Ultrasound of Superficial Lumps and Bumps

Robert D. Harris, MD, MPH

Professor of Clinical Radiology, USC-Keck Section of Abdominal Imaging, Radiology Dept. USC-LAC Med Centers, LA, CA February, 2021
Layers of the Skin

- Epidermis
- Dermis
- Subcutaneous Fat Layer
- Nerve endings
- Sweat gland
- Hair follicles
- Blood vessels
- Sebaceous glands
- Arrector pili

Radiographics 2006; 26, 1289-1304
Superficial Anatomy

Epidermis and Dermis

Subcutaneous

Deep Fascia

Muscle

Bone

Shah and Callahan, Pediatric Radiology 2013; 43:S23-40
Skin Layers

- **Epidermis**
  - Thinnest layer
  - Keratinocytes
  - Merkel cells, melanocytes
- **Dermis**
  - Fibroblasts, endothelial and neural cells
  - Collagen
- **Subcutaneous**
  - Lipid cells, blood vessels, septa
General Principles

- History-especially for post-trauma pts.
- Physical exam is mandatory (MD)
- Scan with highest frequency transducer (> 8-12 MHz)
- Lots of gel/stand-off pad/light touch
- Color Doppler-optimized for slow flow
- **Use contralateral side for comparison-Dual imaging mode** **
Decision Tree for U/S of Superficial Lumps

POSSIBLE MASS

CLINICAL EXAM AND US

NO US ABNORMALITY

MRI or CT IF SUSPICIOUS

SUPERFICIAL AND < 5 CM.

CHARACTERISTIC OF LIPOMA

CHOICE OF EXCISION OR CLINICAL F/U

NOT CHARACTERISTIC OF LIPOMA

EXCISION, NEEDLE BX, OR MRI

>5 CM OR DEEP

MRI (OR CT)

SPECIFIC DIAGNOSIS

foreign body
hernia
ganglion cyst
lymph node
bone/calcs
epidermal incl cyst
abscess
hematoma

from J. Wagner, Ultrasound Clinics, 2014
4 Criteria of a Simple Cyst by U/S

- Anechoic
- Imperceptible walls
- Smooth, round shape
- Increased through transmission

- Rarely, simple cysts in the skin or subQ tissue
US-All ages (1-90+)

- Foreign Bodies
- Cellulitis/Abscess
Sensitivity, PPV– both > 95%
Wood, thorns, glass, plastic, metal: all well shown
Echogenic structures +/- shadowing
If Hyperechoic rim surrounding hypoechoic center, + compressibility, think = abscess
Foreign body - Ultrasound is best search method (before plain films)

Wooden splinter
Deep wood splinter causing partial tendon tear
Skin and ST infection

- Cellulitis/Phlegmon
  - Infection of skin and soft tissues
- Ultrasound Findings
  - Skin thickening
  - Hyperemia (color Doppler)
  - Subcutaneous edema
- Classic cobblestoning
  - Fluid tracking between fatty lobules in SubQ
- Dirty shadowing
  - Think gas from infection
“Cobblestoning” of Sub-Q fat

Sonosite 180, Kigali, Rwanda
Cobblestoning-Sub Q edema++
Cellulitis

Skin/fat thickening  MRI with contrast  Frank abscess

Shah and Callahan, 2013
Abscess

- Early-difficult clinically to distinguish from cellulitis
- Complex (int. echoes) fluid collection with thick, irregular (+/- hyperemic) wall
- May be pockets of gas-echogenic foci
- US allows for easy aspiration, drainage
Early abscess-discrete, anechoic collection with marginal hyperemia
Late lymphadenitis/early abscess
Early abscess
Early abscess in IV drug abuser
Granulation Tissue @ PEG site
77 yo with Gluteal area lump with + color Doppler-concern for sarcoma

UW bx 5/18–granulation tissue
Non-painful lump in back-asymmetry

No biopsy or f/u imaging—presumed hematoma
Hematoma-no blood flow
Hematoma clip
Among most common superficial nodules/lumps

- Children-95% are benign, reactive, hx infection/inflammation

- Lymphadenitis on U/S
  - Hypervascular cortex, loss of fatty hilum, adjacent cellulitis, indurated fat
  - +/- Necrosis and abscess*
  - *Hard to differentiate from cancer
Lymph nodes

Benign in 8 yo male neck

- Oval Shape, wider than high, uniform cortical thickness

Malignant in 72 yo woman w/ breast CA

- Focal cortical bulge, CA finding + FNA

Shah and Callahan, 2013
Axillary Lymph node-hypoechoic lesion in fatty hilus
+ FNA of focal lesion in sinus
Lymphadenitis in 7 y.o. girl: left pre-auricular space
Lymphadenitis in 7 year old female
Neck lump in 33 yo pt.
Neck lump
Multiple superficial lymph nodes in elderly African female
Superficial lymphadenopathy
Use Spectral Doppler to confirm color Doppler
Infantile hemangiomas (IH) / Vascular lesions
- Hemangioma, vascular malformation (low or high flow), lymphangioma, or AVM
- fibromatosis colli
- ectopic breast tissue
Fibromatosis Colli

