

Liver Ultrasound Scans

Abstract:

Ultrasound scans can be used in a variety of settings to examine internal organs, muscle, joints, tendons and lesions or to monitor foetal growth and development during pregnancy. Ultrasound, is arguably the most frequently requested form of imaging especially within the gastroenterology department. However, to elucidate a cause of abdominal pain, distension, jaundice, abnormal liver function tests; abdominal ultrasound is one of the easiest, quick and cost-effective ways to do so. In addition, ultrasound can assist the practitioner to rule out other considered differential diagnoses.

Since the advent of advanced clinical practitioner roles, nurses are increasingly taking on advanced clinical roles within the field of gastroenterology. With these advanced roles, nurses and other allied health professionals, can act autonomously in the assessment, diagnosis and treatment of patients, which includes the ability to order different tests and investigations, which can comprise of radiological and ultrasound requests. However, it is not just the ordering and requesting of radiological and ultrasound scans, but the requirement to understand the scan report and the ability to deal with the findings in an appropriate and timely fashion, that is vital for improving patient care.

This article will focus on abdominal ultrasound, with emphasis on liver ultrasound scans. It will discuss what an ultrasound scan is, and some of the terminology used in liver ultrasound reports. In addition, it will compare ultrasound images of normal liver to abnormal and explore the importance of background information which should be presented on the request form, to aid the sonographer or radiologist in their interpretation of the scan.

Key words: abdominal ultrasound scan, sonogram, sonographer

Abdominal Ultrasound: what is it?

Ultrasound scans can be used in a variety of settings to examine internal organs, muscle, joints, tendons and lesions or to monitor foetal growth and development during pregnancy. Ultrasound (US), is arguably the most frequently requested form of imaging especially within the gastroenterology department (NHS 2018). However, to elucidate a cause of abdominal pain, distension, jaundice, abnormal liver function tests; abdominal ultrasound (AUS) is one of the easiest, quick and cost-effective ways to do so. In addition, AUS can

assist the practitioner to rule out other considered differential diagnoses. US is also known as a sonogram and although the words are sometimes used interchangeably, technically, a sonogram is the picture that the ultrasound generates (Frotheringham 2018).

AUS is a safe, non-invasive, painless test, which uses high frequency sound waves to produce images of the liver, bile ducts, gallbladder, aorta as well as the kidneys and pancreas (NHS 2018). When investigating abdominal pain, AUS is considered the Gold standard test (National Institute of Health and Care Excellence [NICE] (2014), especially if the pain is biliary in nature. Hassani et al. (2015) concur with this view and along with Bosch, Schmidt and Kendall (2016), highlight how ultrasound can reduce patient harm in those with liver or biliary disease and lead to reductions in overall morbidity. In addition, the European Association for the Study of the Liver (EASL) (2018) and NICE (2016, 2018) clinical guidelines, stress the importance of abdominal ultrasound when trying to find a cause for abnormal liver function tests. Liver ultrasound (LUS) is especially important in six monthly surveillance programmes for hepatocellular carcinoma (EASL 2018, NICE 2016) or AUS for abdominal aortic aneurysm screening (Public Health England [PHE] 2015).

Advanced roles

Nurses and other allied health professionals are increasingly taking on advanced clinical practitioner (ACP) roles within the field of gastroenterology. According to Health Education England [HEE] (2017), to obtain this title, practitioners usually require a minimum of 5 years post registration experience, be educated to a master's degree level, as well as practice within the 4 pillars of advanced practice (Royal College of Nursing [RCN] (2018); Department of Health [DOH] 2010). With the ACP role, health care professionals can act autonomously in the assessment, diagnosis and treatment of patients, which includes the ability to order different tests and radiological investigations such as X-rays, CT scans, MRI scans and USS, subject to successfully completing Ionising Radiation Medical Exposure regulations (IRMER) training (The Stationary Office 2018). This training ensures that the practitioner is aware of the responsibilities for radiation protection not only of themselves but of their employer, the sonographer, radiologist and the patient.

Abdominal USS Procedure

During the scan procedure, the patient is requested to lie flat on their back with their abdomen exposed. The sonographer applies a small amount of a water-based gel to the abdomen. The ultrasound probe, also known as the transducer, is then applied to the gel, directly onto the patient's skin. The gel assists with the transmission of sound waves from the probe and it is these sound waves that bounce off internal structures within the abdomen which are then produced into images. As sound waves are used, there is no risk to the patient of exposure of ionising radiation, unlike X-rays or Computerised Tomography (CT), which, if given to a patient cumulatively, is a cause for concern (U.S. Food and Drug Administration [U.S. FDA] 2017). Therefore, it is safe for patients to undergo multiple, repeat US's with no detrimental effects (NHS 2018; Guys and St Thomas's NHS Foundation Trust 2016). A further advantage is that images produced are seen in "real time" which, for example, allows you to see how muscles are contracting when exercising (Physiocare Body Management, 2019), or with the use of Doppler, the blood flow through blood vessels can be visualised (McNaughton and Abu-Yousef, 2011). This is particularly important when looking for portal or hepatic vein thrombus.

