Learning objectives

To review the imaging appearance on CT of testicular and inguinoscrotal pathology.
Background

Inguinoscrotal and testicular diseases are usually evaluated with imaging techniques such as MR or US since CT involves ionizing radiation. Nevertheless, testicular and inguinoscrotal pathology may be found both as an extension of intraabdominal processes or incidentally on CT scans requested for other reasons.
Findings and procedure details

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Conditions affecting male genitalia and the inguinoscrotal region are primarily vascular, neoplastic, traumatic, infectious or inflammatory but also extension from abdominal or pelvic processes as well as involvement in complications of diagnostic procedures or abdominal surgeries can occur.

Computed tomography (CT) is a widely used diagnostic method for numerous diseases, however most of the pathologies involving the inguinal region and scrotum are better evaluated at ultrasonography (US) without use of ionizing radiation. Especially in asymptomatic patients, inguinoscrotal anomalies may be found incidentally on CT scans requested for other reasons and radiologists should be acquainted with their appearance on this imaging technique in order to make a correct diagnosis, avoid unnecessary tests and facilitate appropriate treatment if needed.

The main types of lesions and conditions, grouped by etiology, are discussed and illustrated as follows:

Vascular processes

Varicocele is a common condition as a result of incompetent or congenitally absent valves in the testicular vein. Secondary varicocele is much less common and result from increased pressure in the testicular vein due to extrinsic compression, obstruction or splenorenal shunting in portal hypertension.

Varicocele is generally diagnosed with US especially during a Valsalva maneuver (1). On CT, a serpiginous engorged venous structure within the scrotum may be seen.

A tortuous dilated artery within the scrotum leads to the diagnosis of arteriocele in patients with total occlusion of the distal abdominal aorta (Leriche syndrome) or iliac arteries secondary to progressive arteriosclerotic vascular disease (2).

Pseudoaneurysms may be found in the aftermath of trauma or procedures like catheterisms as a round contrasted addition image in communication with the vessel wall and with the same dynamic enhancing behavior as the other vessels during CT-contrast phases.

Testicular infarction is seldom observed on CT since the imaging technique of choice is US, and when seen it is mostly in advanced stages, gone unnoticed in severely injured
patients with multiple contusions, as a non-enhancing structure or intratesticular nodule when iv contrast is used. CT perfusion has been considered by some authors as an alternative method to diagnose testicular torsion in indeterminate cases (3).

**Neoplastic conditions**

A variety of malignant and benign masses can involve the inguinoscrotal region. CT allows the assessment of the origin of the tumor ruling out other entities such as hernias, inflammatory or vascular abnormalities, although the imaging appearance of solid tumors is relatively nonspecific and further evaluation is usually needed (1).

Masses in the inguinoscrotal territory and inguinal canal can be divided into extratesticular or intratesticular.

Benign extratesticular masses include lipomas, which are the most common benign extratesticular neoplasms, and adenomatoid tumors that originate in the epididymis, most commonly in the tail. Lipomas are recognized as low attenuating masses and should be differentiated from fat-containing hernias. The most common malignant extratesticular tumor is spermatic cord sarcoma, most frequently liposarcoma. CT might be helpful for the characterization of these masses since this tumor appears as a large mass of fatty component that can be easily recognized intermixed with nonlipomatous thick septa or soft-tissue attenuation nodules (4).

Intratesticular tumors can be divided into benign tumors, malignant tumors and tumors with malignant potential. Benign intratesticular masses are quite rare, highlighting intratesticular lipomas, Leydig cell hyperplasia and testicular adrenal rest tumors. Sex cord-stromal tumors (Leydig and Sertoli cell tumors) arise from male gonadal interstitium and comprise 1%-4% of all testicular neoplasms. Although benign, malignant variants of these neoplasms also exist.

Germ cell tumors are the most common malignant intratesticular masses (95%), and are divided into seminomatous and non-seminomatous tumors. The latter group includes embryonal carcinoma, yolk sac tumor, teratoma and choriocarcinoma. CT demonstrates enhancing solid and nonenhancing cystic components. Another common malignant intratesticular tumor is lymphoma, which is the most frequent testicular malignancy in elderly men and the most common bilateral testicular tumor, spreading occasionally to the spermatic cord causing thickening with diffuse heterogeneous enhancement (5).

