Ultrasound Assessment of the Axilla: Where do we even start?

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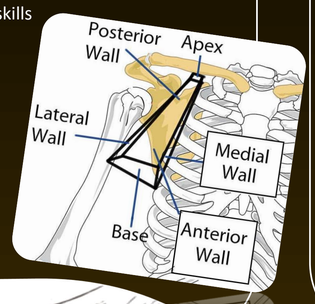
INTRODUCTION

There is a large variation in the ultrasound practitioners that undertake axillary ultrasound. Some imaging departments utilise musculoskeletal (MSK)-trained staff however others include it in the general medical departmental workload whilst others ensure that breast-trained staff only must undertake the role. This is a problem that requires a wide variety of knowledge, skills and planning to ensure the correct practitioners will see this patient cohort.



Borders of the Axilla

Apex: (Lateral border of 1st rib, Superior border of scapula, Posterior border of clavicle)

Lateral Wall: (Intertubercular groove of humerus)

Medial Wall: (Serratus anterior, ribs and intercostal muscles)

Anterior Wall: (Pectoralis major, underlying Pectoralis minor and Subclavius muscles)

Posterior Wall: (Subscapularis, Teres Major and Latissimus dorsi)

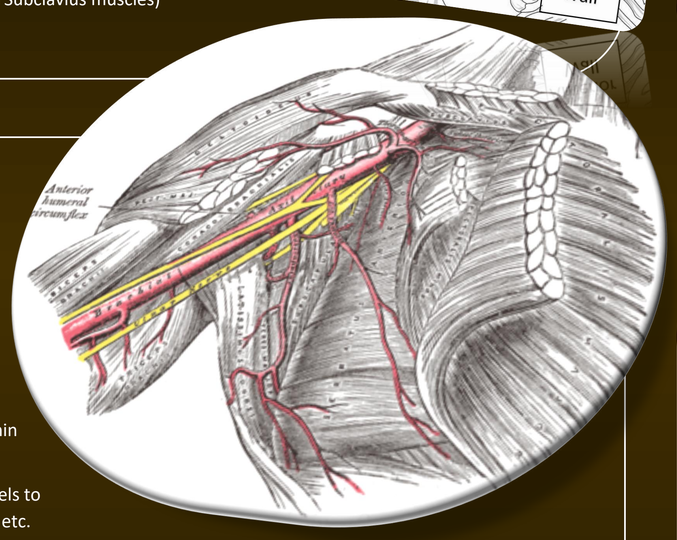
NORMAL VASCULAR ANATOMY

Arterial Anatomy: Brachial >> Axillary >> Subclavian >>

Anterior & Posterior Circumflex

Venous Anatomy: Brachial x2 (venae comitantes) >>

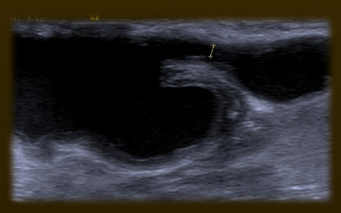
Basilic (superficial) >> Axillary >> Subclavian

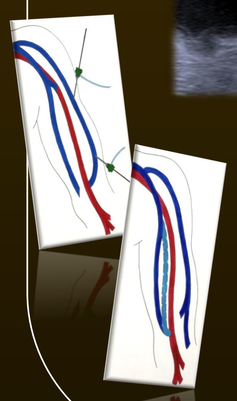


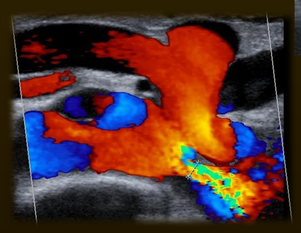
COMMON VASCULAR FINDINGS

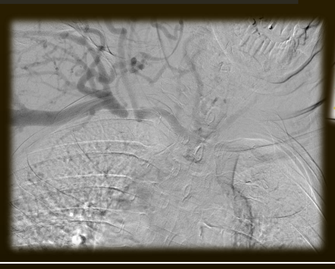
Vascular access devices: PICC line, Midline (should terminate within the axilla region)

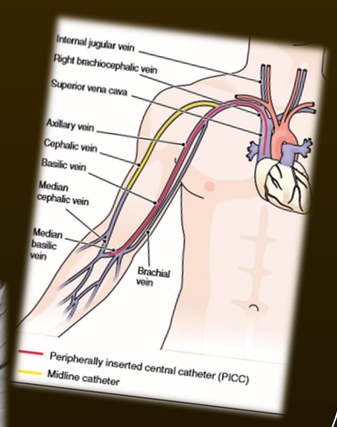
Arteriovenous Dialysis Fistula & grafts: Surgically transposed vessels to facilitate dialysis with possible augmentations with grafts, stents, etc.