Patient Preparation

Prior to an abdominal USS, the patient is requested to be nil by mouth for a minimum of 6-8 hours preceding to the test but they can drink water (Goyal, 2018), fruit juice or black tea/coffee. This is because a full stomach could impede the movement of sound waves, which could make visualisation of abdominal structures difficult as well as allowing the gallbladder to dilate, which enables the sonographer to observe for gallstones, sludge or polyps within the gallbladder (Bisset and Khan, 2002). Moreover, if a patient eats within a 6-hour time frame, this can cause a build-up of gas within the intestine. Anatomically, the kidneys and pancreas are described as retroperitoneal organs, as they are located behind the parietal peritoneum (Innes, Dover and Fairhurst 2018). Because of this, they are often difficult to visualise, as they can be obscured from view by other organs, such as bowel or bowel gas but fasting minimises bowel mobility thereby enabling visualisation of the organs (Bisset and Khan, 2002). AUS usually takes 15 to 30 minutes to complete, depending on the complexity and type of the examination (SCoR, 2015) and the scan findings.

If patients are particularly concerned regarding the ultrasound, sedatives may be given orally prior to the scan to help them relax or occasionally given intravenously. Depending on the type of US requested contrast may be injected into the patient to make the images clearer (NHS 2018).

Advice to patients

Any patient undergoing an AUS should be advised on what to expect. Therefore, it is important that nurses and other allied professionals involved in a patient's care, are aware of what the procedure involves and can explain this clearly, in a language the patient can understand. Patient information leaflets should be given to the patient if available. If a patient is attending ultrasound department as an outpatient, then a patient information sheet should be sent to them in the post several days, or weeks before their appointment is due.

During the AUS procedure, the sonographer may request the patient to take a deep breath in and hold for short periods. This breathing technique can assist the sonographer in visualising the liver and gallbladder (Bates, 2011). In addition, it is not uncommon for the patient to be asked to change position, for example; from lying on their back, to then be requested to lie on their side. This change in position enables the sonographer to visualise different views of organs, such as when looking at the liver. Discussing the deep breath technique and change of position to the patient beforehand, not only helps to prepare them for the procedure but allows the nurse to inform the sonographer if the patient has difficulty in undertaking these requests.

Although AUS is considered a painless test, it can cause the patient pain or discomfort if the ultrasound probe is placed over an inflamed organ, such as the liver, or if pain is elicited over the gallbladder, it is known as a positive sonographic Murphy's sign (Borzellino et al., 2015). It is important that the patient is aware that this discomfort can occur, and to inform the sonographer as it occurs as it can confirm the sonographer's findings.

US request forms

US requests play an important role in the diagnosis of liver disease as they can provide the sonographer with information that can assist in determining the appearances on the scan and provide an accurate diagnosis instead of providing several differentials.

British Medical Ultrasound Society (BMUS) produced guidelines for the justification of ultrasound requests. This document, updated in October 2017, is based on several principles (**Table1**).

Justification of Ultrasound requests
Imaging requests should include a specific clinical question(s) to answer
Contain sufficient information from the clinical history, physical examination and relevant laboratory investigations to support the suspected diagnosis(es)
Suspected diagnoses must be clearly stated, not implied by vague, nonspecific terms such as “Pain query cause” or “pathology” etc

Table 1: Justification of ultrasound reports. Taken from BMUS Justification of Ultrasound Requests Revision (4 October 2017)

Although US is an excellent imaging modality for a wide range of abdominal diseases, there are many for which ultrasound is not an appropriate first line test e.g. suspected occult malignancy due to patient’s appearance; cachexic, pale, discomfort, or a abdominal mass noted on clinical examination, then CT or MRI would be the immediate preferred option (BMUS 2017).

Providing the relevant clinical information for each Ultrasound examination including follow up scans as outlined in **Table 1** will improve the diagnostic quality of the scan and ensure the patient undergoes the correct examination in a timely manner, thus preventing delays to the commencement of treatment for any identified liver disease.

Understanding US images of the liver

When a US of the liver is taken, the normal liver is identified by comparing echotexture of the liver to that of the adjacent cortex of the right kidney. They should both appear to have similar echotextures. If the liver looks “brighter” as in whiter, then that could indicate fatty infiltration of the liver (Image 1). In a normal liver, the walls of the intrahepatic blood vessels, bile ducts and the diaphragm should be **bright**, also known as **echogenic on ultrasound (Image 2)**.

Severe fatty infiltration can be diagnosed by poor visualisation of the intrahepatic vessels the diaphragm and the posterior of the liver. In addition, the liver becomes grey and featureless (**Image 3**).

As fatty infiltration progresses, the echotexture of the liver on ultrasound changes. Normal liver is smooth in echotexture but as the disease progresses, the echotexture becomes coarse especially in a cirrhotic liver (**Image 4**). Fatty liver can be graded. The grading system is from 0-3 (**Table 2, Image 5**).

Cirrhosis can be identified on ultrasound by the presences of an irregular liver edge, known as saw tooth appearance and the presence of ascites around the liver, spleen and both iliac fossae (**Image 6**). Other features can include presence of portal vein thrombus or elevated portal velocities on Doppler.

Conclusion

US is an excellent imaging modality for a wide range of abdominal diseases and is one of the easiest, quick and cost-effective forms of imaging available. For nurses who have taken on advanced training and can request US and other forms of imaging, it is of paramount importance to complete the US request form completely and accurately. By adding useful background information, for example, when querying a cause for raised liver function tests, noting on the request that the patient has a raised Body Mass Index (BMI) and past medical history of Type 2 diabetes, can assist the sonographer in narrowing down possible differentials and gaining a primary diagnosis of Non-Alcoholic Fatty Liver Disease. This background information will improve the diagnostic quality of the scan by the sonographer and ensure the patient undergoes the correct examination in a timely manner, thus preventing delays to the commencement of treatment for any identified liver disease.

Reflective questions

- 1. Why is it important to write background information on the Ultrasound request?**
- 2. What information, or advice should you inform your patient, prior to the USS?**
- 3. Why do sonographers compare images of the liver to the right kidney?**

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