Metastases in the inguinoscrotal region should always be included in the differential diagnosis, especially if there is a known a primary neoplasm. Metastases appear as nonspecific, enhancing, soft-tissue attenuation masses (5, 6, 7).
Inguinoscrotal trauma

Groin and especially testicular lesions account for less than 1% of all trauma and are usually due to blunt mechanism or sports-related. US with a linear-array transducer is the modality of choice for the evaluation of testicular trauma, although this examination is poorly tolerated in severe trauma. However, in a polytrauma setting, a CT will be performed and testicular trauma may be observed (8). Testicular trauma includes contusion, hematoma, torsion, fracture and rupture. Fracture is defined as a discontinuity in the normal testicular parenchyma associated or not with a tunica albuginea rupture whereas rupture involves a disruption of the tunica albuginea with protrusion of the seminiferous tubules and might be the only lesion conspicuous on CT (9).

Epididymal and urethral injuries, dislocation of the testes to the inguinal canal or hematomas involving either the groin or the scrotum occur sometimes after trauma. In fact, testicular dislocation is commonly accompanied by scrotal hematoma and pelvic fracture.

Urethral injuries should be suspected in unstable pelvic fractures, bilateral ischiopubic rami fractures ('straddle fracture') and symphysis pubis diastasis. CT role in the initial assessment of urethral injuries is limited since the patient has to be fully co-operative and must have shown the ability to void. However, it is useful in the acute phase to evaluate concomitant injuries in the penile crura and intra-abdominal organs (10).

The sequelae of former trauma may be recognized as bone deformities or callus from previous fractures.

Infectious and inflammatory conditions

The hip forms the floor of the groin, and inflammatory processes affecting the joint like the inflammation of the iliopectineal bursa, joint efusions or synovial proliferative diseases such as synovial osteochondromatosis can all be seen on CT (1).

Inguinoscrotal abscesses secondary to epididymitis/epididymo-orchitis or superinfection of a previous testicular hematoma or infarction are depicted as hypoattenuating fluid collections with enhancing wall (11).

In immunocompromised and diabetic patients, cellulitis in the groin can evolve into a Fournier gangrene, which is a necrotizing fasciitis of the perineum representing a life threatening condition with a high mortality rate. This entity usually requires an emergency CT scan as initial imaging modality to clarify the underlying cause and assess the extent
of the disease for surgical planning (12). Soft tissue gas bubbles, fat planes stranding and fascial thickening of the involved areas suggest this diagnosis (13).

Surgical sequelae and extension of abdominal processes

The inguinal canal and scrotum might be filled with blood secondary to catheterisms with femoral artery/vein approach. Likewise, fluids from the peritoneal cavity or retroperitoneum (such as urine, biliary leaks, ascites and pancreatic fluid) can extend to the inguinal canal tracking the retroperitoneal fascial planes downward producing scrotal swelling or pain. This can mimic inguinal hernias or testicular torsion, especially when pancreatic fluid from acute severe pancreatitis spreads to the scrotum, in which scrotal necrosis has been reported (14, 15, 16). If a urine leak is suspected to extend to the scrotum an excretory contrast phase CT is mandatory.

Inguinal hernias are a very common finding and rarely symptomatic unless incarcerated. Inguinal hernias may be direct when medial to the inferior epigastric artery herniating through a defect in the Hesselbach triangle, or indirect when originated at the deep inguinal ring, lateral to the inferior epigastric artery and follow the path of the inguinal canal inferomedially. Femoral hernias lie in the femoral canal, accompanying femoral neurovascular bundle, medial to the femoral vein (1). Only indirect hernias extend into the scrotum. Hernias can contain mesenteric fat, intestinal bowel loops, the bladder or even the appendix.

Postsurgical changes secondary to hernia repair may be visualized. Surgical mesh can sometimes be seen on CT as a high density linear material in the abdominal wall of the femoral/inguinal region. Other devices such as testicular prosthesis may be present following orchiectomy, seen as rounded metallic density images located in the scrotum.
Fig. 1: Varicoceles. Two cases of testicular varicocele (arrows). Images depict dilated veins within the scrotum (A) and spermatic cord (B).

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Fig. 2: Arteriocele. 72 year-old patient with right iliac artery occlusion. Secondary right arteriocele with a dilated testicular artery is seen (arrow).

