Acute Lower Limb Pain in the Emergency Department: What to Look for When Deep Venous Thrombosis is Ruled out.

Poster No.: C-1724
Congress: ECR 2015
Type: Educational Exhibit
Authors: L. J. Burgos Vigara¹, A. Benito Ysamat¹, P. Segui², M. J. García Ortega², R. Montero Perez-Barquero²; ¹CORDOBA/ES, ²Córdoba/ES
Keywords: Embolism / Thrombosis, Athletic injuries, Education, Ultrasound-Colour Doppler, Ultrasound, Management, Extremities, Emergency
DOI: 10.1594/ecr2015/C-1724

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

To review the different entities that may present with pain, swelling and acute lower limb oedema.

To highlight the usefulness of sonography in detecting these disorders that can mimic deep vein thrombosis (DVT) clinically.

Background

DVT is a major health problem and it is estimated to have an annual incidence of 160 cases per 100,000 in North America and Europe. In patients with painful edema of the lower limb, DVT is often the presumptive diagnosis until proven otherwise Fig. 1 on page 2. Anticoagulation therapy is required for treatment and to prevent the risk of pulmonary embolism (PE), therefore, a correct diagnosis is mandatory. The clinical diagnosis is not always easy as there are several conditions that can simulate DVT. Ultrasound is considered the most useful initial imaging modality when DVT is suspected.

Images for this section:
**Fig. 1:** Deep Venous Thrombosis (DVT): Transverse US image of the anterior side of the thigh demonstrates enlarged, non-compressible, superficial femoral vein (yellow asterisks) with low-level internal echoes.
Findings and procedure details

An anatomical approach dividing the lower limb in four regions is followed Fig. 2 on page 8

- Inguinal region: Delimited superiorly by the inguinal ligament and inferiorly by a theoretical horizontal line drawn at the level of the intersection of the sartorius and adductor longus.

- Thigh: Located between the inferior border of the inguinal region and the adductor or Hunter’s canal.

- Popliteal region: The superior border is the adductor canal and the inferior border is located 10 cm below the popliteal fold.

- Leg: Extends from the inferior border of the popliteal region to the ankle.

A comprehensive pictorial review of the typical imaging findings of different entities that commonly affect these four anatomical regions is included, focusing on ultrasound.

Cellulitis and superficial vein thrombosis are excluded from this classification and discussed separately as they can affect the entire lower limb.

**Lower Leg:**

Musculotendinous injuries:

- Tennis leg: It is caused by a tear of the medial gastrocnemius muscle, with partial detachment of its adjacent common aponeurosis with the soleus. It usually occurs after sports activity in people unprepared and sometimes without preceding trauma.

The presentation is one of sudden sharp pain in the posterior aspect of the calf, associated with a sensation of something 'snapping' within the calf. This is associated with focal tenderness and swelling. A focal 'gap' can sometimes be felt early on (prior to swelling) at the sight of the tear.

Ultrasound demonstrates fluid deep to medial gastrocnemius and superficial to the soleus muscle most prominent at the level of the myotendinous junction. A tear in the deep
surface of gastrocnemius may be seen as a disruption in contour and echogenicity of muscle fibres Fig. 3 on page 10.

- Achilles tendon rupture: The Achilles tendon is the strongest tendon in the human body, measuring 10 to 15 cm in length. A hypovascular zone about 4 to 6 cm above the calcaneal insertion is described, where tendinopathy and tears most commonly occur. Clinical diagnosis of partial or complete tendon tear may be challenging if there is significant soft tissue swelling, mimicking DVT.

On US, full-thickness tears are depicted as a fluid or blood-filled defect with retraction and swelling of tendon ends. Herniation of the Kager fat pad into the gap can also be appreciated Fig. 4 on page 10. Care must be taken to prevent confusing the plantaris tendon with intact fibers of the Achilles tendon.

In partial-thickness tears, only a part of the tendon is affected. The tendon is usually enlarged and hypoechoic. Dynamic maneuvers with passive flexion and extension are useful of a partial from a complete tear.

