Scrotal Ultrasound

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Lecture Content

- Background Anatomy
- Normal Variants
- Extra-testicular pathology
- Intra-testicular pathology
- Global Abnormalities
- New US techniques

ANATOMY

Scrotal Ultrasound Anatomy

• Testicular artery
  - High vascular resistance
  - Broad systolic peak
  - High diastolic flow

• Cremasteric artery and artery to ductus deferens
  - Epididymis/peritesticular tissues
  - Narrower systolic peak
  - Low diastolic flow

Scrotal Ultrasound
Vascular Anatomy

- Pampiniform plexus
- Cremasteric plexus
- Testicular vein

NORMAL VARIANTS

1. Testicular appendages are remnants of the paramesonephric ducts found at the upper pole of the testes in a groove between the testis and the head of the epididymis.
2. Consist of the epididymal head and tail, and scattered tubules.
3. Appendages in the testis are not unusual and sometimes calyces from the 10% of patients. 30% of patients on the testis.
4. Normal appendages may form a scrotal nodule.

Testicular Appendages

- Paradidymis (Organ of Giraldes)
- Appendix testis (Hydatid of Mogagni)
- Appendix epididymis
- Vas aberrans of Haller


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• Infarcted appendix may form a scrotal pearl.

Torsion of an Appendix Testis

- Age range 7-12 years
- 'Blue dot' sign on a fair skin.
- Torsion of a testicular appendix is a common cause for scrotal pain in children.
- The presenting features of appendicular torsion and testicular torsion are often similar, though pain localised to the upper pole of the testicle and a tender nodule are suggestive of a torsed appendix.
- Differentiation is important as an appendicular torsion may be treated conservatively.
- Ultrasound appearance is usually a mixed echogenic mass with increased surrounding blood flow. It may be associated with hemorrhage.

12 year old boy with 7 day history of left testicular pain with a 'blue dot' sign.

Rete Testis

- Composed of numerous serousinous serpiginous tubules which drain to the epididymal head.
- Dilatation of the rete testis is common and seen in patients over 50yrs.
- Associated with epididymal obstruction, a spermatocele or dilated efferent spermatic ducts.
- The cystic structures usually measure a few millimetres but as large as 7cm.


68 year old man with obstructive azoospermia, which is responsible for 5% of male infertility.

'Two-tone' Testis

- This describes the appearance of a normal testis where the testis is divided into an outer testicular artery.
- The portion nearest to the probe is of normal reflectivity whereas the portion distal to the probe is of decreased reflectivity.
- The appearance is thought to be due to a reflective artefact caused by scanning obliquely through the walls of the artery.

A rare abnormality described as the presence of three or more testes. Based on the differential diagnosis, applied or a benign lesion like the Leiomyoma, problematic, the cavity can experience a narrow cord.

The leiomyosarcoma is a well-defined rounded lump occurring either at the superior or inferior aspect of the epididymis, with adjacent reflectivity and echogenicity. The length of the supernumerary testes and ipsilateral testicle added together equates to the length of the contralateral side. This management is conservative unless there are associated complications or features.

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Rhabdomyosarcoma is a malignant fibrous histiocytoma that has been affected by the differential diagnosis to a draining vas and epididymis. The ultrasound features are a well-defined rounded lump occurring either at the superior or inferior aspect of the epididymis, with adjacent reflectivity and echogenicity. The length of the supernumerary testes and ipsilateral testicle added together equates to the length of the contralateral side. This management is conservative unless there are associated complications or features.

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Scrotal Ultrasound
Extra-testicular Pathology

A longitudinal image through the right scrotal sac, with the testis (star) inferior to a simple cyst of the epididymis (long arrow). There is posterior acoustic enhancement present (short arrows) distal to the cystic structure, confirming the fluid content.

A longitudinal image through the right scrotal sac, with the testis (star) superior to a well circumscribed high reflectivity lipoma (arrow).

A longitudinal image through the left scrotal sac, with the testis (star) superior to a well circumscribed low reflectivity adenoma (arrow).

A longitudinal image through the left scrotal sac, with the testis (star) superior to a predominantly septated lesion with linear areas of high reflectivity; a papillary cystadenoma of the epididymis (arrows).

