Ultrasound of soft-tissue vascular anomalies

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Declaration of Disclosure

- I have no actual or potential conflict of interest in relation to this presentation
Objectives

- Review terminology and current classification of vascular anomalies
- Review sonographic features of soft tissue vascular anomalies
- Emphasize the role of clinical information in the sonographic diagnosis of vascular anomalies
Indications for Imaging

- Superficial lesion but atypical presentation
- Deep lesion difficult to assess on physical examination
- Prior to therapy to define nature and extent and as a baseline
Imaging

- Ultrasound is first line modality for most cases
- MRI may be considered first line in
  - very large lesions
  - complex combined vascular malformations affecting entire extremity
  - assess deep extent in areas difficult to evaluate with US (orbit, intracranial, etc)
Ultrasound Technique

- Transducer selection determined by size & depth of lesion – higher frequency possible
- Larger & deeper lesions may require combination of transducers
- Color & Spectral Doppler are crucial but may be limited by patient motion and cooperation
- Compression
ISSVA Classification

- Updated in 2014
- Available at issva.org

- Vascular tumors
- Vascular malformations
Vascular tumors

- **Benign**
  - Infantile hemangioma
  - Congenital hemangiomas (RICH, PICH, NICH)
- **Locally aggressive or borderline**
  - Kaposiform hemangioendothelioma
- **Malignant**
  - Angiosarcoma
Infantile hemangioma

- Well-defined soft tissue mass
- Variable echogenicity
  - Hypoechoic (65%)
  - Hyperechoic (19%)
  - Heterogeneous (16%)
- Calcifications are rare (8%)

Paltiel HJ et al (Radiology 2000; 214:747-754)
Infantile hemangioma

- Hypervascular with arterial and venous flow
  - ≥5 vessels/cm²
- High velocity arteries
  - Mean 28.4 ± 5 cm/s

Paltiel HJ et al (Radiology 2000; 214:747-754)
Infantile hemangioma

3m♀: Chest wall lump
Infantile hemangioma

8m♂: lump chest wall
Infantile hemangioma

4m♀: posterior neck mass

Courtesy Dr. Hameed, Evelina Children’s Hospital, London, UK
Involuted infantile hemangioma

9y♂: Hemangioma in forearm as a toddler with residual deformity?resolution
Congenital hemangiomas

- Rapidly involuting (RICH)
- Partially involuting (PICH)
- Non-involuting (NICH)
Congenital hemangiomas

- Differentiation is based on clinical findings & evolution - not on imaging findings
- High vascular density similar to infantile hemangioma
- Distinct US features:
  - heterogeneous echogenicity
  - visible vessels on gray scale imaging
  - calcifications

1d♀: Right chest wall mass diagnosed antenatally
6w♂: Left upper arm mass diagnosed antenatally
8y♀: Lesion right mandibular area since birth, growing slowly with child, initially interpreted as venous malformation
8y♂: Right cheek lesion present since birth, growing with child
Kaposiform hemangioendothelioma

- Ill-defined soft tissue mass
- Heterogeneous
- Ca++ (80%)
- High vascular density not frequent (20%)
- Most show moderate vascular density (2-4/cm²)

Dubois J et al (AJR 2002; 178:1541-1545)
Kaposiform hemangioendothelioma

5m♂: Left thigh mass
Capillary-type intramuscular hemangioma

- Not included in ISSVA
- Different from intramuscular venous malformations
- Rare benign small-vessel tumor of skeletal muscle
- Present at any age
- In extremities, trunk (paraspinal), head/neck
- Stable in size or slow growth on follow-up
Capillary-type intramuscular hemangioma

- Well-defined mass, heterogeneous, mainly isoechoic & less common hypoechoic
- Involvement of almost entire muscle without discrete mass & relatively preserved muscle architecture
- Focal areas of ↑ echogenicity due to fat
- ↑ vascular density on color Doppler

Capillary-type intramuscular hemangioma

17y♂: Paraspinal back mass recently noticed
Vascular malformations

- AVM, AVF → High flow
- Capillary, venous, lymphatic → Low flow
- Combined
Arterio-venous malformation

- Multiple dilated, tortuous arteries & veins, always shown with color Doppler but not always seen on gray-scale
- Sometimes no gray-scale abnormalities
- No discrete soft tissue mass

7y♂: Right quadriceps femoris mass
Arterio-venous malformation

6y♀: Persistent swelling over lateral malleolus for months
Venous malformation

- Well-defined, hypoechoic, heterogeneous sponge-like mass
- Poorly marginated collection of veins
- Isoechoic thickening of subcutaneous tissues
- Compressibility
- Presence of phleboliths (16%)
- Low-velocity venous flow (84%)
- Absent flow (16%)

Trop I et al (Radiology 1999; 212:841-845)
Venous malformation

3y♂: Lump in left forearm
Synovial venous malformation

4y♀: Swelling right knee
Venous malformation

3y♂: Swelling left posterior chest wall
Venous malformation

3y♂: Swelling left posterior chest wall
Venous malformation

15y♂: Swelling over right ankle for many years, initially growing, now stable
Venous malformation

15y♂: Swelling over right ankle for many years, initially growing, now stable
Lymphatic malformation

- Macrocystic (cystic hygroma)
- Microcystic
- Combined
Lymphatic malformation

Macrocystic

- Large, cystic cavities, separated by septa
- Debris may be present within cysts
- Arterial and venous flow only in septa

3y♀: Left arm mass
Lymphatic malformation

Microcystic

- Hyperechoic
- Ill-defined
- Small cysts <1 cm, may not be visible

5y♀: Pretibial swelling
Combined lymphatic malformation

8m♂: Left arm & chest wall mass
Fibro-adipose vascular anomaly

- Complex combined low-flow vascular malformation
- Often involving calf or forearm
- Anomalous veins within the muscle and adjacent subcutaneous soft tissue mixed with fibrofatty tissue
- Any age, worsens in adolescence
- Severe pain

Fibro-adipose vascular anomaly

- Hyperechoic mass replacing normal fibrillar pattern of muscle
- Dilated intramuscular & subcutaneous veins

14y♀: Calf pain & swelling
Summary

- US is useful for diagnosis of vascular anomalies
- US findings are better interpreted in conjunction with clinical findings
- Familiarity with ISSVA classification facilitates communication and collaboration with other clinicians