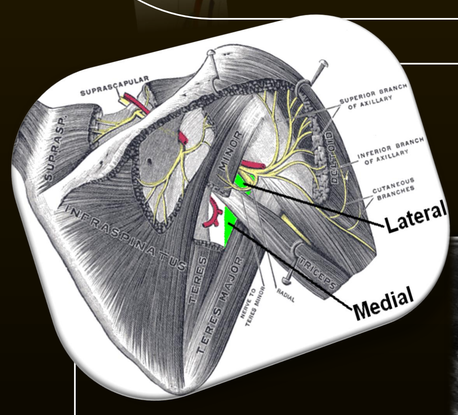








NORMAL MSK ANATOMY

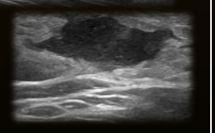


Joints: Glenohumeral, Acromioclavicular

Muscles: Coracobrachialis, Pectoralis minor & major, Teres major

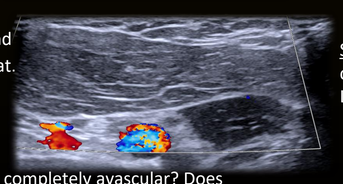
Nerves: Ulnar, Median, Musculocutaneous, Axillary nerve and other derivatives from the Brachial Plexus.

Hidradenitis: Inflammatory skin disease, can cause abscesses, sinus tracts and scarring. Non-specific findings on imaging, patient history is important!

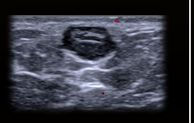


COMMON MSK FINDINGS

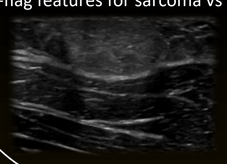
Lipoma: Lipomata are common in the axilla and can sometimes be misinterpreted as normal fat. Always check the borders and in both planes. Does it appear well-encapsulated?

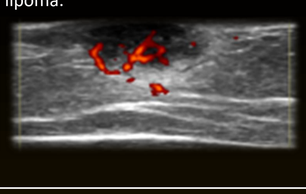


Skin Cysts: Epidermal inclusion/sebaceous cysts are common within the axilla. Look for a punctum!

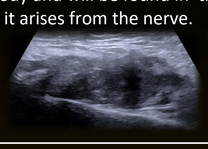


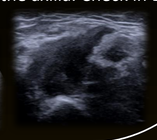
Sarcoma: Think: Does the lesion appear to be completely avascular? Does it measure deeper than wider? Are the borders well-defined? Check for red-flag features for sarcoma vs lipoma.





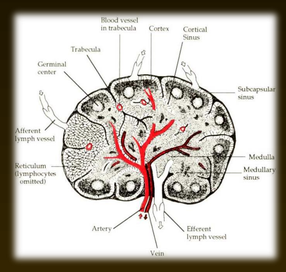
Neuroma: Nerve sheath lesions can occur anywhere in the body and will be found in the axilla. Check in LS and see if it arises from the nerve.

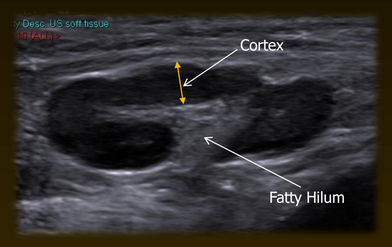


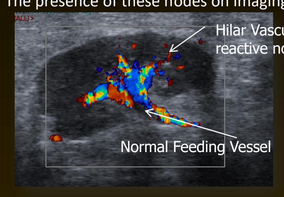


ULTRASOUND APPEARANCES OF THE NORMAL LYMPH NODES

An abundance of lymph nodes are present throughout the body, most of which are small and not visible on normal ultrasound scans (transducer/frequency dependent). When a node is reacting to an inflammatory response, the node becomes "reactive" and increases in size. Reactive nodes are the normal immune system response to fight infections and other benign illnesses. The presence of these nodes on imaging can be useful in highlighting active or persistent illnesses.