A longitudinal image through the right scrotal sac, seen at the upper aspect of the testis is a mixed reflective area (arrows); a low grade liposarcoma.

A longitudinal image through the left scrotal sac, a heterogenous testis (star) is displaced superiorly by a mixed reflective lesion (arrows), with patchy areas of increased reflectivity; epididymal lymphoma.

A transverse image through the lower aspect of the left scrotal sac, demonstrating a varicocele (arrowheads) and a well circumscribed mixed reflective lesion; a haemangioma of the para-testicular space.

A longitudinal image through the right scrotal sac, with the testis (star) superior to a focal high reflective area in the sac, between the two layers of the tunica vaginalis and albuginea (arrow), demonstrating posterior acoustic shadowing; a scrotal pearl.

A longitudinal image through the right scrotal sac, seen at the upper aspect of the testis is a mixed reflective area (arrows); a low grade liposarcoma.

Scrotal Ultrasound
Varicoceles

Varicoceles
Standing and Supine [1]
Inguinal reflux only during Valsalva in not enlarged vessels [2]
Supra-testicular varicosities with reflux only during Valsalva [3]
Peri-testicular reflux only during Valsalva in enlarged vessels.
Visible but not dilated vessels when supine.
Enlarged when standing [4]
Enlarged vessels in supine and standing position, with increasing caliber with Valsalva. Reflux at rest, increasing during Valsalva. Possible testicular hypotrophy [5]
Enlarged vessels in supine and standing position, with caliber not increasing with Valsalva. Reflux at rest, not increasing during Valsalva. Testicular hypotrophy.

Scrotal Ultrasound
Intra-testicular Pathology

INTRA-TESTICULAR PATHOLOGY

Germ cell tumours
- Precursor lesions
  - Intratubular germ cell neoplasia
- Tumours of one histological type
  - Seminoma
  - Embryonal carcinoma
  - Yolk sac tumour
  - Choriocarcinoma
  - Teratoma
- Tumours of more than one histological type
  - Tumours with both sex cord and stromal cells and germ cells
    - Gonadoblastoma
  - Lymphoid and hematopoietic tumours
    - Lymphoma
    - Leukaemia
  - Metastasis

Benign lesions
- Epidermoid cyst
- Segmental Infarction
- Abscess formation
- Tunica albuginea cyst
- Rete testis
- Simple cyst
- Fibrosis and scarring
- Post-biopsy
- Sarcoidosis
- Adenomatoid tumour
- Lipoma
- Granuloma
- Polyorchidism
- Ectopic spleen
- Haematoma
- Fracture

Sex cord and stromal tumours
- Leydig cell tumour
- Sertoli cell tumour
- Granulosa cell tumour
- Fibroma-thecoma
Incidence and Aetiology
- Affects younger men
- Commonest malignancy in men aged 20-40 years
- 1,000 new cases per year in UK
- 1% of all cancers in men
- Incidence varies from country to country
- Denmark: 6 per 100,000 men
- Incidence steadily increasing
- 1940: Incidence in USA 2.88 per 100,000 men
- 1990: Incidence in USA 4.50 per 100,000 men
- Increased in:
  - Undescended testis (2-4%)
  - Contralateral cancer (5%)
  - Extra-gonadal germ cell cancer (40%)
  - Cases of intersex
  - x 6-10 in siblings (mutation chromosome Xq27)

Scrotal Ultrasound
Intra-testicular Pathology

Embyronal Cell Carcinoma
- The assumption is that intra-testicular vascularity is a hallmark of malignancy.
- The ultrasound appearance of an intra-testicular haematoma changes with time.
- Acutely the haematoma appears as a patchy area of increased reflectivity.
- The haematoma does not demonstrate vascular flow.
- The most important differential diagnosis is malignancy and therefore an accurate history, lack of vascularity and tumour markers are important.
- If suspected sequential scans are advocated to show the haematoma decreasing in size.

