Soft Tissue Ultrasound: *Abscess versus Cellulitis*

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Background:

- CT is the gold standard for the diagnosis of soft tissue infections, but is of course expensive, time-consuming, sparingly available, may involve contrast agents, radiation exposure, and generally can't be used to directly guide aspiration/incision
- MRI is helpful but not really a viable option through the ED
- Plain films are worthless, and reveal soft tissue gas in as few as 40% of cases
- U/S ***is*** great for diagnosing simple abscesses versus cellulitis and changes management[1-5]
- Squire et al. report a sensitivity=98%, specificity=88%, PPV=93%, NPV=97% (comparison to PE, clinical exam; conclusion: ED bedside US improves accuracy in the detection of superficial abscesses)[6]
- U/S in the diagnosis of necrotizing fasciitis is controversial; few studies exist[7]
- Regarding peritonsillar abscesses (PTA), CT is considered the gold standard; however, U/S compares favorably with sensitivities of ~ 90% and specificities ~ 83-100%

Applications:

- Confirm cellulitis
- Confirm occult abscess not apparent on exam
- Localize abscess for drainage
- Identify fluid adjacent to deeper fascial planes
- Identify a peritonsillar abscess (PTA)

Transducers:

- 7.5-10+ MHz linear transducers
- 3.5-5 MHz curved transducers may play a role in deeper abscesses
- **ALWAYS USE** a probe cover (latex glove is fine) for U/S (protect your probe, protect your patients)
- Endovaginal probe (with probe cover, of course) for intra-oral exams (5-10 MHz)

Sono Technique:

- All fluid collections scanned in 2 planes to define their shape (orthogonal views)
- Measurements in 2 planes
- Depth measured using markers on display
- Use Doppler to r/o vascular structure (don't be fooled by a pseudoaneurysm!!)

- **PTA scanning:**
  - May apply topical anesthetic spray to affected tonsil/oropharyngeal swelling
  - Approach from medial to lateral, choking up on the probe and using the pinky finger to stabilized on the cheek
  - Scan the entire tonsil for fluid collections, enhancement
  - Gentle pressure may be applied to assess for "squish sign"
  - Note the location of the internal carotid artery, which runs anterior to the jugular vein in the carotid sheath; it is usually located posterolateral to the tonsil within 5mm to 25mm of a peritonsillar abscess

Normal sono findings/anatomy:

- Subcutaneous tissue generally appears hypoechoic with randomly distributed hyperechoic strands that represent connective tissue
- Fascial planes are hyperechoic
- Muscle has a characteristic striated appearance in a longitudinal plane
- Vascular structures: anechoic
- Nerves: stippled appearance
- Lymph nodes: classic circular to oval shape, echogenic centers with hypoechoic rims
- Normal tonsil has the appearance of a typical lymph node, with a hypoechoic rim and generally echogenic center; may be isoechoic throughout

Abnormal sono findings:

- *Cellulitis*:
    - Diffuse thickening of subcutaneous layer due to edema amidst the fat and connective tissue
    - Edema evolves as well defined hypoechoic septae between the fat and connective tissue; characteristic "cobble-stone" appearance

- *Abscess*:
    - Sonographic appearance is quite variable
    - Ranges from anechoic to irregularly hyperechoic, internal echoes; may find hyperechoic sediment, septae, or even gas
    - Ranges from round and generally well-defined to irregular, lobulated
    - Posterior acoustic enhancement may be your only sonographic finding
    - "Squish sign" with compression: ability to induce motion in the material with palpation/pressure

- *Necrotizing fasciitis*:
    - Marked thickening of the subcutaneous layer (i.e. cellulitis)
    - Layer of anechoic fluid measuring >4mm, adjacent to the deep fascia
    - Subcutaneous gas (acoustic shadowing and reverberation artifact) may be present

- *Peritonsillar abscess*:
    - Usually appears as a hypoechoic, heterogeneous mass, though appearance may be variable
    - Commonly see posterior enhancement

Pitfalls:

- Sometimes difficult to differentiate between interconnected bands of edema fluid and an irregular abscess/pus collection
- May miss abscess if isoechoic to surrounding tissue and no posterior enhancement or "squish sign" appreciated

- PTA exams may be limited by trismus or gag reflex
- Inferiorly located abscesses can be missed by failure to scan in the longitudinal plane

Pearls:

- Use contralateral side to delineate pathology
- Look for areas of echogenicity (suggestive of occult abscess) or a "squish sign" even if no obvious fluid collection

- Use plenty of U/S gel so you limit direct pressure (allows visualization without "hurting" your patient)
- Use water bath for hand or foot infections (the water provides the interface, even better than U/S gel!!)

1. Bureau NJ, Chhem RK, Cardinal E. Musculoskeletal infections: US manifestations. Radiographics 1999;19(6):1585-92.
2. Chao HC, Lin SJ, Huang YC, Lin TY. Sonographic evaluation of cellulitis in children. J Ultrasound Med 2000;19(11):743-9.
3. Swartz MN. Clinical practice. Cellulitis. N Engl J Med 2004;350(9):904-12.
4. Tayal VS, Hasan N, Norton HJ, Tomaszewski CA. The effect of soft-tissue ultrasound on the management of cellulitis in the emergency department. Acad Emerg Med 2006;13(4):384-8.
5. Vincent LM. Ultrasound of soft tissue abnormalities of the extremities. Radiol Clin North Am 1988;26(1):131-44.
6. Squire BT, Fox JC, Anderson C. ABSCESS: applied bedside sonography for convenient evaluation of superficial soft tissue infections. Acad Emerg Med 2005;12(7):601-6.
7. Yen ZS, Wang HP, Ma HM, Chen SC, Chen WJ. Ultrasonographic screening of clinically-suspected necrotizing fasciitis. Acad Emerg Med 2002;9(12):1448-51.