Scrotal masses: Clinical questions that can be addressed with imaging

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I have no conflict of interest related to this presentation
Clinical questions

- A painless solid scrotal mass in a young man is de facto considered by us urologists as testicular malignancy.
- Treatment consists of surgical removal of the testis.
  - How reliable is color Doppler US for the diagnosis of benign scrotal masses?
  - When is further imaging (MRI) indicated to characterize a mass as benign and guide urologists to testis-sparing surgery (TSS).
Case presentation

- Healthy and fit 24-year-old man
- No urological or surgical history
- Gradual onset of right scrotal swelling and feeling of scrotal heaviness
- Clinical examination: painless palpable mass in right hemiscrotum, felt like hydrocele
Scrotal US

Diagnosis: complicated left hydrocele with diaphragms
right “hydrocelectomy” (scrotal incision)

Pathology report:
Mature cystic teratoma with intratubular Sertoli cell tumor and in situ germ cell neoplasia.

Photo courtesy of Dr. M. Papathanasiou
Scrotal masses

- Extratesticular masses
  - Cystic (by definition benign)
  - Solid (3% chances of malignancy)*
- Intratesticular masses
  - Cystic
  - Solid

- exception: in children up to 50% of extratesticular masses are malignant
Benign extratesticular masses

**SOLID masses**
- Lipoma
- Leiomyoma
- Adenomatoid tumour
- Papillary cystadenoma
- Fibrous pseudotumor

**CYSTIC lesions**
- Epididymal
- Spermatic cord
- Tunica albuginea
- Tunica vaginalis
  - Spermatocele
Benign extratesticular masses

- Solid neoplasms of the paratesticular space are rare.
- They may occur at all ages, usually presenting as slow-growing painless scrotal masses.
- Preoperative characterization of paratesticular tumors may be difficult.
Epididymal masses

- extremely rare, 70% benign, 30% malignant
- benign epididymal tumors
  - adenomatoid tumor (60-70%), 1/3 of extratesticular scrotal tumors
  - Leiomyoma
  - Cystadenoma
- malignant epididymal tumors
  - Adenocarcinoma

**Challenge:** epididymal mass or testicular tumor (if close to the tunica)
Epididymal tumor
Lipoma of the cord

- Most common (45%) extratesticular benign tumor, originates from spermatic cord.
- All ages: non-tender scrotal lump.
- US: homogenous appearance, typically hyperechoic (neither sensitive nor specific).
- US: atypical lipomas may appear hypoechoic or of mixed echotexture.
- MRI: fat content of lesion confirms diagnosis.

Diagnostic Challenge: malignant liposarcoma
Adenomatoid tumor of the epididymis

- 30% of all extratesticular tumours
- most common solid tumour of the epididymis.
- 14% outside the epididymis (tunica albuginea, tunica vaginalis, spermatic cord)
- age group 20-50 yrs (mean age 36)
- painless palpable nodule
  - 5% acute epididymitis
  - 30% chronic pain
Adenomatoid tumor of the epididymis

US non-specific: isoechoic heterogenous lesions at the epididymis tail, well-defined, oval in shape.

Diagnostic challenge: adenomatoid tumor OR peripheral testicular lesion.
Fibrous pseudotumor

- 3rd most common paratesticular mass
- reactive proliferation of paratesticular tissue.
- 75% of cases from the tunica vaginalis
- may mimic a tumor on US (hypoechoic hypovascular lesion)
Leiomyoma

- 2nd most common tumor of the epididymis, age >40
- slow-growing non-tender mass involving the epididymal head.
- US: no specific features, cystic or solid mass with calcifications.
- No adequate data on the MRI appearance of this tumor
Spermatoceles

- Cystic dilatation of efferent tubules-epididymal head, contains fluid (degenerative spermatozoa, protein)
- 1-2 cm, rarely >15 cm
- 10%-30% of middle aged men referred for US
- Painless / slightly painful mass
Spermatoceles on US

Diagnostic challenges:
- very large spermatocele OR large hydrocele
- solid complicated spermatocele OR extratesticular mass
- Calcifications rare - extratesticular tumor

“falling snow” sign on Color Doppler (internal echoes move away from transducer)
Sperm granuloma

- vasectomy (up to 40%), inflammation
- solid mass in the epididymis or along the vas deferens and scrotal pain after vasectomy = a sperm granuloma.
- US: well-demarcated, small (< 2 cm) avascular isoechoic-hypoechoic mass
  - Challenge: adenomatoid tumour (normal-increased vascularity)