Epidermoid Cysts
- Epidermoid cysts are the commonest benign tumours arising from the testis, though accounting for only 1-2% of all resected testicular masses.
- The ultrasound features correlate with the degree of maturation, compactness and quantity of the keratin within the cyst
  - Type 1: classic 'onion skin' appearance
  - Type 2: densely calcified mass with no cyst seen
  - Type 3: cyst with a rim and either peripheral or central calcification
  - Type 4: mixed pattern, heterogeneous and poorly defined

Intra-testicular Abscess
- Intra-testicular abscesses are unusual and are usually associated with epididymo-orchitis but may also occur secondary to trauma, infection or infection.
- The ultrasound appearances are of a complex hyperechogenic intratesticular lesion with irregular hypoechoic borders.


Intra-testicular Haematoma
- The ultrasound appearance of an intra-testicular haematoma changes with time.
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**Segmental Testicular Infarction**

- The inability to differentiate this from testicular malignancy has resulted in widespread use.
- Clinically segmental infarction presents with pain.
- Segmental infarction appears as an echogenic area surrounded by a rim of low reflectivity which may be wider than the infarcted area.
- There is associated acoustic enhancement and focal resolution of the testis. Testes with large thick septa are at risk for chronic infarction.
- The assumption is that patients with TM have ITGNC as a marker for testicular malignancy.

**Testicular Microlithiasis:**

- Defined as the presence of multiple (>5) tiny (2-3 mm) echogenic foci throughout the testis.
- Testicular microlithiasis is present in 1 in 4000 males under 15 years of age.
- Testicular volume > 1ml; 84% of >5 mm calcifications are malignant lesions.
- Malignant Testicular Microlithiasis (TM): Granuloma, Infarct, Haematoma, Non TM benign calcification.
- Testicular cancer arises from intra-testicular germ cell tumors.
- Testicular pain in its acute presentation can reliably distinguish torsion from other causes.
- Chronic/missed Torsion:
  - Phleboliths
  - Extratesticular
  - Non TM benign calcification

**Neoplastic Lesions**

- All testicular malignancies account for approximately 30% of all intratesticular malignant tumors and can be broadly divided into seminomatous, nonseminomatous, and mixed types, affecting the 20-45 year age group.
- Each pure form of germ cell tumor demonstrates characteristic b-mode appearances, whilst mixed types can display a variable pattern.
- Symptomatic, transient and metastases make up the remainder of the intratesticular malignant tumors and occur in an older age group.

**Segmental Testicular Infarction**

- Segmental infarction appears on ultrasound as a low reflective area which may be wedge shaped.
- Other features include absence of intranodular blood flow and presence of blood flow along the infarcted area.
- Other features on color Doppler include a 2-3 mm hyperechoic rim surrounding a hypoechoic infarct which may enhance with Doppler.
- Ultrasound examination alone for testicular torsion is unreliable as torsion is often irreversible by the time of presentation.

**GLOBAL ABNORMALITIES**

- Non TM benign calcification
- Haematoma
- Scrotal pearl
- Epididymal calcification
- Chronic inflammations (tubular germ cell neoplasia (ITGCN) on the basal membrane of the seminiferous tubules)
- Infarct
- Granuloma
- Phleboliths
- Scrotal calcification
- Testicular Microlithiasis (TM)
- Intra-testicular Pathology

**Scrotal Ultrasound**

- Intra-testicular Pathology

**Scrotal Ultrasound**

- Intra-testicular Pathology

**Neoplastic Lesions**

- Intraductal microlithiasis tumors:
  - There has been an increase in the prevalence of testicular sarcomas.
  - Germ cell tumors account for approximately 30% of all intratesticular malignant tumors and can be broadly divided into seminomatous, nonseminomatous, and mixed types, affecting the 20-45 year age group.
  - Each pure form of germ cell tumor demonstrates characteristic b-mode appearances, whilst mixed types can display a variable pattern.
  - Symptomatic, transient and metastases make up the remainder of the intratesticular malignant tumors and occur in an older age group.

**Intraductal microlithiasis tumors**

- Lobular and Sertoli cell tumors are the most important elements of the sex cord-stromal tumors and can exhibit clinical and symptoms, such as pain, cystic, and hemorrhagic pathology, due to their ability to produce vasoactive and/or vasoconstrictor factors.
- They form 4% of all testicular malignancies, and while 90% are benign, the remaining 10% are malignant and cannot be differentiated on ultrasound.

