



Musculoskeletal Imaging and Intervention Section Procedures CT-Guided Sclerotherapy Aneurysmal Bone Cyst Intra-lesional Injection

INDICATIONS

- Aneurysmal bone cyst – alternative treatment to curettage and packing
- Some ABCs are not in an optimal location to be curettage (pelvis, spine)
- Referred from orthopedic oncology as a non-surgical alternative

BACKGROUND

- Preliminary data demonstrate positive healing response of ABC lesions to intralesional injection of calcitonin and steroid
- Calcitonin thought to inhibit osteoclasts and promote new bone formation
- Steroid shows synergistic effect, and is thought to inhibit fibroblasts and have angiostatic properties

RISKS

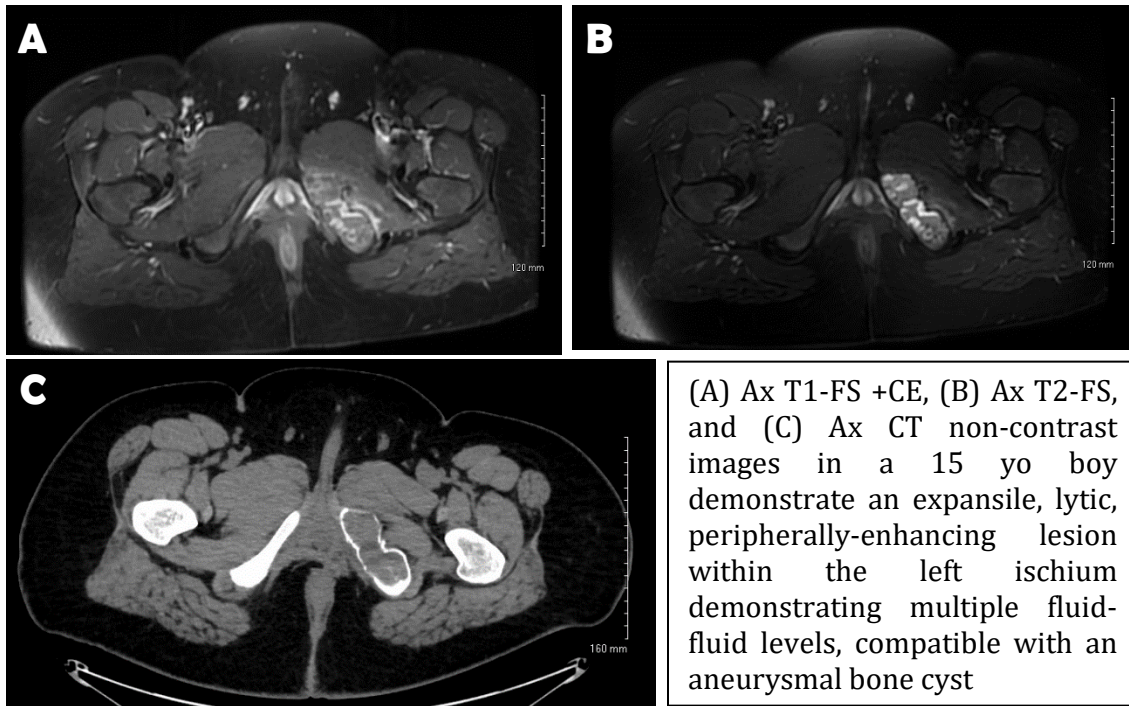
- Bleeding
- Pain
- Infection
- Non-target injection/sclerotherapy

MODALITY

- CT-guided

PRE-OPERATIVE WORKUP

- Will need pre-operative contrast-enhanced MRI to confirm diagnosis, evaluate surrounding structures
- Biopsy proof is preferred but diagnostic imaging is acceptable
- CT can help to determine overlying cortex, extent of osseous involvement, assess for pathologic fracture
- Patients are generally seen in MSK Outpatient Clinic after referral from Orthopedic Oncology for full evaluation and an in-person discussion of the procedure
- As with other biopsy-like procedures, a recent INR and platelet lab values are required



MATERIALS

- 1% lidocaine (for skin numbing); buffered with sodium bicarbonate
- Spine needle for periosteum anesthesia (1.5", 3.5", or 6" 22G depending on depth of overlying subcutaneous tissue)
- 50:50 mixture of 0.5% Ropivacaine/1% PF Lidocaine for periosteum anesthesia (approx. 4 mL)
- Penetration needle set – Bonopty 12G (10 cm); can use associated 13G
- Bonopty biopsy needle for coaxial positioning – this can also be used as a longer penetration needle, but is not optimal for drilling through cortex
- Bonopty extended drill (13G, up to 17cm in length) – if needed
- Long spinal needle for injection (22G – 6", 7", or 8") – can add gentle curve to tip if steering desired
- Kenalog: 40-80 mg Triamcinolone included with mixed injectate, divided between number of injected sites
- Calcitonin: comes as 200 U/mL; doses vary, through range from approximately 200-400U depending on the size of the lesion, split among a number of injected sites
- Iodinated contrast
- Sterile saline: if needed to dilute injectate
- Curved needle, such as a Pakter needle (optional)