Amin AB et al, Modern Pathology 2005
Benign Intratesticular masses

- the vast majority of intratesticular masses are malignant, unlike extra-testicular solid masses, which are mostly benign.
- intra-testicular solid masses should be assumed to be malignant ('surgical' masses) until proven otherwise
- although rare, benign intratesticular masses should be accurately diagnosed to avoid unnecessary radical orchiectomy
Epidermoid cyst

- most common benign intratesticular mass
- 1-2% of all resected testicular masses
- concentric layers of laminated keratinous material
- Is MRI accurate in guiding urologists towards testis sparing surgery?
Adrenal rest tumors

- Tumour-like abnormality in response to elevated ACTH
- Congenital adrenal hyperplasia (CAH) or rarely Cushing’s syndrome
- US: multiple, low reflective lesions abnormal flow, no interval growth
- Respond to medical therapy, if not MRI for testis-sparing surgery planning

Tsili A et al. Diagn Interv Radiol 2018
Other benign conditions

- testicular lesions that may cause clinical and US confusion:
  - Granulomatous epididymo-orchitis
  - Sarcoidosis
  - Tubular ectasia
  - Cysts: Intratesticular or adjacent to the tunica albuginea
Tubular ectasia of rete testis (TERT)

- benign condition of unknown cause
- **Diagnostic challenge**: cystic teratoma
  - TERT: strict hilar orientation
  - disordered cystic degeneration within teratoma.
  - cystic testicular tumours = increased vascularity
- MRI imaging findings diagnostic?
Isolated granulomatous orchitis

- inflammatory condition, mimics neoplasia especially in chronic stages
- the most common cause of false-positive scrotal explorations
- Causes: trauma, autoimmune diseases
- US: diffuse hypoechoic infiltration with peripheral low-resistance flow on color Doppler US
- MRI: absence of contrast enhancement (feature of benign nature)
Testicular cancer

- 1-1.5% of all neoplasms in (white) men
  - most common malignancy in the 15-35 year-old age group.
  - 2nd peak prevalence at 71-90 year-old age group, (metastasis, lymphoma)
- painless scrotal lump; only 10% present with pain.
- rarely metastases or endocrine abnormalities (gynaecomastia)
- germ cell tumors (GCTs) and non-germ cell tumors (NGSTs)
- 95% of testicular tumours are GTCs
- Non-germ cell tumours: sex cords (Sertoli cells), stroma (Leydig cells), <10% malignant

GCTs: seminomas-non seminomatous GCTs
- Multiple histological types occur together (mixed germ cell tumour)

NSGCTs: 4 basic types
- embryonal carcinoma
- teratoma
- choriocarcinoma
- yolk sac tumor.
Non germ cell tumors

• Most non–germ cell neoplasms of the testis derive from the cells forming the sex cords (Sertoli cells) and the interstitial stroma (Leydig cells).

• approximately 4% of all testicular malignancies in adults- higher incidence in the paediatric age group (10%–30%).

• 90% of all non-germ cell tumours are benign

• no ultrasound criteria to differentiation from malignant tumors.
Leydig cell tumors

- all age groups, small (1-6 mm) non palpable, multifocal testicular nodules
- primary form (children) = precocious puberty
- secondary form (adults) = painful gynaecomastia + decreased libido, scrotal pain/swelling, infertility
- Identifiable causes
  - cryptorchidism, congenital adrenal hyperplasia, Klinefelter syndrome, hCG production by germ cell tumors, exogenous hCG administration, diseases of the pituitary gland, antiandrogen therapy for CaP,
  - cachexia, TB, syphilis, alcoholism,
  - chronic spermatic cord compression, strictures of the vas deferens
Leydig cell tumors on US

- small, well-outlined homogenous intratesticular masses
- colour Doppler US: appearances indistinguishable from seminoma
- poor internal flow with increased peripheral vascularity in small Leydig tumors
- Can MRI set the diagnosis and avoid surgical removal?
  - Secondary LC tumors can be treated medically
Testicular tumors on US

- Ultrasound will identify almost all testicular tumours, typical appearances being a hypoechoic or mixed echoic mass of increased vascularity.