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Fig. 3: Pseudoaneurysm. 58 y/o male with inguinal hematoma and inguinal artery pseudoaneurysm following catheterism. CT in (A) arterial and (B) venous phase and (C) angiography depicts a pseudoaneurysm (arrow). A stent was successfully placed (D).

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Fig. 4: Testicular infarction. 64 y/o male with renal transplantation. Follow-up CT depicts well defined hypodense intratesticular lesion (arrow). Left orchiectomy was performed for suspicion of testicular tumor. Testicular infarction secondary to venous thrombosis was the histopathologic diagnosis.

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**Fig. 5:** Liposarcoma. 71 y/o male with large left scrotal tumor. CT shows areas of fat-attenuation within the mass (asterisk). The tumor was removed and liposarcoma was confirmed on histopathology. Note a large inguinal hernia in the right scrotal sac (arrow).

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Fig. 6: Melanoma metastasis. 57 y/o man with right inguinocrotal melanoma. Note the multiple cutaneous nodules (arrow) and lymphadenopathy in right inguinal region (arrowhead).

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Fig. 7: A. 81 y/o man with pneumoscrotum (asterisk) secondary to perforation after ERCP. Gas in the retroperitoneum traces its way down to the scrotum (arrow). B. 33 y/o male involved in a motorcycle accident. CT illustrates gas in the scrotum due to traumatic skin disruption.

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Fig. 8: Testicular burst. 27 y/o man involved in a car crash. CT performed in the polytrauma setting shows left testicle rupture (arrow) with hematocele in both scrotal sacs.

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Fig. 9: Anticoagulant-related hematoma. 54 y/o male on anticoagulation therapy with pain and scrotal swelling. Spontaneous extensive hematoma in the left scrotal sac is shown on CT.

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Fig. 10: Fournier’s gangrene. 64 y/o male with fever and hypotension secondary to Fournier's gangrene. CT shows extensive soft tissue stranding and gas bubbles in the right inguinoscrotal region.

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**Fig. 11:** Strangulated hernia. 78 y/o male with abdominal pain and small bowel obstruction signs. CT shows a right inguinal incarcerated hernia containing a necrotic small bowel loop (arrow). Notice the gas bubbles surrounding the loop indicating small bowel perforation.

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**Fig. 12:** Urinary bladder hernia. 84 y/o patient with left lower quadrant (LLQ) pain and fever. CT depicts a left inguinal hernia containing part of the bladder and inflammatory changes.

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Fig. 13: Crural hernia. 85 y/o male patient. CT following abdominal surgery with postsurgical abscess in the abdominal subcutaneous tissue (asterisk). A femoral left hernia containing small bowel is seen (arrow). Note the normal left spermatic cord (arrowhead).

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Fig. 14: Urinoscrotum. 42 y/o male status post renal transplant. Renal allograft is seen in LLQ (arrow). CT also shows a urine collection surrounding the transplanted kidney extending into the left inguinal region (asterisk). In excretory phase a leak from the urinary system is seen (curved arrow).

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Fig. 15: Bilioscrotum. 56 y/o patient with suspected incarcerated inguinal hernia. CT shows an occupation of the retroperitoneal space, inguinal canal and scrotum (arrow). Retroperitoneal fluid was aspirated and the patient was diagnosed with retroperitoneal biloma due to spontaneous biliary duct rupture secondary to choledocholithiasis.

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**Fig. 16**: Cryptorchidism. Retractile testicle in a 44 year-old patient with sigmoid cancer on post-operative follow-up CT. An atrophic left testis is seen in the left inguinal canal (asterisk).

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**Fig. 17:** Inguinal cord cyst. 62 y/o male in follow-up for bladder cancer with incidental spermatic cord cyst. On CT a cystic round lesion within the right spermatic cord is seen (asterisk).

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Fig. 18: Mesh in repaired hernia. 67 y/o man on follow-up for prostate cancer. CT shows linear high density material in the right inguinal canal corresponding to mesh placed for hernia repair.

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**Fig. 19:** Testicular prosthesis. 27 y/o patient with previous non-seminomatous germinal cell tumor. Follow-up CT shows testicular prosthesis in the right scrotal sac following orchiectomy.

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Conclusion

Despite the fact that CT is not the eligible imaging technique to assess either the scrotum or the testes, radiologists should be acquainted with the appearance of inguinoscrotal pathology on CT in order to make an accurate diagnosis.
References