- Plantaris tendon rupture: The plantaris muscle is a small and rudimentary muscle located deep to the medial head of the gastronecmius. Isolated tears are infrequent, and clinically simulate a tear of the Achilles tendon. On US, the plantaris tendon is enlarged and hypoechoic, but there are few reports describing the US findings on English-language literature Fig. 5 on page 11. Tears of the plantaris tendon are commonly associated with other injuries such as the tennis leg or tears of the Achilles tendon.

Soft-tissue tumors:

Soft-tissue tumors are lesions that originate from mesenchymal cells. The prevalence is age dependent and the symptoms are vague and nonspecific, although the initial manifestation of a sarcoma can simulate DVT. Most common benign tumors are lipomas, fibrous histiocytoma, nodular fasciitis and neurogenic tumors such as schwannomas and neurofibromas. Sarcomas are the most common malignant soft-tissue tumors Fig. 6 on page 12.

Deep Fibromatosys (Desmoid Type Fibromatosis):

Desmoid type fibromatosis occurs most frequently in patients in the 2nd to 4th decades of life, with a peak incidence between the ages of 25 to 35 years. Lower extremity desmoid type fibromatosis can involve the anterior quadriceps musculature or, more often, the
popliteal fossa and the lower leg. It is a benign fibroblastic tumor that is capable of locally aggressive growth, but it does not metastasize, and it typically manifests as a deeply seated but poorly circumscribed soft-tissue mass Fig. 7 on page 13.

**Popliteal Region:**

In the popliteal region the most relevant differential diagnoses of DVT are synovial cysts and popliteal artery aneurysms.

**Baker Cysts** (or popliteal cysts) are fluid-filled distended synovial-lined bursa arising between the medial head of the gastrocnemius and the semimembranosus tendons via a communication with the knee joint. They are usually located at or below the joint line.

Baker cysts are most often found incidentally when the knee is imaged for other reasons and are frequently associated with rheumatoid arthritis, other degenerative diseases and meniscal tears.

A well-defined cyst is identified with a 'neck' at its deepest extent between the semimembranosus tendon and the medial head of the gastrocnemius into the joint Fig. 8 on page 14. Identification of a fluid-filled structure at the posteriomedial knee is suggestive of a popliteal cyst, but identification of the 'neck' between the tendons is necessary for a definitive diagnosis.

Symptomatic presentation may be acute when rupture occur thus mimicking deep venous thrombosis Fig. 9 on page 15. Popliteal cysts may also have a chronic/sub-acute presentation as a popliteal fossa mass or pain.

**Popliteal artery aneurysm:** it is the most common location for peripheral arterial aneurysm and the second most common in the human body after abdominal aortic aneurysms. Although uncommon, they are bilateral in 50 to 70% of cases. They can either be true or false aneurysms:

- True aneurysms of the popliteal artery Fig. 10 on page 16 are usually the result of atherosclerosis or arteriomegaly.

- False aneurysms are usually the result of knee trauma, surgery/intervention or infection.
**Thigh:** the most important pathologic conditions that can simulate DVT in this region are muscular conditions.

**Musculotendinous injuries:**

Muscular lesions are subdivided into contusions, hematomas Fig. 11 on page 17 muscle strains, tears, and lacerations. They are usually related to sport activities, but they can also result from normal daily activities. Traumatic injuries to the thigh most frequently compromise the adductor group. Other muscular groups that may be injured in this region are the hamstrings and the quadriceps:

- The adductor longus is the most commonly injured muscle, particularly at the pubic myotendinous junction Fig. 12 on page 17 , although tear at the origin on the symphysis pubis or at the distal insertion on the femur may also occur. US in the acute setting demonstrate a defect or gap filled with hypoechoic hematoma and hyperemia with color or power Doppler. Cortical irregularity at the insertion in the symphysis pubis or distal femur may also be seen.

- Rectus femoris muscle is the most anterior and the most commonly injured of the quadriceps group. Tears are more common at the distal musculotendinous junction but may also occur proximally.