- Contracture of SCM
- Head tilt to ipsilateral side
- Chin rotates to contralateral side
- Right side 75%
- Frequent traumatic breech or forceps delivery HX
- Occurs ~ age 4-6 weeks, regresses over 4-8 months
- Treat conservatively
- US-fusiform swelling of SCM
Fibromatosis Colli
Fibromatosis Colli

Contralateral SCM

Trans neck view
Fibromatosis Colli

Transverse view of the neck anteriorly
Rib chondroma in 2 year old girl
Ectopic Breast tissue

- Failure of regression of embryologic tissue
- Puberty-becomes more prominent
- Palpable, tender lesion(s) in axilla
- Echogenic tissue similar to breast tissue
Ectopic breast tissue

- Generally ill-defined
- Multiple small, hypoechoic areas
- May mimic lymph nodes
- Comparison to contralateral breast or area helpful
Common Lumps/Bumps in Adults

- Lipoma
- Hernia
- Epidermal inclusion cyst
- Ganglion cyst
- Popliteal cyst
- Morton’s “neuroma”
- Fat necrosis
- Neurofibroma
- Uncommon: Sarcoma/malignancy
Lipoma

- Common in adults
  - > 50% or more of superficial lesions on U/S
  - 2-4% prevalence overall
- Rarer in children
  - 10% of all lesions
- Variable in appearance
  - Hypo- to hyperechoic, well-defined to vague borders
- Difficult to separate from surrounding fat
- Asymmetry of soft tissues
- Hard to see—*Look at contralateral body part*
- Ultrasound usually pathognomonic
Lipoma: typical and atypical
Ill-defined upper back mass in 62 yo male
Lipoma – use contralateral side comparison!!
Lipoma in 57 yo woman - back
Lipoma – usually compressible
Lipomas and Blood flow (Color Doppler)

- 7 of 31 (23%) echogenic masses (lipoma or lipoma-like) in subQ fat had blood flow on color Doppler US
- Most were in upper arm, mean size 1.7 cm.
- Second most common site: trunk and chest
- Well-circumscribed
- Half homogeneous, half heterogeneous echogenicity

Superficial lesion in 25 yo male with hx of Burkitt’s lymphoma
Bx x 3 => mature fibrous and fatty tissue
Cine clips of lipoma in axilla
Hernia-Ingual
Abdominal hernia - mind the gap!
Hernia—only visible standing
Ventral Hernias - large and small
Epidermal Inclusion Cyst (EIC)

- Most common subcutaneous “cyst”
- Most common over trunk & scalp
- Rarely extremities
- Often clinical diagnosis
- Congenital or post-traumatic etiology
- Inclusion of squamous epithelium into dermis
- Hypoechoic rim
- Varying internal echoes
- No vascularity
Epidermal Inclusion Cyst - Scalp
Epidermal Inclusion Cyst
If in doubt, always exclude color Doppler twinkle artifact with **spectral Doppler**—if it is artifactual, only see noise.
Epidermal Inclusion Cyst

Shah and Callahan, Pediatric Radiology 2013; 43:S23-40
Gluteal Crease Mass in Man

Pilonidal Cyst
Baker’s or Popliteal Cyst

- 5% of palpable masses
- Fluid in bursa behind knee
  - Postero-medial to the joint
  - Usually anechoic fluid, may contain debris or septa
  - Usually reflects knee joint pathology
  - May see septa in R.A., inflammatory processes
Popliteal (Baker’s) Cyst
Hand and wrist most common—near articular joints
- Often feel hard
- Pain and/or palpable abnl.
- 10-40 years of age
- 2nd most common soft tissue lesion after lipoma
- U/S appearance
  - Anechoic or mildly complex cystic
  - Generally round or oval
  - Often, lobulated or septated
  - No blood flow
  - Connection to tendon sheath or joint capsule
Ganglion Cyst
Wrist ganglion
Morton’s “Neuroma“-perineural fibrosis

- 2nd-3rd web space of foot - most common site
- Bilateral in 10%
- Multiple in up to 30% of pts
- Middle aged
- Female
- US appearance
  - Hypoechoic
  - Well-defined
  - Ovoid, ~ 5-7 mm. diameter
Morton’s “Neuroma” - “pops” out
Fat (Dystrophic) Necrosis