SEDATION

- Moderate conscious sedation should be appropriate for most adults
- Given age of patients with ABCs, pediatric sedation or pediatric anesthesia may be required

CONSIDERATIONS

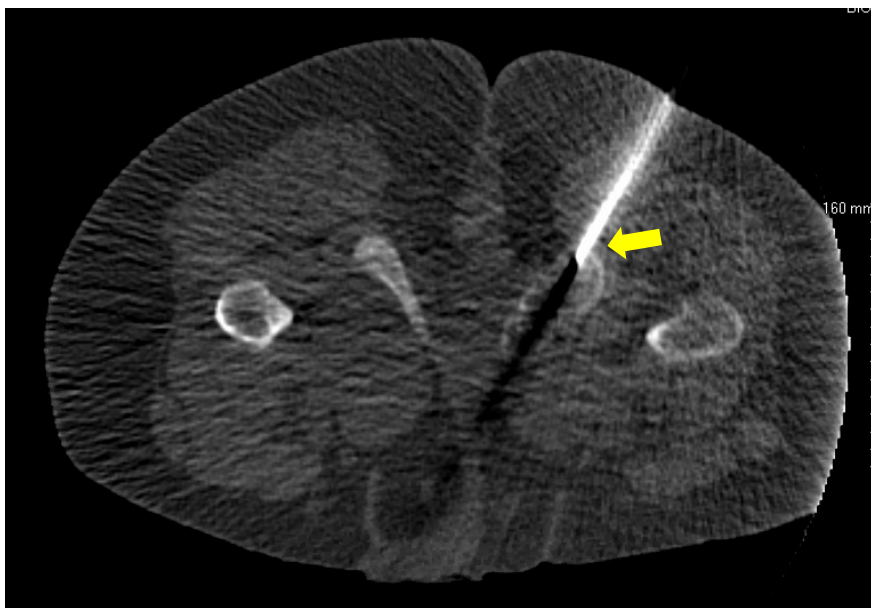
- Though often requested, a biopsy of an ABC often is unable to be performed due to the friable nature of the lesion. Fortunately, identification of the lesion is usually not a diagnostic dilemma based on characteristic MRI features
- The best approach will likely be along a trajectory where a maximal dimension of the lesion can be crossed from a single linear approach, remaining parallel to the selected axial slice so as to stay in plane

TECHNIQUE

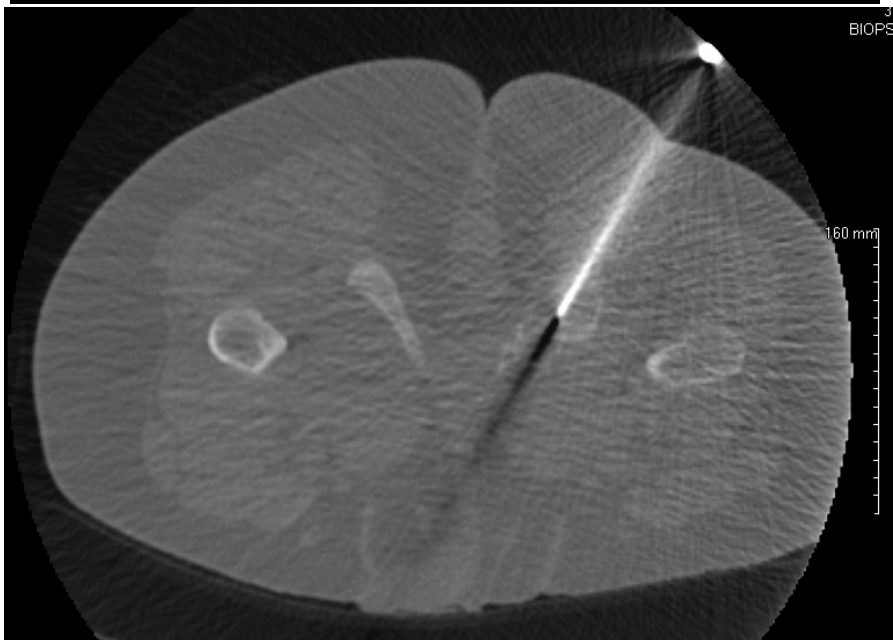
1. Affix a dilator with tape to the skin over the anticipated entry site as a marker for the initial CT scan
2. Pre-scans through the region of interest, use 'Standard' kernel, not BonePlus.
3. May need to angle gantry to optimize needle access to the greatest diameter of the lesion
4. Select the shortest and safest path to the lesion, paying attention to the needle orientation with respect to the lesion shape and dimensions; multiple access sites may be required for a single lesion
5. Mark the skin, sterilize and drape, anesthetize the skin and subcutaneous fat
6. Place the periosteum anesthesia spinal needle to the bone surface under CT fluoroscopic guidance, inject approximately 4 mL of the 50:50 Ropivacaine/Lidocaine mixture onto the periosteum
7. Small skin nick with a scalpel
8. Advance the penetration needle under CT fluoroscopic guidance to the cortex using a towel roll or Kelley clamp to hold/brace the needle while scanning
9. If satisfied with positioning and needle alignment, gain purchase through the cortex so the needle is well-seated within the bone
10. At this point, you can either drive the penetration set forward, or continue through the lesion coaxially with the biopsy needle (as an access cannula, not for the purpose of taking a biopsy – this will be easiest with the stylet remaining in while drilling)
11. If needed, the extended drill can be used to cross a lesion depending on the bony quality of the lesion
12. A long 22G needle is then placed coaxially through the introducer needle(s) to the far edge of the lesion. If you need to move more laterally within the lesion, a gentle curve can be introduced to steer to one side
13. Once across the lesion, inject iodinated contrast through the spinal needle in 0.5 mL increments after repositioning the needle – the goal is to get a general idea of the communication and size of the lesion without completely filling it with contrast. Single fluoroscopic CT shots can be taken to view contrast flow
14. Attempt to aspirate as much contrast and intrinsic lesion fluid as possible – this may not prove fruitful
15. Mix injectate solution – contains calcitonin, steroid, contrast, and sterile saline – this can be split between multiple injections
 - a. Steroid dose 40-80 mg Triamcinolone depending on lesion size
 - b. Calcitonin dose 200-400U depending on lesion size
 - c. Contrast (Isovue 300) should represent approximately 30-50% of injectate volume as not to dilute more than 1/3
 - d. Saline can be used as a volume spacer if the total volume needs to be increased
 - e. Total volume can range from 2-20 mL depending on the size of the lesion
16. Inject the solution through the 22G spinal needle in small increments as to disperse it throughout the lesion, while adjusting/moving/retracting the needle in between each injection.
17. Take various CT fluoroscopic images to show the solution dispersing throughout the lesion
18. Depending on the size and shape of the lesion, multiple access sites may be required, and can be repeated multiple times starting at step 2.
19. After completing injections, remove needle(s), place sterile dressing, return to PACU