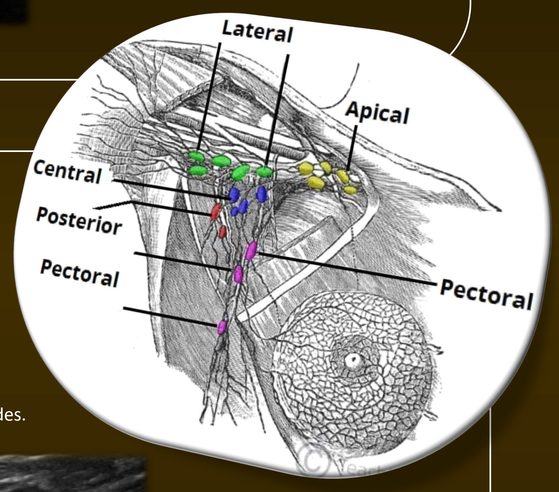


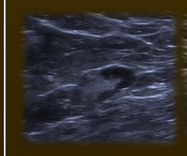


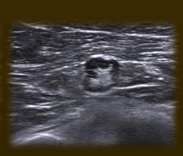
AXILLARY NODES

There are approximately 50 lymph nodes within the axilla spread over 3 levels:
- Level 1 – subscapular, lateral and pectoral lymph nodes
- Level 2 – Central and some apical lymph nodes
- Level 3 – Apical lymph nodes

Always use the highest frequency linear or 'hockey stick' probe available (> 14 MHz) to maintain high image quality and interrogate superficial axillary lymph node.
A lower frequency probe can sometimes help assessing deep lying axillary lymph nodes.



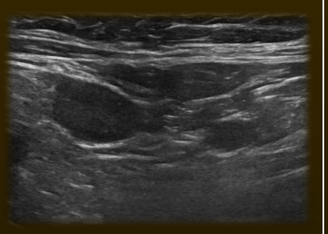




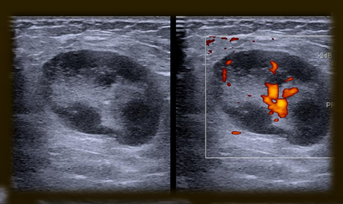
ABSENCE OF BREAST DISEASE

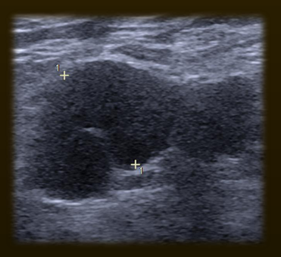
Follow the normal rules for assessment of lymph nodes throughout the rest of the body, i.e. neck, groin, etc.

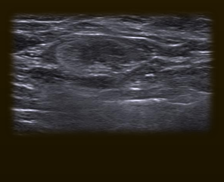
Normal axillary lymph node appearances:
- ovoid/'bean' shape
- smooth thin cortex with retained fatty hilum.
- <10mm short-axis diameter

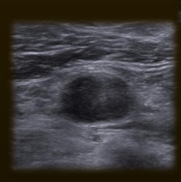


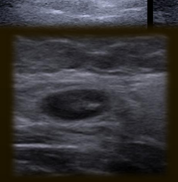
Abnormal axillary lymph node appearances:
- loss of 'bean' shape (becoming more rounded)
- uneven thickened cortex,
- loss of fatty hilum
- increased central & peripheral vascularity
- >1cm in short-axis diameter

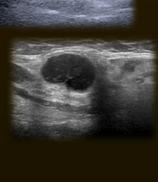










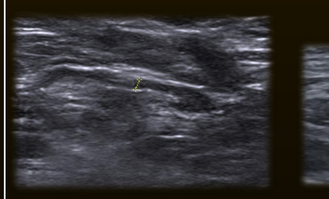


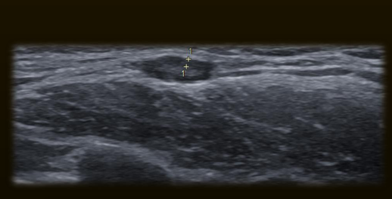
BREAST DISEASE PRESENT

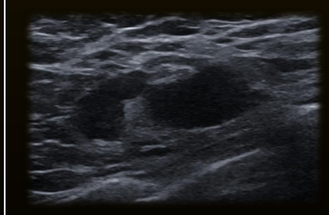
Different rules apply! NHSBSP Standards are followed, and cortical thickness of the node is key!