- **Etiology**
  - S/p blunt trauma (but pt may not recall, often minor)
  - Sickle cell dz, vasculitis
  - Autoimmune disease (SLE, Wegener’s)
  - Hypothermia
  - Medication injection
- **PE**
  - Firm, non-tender
- **US**
  - Hyperechoic, in subcutaneous tissues
  - Indistinct, hypoechoic margins
  - Little vascularity
Fat necrosis

Shah and Callahan, Pedi Radiology, 2013
Fat necrosis in 70 yo female
Fat Necrosis
Fat necrosis s/p hysterectomy
Benign lesion of nerve / nerve sheath (Schwann cells)

- Age ~ 20-50
- Most in deep locations
- Rarely superficial-dermal
- Tenderness, numbness frequent symptoms
- Smooth, well-defined
- Optimally-see nerve at either end of lesion
36 yo male with slow growing lump
Vascularity??
Neurofibroma with degen. changes
Neurofibroma - Mercy Ships (West Africa) screening

13 yo male, Congo-Brazzaville, 2013
88 yo s/p melanoma resection

Large groin hematoma - confirmed by MRI, no tumor
Hematoma (s/p melanoma resection) – color Doppler absence helpful
81 yo female with thigh pain, lump

Probable hematoma, no therapy given
Abdominal wall mass in young woman, tender, near umbilicus
Abdominal wall mass at surgery: Endometrioma
62 yo cardiologist with painless lump 3rd DIP jt
Lesson-use plain films – bony or Ca++
Benign vs. Malignant ST Masses

- Benign much more statistically common (~ 50:1)
- No single US predictor very accurate
- Margins & Vascularity “important”
- Clinical hx important
- PE-not so important (cysts or LN can feel fixed and solid & malignancy feel somewhat soft, mobile!)
Giant Cell Tumor of Tendon Sheath

Looks malignant, path: benign!

Shah and Callahan, Pediatric Radiology 2013; 43:S23-40
ST tumors: Malignant trending...

- Size > 5 cm., or intramuscular location
- Involvement of the deep fascial layers
- Lesion heterogeneity
- Poorly defined margins
- Increased vascularity +/-
Supporting Malignant Lesions:

- rapid growth
- clinical predisposition
- syndromes
- family history
Color Doppler grading scheme

Type I

Type II

Type III

Type IV
### Color Doppler Discrimination: Benign vs. Malignant

**N = 71 lesions**  
(39 benign, 32 malignant)

<table>
<thead>
<tr>
<th>Type</th>
<th>Benign (total 100%)</th>
<th>Malignant (total 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>86</td>
<td>9</td>
</tr>
<tr>
<td>II</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>III</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>IV</td>
<td>0</td>
<td>41</td>
</tr>
</tbody>
</table>

Giovagnorio, JUM 1999, 18:89
Malignant Soft tissue tumors

- Incidence - 1:100 palpable soft tissue tumors in adults
- Uncommon in pediatrics
Malignant lymph node

- Height : Length > 0.5
- Loss of hilar fat sign
- Cortical thickening
- Hypervascularity
Metastases to axillary lymph node male breast cancer
Subcutaneous carcinosarcoma metastasis upper abdomen
Carcinosarcoma pt-rectus hematoma—probably benign?
Sarcoma

- 1 percent of all adult malignancies and 12 percent of pediatric cancers
- 80 percent of sarcomas originate from soft tissue, and the rest from bone
- ~12,000 new cases of soft tissue sarcoma diagnosed each year in the United States, with 4,740 deaths
- Thigh, buttock, groin - ~ 50% cases
Sarcoma vs. dermatofibroma vs. desmoid tumor-57 yo man
Sarcoma or Desmoid tumor?
72 m–myxoid spindle cell tumor

Surgery- intramuscular myxoma
Superficial soft tissue bumps are common, malignancy rare (1-2%).

Diff Dx based upon age, clinical hx, US appearance-get good history

Know “leave-alone” lesions-fibromatosis coli, lipomas, cysts, hematomas.

Color Doppler very helpful- ~25% of lipomas may show Color Doppler flow.

Size > 5 cm. or deep location suggests malignancy (needs MRI or CT).

If heavy Ca++ or bone, get plain films.
POSSIBLE MASS

CLINICAL EXAM AND US

NO US ABNORMALITY

MRI or CT IF SUSPICIOUS

MASS-LIKE LESION

SUPERFICIAL AND < 5 CM.

CHARACTERISTIC OF LIPOMA

NOT CHARACTERISTIC OF LIPOMA

EXCISION, NEEDLE BX, OR MRI

>5 CM OR DEEP

MRI (OR CT)

SPECIFIC DIAGNOSIS

foreign body
hernia
ganglion cyst
lymph node
bone/calcs
epidermal incl cyst
abscess
hematoma

from J. Wagner, Ultrasound Clinics, 2014
The End-Questions?

Thank you for your attention....