Ultrasound imaging of vascular anomalies: pearls and pitfalls

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Declaration of Disclosure

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

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• Soft-tissue vascular anomalies are common:
  • Hemangiomas in 5-10% infants <12mo
  • Vascular malformations 1.2-1.5% prevalence
• Most cutaneous lesions are diagnosed clinically
• Deeper lesions are difficult to diagnose clinically
• Association with other pathology or syndromes, especially overgrowth
Indication for US

• Atypical superficial lesions or with suspicion of deeper involvement
• Palpable lesions without diagnostic visible features
• MRI better for:
  • Obviously large & deeper lesions
  • Part of complex vascular anomalies or overgrowth syndromes
  • Prior to invasive treatment
  • US prior to MRI may be useful to tailor study (probably not vascular, low-flow vs. high flow)
Technique

• Transducer selection determined by size & depth of lesion - higher frequency possible
• Use of stand-off pads & submersion in water of hands or feet
• Larger & deeper lesions → combination of transducers
• Color & spectral Doppler → useful but limited by patient motion & cooperation
• Compression
Gray scale

- Margins of the mass
- Visible vessels
- Intravascular clots
- Involvement of one or more soft tissue planes
- Calcifications
- Cystic components
Doppler US

- Useful to differentiate high from low flow lesions
- Classical categorization based on number of color pixels per cm²
  - >4 high
  - 2-4 moderate
  - <2 low
- Compare with normal adjacent or contralateral soft tissues
- Spectral Doppler:
  - Differentiate arterial from venous
  - Magnitude
  - Resistive indices
Get clinical history & look at the lesion

- Present at birth?
- When was it first seen?
- Growth pattern (proportional or not to child’s growth)
- Does the lesion change in appearance or size?
- Skin discoloration
- Other skin abnormalities (vesicles, hair)
ISSVA Classification

- Last updated in 2014
- issva.org
- Vascular tumors
- Vascular malformations
Vascular tumors

- **Benign**
  - Infantile hemangioma
  - Congenital hemangiomas (RICH, PICH, NICH)
  - Lobular capillary hemangioma (pyogenic granuloma)
  - Tufted angioma
- **Locally aggressive or borderline**
  - Kaposiform hemangioendothelioma
- **Malignant**
  - Angiosarcoma
Vascular malformations

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

- Mass with vessels (hemangiomas or other vascular tumors) vs mass formed by vessels (AV malformation)
Arteriovenous malformation

6y♀: Persistent swelling over lateral malleolus for months
Infantile hemangioma

11w♀: Left breast mass
Congenital hemangioma

6w♂: Left upper arm mass diagnosed antenatally
Kaposiform hemangioendothelioma

2d♂: Left thigh mass diagnosed antenatally
Hemangioma or sarcoma? - Red flags

• First detected or rapid growth after 6-12 months
• Painful mass
• Involvement of muscles
• Lymphadenopathy
• Bone destruction
• Calcifications, hemorrhage or necrosis in non-congenital lesions
Infantile fibrosarcoma

7m♂: Rapidly growing palmar mass
Low flow lesions

- Capillary malformation: often minimal changes (skin/subcutaneous thickening)
- Venous malformation
- Lymphatic malformation
  - Macrocystic
  - Microcystic
  - Combined
Venous malformation

5y♂: Slowly growing forearm mass
Venous malformation

2y♀: Right paraspinal mass
Venous malformation

13y♂: Mass left foot present since birth, growing with child
Venous malformation

16y♀: Swelling posterior neck
Venous malformation

16-year-old female: Swelling posterior neck
Venous malformation

- Phleboliths are characteristic but uncommon (9-16%)
- Absence of flow does not exclude diagnosis (16%)
- Increased color Doppler signal can be apparent with compression & release of transducer - do not confuse with high flow lesions
- Arterial flow can be present
Lymphatic malformation

3y♀: Left arm mass
Lymphatic malformation

8m♂: left arm & chest wall mass
Lymphatic malformation

8w♀: Growing mass in dorsum of hand since birth
Conclusion

- US extremely useful in diagnosis & treatment monitoring of soft-tissue vascular anomalies
- High diagnostic yield when used in combination with clinical assessment
- Some lesions, especially venous malformations, can be challenging on US & may require further MRI
- Large, deep lesions or associated with overgrowth syndromes are better evaluated with MRI