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Day 1 Tuesday 6th December

General Imaging and Paediatrics

Case Report: Rare finding of occlusive thrombus of a testicular varicocele

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Abstract

Acute scrotal pain has a variety of possible causes. The most common causes include epididymo-orchitis and torsion. Thrombosis of a varicocele, however, is a very rare clinical finding and therefore not a common cause of acute scrotal pain. A 57-year-old male inpatient presented to the ultrasound department with new acute left scrotal pain following hospital admission for acute urinary retention due to an enlarged prostate. Clinically, the left testicle was assumed undescended. In view to patient's pain, an ultrasound scan of the scrotum was requested to check for undescended left testis, exclude malignancy/confirm the cause of pain. The left testicle was located within the left scrotum but was avascular and atrophic measuring only $12 \times 7 \times 6$ mm (volume 0.2 cc). Atrophy secondary to previous trauma. The left epididymal head contained a 3.6 mm simple cyst. The left epididymis appeared otherwise unremarkable. A thrombosed varicocele was noted on the left which appeared to be abutting the midpole region of the left epididymis and extending into the left groin. No vascularity was evident on Doppler imaging, suggestive of occlusive thrombus. The thrombosed vessel measured at least 66 mm in length. The right testis (volume of 11.3 cc) and epididymis were unremarkable. A thrombosed varicocele is a very rare cause of acute scrotal pain, and the condition is nearly impossible to diagnose clinically. Therefore, diagnostic imaging is necessary to ensure correct diagnosis. Ultrasound is the modality of choice for assessing the scrotum and Doppler ultrasound can be

used to evaluate vascularity. Ultrasound imaging was vital in this case as it not only confirmed the atrophic left testicle to be correctly located, but ruled out malignancy and infection as the cause of the patient's symptoms but also identified a thrombosed varicocele, which is a very rare cause for acute scrotal pain.

Paediatric abdominal ultrasound appearances in acute hepatitis patients in a tertiary paediatric hospital

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Abstract

There has been an increase in reports of acute hepatitis of unknown cause in children. Abdominal ultrasound, including Doppler assessment (UABDO), is the first line imaging modality for paediatric patients with acute liver pathology. We aim to present our UABDO findings in a series of children with hepatitis referred to a single paediatric liver-transplantation centre between January 1st and July 24th 2022. A retrospective cohort of children (< 16 years old) with hepatitis meeting the UK Health Security Agency case definition for acute non-A-E hepatitis were identified from a local hepatology case list. Further blood tests enabled differentiation of acute hepatitis (AH) from cases of acute on chronic hepatitis (ACH). The images and reports from admission US exams of each patient were reviewed by a consultant sonographer and radiologist. A total of 24 children were included, of which 17 had AH and 7 had ACH. The median age was 5 years and male to female ratio was 1:4. The most common findings seen were a heterogenous liver echotexture in 75% (82.3% AH v 57.1% ACH), gallbladder wall thickening in 54% (70.5% AH v 14.2% ACH), splenomegaly in 45.8% (29.4% AH v 85% ACH) and hepatomegaly in 41.6% (41.1% AH v 42.8% ACH). US findings in cases of acute hepatitis are described to assist clinical teams assessing children with AH and ACH.

Professional Issues

Case report: From concept to reality: BSc Medical Ultrasound Degree apprenticeships- a new route for sonographer education

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Abstract

Increasing demand for UK ultrasound services is currently reliant on an Agenda for Change band 7 and above workforce, with few sonographers employed at lower bands (Sevens&Reeves, 2018). Longstanding national workforce deficits (SCoR, 2019; CFWI, 2017) are further compounded by current postgraduate training unable to meet demand for sonographers and service delivery. In order to meet the needs of patients and NHS services, recent work has proposed solutions to workforce shortages through new models of education and the introduction of an attractive and rewarding career path for Sonographer. This includes the development of a career framework, which incorporates graduate level qualifications for practitioner level skills in medical ultrasound (HEE, 2019). Following extensive consultations by the Trailblazer group established in 2017, the Sonographer degree apprenticeship (integrated degree) was approved in August 2019. Sheffield Hallam University is among the first to offer this degree apprenticeship, supporting the implementation of this vision through the education of sonographer practitioners (career level 5) to work alongside the current workforce. Chronic workforce deficits and increasing demand for imaging services are detrimental to NHS services and delivery of effective patient centred care. Future forecasting predicts further increases in demand (NHS, 2019) requiring significant workforce growth. Degree Apprenticeships (DA) offer a new route in sonography education, widening participation and facilitating career progression for the whole workforce. The introduction of this new model expands the existing portfolio of AHP degree apprenticeship routes at Sheffield Hallam University. The BSc Medical Ultrasound Degree Apprenticeship programme provides an innovative and coordinated approach to learning. Extensive stakeholder consultation and collaboration has enabled the generation of ideas with a high degree of originality, improved knowledge of workplace requirements and future workforce transformation. The shared enthusiasm for innovation and change ensures we situate apprenticeships in the current context whilst anticipating future workforce needs.

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Physics

Modelling of diaphragm motion using 4D ultrasound

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Abstract

Recent work undertaken at the University of Salford has used 4D Ultrasound acquisition, with post-acquisition modelling in an attempt to provide a reproducible, accurate 4D model of diaphragm motion and excursion. The ultrasound modelling will be combined with other external models, such as point cloud data with marker tracking. The combined data set will then be used to create a multimodal biofeedback system for people who suffer with dysfunctional breathing. The main aim is to deliver a real-time system to show underlying muscle function to patients integrated into a new intervention tool. Pilot data have been collected using a GE Voluson e10 using a RAB6-RS probe. The probe is positioned between the lower ribs and steered to ensure the diaphragm is within the field of view. Maximum depth is selected, with a 0.5 mm slice thickness capturing the widest field of view possible. This results in a frame rate of 2.6 Hz. Images are acquired to capture 10 breath cycles. In-house analysis software has been developed using the .vol image sets, outputs are CVS datasets of surface plots of the diaphragm over time. The work is still at pilot stage. Imaging protocols have been developed and reproducibility data have been collected. 4D modelling is being developed, with initial findings looking positive. Current issues are due to

noise within the image, and automatic detection of the diaphragm vs other structural objects within the field. Examples of current data outputs can be seen here: <https://youtu.be/ClxOTxxK4RE>. Next steps are to further develop the post-acquisition modelling, acquire point cloud data sets and correlate findings to develop feedback mechanism. The work presented here will be a proof-of-concept, with current status of the project and findings.

Ultrasound QA – The good, the bad and the ugly

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Abstract

The requirement for quality assurance (QA) of ultrasound equipment in the UK has been brought to the foreground in recent years. Because of this, many ultrasound managers and lead sonographers have been implementing or updating their QA programmes. The aim of this study was to investigate which methods have been used to implement ultrasound quality assurance within the NHS. In the years 2021-2022, Multi-Medix (an ultrasound QA specialist) spoke to more than 20 NHS sonographers who have begun the process of implementing QA. The approaches taken by each of the relevant departments have been sorted into 6 generic categories which describe what QA is being performed, and which staff are undertaking it. The results show that there is significant variability in how sonographers have attempted to implement their QA. But are all of these approaches efficient and do they ensure patient safety? The potential flaws in some of the methods include a single point of failure when one person performs all of the QA, lengthy procedures which take up valuable sonographer time or infrequent checks which fail to capture transducer faults in a timely manner. The conclusions of this study consider the options for successful QA implementation which minimise the time taken for sonographers to perform checks and maximise scanner availability.