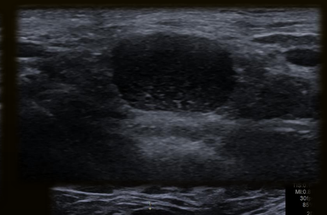
Normal axillary lymph node appearances:
- ovoid/'bean' shape
- smooth thin cortex & fatty hilum
- maximum Cortical thickness 3mm **can vary locally**

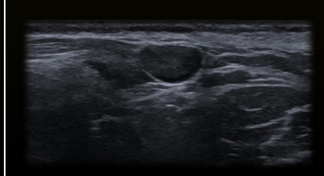
Abnormal axillary lymph node appearances:
- loss of 'bean' shape (becoming more rounded)
- uneven thickened cortex (>3mm) **can vary locally**
- loss of fatty hilum
- overall size is less important.

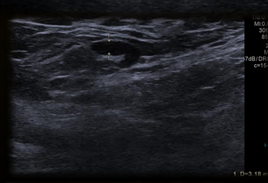












Reporting of axilla node findings in breast patients follow the "Classification of Axilla Imaging Findings" (RCR) 2019.

A1 – Normal
(No significant abnormality)

A3 – Indeterminate findings
(Small risk of nodal metastasis;, biopsy of A3 nodes may only be necessary if breast malignancy is confirmed)

A4 – Findings suspicious of malignancy
(Moderate risk of nodal metastasis, Biopsy needed)

A5 – Findings highly suspicious of malignancy
(High risk of nodal metastasis, Biopsy needed)

NORMAL BREAST TISSUE

Breast tissue is a complex structure made up glandular (milk-producing) and fatty tissues. The ration of this varies with individuals and changes over time.

It is important to have an awareness of typical breast ultrasound appearances when assessing the axilla, so that findings that may be related to breast tissue is not missed or mis-interpreted.

COMMON BENIGN FINDINGS

Accessory Breast Tissue:

This is present in up to 20% of the population, can be bilateral or unilateral, and will undergo similar changes, as normal breast tissue, with the normal menstrual cycle, hormonal changes,

Silicone-infiltrated lymph nodes

INCIDENTAL ACCESSORY BREAST FINDINGS

Focal Masses: Within accessory breast tissue, there is a risk (just like normal breast tissue) for both malignant and benign lesions.

Pregnancy & Lactation changes: The normal glandular features of the breast tissue distend with ductal fulness identified.

CONCLUSION

Ultrasound assessment of the axilla proves to be an important and common referral. Irrespective of the background of the ultrasound practitioner, it should not matter who undertakes the assessment of the axilla. Correct training, guidelines/protocols and understanding of the patient's clinical background is the key to the examination. As described above, the assessment of the axilla required an understanding of multiple over-lapping disciplines, each as important as each other.

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References List:
- Image plates from Gray's Anatomy (1918) *in the public domain*
- AVF medical illustrations courtesy of artist N.J. Cullen
- Chen, I. et al. (2023) 'To scan or not to scan: the effect of scanning the axilla of all patients undergoing diagnostic breast ultrasound', *Clinical Imaging,* 99, pp33-37.
- Coco, G. et al (2023) 'Ultrasound of the axilla' , *insights into Imaging* ,14:78
- RCR (2019) Guidance on screening and symptomatic breast imaging, 4th ed.
- Le-Petross, H.T. et al (2022) 'ACR appropriateness criterialimaging of the axilla', *ACR*,q9, S87-2113.
- Dialni, V. et al. (2014) 'A practical approach to imaging the axilla', *Insights into imaging,* 6, pp.217-229