominent, endovascularly accessible arterial supply or arteriovenous shunt. However, most ABCs appear similar to low-flow venous malformations with delayed and prolonged tumoral blush in the venous phase in the absence of a discrete arterial feeder (4). This is often the case for some aggressive, well-vascularized ABCs (5). In these instances, transarterial embolization is unfavorable, and percutaneous embolization may be an effective alternative.

Three cases of intralesional injection with *n*-butyl-2-cyanoacrylate (*n*-BCA) (Histoacryl; B. Braun Melsungen AG, Melsungen, Germany) into an ABC before surgery have been reported (6). Two were from a series of 17 ABCs in children treated by percutaneous sclerotherapy with Ethibloc (n = 14) or *n*-BCA (n = 3). These two patients had ABCs involving the spine: a 6-year-old child with a T3-4 lesion and a 15-year-old child with an L2 lesion. The ABCs were moderately sized, 40 mm and 28 mm in maximal diameter, and both patients underwent surgical resection (6). Technical details such as the volume and concentration of *n*-BCA were not reported. The third patient was a 4-year-old child with a sphenoid ABC who underwent direct intraoperative injection with *n*-BCA via a left frontotemporal craniectomy (7). Injection of 4 mL of embolic agent (2 mL of *n*-BCA mixed with 2 mL of ethiodized oil) into the lesion was performed; the lesion was not resected because of immediate thrombosis and difficult surgical access.

We present our experience in two children with large spinal ABCs (maximal diameters 68 mm and 75 mm) without arterial supply suitable for a transarterial approach. Preoperative embolization was performed by direct percutaneous injection of 30 mL and 31 mL of liquid embolic agent (*n*-BCA mixed with ethiodized oil) (Trufill; Codman Neurovascular, New Brunswick, New Jersey).

CASE REPORTS

Our institutional review board does not require approval for case reports involving fewer than three patients. However, these patients were included in an IRB-approved research database.

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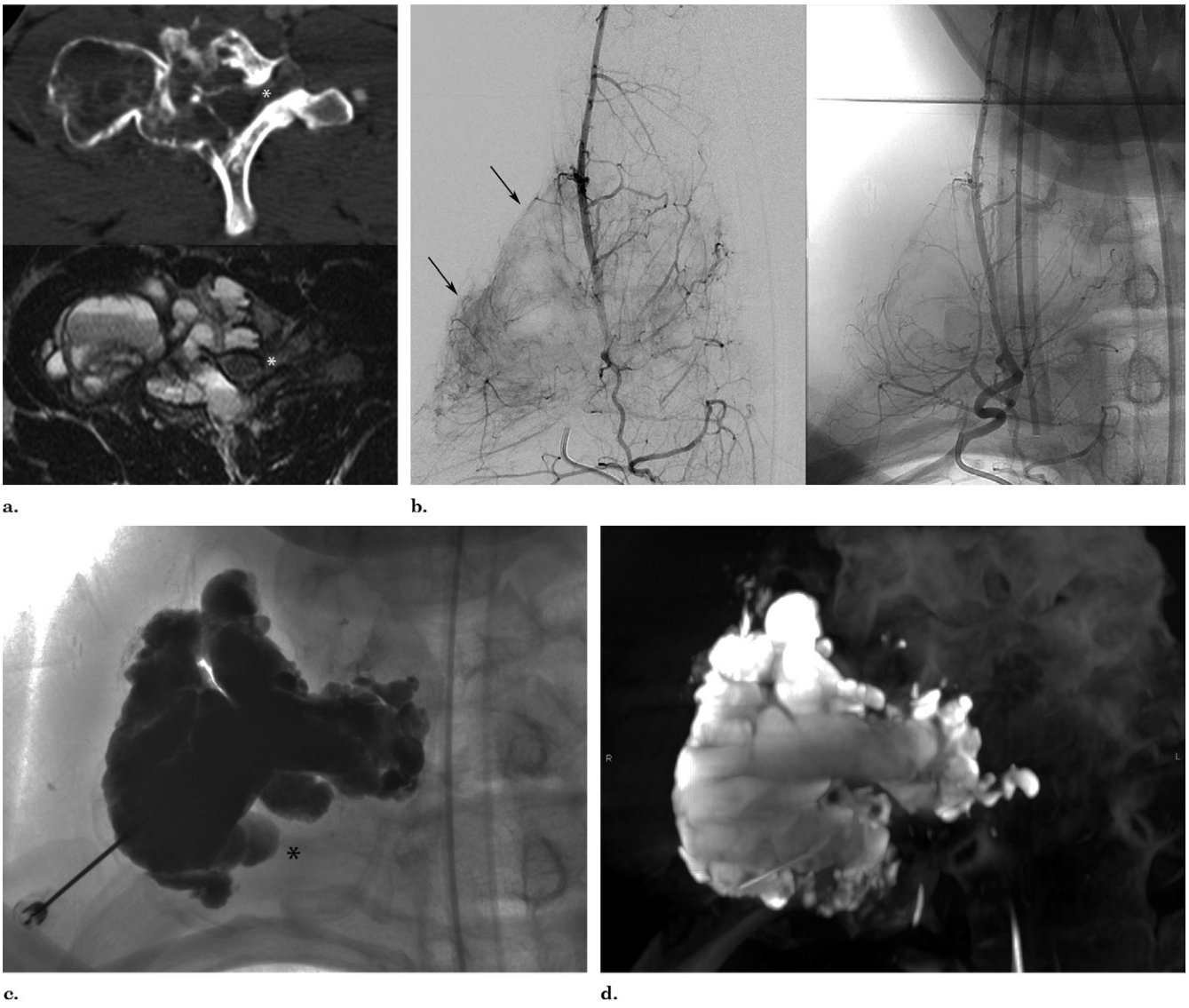