Development of image analysis software to enable objectivity in ultrasound quality assurance

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Abstract

Since the inception of medical ultrasound scanning, ultrasound image quality parameters have been difficult to measure accurately with the aim of

extracting absolute quantitative information. Consequently, it is common for the results of ultrasound quality assurance tests to be assessed qualitatively, typically by visual assessment and expert opinion of the professional (observer) performing the test. This approach is problematic, as the assessment of qualitative performance is highly subjective. Consequently, the repeatability of ultrasound quality assurance is compromised. Consistent assessment of performance on an annual basis is difficult since the observer is highly likely to change during the lifetime of an ultrasound system. Additionally, subjective assessments are vulnerable to intra-observer inconsistencies. Other factors such as ambient lighting in the room where the assessment is taking place further reduce the repeatability of qualitative assessments. The aim of this project is to develop a software application that will enable the objective and repeatable assessment of image quality parameters used in a routine ultrasound quality assurance programme. The application will not be designed to measure the absolute values of performance parameters, but rather to provide a consistent assessment metric. Various image quality parameters will be monitored by the application, including but not limited to axial and lateral resolution, contrast, uniformity and penetration depth. The application will ultimately be used to objectively advise whether ultrasound system performance has deteriorated. The project aim will be tested against the following hypothesis: Implementation of image analysis software significantly increases the repeatability of ultrasound image quality assessments in comparison to qualitative and subjective methods. The following secondary hypothesis will also be tested: Objective assessments have the capacity to identify equipment faults at an earlier stage than subjective assessments.

Student Stream

Can we really detect vulnerable carotid atherosclerotic plaques by routine ultrasound?

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Abstract

Can we really detect vulnerable carotid atherosclerotic plaques from stable ones by routine ultrasound? Can the vascular surgeon trust those answers and operate on an asymptomatic patient with less than 70% stenosis? And why are the European guidelines

not clear on the topic? In this study, we tried to find validated markers in vascular ultrasound that can be used in day-to-day exams to characterise carotid artery plaques. Thirty-four asymptomatic patients were scanned using ultrasound and CT before carotid endarterectomy, and their plaques were categorised using Gray-Weale classification and Hounsfield units (HU), respectively. The plaques extracted were then analysed histopathologically and grouped accordingly. Histology was considered the gold standard for identifying vulnerable plaques (VP). Quantitatively, these VP had a large content of lipidic-necrotic material (48%), a low amount of calcification (2%) and fibrosis (42%) as opposed to non-vulnerable plaques (NVP), which were less lipidic-necrotic (8%), more calcified (13%) and fibrotic (65%) ($P < 0.05$). Doppler ultrasound analysis showed that VP was more frequently type 2/3 plaques (70.6%) as opposed to NVP that mainly were type 4/5 plaques (56%) ($P < 0.001$). Ultrasound showed better correlation with histology than HU analysis in CT. Ultrasound is a valuable tool that can almost acknowledge vulnerable plaques; however, not sufficiently to be a decision-making marker. How to improve that?

Do patients enrolled within the iliofemoral venous stent surveillance programme continue to report increased quality of life and venous symptom resolution?

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Abstract

Currently, iliofemoral venous stent patients undergo regular ultrasound surveillance for the foreseeable future to help preserve stent patency. A service evaluation at Cambridge University Hospitals was conducted to see if stent patency is related to venous symptom resolution and quality of life. Questionnaires were sent to 49 eligible patients to measure residual venous symptoms (VEINES-Sym score), quality of life in respect to venous symptoms (VEINES-Qol score) and overall quality of life as determined by the patient (EQ-VAS score). Of the 23 returned questionnaires, 11 patients had an occlusion or a $>50\%$ in-stent stenosis on their last ultrasound scan and were categorised as diseased, while 12 patients had mild or no disease and were categorised as non-diseased. Significant correlations existed between VEINES-Qol and EQ-VAS scores (0.63, $P = .002$, $CI = 95\%$), and VEINES-Sym and VEINES-Qol scores (0.90, $P = < .001$, $CI = 95\%$). No

significant difference was seen (independent samples t-test) between non-diseased and diseased groups for VEINES-Sym score ($P = .996$, $CI = 95\%$), VEINES-Qol score ($P = .400$, $CI = 95\%$), and EQ-VAS score ($P = .151$, $CI = 95\%$). In-stent disease was not a predictor of either venous symptoms or quality of life.

Carotid atherosclerosis in people of European, South Asian and African Caribbean ethnicity in the Southall and Brent Revisited study (SABRE)

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Abstract

Atherosclerotic cardiovascular disease (CVD) risk differs by ethnicity.¹ In comparison with Europeans (EA), South Asian (SA) people in the UK experience higher risk of coronary heart disease and stroke, while African Caribbean (AC) people have a lower risk of coronary heart disease but a higher risk of stroke.² In this study, cardiovascular risk factors were measured, and carotid ultrasound was performed in 985 individuals. Carotid plaques and intima-media thickness (cIMT) were measured. Associations of carotid atherosclerosis with ethnicity were investigated using regression analyses, with and without adjustment for potential confounders (age, sex) and mediators (education, diabetes, hypertension, total cholesterol, HDL-C, alcohol consumption, current smoking). We found that the prevalence of any plaque was similar in EA and SA, and lower in AC (17%, 17%, and 6% respectively; $p < 0.001$ by ANOVA). Total plaque area was also similar in EA and SA but reduced in AC, but there were no major differences in the maximum height or length of plaques in people with plaques by ethnic group. These ethnic differences were unaffected by adjustment for potential confounders or mediators. After adjustment for age and sex, cIMT was higher in AC but this difference was attenuated by adjustment for CVD risk factors. Prevalence of carotid artery atherosclerotic plaques varies by ethnicity, independent of risk factors. The similarity of plaque burden in SA and EA, despite established differences in CVD risk in these ethnic groups, casts some doubt on the utility of carotid ultrasound as a means of assessing risk across ethnic groups.

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Ultrasound of Covid 19

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Abstract

We present how we used ultrasound to improve our diagnosis of lung Covid 19 and use ultrasound to diagnose the complications of Covid 19. Ultrasound was more sensitive in detecting early Covid 19 than chest radiograph. The complications of Covid 19 include renal impairment, liver impairment and vascular complications, mainly large vessel venous thrombosis, including renal vein thrombosis. We are all suffering from post-viral fatigue but lessons can be learnt from this pandemic and the use of ultrasound.

Ultrasound screening of non-alcoholic fatty liver disease (NAFLD) in children and adolescents: A critical review

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Abstract

Paediatric NAFLD is a global health concern, which can be effectively managed with early detection. Screening, using accurate and affordable/accessible tests, is recommended. However, there is currently no consensus on which tests are most appropriate. Although ultrasound is widely used, the performance against reference tests has not been fully assessed. Our aim was to critically evaluate the performances and potentials of ultrasound-based techniques for paediatric NAFLD screening. A systematic literature search of related databases/journals for peer-reviewed original articles published from January 2010 – July 2021 was conducted. PRISMA guidance was used to systematise and document the search/selection process. The NIH quality assessment tool was used to critically appraise selected studies. The data extracted were subjected to thematic analysis and narrative synthesis. Eleven studies, with 774 participants, met the inclusion criteria. More studies included higher risk participants. B-mode and quantitative ultrasound (QUS) techniques were

compared against MR spectroscopy, MRI-PDFF and liver biopsy. Ultrasound effectively detected steatosis, but performed better with moderate-severe steatosis. While B-mode methods - liver echogenicity and steato-scores - are commonly used, with a reported sensitivity of 70%, the former is not very effective. The latter (QUS) reached up to 100% sensitivity, and greater than 80% specificity, hence recommendable for screening. Quantitative (QUS) methods performed better than B-mode methods. Although QUS generally demonstrated excellent performance, with sensitivity/specificity of up to 100%, they will require further verification with more studies for effective use in screening. Ultrasound techniques can effectively be used for paediatric NAFLD screening, especially in higher-risk subjects. The steato-scores method is recommendable for routine use. QUS may potentially replace B-mode ultrasound for this purpose, however, non-standardised cut-off values are needed.