- The biceps femoris is the most commonly injured hamstring muscle followed by the semimembranosus Fig. 13 on page 17 . Tears of the hamstrings usually involve the musculotendinous junction followed by the myofascial junction. Avulsion at the insertion sites is uncommon.

**Inguinal region:**

**Vascular Conditions:** the most common vascular pathologic conditions that simulate DVT are hematomas and secondary pseudoaneurysms.

Pseudoaneurysms originate from disruption of the arterial wall continuity due to inflammation, trauma, or iatrogenic causes such as surgical procedures, catheterization, percutaneous biopsy or less commonly, as a result of nonsurgical trauma.

The dimensions of the neck should be measured to determine whether the best treatment is compression therapy or thrombin injection. Due to the turbulent forward and backward
flow, a characteristic yin-yang sign can be seen on colour Doppler while a "to and fro" pattern may be seen with pulsed Doppler Fig. 14 on page 18 and Fig. 15 on page 19.

Lymphatic Conditions:

- Adenopathies: Adenopathies in the inguinal region are most commonly inflammatory, but neoplastic nodes are not unusual. The most common neoplasms are lymphomas, genital squamous cell carcinomas and melanomas. Normal reactive lymph nodes are usually oval or elongated with the long-short axis exceeding 2 and an echogenic centre or hilus in continuity with the adjacent tissue. On the other hand, neoplastic nodes are commonly round in appearance, with the long-short axis below 2 and absence of identifiable echogenic hilus.

- Lymphangitis: Represents inflammation of the lymphatic vessels. In the inferior extremities, lymphangitis usually presents with edema, thus simulating DVT clinically.

Miscellaneous

Superficial vein thrombosis:

In patients with venous incompetence, a painful induration with dilated superficial veins can be present. Thrombosis of these structures is common, manifesting with pain, swelling and warmth with palpable superficial varicose cords representing the thrombosed veins. US shows dilated non-compressible veins with increased internal echogenicity and absence of internal flow Fig. 16 on page 19.

Cellulitis:

Acute infection of the skin and subcutaneous tissue: It is one of the entities most commonly confused with DVT. Early cellulitis presents as thickening with increased echogenicity of the subcutaneous tissue on US. Later on, the accumulation of fluid in the subcutaneous tissue gives it a "cobble stone appearance" that can be seen in subcutaneous edema caused by many other entities, for instance congestive heart failure. Abscess formation may also occur Fig. 17 on page 20.

Images for this section:
**Fig. 2:** Superficial and deep venous system of the lower limb.

