Usual and unusual causes of inguinal canal masses on ultrasound

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Learning objectives

By the end of the review, readers will be familiar with:

1. The anatomy of the inguinal canal

2. The approach to performing an ultrasound of the inguinal canal

3. The ultrasound features of common and uncommon pathologies within the inguinal canal
Background

Ultrasound examination of the inguinal canal is a frequently requested investigation performed by radiologists and sonographers. The inguinal canal is an unfamiliar part of the anatomy to many healthcare professionals. The pathology which can affect this region is vast, and we are demonstrating the imaging features of both common and uncommon pathologies using examples from cases at our institution.
Findings and procedure details

Ultrasound equipment:

The optimal transducer for examination of the inguinal canal depends on the patient body habitus. Given the relatively superficial location of the inguinal canal, the highest frequency transducer should be used to achieve good resolution. For example, for a thin patient, a linear transducer of >10MHz is ideal. If there is excessive subcutaneous fat obscuring the view, a curvilinear transducer <10MHz is often needed.

Anatomy:

There are three anatomical landmarks for orientation when scanning the inguinal region:

- The lateral margin of rectus abdominis muscle
- The inferior epigastric artery
- The inguinal ligament

These three boundaries outline the Hesselbach’s triangle, which is the site of a direct inguinal hernia.

The location of an indirect hernia, the deep inguinal ring, is located lateral and superior to the origin of the inferior epigastric artery.

Both direct and indirect inguinal hernias are common, and most frequently contain omental fat +/- bowel\(^1\).

Patient position:

In our institution, patients are initially scanned in the supine position. Patients are asked to perform the Valsava manoeuvre - usually straining. This is a more controlled action than coughing, and allows better assessment for herniation during raised intra-abdominal pressure. Some hernias may not be visible in the supine position and patients may be asked to stand during the ultrasound examination if a hernia has not been identified in the supine position.

Cases:
1. A 51 year old male presented with a slow-growing, palpable, non-tender inguinal mass. Ultrasound (Fig. 1 on page 7) revealed a complex, mixed echogenic mass in the inguinal canal, with markedly increased vascularity on colour Doppler assessment. Histology demonstrated Castleman Disease. Castleman Disease is a benign lymphoproliferative disorder, and can affect any parts of the body. It can be unicentric or multicentric. It typically presents as a solitary enlarged lymph node, or a localised nodal mass.\(^2\)

2. A 48 year old female post inguinal hernia repair presented with a recurrent lump in the groin. Ultrasound (Fig. 2 on page 7) demonstrated a moderately well defined soft tissue mass, with a heterogeneous echotexture measuring 2.3cm x 2.5cm x 2cm. It demonstrated moderate vascularity. Histology confirmed an endometriotic deposit within the inguinal hernia repair scar. Endometriosis typically occurs in women of childbearing age, and usually presents with infertility or pelvic pain. It is known to deposit on surgical scars, generally from prior gynaecological operations. These can occur weeks to months after surgery and have variable appearances on ultrasound.\(^3\)

3. A 9 month old female presented with left groin swelling. Ultrasound (Fig. 3 on page 8) revealed a 1.4cm well-defined discrete cystic mass within the inguinal canal, and an absent pelvic left ovary. This is in keeping with a herniated ovary. Inguinal hernias are more common in male than female newborns. Approximately 15% of inguinal hernias in female newborns contain the ovary or fallopian tubes. A herniated ovary would be at risk of torsion.\(^4\) This patient was transferred to a paediatric centre for surgical management.

4. A 33 year old lady who was 28 weeks pregnant presented with an intermittent lump in the left groin. Ultrasound (Fig. 4 on page 9) demonstrated a collection of tortuous, dilated veins within the inguinal canal, increasing in size upon Valsalva manoeuvre. Appearances were in keeping with a varicocoele of the round ligament of the uterus. This is a rare but well described phenomenon during pregnancy. Factors for developing varicocoele during pregnancy include increased venous return, elevated progesterone levels and pelvic obstruction caused by the gravid uterus. It can be difficult to differentiate varicocoele of the round ligament and inguinal hernia on physical examination. Ultrasound can aid in establishing the diagnosis.\(^5\)

5. A 76 year old man presented with focal right groin pain, and no other associated symptoms. Ultrasound (Fig. 5 on page 10) demonstrated a direct inguinal hernia containing a cystic sac in continuity with the urinary bladder, in keeping with a herniated anterior portion of the urinary bladder within the inguinal canal.
6. A 7 month old male with an impalpable left testis. Ultrasound (Fig. 6 on page 11) demonstrated a 13mm round, discrete mass in the inguinal canal, with homogeneous echotexture and presence of internal vascularity, with an adjacent triangular cap of soft tissue, in keeping with an incompletely descended left testis and accompanying epididymis. In cases of undescended testis, there is increased risk of developing testicular germ cell tumour\(^6\).