The use of ultrasound elastography of the spleen in the investigation of human disease: a scoping review

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Abstract

Ultrasound elastography is an emerging technology increasingly utilised for clinical evaluation of patients. This review examined the available literature to assess the potential value elastography has in investigating pathologies of the spleen. Given the broadness and open-endedness of the topic, a narrative scoping review was performed. The online databases PubMed and Web of Science were searched for original clinical research published between January 2012 and November 2021 using key terms selected by the author. The inclusion criteria were: original studies (reviews and meta-analyses were excluded), published in the last ten years (2012 – 2021 inclusive), in English, conducted on human adults, examining disease in spleens. 203 reports were obtained, of which 26 met the inclusion criteria for the scoping review. Reports that met the inclusion criteria were tabled, detailing the author, title, publication date, sample size, population, and key research findings. The research findings of these reports were then scrutinised, and common themes were identified. This allowed a narrative overview to be produced on the usefulness of elastography in the assessment of the spleen for the purpose of diagnosing and monitoring diseases. Elastography can assist in diagnosing cirrhosis, diagnose and monitor portal hypertension, predict

oesophageal varices in hepatitis-induced cirrhosis, and monitor the patency of Transjugular Intrahepatic Portosystemic Shunts (TIPSS). Spleen elastography is sensitive enough that it can also distinguish between different causes of splenomegaly – namely hepatoportal, myeloproliferative and infectious diseases. This adds a wealth of diagnostic detail that cannot be determined by grey-scale ultrasound alone. Given the tool's sensitivity in assessing the spleen and discriminating between different causes of splenic stiffness, research into the use of splenic elastography should expand beyond investigations of hepatoportal diseases, into other diseases that may alter splenic stiffness.

Case report: Use of ultrasound and computed tomography in the diagnosis and management of early-stage Fournier's disease

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Abstract

In this study I will discuss a confirmed case of early-stage Fournier's disease in a 46 year old male, with the aim of increasing awareness of clinical symptoms and radiographic appearances upon initial presentation. The patient presented to accident and emergency with painful bilateral hemiscrotal swelling and temperature of 38.8 °C. The patient reported 'banging' his scrotum a few days prior, with the swelling initially beginning in the right hemiscrotum before spreading to the left side. Upon examination there was no evidence of bleeding, dysuria, or discharge, and the skin was intact with no other infective symptoms. The pain seemed inconsistent with the level and duration of inflammation, and erythema was noted with dark areas on midline. The working diagnosis was necrotising fasciitis. The patient commenced vancomycin, clindamycin and meropenem. A subsequent ultrasound scan showed a distended and thickened scrotum with a 71 mm echogenic right extratesticular collection suggestive of a hemiscrotal pyocele. Both testes were grossly unremarkable in size, shape and echotexture with mild right-sided hyperaemia. Subsequent contrast computed tomography demonstrated similar findings, with satisfactory appearances of the remaining pelvis. The patient was listed for an urgent scrotal exploration and debridement; the necrotic tissue was debrided and both testes shown to be healthy and spared.

Following wash-out the testes were placed into the ischiorectal pouch to await skin grafting. Follow-up monitoring showed regression of the erythema post-surgery suggesting resolution of infection. This case demonstrates an early presentation of Fournier's disease with clear symptoms, clinical findings and radiographic appearances on US and CT. The appearance of the right-sided extratesticular pyocele and scrotal thickening is a useful ultrasonic indicator for Fournier's disease, highlighting the importance of rapid radiological imaging and good communication with the clinical team to facilitate prompt surgical management, prevent the spread of infection and improve clinical outcome.

Case report: Diagnosis of a heterotopic pregnancy

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Abstract

Heterotopic pregnancy (HP) is described as the coexistence of an intrauterine pregnancy (IUP) and an ectopic pregnancy. The diagnosis can be difficult due to the simultaneous presence of a viable intrauterine pregnancy and the lack of symptoms. Diagnosis of HP is important as it is potentially life-threatening. The case involves a 29-years-old female, gravida 2 para 1 who was referred by her general practitioner to the early pregnancy unit with a light vaginal bleed. The initial visit was at 5+6 weeks gestation. She was sure about her last menstrual period and reported having regular periods every 28 days. A transvaginal ultrasound scan (TVS) at 5+6 weeks showed an intrauterine gestational sac (IUGS). No yolk sac or foetal pole (FP) were seen. Both ovaries were examined and contained a cystic structure suggestive of bilateral corpus luteum. At 6+6 weeks a transabdominal ultrasound (TAS) identified the IUGS containing a FP with slow cardiac pulsations, however, neither of the adnexa were assessed. TVS was not performed, and a plan was made for the patient to come back in 7 days as pregnancy was of uncertain viability. At 7+6 weeks a TAS and a TVS were performed. The intrauterine pregnancy (IUP) was seen containing a FP with no cardiac activity. The left adnexa was assessed and an ectopic gestational sac containing a FP was noted adjacent to the left ovary. No cardiac pulsations were seen. The right adnexa appeared normal. HP is rare in spontaneous pregnancy. TVS is an effective tool for the diagnosis of ectopic pregnancy. The aim of the TVS is to assess both adnexa as well as the presence of an IUD. Even in

the presence of IUP, both adnexa should be assessed as an IUP does not eliminate the possibility of HP.

Factors influencing sonographer-led bowel ultrasound service

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Abstract

The aim of this study was to investigate factors influencing UK sonographers' practice of adult bowel ultrasound. A mixed-method online questionnaire was designed and shared on social media platforms in April 2021. Research restrictions due to COVID19 limited the sample size permitted. Convenience sampling recruited thirty UK sonographers performing adult abdominal ultrasound in their practice. Quantitative data were analysed using descriptive statistics, and qualitative data were analysed using inductive thematic analysis. Quantitative data revealed that 53% (n= 16) of the participants expressed a lack of confidence in scanning the bowel, while 77%, (n = 23) indicated a high level of interest in training in bowel ultrasound. Although 63.3% (n = 19) of the participants reported a high level of confidence in scanning the bowel for suspected appendicitis, the majority (70%, n = 21) expressed lack of confidence in examining the bowel for other pathologies like inflammatory bowel disease (IBD). Inductive thematic analysis of qualitative data revealed that the participants had varying opinions on this topic. Emerging themes included training opportunities, preference of other imaging modalities, management challenges, sonographers, and radiologists' influence. Qualitative results suggested that factors influencing sonographer evaluation of the bowel include advanced levels of training, a high degree of support from radiologists, regular bowel ultrasound lists, audits, and feedback from clinicians. Based on the findings of this study, most sonographers are not confident in practising bowel ultrasound beyond the evaluation of suspected appendicitis. Surveyed sonographers were interested in expanding their roles into other areas of bowel ultrasound like examining for Crohn's and ulcerative colitis. Sonographer role extension into this area of practice is limited by various factors like chronic shortage of sonographers, increasing workload, limited training, and the perception of diminishing support from radiologists. We recommend a future study that is not limited by a small sample size.

Implementation of point of care ultrasound (POCUS) following a new curriculum focusing on common pathologies encountered in Ghana: physician's first experiences and perspectives

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Abstract

Point of care ultrasound is increasingly recognised as an important tool, especially in countries like Ghana, where imaging services are scarce. Which indications are helpful for general physicians and how they impact patient outcomes remain largely unknown. Similarly, more information is needed on how implementation is perceived and can be made sustainable. Our objective was to evaluate POCUS in daily practice, following delivery of a new broad POCUS curriculum targeted to pathology that is most common in Ghana. We retrospectively performed a mixed methods study to evaluate the experience of 8 participants in their first 6 months of work after the pilot course. Questionnaires collected quantitative data, including physician's background, type and frequency of scans performed, level of difficulty, cases referred to radiology and results. Semi-qualitative interviews explored 5 domains affecting implementation of interventions: characteristics of the intervention, outer setting, inner setting, individual characteristics and process. We found that 50% of participants applied 14/34 indications 2-6 times/week, mainly chest, cardiac and DVT scans. More complex scans (liver/female pelvis) were performed more frequently than anticipated (2-3/week by 25-60% participants). For referred cases, confirmation of diagnosis varied by indication (0-100%). Interviews revealed that POCUS was seen as a low complexity/cost, advantageous tool that improved patient diagnosis and management. They reported barriers to upscaling implementation such as a lack of quality assurance and difficulty acquiring portable probes in Ghana. POCUS was seen as a duplication of radiology by few hospital administrators and hospital radiologists. There was generally a lack of dedicated clinical space and staff trained in POCUS in the participants' hospitals. In conclusion, overall uptake of scanning was excellent

and implementation reported as beneficial to patients, supporting investment in further training and wider implementation. We will adapt the curriculum guided by these results and call for high quality, prospective implementation research.