**Fig. 3:** TENNIS LEG: Sagittal US views show tear of the medial gastrocnemius muscle (GEM INT), with a disruption in contour and echogenicity of muscle fibres (white arrows) and fluid deep to medial gastrocnemius and superficial to the soleus (SOLEO) muscle (A). Mild internal flow in the myotendinous junction is present (B). Panoramic us view shows an increase in the fluid collection deep to medial gastrocnemius one month later.
Fig. 4: ACHILLES TENDON RUPTURE: Longitudinal us paroramic (A) and sagital (B) views show a complete Achilles tendon rupture with formation of an organized hematoma of heterogeneous appearance (white arrows). Herniation of the Kager fat pad into the gap is appreciated (yellow arrow).
Fig. 5: PLANTARIS TENDON RUPTURE: Sagital US view shows an hypoechoic, enlarged and retracted plantaris tendon (A). Transverse US Image (B) compares normal side and pathological side, with the tendon sheath empty and occupied by liquid (white arrow).
Fig. 6: Ewing Sarcoma: Transversal US views obtained in a 19-year-old female with local calf pain and swelling show a solid hypoechoic mass (A) with internal arterial flow (B) at the popliteal region extending to the lower leg. MRI demonstrates a large, lobulated and heterogeneous soft-tissue mass (red asterisks), in intimate contact with the proximal metaphysis of the fibula bone (yellow arrow), with clearly aggressive appearance. The lesion presents intense and heterogeneous enhancement after contrast administration. Ewing sarcoma was confirmed by percutaneous US guided biopsy.
Fig. 7: DESMOYD TYPE FIBROMATOSIS: Longitudinal US panoramic (A) and transverse (B) views obtained in a 30-year-old female with calf pain and swelling shows a solid hypoechoic mass (red asterisks) with mild internal flow (yellow arrow) at the popliteal region extending to the deep posterior muscular compartment of the leg. MRI demonstrates a large heterogeneous soft-tissue mass (red asterisks) that contains dense hypointense fibrous bands (blue arrows). The lesion obliterates the popliteous vein (yellow arrow) and has predominantly high signal intensity on fluid-sensitive sequences (Stir) with intense and homogenous enhancement (C). Deep desmoid type fibromatosis was confirmed by percutaneous US guided biopsy.
Fig. 8: TYPICAL BAKER CYST: Longitudinal US view shows baker cyst arising between the medial head of the gastrocnemius and the semimembranosus tendon (white arrow).
Fig. 9: RUPTURED BAKER CYST: Longitudinal US panoramic view shows a collapsed baker cyst (blue asterisks) with a pointed distal edge (red arrow) and fluid extending superficially to the medial gastrocnemius muscle (yellow arrows).
**Fig. 10:** POPLITEAL ARTERY ANEURYSM: Sagital ultrasound images show a popliteal artery aneurysm with mural thrombus (yellow asterisks) that compresses the popliteal vein (green arrows) causing distal venous thrombosis.

**Fig. 11:** HEMATOMA OF THE MEDIAL VASTUS: Thirty-five year old male patient with trauma to the left thigh five days ago. US panoramic view (A) shows large hematoma in the thickness of the muscle belly of the vastus medialis (white arrows). No vascular vessels are detected in the color Doppler exploration (B).

**Fig. 12:** ACUTE RUPTURE OF THE INSERTION OF THE ADDUCTOR LONGUS: Longitudinal US panoramic view shows an acute rupture of the insertion of the adductor longus. The retracted tendon and myotendinous union (yellow arrows) are surrounded by hypoechoic hematoma (red asterisks).
Fig. 13: ACUTE RUPTURE OF THE PROXIMAL INSERTION OF THE BICEPS FEMORIS: Transverse and longitudinal US view show an acute rupture of the insertion of the adductor longus. The retracted tendon and myotendinous union (yellow arrows) are surrounded by hipoechoic hematoma (red asterisks).

Fig. 14: PSEUDOANEURYSM OF THE SUPERFICIAL FEMORAL ARTERY: Longitudinal US view (A) shows a narrow neck region (red asterisks) that communicates
with the superficial femoral artery (SFA). This confirms the finding of a pseudoaneurysm arising from the SFA. Bidirectional "to and fro" flow is present (B).

**Fig. 15:** PSEUDOANEURYSM OF THE PROFUNDA FEMORAL ARTERY: Fifty year old male with a history of stab wounds two weeks ago. Readmitted for left lower limb edema and functional impotence. Ultrasound was performed for suspected DVT. Doppler US shows swirling flow as evident by different colour signal within the lesion (yin-yang sign).
**Fig. 16:** SUPERFICIAL THROMBOPHLEBITIS: Transverse US image of the anterior side of the leg demonstrates enlarged, non-compressible superficial veins (yellow asterisks) with low-level internal echoes.

**Fig. 17:** CELLULITIS: Longitudinal US images show swelling of the subcutaneous tissue of the leg, which appears as an area of increased echogenicity with hypoechoic bands, caused by an accumulation of fluid (A). Doppler-power shows increased vascularity with high internal flow surrounded by hypoechoic image (abscess) extending between subcutaneous tissue and the superficial muscular fascia.
Conclusion

Radiologists must be familiar with the different conditions that can simulate DVT clinically in order to establish a correct diagnosis and avoid adverse effects of anticoagulation.

An anatomic approach is a useful strategy to derive an appropriate differential diagnosis in patients with suspected DVT.

Personal information

References