**Testicular Microlithiasis**

- Testicular Microlithiasis (TM) in any testis is associated with the presence of ITGNC.
- TM calcification?
- Should we follow up men with non-TM microlithiasis: US follow up?
Scrotal Ultrasound

A: No risk factors for testicular cancer
- Self-testicular examination
- Annual physical examination by GP
- Annual ultrasound

B: Risk factors for testicular cancer
- Self-testicular examination
- Annual physical examination by GP
- Annual ultrasound

Patient TC, 28 years old

2000
- Bilateral classical TM
- Multi-centric left seminoma with surrounding intratubular germ cell neoplasia

2006
- 4 x 5 mm right seminoma with surrounding intratubular germ cell neoplasia

Risk factors for Germ Cell Tumour

- Age
- Cryptorchidism (risk x4-8)
- Contralateral tumour (risk x12.4-27.5)
- Family history – first degree relative (risk x4-8)

Risk for Leydig cell hyperplasia

- Kleinfelter’s syndrome
- Infertility

NEW TECHNIQUES

Contrast Enhanced Ultrasound (CEUS)
- Truly intravascular agent, able to depict vascularity to very low levels, good for distinguishing vascular from non-vascular tissue

Tissue Elastography
- Able to depict the ‘stiffness’ of the lesion with the presumption that a ‘hard’ lesion is more likely malignant

Epidermoid Cyst
- Heterogenous
- High vascularity on CDUS
- Rapid and longer lasting enhancement on CEUS
- Strain ratio 1.56

Seminoma
- More homogeneous
- Less vascular on CDUS
- Rapid and shorter lasting enhancement on CEUS
- Strain ratio 0.72
Scrotal Ultrasound New Techniques

Incidental Indeterminate Testicular Lesion Role of MR Imaging

Scrotal Ultrasound New Techniques

ROLE OF MRI

Scrotal Ultrasound New Techniques

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ROLE OF MRI

Incidental Indeterminate Testicular Lesion Role of MR Imaging

Magnetic Resonance Imaging (MRI) is a non-invasive imaging technique that uses magnetic fields and radio waves to produce detailed images of a specific area of the body. MRI is particularly useful for imaging the soft tissues, organs, and structures inside the body.

In the context of testicular lesions, MRI can provide valuable information that helps in distinguishing between benign and malignant conditions. Here are some key points about the role of MRI in this context:

1. **Incidental Lesions**:
   - **Incidental testicular lesions** are often discovered during routine imaging or physical examination.
   - **Role of MR Imaging**: Magnetic Resonance Imaging (MRI) plays a critical role in evaluating these lesions.

2. **Lesion Characteristics**:
   - **Lesion Signal Intensity**: The signal intensity on T2-weighted images can help differentiate between lesions. Most testicular tumours are of low signal intensity on T2-WIs, while normal testicular parenchyma shows high signal intensity, and lesions may appear heterogeneous.
   - **Enhancement Patterns**: Lesions may enhance after contrast administration. Different enhancement patterns can help in distinguishing between different lesion types.

3. **Dynamic Contrast-Enhanced MRI**:
   - **Time-Intensity Curves**: Dynamic contrast-enhanced MRI allows for the assessment of the lesion's response to contrast administration. Different types of time-intensity curves can help in diagnosing different types of lesions.

4. **Lymphatic and Vascular Drainage**:
   - **Assessment**: MRI can also assess lymphatic and vascular drainage patterns, which may be altered in malignant lesions.

5. **Benign vs. Malignant**:
   - **Differentiation**: While there are some overlapping features between benign and malignant lesions, MRI can help in distinguishing them based on specific characteristics.

6. **Contrast Agents**:
   - **Use of Contrast Agents**: Advanced MRI techniques, such as diffusion-weighted imaging, provide additional information about the lesion's microstructure.

7. **Clinical Impact**:
   - **Decision-Making**: MRI results can guide further clinical management, including biopsy, radiation therapy, or surgical intervention.

Remember, the clinical decision-making process should integrate all available diagnostic data, including patient history, physical examination, and other imaging findings. MRI is a powerful tool in the assessment of testicular lesions, offering valuable insights into their nature and potential clinical implications.