Does performing the sliding sign technique on TVUS accurately identify deep infiltrating endometriosis?

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Abstract

Endometriosis is a common gynaecological condition that may cause cyclical pain, dyspareunia, dyschezia, affects fertility and impacts patients' psychological and social wellbeing. Endometriosis often remains undiagnosed for years as symptoms also overlap with other conditions. Deep infiltrating endometriosis (DIE) is the most aggressive phenotype, affecting around 20% of women of reproductive age with endometriosis. NICE guidelines recommend using ultrasound as the initial imaging method to identify DIE. Subsequently, the IDEA consensus group suggests integrating the sliding sign technique for the same. For this literature review, PubMed and LibraryPlus were searched using the terms: "sliding sign technique", "endometriosis", "deep infiltrating endometriosis". Other imaging modalities and autopsy results were excluded. Peer-reviewed, international studies and quantitative results were used to reflect robust research. Guerriero et al. (2020) followed 333 patients with suspected deep endometriosis;¹ of these, 106 were found to have rectosigmoid involvement when using the sliding sign technique during TVUS. Hudelist et al. (2013) studied 117 patients before laparoscopy and accurately identified 34 patients with DIE.² Additionally, Reid et al. (2013) surveyed 100 patients to compare pouches of Douglas obliteration using the sliding sign technique against laparoscopy and yielded 93% accuracy.³ Relevance to practice: Incorporating the sliding sign technique with TVUS may improve detection and localisation of DIE in patients with suspected endometriosis. It may also expedite diagnosis thus allowing women to access treatment sooner. However, incorporating this technique into practice will require further sonographer training along with protocol updates. The sliding sign technique helps identify DIE in women with suspected endometriosis and demonstrates high sensitivity and specificity. However, extra training provision for sonographers and changes in local protocols to include the sliding sign during TVUS need to be addressed first.

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Guidelines and coping mechanisms for obstetric sonographers delivering unexpected news via ultrasound

G Hicks

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Abstract

The delivery of difficult news is a commonly cited stressor of those working in obstetric ultrasound, contributing to a high rate of burnout in the sonography workforce. Whilst the impact of occupational and musculoskeletal aspects of sonographer duties are recognised, the emotional challenge and coping mechanisms facing the sonographer workforce delivering bad news in obstetric ultrasound are less understood. This study reviews guidelines and recommendations for sonographers and departments delivering difficult news, ensuring the highest quality of care, staff and patient wellbeing. A systematic literature search included the National Institute for Health and Care Excellence (NICE), British Medical Ultrasound Society (BMUS), Society of Radiographers (SoR), Royal College of Obstetricians and Gynaecologists (RCOG), academic databases Google Scholar, PubMed, PsycINFO, Cochrane and the Stillbirth and Neonatal Death Charity (Sands). Inclusion criteria included studies of workforce census, empirical qualitative or mixed methods design. Three blocks of MESH terms comprised 'ultrasound,' 'experiences,' and 'foetal abnormalities.' An exclusion criterion removed grey literature and studies not written in English. Guidance for delivering unexpected bad news in ultrasound has been advanced significantly by the systematic review and meta-ethnographic synthesis of expectant parent and staff experiences, leading to the Consensus Guidelines on the Communication of Unexpected News via Ultrasound: The ASCKS framework.¹ Furthermore, in 2018, the National Bereavement Care Pathway (NBCP) began rolling out to NHS

Trusts, as of July 2021, 63% of NHS England trusts have committed to the NBCP standards. Delivering difficult news is a commonly cited stressor for those working in obstetric ultrasound. This study has shown that common themes beneficial to staff and patient wellbeing are prevalent; benefits of observational training; MDT or team-based debriefs; appointment times allowing for unexpected news, not determined by oversaturated worklists; it is imperative staff are fully supported by their department.

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Day 2 Wednesday 7th December

Obstetrics

Clinical value of 3D ultrasound at 11-14 weeks of gestation

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Abstract

Early fetal anatomical assessment can detect a large proportion of congenital abnormalities but requires significant operator skill. In this study we aimed to understand the clinical value of using 3D ultrasound as an adjunct to standard examination. This was a prospective observational study of pregnant people presenting for routine first trimester ultrasound between November 2021 and April 2022. Those recruited to the study and agreeing to participate underwent a standard first trimester 2D scan. A 3D volume in an anterior coronal view was then attempted and when successful, uploaded to GE 4D view software. Each 3D volume was examined both as a surface image and in multiplanar view to determine which of the following anatomical views were visible: head, facial profile, heart, abdomen, cord insertion, bladder, upper and lower limbs, CRL and NT. We prospectively recruited 81 participants. In five (6%), it was not possible to obtain a good quality 3D volume. For the remaining 76 patients (94%) at least one 3D volume was stored. Based on each 3D volume, a diagnostic CRL (88%) and NT image (72%) was obtainable in most cases. In addition, it was possible to adequately visualize the following anatomical fetal structures: head (93%), facial profile (80%), bilateral hands (92%), bilateral feet (80%), cord

insertion (80%), stomach (62%), bladder (22%) and heart (4CV) (13%). Adding 3D ultrasound is of clinical value when examining the first trimester fetus. With appropriate training, a 3D volume can be obtained within minutes, allowing the visualization of major anatomical structures in the first trimester without adding significant time pressures on ultrasound departments. Future studies should examine if it could be a useful alternative to 2D imaging rather than an adjunct, particularly in cases where a fetal anomaly is suspected.

How much extra time do sonographers really need to perform 20-week uterine artery Dopplers?

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Abstract

Obstetric ultrasound departments across England have seen an increase in demand for growth scans associated with the implementation of the original Saving Babies' Lives care bundle in 2016. Version 2 of the care bundle saw the introduction of 20-week uterine arteries screening for women with risk factors for fetal growth restriction (element 2). The time taken to perform and report uterine artery Doppler at 20 weeks has been overlooked in the planning of version 2 of the care bundle, and although it might seem trivial to policy makers, on a practical level it is an important factor to consider and one this study aims to answer. The scans from 276 consecutive participants recruited to the Pregnancy Outcome Prediction Study 2 (REC reference 19/EE/0331) for combined 20-week FASP and research scan were reviewed retrospectively. Scans were performed by sonographers with experience of working in both a research and NHS setting; all had undertaken in-house uterine artery Doppler training. The time taken to perform the uterine artery Doppler for each scan was defined as the time of final uterine artery image minus the time of the image taken before the first uterine artery image. Preliminary results suggest that uterine artery Dopplers can be performed to a high standard in less than five minutes. This study suggests uterine Doppler measurements can be acquired in less than five minutes by sonographers. Clinically however, sonographers will also need additional time to report the measurements, explain the findings to potentially anxious parents and arrange appropriate onward referral when required. The addition of 15 minutes to the 30-minute FASP 20-week scan can therefore be easily justified.