Figure 1. Case 1. An 18-year-old boy with neck and right arm pain, right hand weakness, and C7 ABC. **(a)** Axial CT scan (top) and T2-weighted MR imaging (bottom) of the cervical spine at the C7 level show a 30 mm × 53 mm × 68 mm osteolytic lesion emanating from the right C7 pedicle and lamina, with extension into the C7 vertebral body, facets, and transverse process. Multiple fluid levels are present throughout the large ABC. Note the marked narrowing of the right C7-T1 neural foramen compared with the patent left neural foramen (asterisks). **(b)** Subtracted (left) and unsubtracted (right) anteroposterior views from a selective right costocervical trunk angiogram depict the vascular nature of the right C7 ABC. Note the tumoral blush (arrows) in the absence of a dominant arterial feeder. **(c)** Coned-in fluoroscopic image after percutaneous injection of 22 mL of liquid embolic agent shows broad distribution throughout the ABC from a single needle access. The inferomedial compartment (asterisk) was subsequently targeted with a second needle, and an additional 8 mL of the same mixture was injected. **(d)** Coronal view from a low-dose Dyna CT scan of the neck after percutaneous injection of 30 mL of liquid embolic mixture (4.3 mL of *n*-BCA) shows excellent penetration throughout the lesion.

Case 1

An 18-year-old boy presented with neck and right arm pain and right hand weakness. Computed tomography (CT) and magnetic resonance (MR) imaging (**Fig 1a**) revealed a 30 mm × 53 mm × 68 mm right C7 ABC, confirmed by CT-guided biopsy. The patient underwent diagnostic angiography as part of a planned preoperative embolization, with selective evaluation of the right vertebral, ascending cervical, and suprascapular arteries and the thyrocervical and costocervical trunks. Although a typical tumoral blush was observed (**Fig 1b**), transarterial embolization was precluded by the absence of a high-flow arteriovenous shunt or predominant arterial feeder. Instead, direct percutaneous intralesional *n*-BCA injection was performed under general anesthesia in the angiography suite. An 18-gauge, 3.5-inch spinal needle was advanced into the ABC under fluoroscopic guidance until venous blood returned. Injection of 2 mL of iodinated contrast agent (Omnipaque 300, GE Healthcare, Inc, Princeton, New Jersey) was performed under fluoroscopic monitoring. The ABC was opacified, and no contrast extravasation or rapid venous drainage was visualized. Percutaneous embolization was then performed