FOLLOW-UP

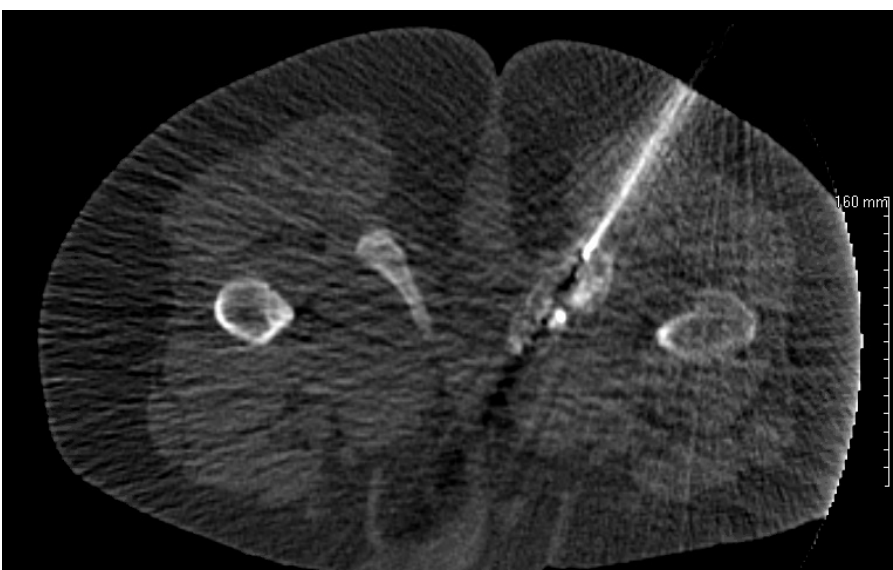
- Though no official follow-up algorithm exists, patients will generally receive a CT scan of the lesion approximately 8 weeks after the procedure, before following up in the orthopedic oncology clinic
- If needed, a repeat sclerotherapy procedure may be required, even multiple times for large lesions



The 12G Bonopty penetration needle is positioned at the ischial tuberosity to cross the long axis of the lesion. Once purchase of the cortex is gained (arrow), the penetration needle can be advanced across the lesion, or a smaller needle can be placed coaxially.



The 13G Bonopty biopsy needle is passed coaxially through the penetration needle to the end of the lesion, with intermittent CT fluoroscopic imaging demonstrating positioning of the needles



Contrast and the subsequent injectate solution are injected through the 22G spinal needle, showing flow throughout the lesion. This CT fluoroscopic image after the injection demonstrates diffuse flow of the solution throughout the lesion

REFERENCES

1. Chang CY, Kattapuram SV, Huang AJ, et al. Treatment of aneurysmal bone cysts by percutaneous CT-guided injection of calcitonin and steroid. *Skeletal Radiology*. Jan 2017, 46(1) p. 35-40.
2. Gladden ML, Gillingham BL, Hennrikus WM, Vaughan LM. Aneurysmal Bone Cyst of the First Cervical Vertebrae in a Child Treat with Percutaneous Intralesional Injection of Calcitonin and Methylprednisolone: A Case Report. *Spine*. Feb 2000, 25(4) p. 527

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