- NSGCT have a wide range of appearances including high reflectivity, heterogeneous lesions with areas of calcification and cystic change. Larger tumours demonstrate increased vascularity.
seminomas

- most common pure GCT, up to 50% of cases, slightly older patients (> 40)
- US: low reflectivity, abnormal echotexture, increased or decreased, with increased vascularity
Non seminomatous GCTs

- Embryonal carcinoma
- Choriocarcinoma
- Yolk sac tumours
- Teratoma

- **Mixed germ cell tumours**
  - contain more than one germ cell component.
  - Any combination of cell type.
  - average age at presentation 30 years.
Embryonal carcinoma

- younger men (25-35)
- 2% of all testis tumors (pure)
- 87% of mixed GCTs
- >50% of embryonal carcinoma ➔ adverse prognostic factor for relapse & metastases

US features
- mixed echoic/slightly hypoechoic, partly cystic vascular mass,
- blending with normal parenchyma
- may be overlooked

Albers P et al, EAU Guidelines on testicular cancer 2017
Yolk sac tumor

- 80% of childhood (< 2 years) tumors - rare in adults (post-pubertal type), ↑AFP
- US: focal or diffuse lesions
  - focal: solid, ovoid, homogeneous
  - diffuse: heterogeneous, hypervascular.

large isoechoic mass with central hypoechoic region
Teratomas

- 2nd most common testicular tumor in children (<4 years)
- > 50% of mixed GCTs (adults)
- Normal tumor markers (pure teratoma)
  - Mature teratoma in 50% of RP residual masses following 1st line chemo
  - US: well-defined complex, partly cystic mass with microlithiasis.
choriocarcinoma

- rare tumor,
- <1% in pure form
- 8% in mixed germ cell tumors
- elevated HCG.
- highly malignant, worst prognosis of any GCT
Testicular Lymphoma

- 9% of all testicular tumors
- most common testis tumor in men > 60, bilateral (35%)
- diffuse large B-cell lymphoma (80-90%)
- secondary testis involvement
- involvement of CNS-bilateral testis

Systematic treatment:
- Radiotherapy (other testis) & Chemotherapy
- CNS-directed prophylaxis

- poor prognosis due to high relapse rate

Multifocal hypoechoic masses
Leukemia

- Primary leukaemia of the testis is rare
- Common site of recurrence in children
- Infiltrative testicular mass in patients with a history of leukemia
- Non specific US findings
Metastases to the testis

• unusual, most common primary sites: prostate, lung, melanoma, colon, kidney
• US: multifocal, bilateral, hypoechoic, solid lumps
• challenge: seminoma can be multifocal but less likely to be bilateral.
Burnt-out tumors

- Metastases but primary testicular tumour regressed to a scar or calcified body on US
- Up to 10% of all retroperitoneal GCTs are secondary to burnt-out tumors
- High metabolic tumor rate ➔ vascular invasion ➔ infarction ➔ necrosis.

US:
- Cystic or ill-defined hypoechoic areas within the testis,
- Atrophy of the testicle, microlithiasis

McQueen TS, Dyer RB. The "burnt-out" testicular (Azzopardi) tumor. *Abdom Radiol (NY)*. 2018
Testis sparing surgery

- No RCTs comparing TSS with radical orchiectomy.
- 28 patients treated with TSS for small (< 2cm) testicular lesions and a normal contralateral testicle.
- 18 patients (64.3%) diagnosed with stromal tumors and miscellaneous lesions, while 10 (35.7%) had a germ cell tumor.
- 1 patient developed local recurrence at 39 months.
Testis sparing surgery

- TSS for testicular lesions <25 mm and lesion volume <30% of the testis.
- Normal serum tumor marker levels & US not indicative of malignancy.
- Inguinal approach with temporary cord occlusion and FSA. (benign FSA-TSS, malignant FSA- radical orchiectomy)
- 14/15 (93%) had benign pathology on FSA.
- 1 patient with malignancy on FSA.
Testis sparing surgery

- Retrospective analysis of 522 patients diagnosed with testicular masses
- 5% benign tumors, all normal markers
  - Leydig cell tumors (32%)
  - Epidermoid cysts (32%)
  - Adenomatoid tumors (29%)
  - Sertoli cell tumors (7%)
- Tumor volume > 2.8 ml = predictor of malignancy (83% sensitivity-89% specificity)
- Testis sparing surgery in 22/28 (79%) patients with benign tumors-no recurrence

Paffenholtz P. Testis sparing surgery for benign testicular masses. J Urol 2018
Thank you for your attention