Assessing the introduction of the new BMUS 'Growth' guidelines into routine practice

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Abstract

The aim of this study was to identify any differences between measurements of the fetal abdominal circumference using two methods. The 2022 BMUS 'growth' guidelines recommend the two diameters method for measuring abdominal circumferences (AC). This study investigates the potential impact of changing from the ellipse method to the two diameters method. Two 28-week and 36-week scans were randomly selected and the reported AC measurement was removed from each image. The AC section in the two 28-week images and in one 36-week image were reasonably circular and considered potentially 'straightforward'. The second 36-week image was considered potentially 'difficult' owing to the proximity of a fetal knee. Eight sonographers 'blindly' measured each image using the two diameters method followed by the ellipse method. The intra-operator and inter-operator variabilities for both methods were calculated for each of the four images. Thirty sets of paired measurements were analysed. The ellipse measurement was bigger in 27 cases. The intra-operator variability between the two methods varied, with the largest differences of 0.1-18.4 mm resulting from the 'difficult' 36-week image. The inter-operator variability varied from 11.6-12.1 mm, equivalent to 4.1-6.1% of the reported AC, for the two diameter measurements and 4.3-16.5 mm, equivalent to 1.7-5.6% of the reported AC, for the ellipse. The large intra-operator variability when applying the two methods to the same image emphasises the potential clinical implications of introducing a new working method into routine practice. The fact that the inter-operator variability was less for the ellipse method than for the two diameters method in the three 'straightforward' AC images underlines the importance of training before a new method is introduced. The benefits of using the two diameters method in difficult cases is supported from the data.

MSK

Semi-automated tracing of hamstring muscle architecture for B-mode ultrasound images

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Abstract

Hamstring strains are the most prevalent injury sustained by field-sport athletes. Insufficiencies in the architectural characteristics of the hamstring muscles can heighten an athlete's risk of incurring a hamstring strain. To evaluate the influence of hamstring muscle architectural characteristics (i. e., fascicle length, pennation angle, muscle thickness) on injury risk, it is necessary to precisely evaluate these characteristics. The purpose of this study was to develop novel semi-automated tracing software for measuring the architectural characteristics of the hamstring muscles, and to quantify its accuracy and precision. Static sonograms of the Biceps Femoris long head (BFLh) muscle were acquired from ten different healthy male athletes, with their respective architectural characteristics (fascicle length (Lf), pennation angle (PA) and muscle thickness (MT)) analysed ten times using the tracing software, in order to determine the measurement precision. The precision of the PA was evaluated for distances of 2.5 mm, 25%, 50%, 75% along the total fascicle length from the insert into the aponeurosis. Excellent precision was found for the BFLh muscle architectural characteristic measurements: Lf [%CV: 0.64-1.12], PA [%CV: 2.58-10.70] and muscle thickness [%CV: 0.48-2.04]. We have developed an accurate and precise semi-automated skeletal muscle tracing algorithm for quantifying fascicle length, pennation angle and muscle thickness on static B-mode ultrasound images.

Young Investigators

The effect of suspension medium on the ultrasound backscatter signature of microbubbles within a flow phantom

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Abstract

Systemically circulating microbubbles (MBs) are used as an ultrasound contrast agent and have more recently been investigated as a drug delivery tool. When MBs oscillate within an ultrasound field, they scatter the signals which can then be detected and analysed. We previously showed that non-linear content within MB backscatter signals is influenced by the flow rate and mechanical index when investigated in tissue-mimicking flow phantoms. Here, we investigate the

effect that the fluid medium (blood vs saline) has on backscatter signals and consider implications for in vivo drug delivery and contrast enhanced ultrasound imaging. A 200 μm cellulose fibre was positioned at the coaxial focal point of two matched, single element transducers within a tank of outgassed water. A MBs (Sonovue) suspension was added to phosphate-buffered saline (PBS) or blood and drawn through the fibre using a syringe pump (flow rates; 30, 50, 70 $\mu\text{L}/\text{min}$). The transmit transducer was driven at 3.5 MHz with a 10 cycle burst, PRF 100 Hz, and mechanical index: 0.1, 0.2, 0.3, 0.4, 0.5. Signals scattered by MBs were amplified and acquired to a PC for post processing in MATLAB to reveal peak spectral energy and peak amplitude for the first (fundamental), second and third harmonic frequencies under each condition. Harmonics of the fundamental driving frequency appeared in the backscattered signals acquired, confirming that signals originated from MBs travelling through the flow phantom. Spectral energy at each harmonic increased with MI, while spectral energy overall was reduced in blood as compared with saline. The proportion of energy carried within the higher harmonics was greater at lower flow rates for higher MI, which is likely due to the MBs having spent longer in the focal zone. Experiments are ongoing to perform these tests in 3D printed tissue mimicking flow phantoms containing complex geometries which will produce more varied flow.

Sonographer led discharge in a deep vein thrombosis clinic; a feasibility study

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Abstract

Radiographer-led discharge is not a new concept, but there is a lack of evidence exploring the role of sonographers in improving patient flow through hospitals. NHS Improvement and NHS England¹ promote utilising Allied Health Professionals (AHPs) in care pathways to increase efficiency. We establish if sonographer-led discharge could be employed in a deep vein thrombosis clinic to improve efficiency without detrimental effect on patient satisfaction and safety. A prospective mixed methods service evaluation was completed. Length of appointment times between the control group who see an advanced clinical practitioner and a sonographer, and the intervention group who see a sonographer only were compared. Patient views were collected in a survey. Discharge summaries were assessed blindly for quality by acute medical consultants. Patients in

the sonographer group had a statistically significant shorter appointment time than those in the control group. Patients did not have a preference about which professional group cared for them, provided the staff were competent to do so. There was no impact on patient satisfaction or safety when seen by a sonographer alone. This study has confirmed that sonographer-led discharge is feasible, efficient and has no detrimental effect on patient safety or satisfaction. It also has the possibility to enhance professional practice of sonographers. Work such as this is in line with national initiatives to improve patient flow through hospitals by incorporating the skill mix of AHPs into new patient pathways. Role extension such as sonographer-led discharge could provide supporting evidence for advanced practice portfolios for sonographers.

Reference

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Prediction of arteriovenous fistula maturation outcomes in end-stage renal disease patients, using invasive and non-invasive techniques – a pilot study

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Abstract

Predicting arteriovenous fistula (AVF) remains a challenge. This study investigates the role of arterial stiffness and endothelial dysfunction on AVF maturation outcomes in end-stage renal disease (ESRD) patients using advanced ultrasound applications. This study was a prospective observational cohort pilot study. Seventeen patients with ESRD who underwent AVF surgery were recruited. AVF native artery and vein were scanned and assessed pre- and post-surgery using ultrasound B-mode, 2D shear wave elastography (2DSWE), 2D strain speckle tracking (2DSST) and laser Doppler flowmetry (LDF). During the surgery, blood volume flow (BVF) was measured intraoperatively using a transonic vascular probe. Patients were then followed for six weeks. Seventeen fistulas were created and four failed to mature. Patients' average age was 56.3 ± 14.1 years, 80.4% males. BMI average was 28 ± 5.3 kg/m², hypertension (100%), diabetes (41.2%), and CVD (35.3%). 2DSWE readings among the failure group

were higher than the patent group 4.23 ± 0.43 m/s vs. 3.90 ± 0.42 m/s respectively. 2DSST readings were similar between both groups: failure $2.65 \pm 0.52\%$ and patent $2.12 \pm 0.70\%$. LDF significantly correlated with AVF maturation outcome, $p < 0.001$, failure 17.3 ± 0.50 a.u, patency 22.2 ± 2.24 a.u. BVF in the failure group was lower than the patency group: 164.8 ± 135 ml/min vs. 434.5 ± 209.5 ml/min respectively, $p < 0.057$. 2DSST and 2DSWE are promising tools to study arterial wall properties but were not correlated with AVF maturation outcomes, possibly due to the small sample size. LDF and BVF measurements showed a strong indicator for predicting AVF maturation outcomes.

