MSK SONOGRAPHIC FINDINGS MIMICKING DVT

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DISCLOSURE

No conflict of interest

Thank you to the Michigan Sonographer’s Society for inviting me

A special thank you to Liz Lawrence, RDMS, RDCS, RVT for sharing many of these cases
PURPOSE

• Not to teach you MSK ultrasound
• Make aware of conditions with symptoms similar to a DVT
  • May encounter during vascular US
    • Recommend dedicated MSK US
    • Avoid unnecessary consults, imaging
• Cover entities that can appear as a DVT on US
  • Avoid unnecessary anticoagulant therapy
OUTLINE

• Background of MSK US
• Lower Extremity MSK Anatomy Review
• MSK US Basics
• Cases of DVT Mimickers & MSK Pitfalls
MSK US

• Use of MSK US has significantly increased over the past two decades

BENEFITS OF US OVER MRI

- Dynamic assessment while interacting directly with patient
- Higher spatial resolution than MRI & excellent in imaging superficial structures
- Real time Doppler analysis & allows comparing with contralateral side
- Ease of accessibility & lower cost of US when compared to MRI
- Ability to perform US in patients with contraindications to MRI

Alves TI, et. al. Radiographics 2016; 36(6):1759-1775
MSK US BENEFITS

- Therapy can be performed simultaneously with diagnostic scan
- Joint injections/aspirations require no contrast injection
- No radiation/lead apron
- Allows evaluation of surrounding soft tissues & neurovascular structures during aspiration/injection
MSK US INDICATIONS

- Tendon & muscle pathology
- Fluid assessment (i.e. Joint effusion/septic jt, bursae/baker’s cyst, hematomas, abscesses)
- Ligament pathology
- Nerve pathology (entrapment, subluxations)
- Soft tissue masses (i.e. Sarcomas, Lipoma, Ganglia, Morton’s neuroma, etc.)
- Foreign bodies
MSK US INDICATIONS

- Dynamic evaluations
  - Tendon subluxation/snapping
  - Impingement
  - Muscle herniation
- Procedures
- Inflammatory arthropathy
  - Synovitis: US more sensitive compared to MRI
  - Erosions: US better than radiographs

¹Backhaus M. Arthritis and Rheum 1999; 42:1232
²Lopez-Ben, et al. Skeletal Radiol 2004; 33:80
MSK US LIMITATIONS

- Bone pathology
  - Contusions/marrow edema
  - Bone tumors
  - Fractures - use for fracture healing*
- Deep structures
  - Glenoid labrum
  - Menisci
  - Glenohumeral ligaments
  - Deep articular cartilage

NORMAL ANATOMY OF UPPER LEG

- Quadriceps (Anterior)
- Adductors (Medial)
- Hamstrings (Posterior)
NORMAL ANATOMY OF UPPER LEG

- Rectus femoris m.
- Vastus intermedius m.
- Linea aspera
- Femur
- Deep femoral a. and v.
- Sartorius m.
- Saphenous n.
- Femoral a. and v.
- Intermediate cutaneous n
- Great saphenous v
- Adductor longus m.
- Gracilis m.
- Intermuscular septum of median femoral
- Perforating a. and v.
- Semimembranosus m.
- Semitendinosus m.
- Sciatic n. Adductor magnus m.
- Vastus lateralis m.
- Intermuscular septum of lateral femoral
- Biceps femoris m. (short head)
- Biceps femoris m. (long head)
- Post. femoral cutaneous n.
NORMAL ANATOMY OF LOWER LEG

- Anterior compartment
- Lateral compartment
- Posterior compartment
  - Superficial
  - Deep
NORMAL ANATOMY OF LOWER LEG

- Anterior compartment
  - Tibialis Anterior m.
  - Extensor Hallicus Longus m.
  - Extensor Digitorum Longus m.
NORMAL ANATOMY OF LOWER LEG

- Lateral compartment
  - Peroneus Longus m.
  - Peroneus Brevis m.
NORMAL ANATOMY OF LOWER LEG

- Posterior compartment
  - Superficial
    - Gastrocnemius m.
    - Soleus m.
  - Deep
    - Tibialis Posterior m.
    - Flexor Digitorum Longus m.
    - Flexor Hallicus Longus m.
NORMAL VENOUS ANATOMY

- Tibio-peroneal Trunk
- Anterior Tibial Veins
- Peroneal Veins
- Posterior Tibial Veins

Deep Paired Calf Veins
NORMAL VENOUS ANATOMY
NORMAL ANKLE ANATOMY

Tendon extension from lower leg musculature

- **Anterior**
  - Extensors

- **Medial**
  - Flexors

- **Lateral**
  - Peroneals

- **Posterior**
  - Achilles
NORMAL ANKLE ANATOMY

- Anterior
  - Extensors

- Medial
  - Flexors
  - “Tom, Dick, AND Harry”