7. A 67 year old man presented with a palpable left groin mass. Ultrasound (Fig. 7 on page 12) revealed a lymph node measuring 2.3cm in the left inguinal canal. It demonstrated markedly abnormal vascularity on colour Doppler (Fig. 8 on page 13). Biopsy of the lymph node revealed metastatic melanoma.

8. A 3 year old girl presented with a swelling within the left groin. An ultrasound (Fig. 9 on page 14) revealed a tubular structure with a linear central cavity. Adjacent to this was a cystic round structure. Further assessment of the pelvis revealed an absent uterus and left ovary. The uterus and left ovary had herniated through the inguinal canal. This is a well described occurrence, however it remains a rare diagnosis.

9. An elderly gentleman presented with a lump in the groin, which he claimed increased in size prior to him emptying his bladder. It then decreased in size following micturition. As expected, this lump was related to the bladder, and on ultrasound, as depicted in Fig. 10 on page 14, the bladder could not be identified within the pelvis, and the entire bladder was found to lie within the inguinal canal.
Fig. 1: Ultrasound of the inguinal canal revealed a mixed echogenic mass with increased vascularity on assessment with colour Doppler. Biopsy of this mass confirmed Castleman Disease.

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Fig. 2: Ultrasound over the inguinal hernia repair scar reveals a relatively well-defined soft tissue mass with moderate vascularity. The patient has a history of endometriosis and histology of this subsequently confirmed an endometriotic deposit.

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**Fig. 3:** Ultrasound of the left groin in a 9 year old female infant reveals a well defined cystic mass. The left ovary could not be identified within the pelvis. The patient was diagnosed with a left inguinal hernia containing the left ovary. She was transferred to a paediatric centre for surgical management.

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**Fig. 4:** Ultrasound of a 33 year old woman who was 28 weeks pregnant and had presented with intermittent left groin lump, which revealed a collection of tortuous dilated vessels with venous flow. The vessels increased in size upon Valsalva manoeuvre. This was in keeping with a diagnosis of a varicocoele of the round ligament of the uterus.

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Fig. 5: Ultrasound of the right groin demonstrated a cystic mass in the proximal inguinal canal. The mass was in continuity with the urinary bladder. This was in keeping with a partially herniated urinary bladder.
Fig. 6: A 7 month old male with an impalpable left testis. Ultrasound demonstrated a round mass and a separate, adjacent triangular mass in the proximal inguinal canal. This was in keeping with an incompletely descended left testis with the accompanying epididymis.

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Fig. 7: Ultrasound of the left groin in a 67 year old man. This revealed a 2.3cm lymph node within the inguinal canal.

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**Fig. 8:** (Same patient as in Figure 7) Upon assessment with colour Doppler, there was significant internal vascularity within the lymph node. Histology from the biopsy revealed metastatic melanoma.

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![Image of ultrasound](image_url)

**Fig. 9:** Ultrasound of the inguinal canal of a 3 year old girl demonstrating herniation of the uterus, clearly identified by the endometrial lining, and the left ovary adjacent to it, also within the inguinal canal.

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Fig. 10: Ultrasound of the inguinal canal containing a large cystic structure, and an absent pelvic bladder. The entirety of the patient's bladder was found to lie within the inguinal canal.

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Conclusion

Ultrasound of the inguinal region is a commonly requested and performed investigation, and its approach is not always well understood. The inguinal canal anatomy is challenging for many radiologists and sonographers alike. The encountered pathologies can vary greatly, as demonstrated in this review. A knowledge of the relevant key landmarks during assessment of the inguinal region is essential. Optimisation of images with appropriate choice of transducer according to individual patient body habitus is the first step. An understanding of the possible pathologies which may be encountered ensures a thorough examination and an accurate diagnosis.