The first 5 targeted trans-perineal prostate biopsies diagnose the majority of PROMIS criteria cancer in patients with a Likert 4 or 5 score on mpMRI

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Abstract

The purpose of the study was to see if the first five transperineal (TP) biopsies give a diagnosis of PROMIS criteria cancer in patients with a likely prostate cancer on mpMRI. NICE guidelines suggest multiple prostate biopsies for histological diagnosis of cancer in those patients with a Likert 4 or 5 score on their mpMRI scan. Depending on the treatment planned, some patients need systematic TP biopsy, but in frail patients, those with limited treatment options or extensive disease, a cancer diagnosis may be all that is required. 375 patients had mpMRI for suspected prostate cancer between January and June 2021 in a large volume quaternary centre. 367 were given a Likert score of which 108 were scored Likert 4 or 5. Of these, 94 patients were sent for biopsy. 70 of the biopsied patients were ultimately diagnosed with PROMIS criteria cancer. A separate pot was sent containing the first 2-5 targeted biopsies in 69 of the 70. The median number of biopsies in all patients sent for biopsy was 12 (range 3-19). The first 2-5 targeted biopsies showed PROMIS criteria cancer in 65 of the 69 (94.2%) Likert 4 and 5 patients diagnosed with cancer. 62/69 (89.9%) showed the maximum length or grade of cancer in the first 2-5 targeted biopsies. All 4 of the missed cancers were ISUP 2 or less and located in the apex of the gland. A cancer diagnosis is usually obtained in the first 2-5 targeted biopsies in patients with a Likert score of 4 or 5. Further biopsies may be

required for treatment planning or for lesions in the apex of the gland where cancers can be missed.

Point of Care Ultrasound

Using ultrasound to gain peripheral venous access: A local teaching programme

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Abstract

Ultrasound-guided peripheral intravenous cannulation is not regularly taught during medical training in the United Kingdom, leading to a reliance on specialty anaesthetic trainees and intravenous access teams for more challenging venous access. Delays in establishing access lead to worse patient outcomes, due to delayed administration of intravenous medications and fluids. This study aimed to investigate the efficacy of a local teaching session on doctors' perceived confidence and difficulty in performing ultrasound-guided cannulation. A local teaching session was delivered on the principles of ultrasound, including a model demonstration, and supervised individual attempts with personalised feedback. Pre- and post-session surveys were distributed to measure perceived confidence and difficulty scores using the Likert scale. Microsoft Excel and GraphPad were used for statistical analysis. There were 13 participants, with a mean age of 28.8 years, and a gender ratio of 1:6 (F:M). 23% of participants had received previous formal training on ultrasound-guided cannulation. 69% of participants had self-reported minimal previous experience with ultrasound-guided cannulation. Confidence scores significantly increased from 2.46 to 3.76, ($p=0.00032$, 95%CI=0.74-1.88). Perceived difficulty scores significantly decreased from 6.54 to 3.15, ($p<0.00001$, 95%CI=2.41-4.36). Previous formal teaching did not significantly affect the change in perceived confidence or difficulty. The increase in confidence scores was significantly higher for participants with minimal previous experience, with a mean increase of 1.67, compared to 0.50 ($p=0.01885$). Previous experience did not significantly affect the change in perceived difficulty. A workforce trained in ultrasound-guided cannulation would lead to improved patient outcomes by reducing delays in treatment and improved staff outcomes by reducing specialty team workload. This local teaching programme is a low-cost, effective measure to improve doctor confidence and ability in performing ultrasound-guided cannulation.

Ultrasound skills at ITU teaching experience

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Abstract

Our project was to teach doctors how to perform and interpret point-of-care ultrasound in intensive care settings, and to learn about ultrasound for vascular access, chest ultrasound, echo, renal failure, liver failure and jaundice, and DVT diagnosis. The teaching has been running weekly at Critical Care and in the Radiology Department on a simulation manikin with provided images of different pathologies. After each session, a questionnaire was offered to assess doctors' feedback. During the ultrasound hands-on sessions, a diverse group of the doctors were involved. The doctors' feedback has shown a high interest in learning about ultrasound. The majority had either no or little experience in performing the ultrasound prior to those sessions. The teaching has improved the understanding about the different types of ultrasound probes, scanning positions and obtaining good images. Anonymised ultrasound images have been uploaded on the cloud storage, and shared with the supervising consultant radiologist to review and discuss. While running the programme there were some pros and cons about ultrasound on intensive care noted. The pros were: It saves time, because you do not need to wait for the radiology department. It can be performed as many times as needed. It is relatively easy to learn and acquire competencies. The ultrasound findings can direct the treatment. However, learning ultrasound requires supervision and mentoring by an ultrasound competent professional. It needs regular practice and determination. You have to be aware of limitations and ask for an official scan earlier. To summarise, looking into the future of managing the most complex patient, an ultrasound is a simple, portable investigation which can be widely used at Critical Care. Learning ultrasound skills are the achievable up-to-date competencies for ITU doctors, which can become a routine tool for assessing critically ill patients.

Therapeutic Ultrasound Network for Drug Delivery and Ablation Research

Sonoporation of cells to enhance the liberation of intracellular biomarkers

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Abstract

Contrast microbubbles, when insonated with ultrasound, have the potential to cause cell membrane permeability. This has been shown to be potentially beneficial in techniques such as targeted drug delivery or opening of the blood-brain barrier. Research we are undertaking seeks to establish whether cavitating microbubbles adjacent to cells have the potential to liberate cell-specific biomarkers for non-invasive liquid biopsies. For our *in vitro* studies, human polarized Renal Proximal Tubular Epithelial Cells (RPTECs) were grown on ThinCert membranes. Membranes were suspended in a beaker with an acoustic absorber and insonated in the presence of SonoVue microbubbles or a sodium chloride vehicle. Ultrasound was applied using a Vevo Sonigene with a 1 MHz unfocussed transducer with treatment times of 5, 10, 15 or 30 s at a 50% duty cycle and 2 W cm⁻² nominal output power and at microbubble concentrations ranging from 0.1-10%. Expression of different micro RNA (miRNAs) biomarkers and cell viability were determined. For our *in vivo* studies, a mouse model of unilateral ureteral obstruction (UUO) was used to explore the detection of injury-specific biomarkers. Both Micromarker and SonoVue microbubbles were infused and insonation took place using a Sonidel SP100 (Sonidel, Ireland) 1 MHz transducer. The *in vitro* studies demonstrated that cell-specific biomarkers can be released from RPTECs in the presence of microbubbles without significant cell-death. *In vivo* studies demonstrated that tissue-specific biomarkers can be liberated but at higher acoustic output settings and duty cycles. This work was carried out under a PhD studentship held by Oliver Teenan, University of Edinburgh and funded by a BBSRC:National Productivity Investment Fund PhD scholarship co-funded by GSK.

Detection of HIFU lesions by Optical Coherence Tomography

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Abstract

The use of high-intensity focused ultrasound (HIFU) to induce irreversible changes in tissue due to heating is well established. We have shown that changes in tissue optical properties (scattering and absorption coefficients) could be used as a proxy to improve sensing and imaging of HIFU lesion formation, as an alternative to conventional methods

such as thermometry. Optical coherence tomography (OCT) is a non-invasive optical imaging method which relies on low-coherence interferometry to determine the depth of individual scattering centres within the tissue. Previous studies have demonstrated that OCT signals are sensitive to morphological changes in heated tissue, likely due to denaturation of proteins concomitant with formation of crosslinked structures. The goal of this study was to assess the use of OCT for sensing and imaging HIFU lesions. We demonstrate the feasibility of imaging near-surface lesions in *ex vivo* chicken breast tissue exposed to HIFU. This technique has potential for detecting changes in optical properties corresponding to the progression of surface lesion formation which are antecedents of skin burn during HIFU exposures, thereby increasing safety and reducing treatment times.