Medial Plantar Artery & Nerve
NORMAL ANKLE ANATOMY

- Medial
  - Flexors
    - “Tom, Dick, ANd Harry”
NORMAL ANKLE ANATOMY

- Lateral
  - Peroneals
- Posterior
  - Achilles
NORMAL ANKLE ANATOMY

- Lateral
  - Peroneals

- Posterior
  - Achilles

- Anterior
  - Extensors
BASICS OF MSK US

- A linear array transducer of 9-15 MHz is recommended
- Higher frequency linear transducer (17-22 MHz “hockey stick”) may be beneficial to evaluate smaller tendons, ligaments & joints
BASICS OF MSK US

• Scanning in Long (Longitudinal) Axis (LAX)

Muscle: Pennate (“Feather like”)

Tendon: Fibrillar (Hyperechoic)

Kalia V, et. al. Am J Roentgenol 2018; 211:(3)538-547
BASICS OF MSK US

- Scanning in Long (Longitudinal) Axis (LAX)

Nerve: Fasicular

Ligament: Fibrillar (Hyperechoic)
BASICS OF MSK US

- Scanning in Short (Transverse) Axis (SAX)

  Muscle: “Starry night”

  Tendon: Fibrillar
  (“Broom end” & Hyperechoic)

  Nerve: Fasicular
  (“Honeycomb”)
ANISOTROPY

ANISOTROPY: TRANSDUCER NOT PERPENDICULAR

Biceps tendon bright
Humerus
Transverse

Biceps tendon dark
Humerus
ANISOTROPY

Heel-Toe & Toggle help eliminate anisotropy
DVT MIMICKERS & MSK PITFALLS

- MSK diagnoses that clinically mimic DVT symptoms

- MSK diagnoses that can sonographically appear as a DVT

- May be only opportunity to diagnose these conditions & avoid unnecessary anticoagulants, tests & consults
DVT MIMICKERS & MSK PITFALLS

MSK diagnoses clinically mimicking DVT symptoms:

- Muscle tear / strain / hematoma
  - “Tennis leg”
- Muscle herniation
- Baker’s cyst
- Abscess
- Ankle tenosynovitis
- Neuroma
- Cellulitis
- Diabetic muscle ischemia

MSK diagnoses that can appear as a DVT:

- Muscle tear / strain / hematoma
  - “Tennis leg”
- Muscle herniation
- Dissecting Baker’s cyst
- Abscess
- Ankle tenosynovitis
- Neuroma
- Lymph node
- Lipoma
- Hernia
BAKER’S CYST

- Baker’s cyst
- Only if in gastrocnemius-semimembranosus bursa
BAKER’S CYST

- Dual pathology of DVT & Baker’s cyst has been reported in 3% of DVTs
- Compressive effects of Baker’s cyst may predispose to development of a DVT
- D-dimer levels may be raised with arthritis & multiple other causes leading to false positive
- Studies suggest both venous & MSK US scanning be performed in cases of acute calf pain & swelling

CASE #1
DVT STUDY: NEG DVT, POS FOR ABSCESS, TX: ABX
DVT STUDY: NEG DVT, POS FOR ABSCESS, TX: ABX

MID

LEFT POSTERIOR CALF
DVT STUDY: NEG DVT, POS FOR ABSCESS, TX: ABX
DVT STUDY: NEG DVT, POS FOR ABSCESS, TX: ABX

LEFT CALF MED GASTROC
ACTUAL DX: DISSECTING BAKER’S CYST

- Only if between medial head of gastrocnemius m. & semimembranosus tendon
CASE #2
PT SCHEDULED FOR SSV ABLATION
DX: SOLEAL DVT
PT SCHEDULED FOR SSV ABLATION
DX: SOLEAL DVT
ACTUAL DX: BAKER’S CYST
CASE #3
PT SCHEDULED FOR SSV ABLATION
DX: GASTROSC DVT
PT SCHEDULED FOR SSV ABLATION
DX: GASTROC DVT
ACTUAL DX: BAKER’S CYST
CASE #4 DVT STUDY: NEG DVT, POS FOR CALF MASS. PT SENT TO ORTHOPEDIC ONCOLOGIC SURGEON

LEFT POPLITEAL FOSSA AVASCULAR MASS LONG
DVT STUDY: NEG DVT, POS FOR CALF MASS. PT SENT TO ORTHOPEDIC ONCOLOGIC SURGEON
DVT STUDY: NEG DVT, CALF MASS. PT SENT TO ORTHOPEDIC ONCOLOGIC SURGEON
ACTUAL DX: DISSECTING BAKER’S CYST

DVT STUDY: NEG DVT, CALF MASS.
ACTUAL DX: DISSECTING BAKER’S CYST
DVT STUDY: NEG DVT, CALF MASS.
ACTUAL DX: DISSECTING BAKER’S CYST

LEFT POSTERIOR KNEE LAX MED-MID
CASE #5 CALF PAIN, CLINICAL DX: DVT PLACED ON ANTICOAGULANTS
**MSK PATHOLOGY US BASICS**

- **TENDINOSIS**
  - Thickened, enlarged, & focally or diffusely hypoechoic
  - Decreased normal defined fibrillar architecture
  - +/- Hyperemia

- **TENOSYNOVITIS**
  - Hypoechoic rind surrounding the tendon within sheath, resulting from complex fluid w/ associated echogenic debris or synovium
  - Often incompletely compressible & painful
  - +/- Hyperemia

POSTERIOR TIBIAL TENDINOSIS & TENOSYNOVITIS
MEDIAL ANKLE
MEDIAL ANKLE NV STRUCTURES
ANKLE FLEXOR TENDONS
ANKLE TENOSYNOVITIS

- Ankle flexor tenosynovitis mimicking Posterior Tibial DVT
  - PTT
  - FDL
  - FHL
  - “Tom, Dick, ANd Harry”
CASE # 6
DVT STUDY: POS PTV DVT

WITH OUT COMP

W/ COMP
DVT STUDY: POS PTV DVT

RT PTV W/ COMP
ACTUAL DX: FLEXOR DIGITORUM LONGUS TENOSYNOVITIS
FDL TENOSYNOVITIS

PTT / FD  SAX

LEFT MEDIAL ANKLE
FDL TENOSYNOVITIS

PTT / FD DYNAMIC
LEFT MEDIAL ANKLE
CASE #7 MUSCLE STRAIN / TEAR / “TENNIS LEG”
NORMAL Calf SAX

Area of pain: Med Gastroc
Right lower leg
NORMAL CALF LAX

AREA OF PAIN  MED GASTROC
RIGHT LOWER LEG
MUSCLE STRAIN / TEAR / “TENNIS LEG”

MED GASTROC SAX
RIGHT LOWER LEG
MUSCLE STRAIN / TEAR / "TENNIS LEG"

MED GASTROCNEMIUS LAX
RIGHT LOWER LEG
MUSCLE STRAIN / TEAR / “TENNIS LEG”
MUSCLE STRAIN / TEAR / “TENNIS LEG”
“TENNIS LEG” VS SOLEAL V.
CASE # 8
FEMORAL LIPOMA MIMICKING CFV DVT
CASE # 9
SSV MARKED FOR ABLATION
SSV MARKED FOR ABLATION
DX: FASCIAL TEAR
SSV MARKED FOR ABLATION
DX: FASCIAL TEAR
SSV MARKED FOR ABLATION
DX: FASCIAL TEAR
ANTERIOR TIBIALIS MUSCLE HERNIATION

LEFT ATT DORSIFLEXION
ANTERIOR TIBIALIS MUSCLE HERNIATION

LEFT ATT PLANTARFLEXION
CASE # 10 POSTERIOR KNEE PAIN SUSPECTED DVT

LEFT POP FOSSA MEDIAL LAX
POSTERIOR KNEE PAIN
SUSPECTED DVT
DX: LYMPH NODE

POPLITEAL ART/VEIN

LEFT POP FOSSA MEDIAL SAX
POSTERIOR KNEE PAIN
SUSPECTED DVT
DX: LYMPH NODE
POSTERIOR KNEE PAIN
SUSPECTED DVT
DX: LYMPH NODE
CASE # 11
FEMORAL FAT-CONTAINING HERNIA MIMICKING CFV DVT
CASE # 11
FEMORAL FAT-CONTAINING HERNIA MIMICKING CFV DVT
VEIN ABLATION

- Important to identify Sural n. when evaluating the small saphenous vein for ablation

Close proximity at lateral ankle
SURAL N & S. SAPH V
TAKE HOME POINTS

• Use of MSK US is significantly increasing – Benefits

• Understanding anatomy & MSK US basics is critical
  • Muscles, tendons & nerves reside near vascular structures
  • Common pathologies (tendinosis, tenosynovitis, etc.)

• Keep in mind common DVT mimickers & MSK pitfalls
  • May be only opportunity to identify & avoid unnecessary anticoagulant therapy & consults

• REMEMBER: Baker’s cyst only if between medial head of gastrocnemius m. & semimembranosus tendon

• IMPORTANT: ID Sural n. in close proximity to SSV
THANK YOU