The effects of repeated histotripsy treatments on the viral delivery and growth of murine pancreatic tumours

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Abstracts

Pancreatic ductal adenocarcinoma (PDAC) is a disease with dismal prognosis and 5-year survival rates < 1%. No treatment options exist for advanced PDAC patients, and treatments including immunotherapy have failed to extend survival. Boiling histotripsy can induce cavitation and emulsify solid tumours. These exposures would be particularly suitable for treating pancreatic tumours to interfere with their dense regulatory stroma. In this study boiling histotripsy was used to improve the delivery of viruses and survival of murine PDAC models. The induction of the immune response has also been investigated. Syngeneic orthotopic pancreatic KPC tumours (*Kras^{LSL.G12D/+}; p53^{R172H/+}; PdxCre tg/+*) were grown in immune-competent murine C57BL/6 subjects. Tumours were exposed to histotripsy (P- = 17 MPa, duty cycle = 1 %, PRF = 1 Hz, 15 repeats, f = 1.5 MHz, lesions every 1 mm) with the small animal Alpinion VIFU 2000 platform in the presence or absence of intravenously (IV) injected reovirus (10⁷ pfu/injection). Acoustic cavitation was monitored using 2D high frequency (14 MHz) B-mode ultrasound imaging during treatment and was quantified using a weakly focused polyvinylidene fluoride, broadband (0.1 to 20 MHz) passive cavitation detector after treatment. Reovirus infection of tumours was histologically assessed, and immune effects were determined using single

cell RNA-sequencing. Two histotripsy treatment sessions were delivered to the animals 1 week apart. No side effects were seen. These treatments induced cavitation and approximately doubled the survival of subjects compared to sham-exposed subjects. Histotripsy treatments also increased viral delivery in the pancreatic tumours. Single-cell sequencing of tumours of sham-exposed subjects and those treated with histotripsy with or without reovirus were performed, and results will be presented. The use of multiple histotripsy treatments significantly improves the survival of subjects carrying orthotopic pancreatic KPC tumours. Enhanced viral delivery in histotripsy-treated tumours was also demonstrated.

Temperature measurements during high intensity focused ultrasound exposure

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Abstract

Ultrasound-based therapies continue to develop and show promise as non-invasive tools for cancer treatments. High-intensity focused ultrasound (HIFU) can be used for both thermal ablation and hyperthermia. However, the accurate measurement of temperature during HIFU exposure remains a challenge, especially in case of hyperthermia where maintaining a defined temperature is critical for successful treatment outcomes. The aim of this work was comparing measurements performed using a fine wire thermocouple with thermo-acoustic simulations performed using k-wave. The comparison between measurements and simulations is expected to improve the knowledge of artifacts such as viscous heating and validate simulation against controlled laboratory measurements. A HIFU transducer (H-101, Sonic Concepts, Washington, USA) was characterised (acoustic power and pressure). The transducer was driven at 1.06 MHz using different acoustic powers (1 W, 2 W, 3 W and 4 W) and exposure time (2 min, 3 min and 4 min). The sine wave was triggered using a gate with a period of 4.1 s and 97.6% duty cycle. The time off was added to evaluate the effects of viscous heating. The measurements were performed at the focal distance and 20 mm from the front surface of the tissue mimicking material (TMM). Four K-type thermocouples (T0, T1, T2 and T3) were placed in parallel, 2.5 mm apart from each other. The TMM was prepared according to Annex DD of IEC 60601-2-37:2007/AMD1:2015 and acoustically characterised. The table below reports the comparison for the final

temperature after 2 minutes exposure at different power levels, similar results are available for 3 and 4 minutes.

Power (W)	Measurements (°C)	Model (°C)	Difference (%)
1	4.3	3.9	8.8
2	8.5	7.7	9.8
3	12.6	11.4	9.4
4	16.7	15.1	9.3

There is good agreement between simulations and measurements, with the measurements always reading around 9% higher than simulations. This value can be an indication of the order of magnitude for viscous heating artifact. Further investigations will provide additional insight into the source of the differences.

Acknowledgment

The activities here presented were partly developed in the framework of the EURAMET, European Association of National Metrology Institutes, 18HLT06 RaCHy Project that received funding from the EMPIR program, European Metrology Programme for Innovation and Research (funder ID: 10.13039/100014132) co-financed by the participating States and from the European Union's Horizon 2020 research and innovation program.

Preparation and characterisation of phase-changed nanodroplets for ultrasound blood-brain barrier permeability enhancement in vitro

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Abstract

Phase-change nanodroplets (NDs) have a perfluorocarbon (PFC) core that undergoes acoustic vaporisation and makes them respond to ultrasound (US). This event is called cavitation and potentially causes a reversible permeability to increase the blood-brain barrier (BBB) for a short period. This study analyses the preparation of lipid-based NDs to create a targeted

drug delivery method. The NDs were prepared using the thin-film hydration method, followed by the PFC addition, and were characterised for size, cavitation (high-speed camera) and PFC encapsulation (using FT-IR). BEND3 (mouse brain endothelial) cells were seeded onto transwell inserts. NDs and microbubbles were applied on the BEND3 with and without US, and fluorescein permeability was measured. The Live/Dead assay was used to assess the BBB integrity. Size and PFC content analysis indicated that the NDs were stable while stored. High-speed camera imaging showed cavitation after US exposure of 0.12 MPa. The BBB cell model experiments revealed a 4-fold increase in cell membrane permeation after the combined application of US and NDs. The Live/Dead assay displayed some damage to BBB membrane integrity but less when compared to the one caused by microbubbles. Nanodroplets have the potential to be a safer alternative to microbubbles for BBB opening.

The potential of phase-change nanodroplets in generating reactive oxygen species for sonodynamic anticancer therapy

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Abstract

Sonodynamic therapy (SDT) is a mode of therapy based on the non-invasive ultrasound treatment that aims at generating reactive oxygen species (ROS) through the activation of molecules with sensitizer properties.^{1,2} In this study, two potential sensitizers namely, curcumin and IR780 are introduced as solutes or as in nanodroplets to assess their effect in generating ROS. Solutions consisting of either curcumin/IR780 mixture or curcumin/IR780-loaded phase-change nanodroplets (PCND) were treated with ultrasound and the ROS levels were assessed. Two ROS assays, one with potassium iodide (KI) and one with terephthalic acid (TA) were used to detect and quantify the production of ROS, particularly hydrogen peroxides (H₂O₂) and hydroxyl radicals (OH). Two sets of ultrasound settings were used, a continuous and a pulsed mode with a frequency and acoustic pressures of 1 MHz and 0.9/1.3 MPa, respectively. A duty cycle of 20% was applied in the pulsed mode whereas the continuous mode should possess a duty cycle of 100%. The experiments were run under ultrasound applications in the dark for 5 minutes. The continuous mode ultrasound application showed that

both curcumin/IR780 mixture and curcumin/IR780-loaded PCND generated significantly higher ROS in comparison to their corresponding groups that were not treated by ultrasound. This was observed for both lower and higher acoustic pressures of 0.9 MPa and 1.3 MPa. However, there was almost no ROS production in the 20% pulsed mode irradiations at lower acoustic pressure of 0.9 MPa, which was chosen to comply with the safe mechanical index (MI) requirement used in the clinic. Subsequently, three different concentrations of curcumin/IR780 mixtures i.e. 7.5, 12.5 and 25 μM for each curcumin and IR780 with the same ultrasound settings were used in pulsed mode. Increasing each component concentration to 25 μM resulted in a two-fold increase of ROS production when a 20% pulsed ultrasound was applied. Then, 25 μM curcumin/25 μM IR780 mixture was loaded in PCND to further assess ROS production. Results showed that the production of ROS was higher in the dual-load curcumin/IR780 PCND compared to single-load PCNDs. Hence, 25 μM of curcumin/25 μM IR780-loaded PCND with ultrasound settings i.e. frequency, acoustic pressure and duty cycle of 1 MHz, 0.9 MPa and 20% respectively were the optimal conditions for the highest ROS production in solution. In summary, both curcumin and IR780 and their dual-load form in PCND have been shown to generate ROS upon ultrasound irradiation which can be further evaluated to promote sonodynamic anticancer therapy.

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Characterisation of cavitation threshold properties of selected hydrogels as tissue mimics for therapeutic ultrasound

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Abstract

When ultrasound travels through tissue, the mechanical effects induced to tissue, especially ultrasonic cavitation, can be harnessed for therapeutic purposes. For the evaluation of their potential, tissue mimicking

materials have been characterised. Poly(vinyl alcohol) (PVA) hydrogels (10-20% w/w \pm 5-10% w/w cellulose), agarose hydrogels (1.25-3% w/w \pm 3% cellulose) and gellan gum gels (concentration 2-4% w/w \pm silicone oxide scatterer (2%)) were characterised acoustically and for their cavitation thresholds. The finite amplitude insertion substitution method (frequency range 1.8-3 MHz) was used to gather sound speed (c_s) and attenuation coefficient (α). A passive cavitation detector was used to investigate cavitation thresholds at peak negative pressures of 1.76-9.64 MPa. PVA (c_s :1532-1590 m/s, α : 0.08-0.37 dB/cmMHz) and gellan gum (c_s :1493-1503 m/s, α : 0.19-0.37 dB/cmMHz) hydrogels had higher acoustic parameters than those measured in agarose hydrogels (c_s : 1493-1500 m/s, α : 0.03-0.22 dB/cmMHz). Cavitation thresholds for all materials followed a sigmoidal trend in probability of occurrence as a function of negative acoustic pressure, with agarose showing the lowest (2.9-3.5 MPa for 75% probability). While gellan gum showed cavitation later than the other gels (6.6-7.2 MPa), the increase in cavitation was steeper (slope: 8.7 ± 2.9). Addition of scatterers caused cavitation at lower pressures, with the 75% probability cavitation threshold in PVA gels: 5.4-8.2 MPa (no cellulose) lowering to 3.8-4.3 MPa (+10% cellulose w/w), and to in gellan gum silicone dioxide gels: 3.4-4 MPa). The acoustic properties (attenuation and sound speed) of PVA hydrogels were close to those of published tissue data. Gellan gum and PVA gels show cavitation thresholds properties that appear more suitable than agarose gels for mimicking tissues for these applications. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 813766.

Using magnetic microbubbles to probe colorectal cancer lymph nodes

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Abstract

The localisation and characterisation of lymph nodes in colorectal cancer (CRC) is integral to cancer staging, treatment planning, resection surgery and therefore patient outcomes. However, appropriate imaging technologies capable of providing detailed information to the oncologist or surgeon to inform these processes remain severely limited. To help address this diagnostic challenge, we are investigating the use of magnetic microbubbles, to be employed in both contrast enhanced ultrasound (CEUS) imaging and magneto-motive ultrasound (MMUS) imaging. Our aim is to combine the benefits of two ultrasound contrast agents to deliver contrast-enhanced magneto-motive ultrasound imaging; microbubbles will enable standard perfusion imaging; magnetic nanoparticles that accumulate in the lymph node allow local tissue structures to be displaced with an externally applied magnetic field. The resulting tissue displacement can be recovered with high-resolution ultrasound imaging supporting lymph node delineation and the possibility to interrogate tissue stiffness. Contrast enhanced ultrasound imaging was performed (18 MHz, Vevo 3100, Fujifilm VisualSonics) in a wild type mouse to assess lymphatic drainage of magnetic microbubbles after bolus injection, with peak enhancement occurring at 3.7 s. Preliminary MMUS data were acquired as proof of concept and used to inform a finite-element model to assess magneto-mechanical interactions of a magnetic microbubble with an elastic solid.¹ The tissue displacement that could be generated and recovered via MMUS in our pre-clinical CRC model using magnetic microbubbles was investigated. Separately to this, CEUS was investigated as a method to recover lymph node information capable of indicating metastatic involvement, in the absence of deformation imaging.² We will present an overview of our progress seeking to demonstrate the utility of multi-modal contrast agents to (1) determine lymph node metastatic involvement in a pre-clinical model of colorectal cancer, and (2) to probe lymph node stiffness as a potential indicator of disease involvement.

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Day 3 Thursday 8th December**MSK****Appropriateness of musculoskeletal soft tissue swelling ultrasound scans****R Anwar**

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Abstract

This audit's purpose was to assess the appropriateness of referrals from primary and secondary care for soft tissue lumps and bumps ultrasounds (US) that are being performed in a university teaching hospital imaging department and compare against the British Sarcoma Group (BSG) national guidelines. This is on the background of increasing referrals for ultrasound scans of soft tissue lumps with limited clinical information in the face of increasing workload in the imaging department. This was a retrospective study, analysing data for all US performed for soft tissue swelling – over a one-month period. We focused on all US undertaken in the imaging department for June 2019 (pre-COVID) allowing for a 24 month follow-up period. Indications and findings were recorded. The requests were assessed regarding appropriateness by comparing to NICE and BSG guidelines. 200 ultrasound scans were undertaken during the one month period; 14 paediatric patients were excluded from the data. The majority of referrals were from primary care (92%). Of the 186 cases analysed, 102 cases (54%) did not contain any appropriate clinical information as per the guidelines and no descriptive features were mentioned. Of the 81 cases (44%) that did contain relevant clinical information, 14 cases (17%) mentioned clinical features that, according to the guidelines, did not require ultrasound imaging and hence were also inappropriate. This audit shows the significant proportion of inappropriate requests from primary care. There was a lack of relevant clinical information on requests for US soft tissue, making it difficult to ascertain which patients need to be offered a direct access US in the required two-week time frame. Considerations for improving the quality of referrals include presenting the audit within primary care teams to enhance referrer education and ratifying an US request system with a flowsheet proforma to ameliorate the referral process.

Professional Issues

Patient experience of imaging reports – A systematic literature review

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Abstract

Written reports are often the sole form of communication from diagnostic imaging. These reports are increasingly being accessed by patients as a part of their electronic record. Experiencing medical terminology can be confusing and lead to miscommunication, a decrease in involvement and increased anxiety. To better understand how patients experience imaging reports, a systematic review of the literature was undertaken. The objectives were to: (i) understand patients' experiences of imaging reports; (ii) determine key areas of importance when communicating imaging findings to patients; (iii) use this information to inform further research and influence service delivery. This systematic review was designed to include predefined study selection criteria and was registered prospectively on PROSPERO (CRD42020221734). MEDLINE, CINAHL, Academic Search Complete (EBSCOhost), EMBASE, Scopus, and EThOS were searched to identify articles meeting the inclusion criteria. All studies were assessed against the Mixed Methods Appraisal Tool (MMAT) version 2018 for quality. A segregated approach was used to synthesize the data. This method included a thematic synthesis of the qualitative data and a narrative review of the quantitative data. The findings of both syntheses were then integrated. Twelve articles reporting 13 studies were included. This review found that patients' experiences of imaging reports were related with both positive and negative aspects. The study identified two main themes which encompass both qualitative and quantitative findings. These themes reveal that patients reported their experiences regarding their i) understanding of reports and regarding ii) self-management. Patient understanding of imaging reports is multi-factorial including imaging modality, medical terminology, communication aids and errors. Self-management through direct access is important to patients. Whilst receiving bad news is a concern, responsibility

for accessing this is accepted. A patient-centred approach to writing imaging reports may help to improve the quality of service, patient experience and wider health outcomes.

Professional Supervision – How could this support the sonographer workforce?

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Abstract

Increasing pressure is being felt by the sonographer workforce in the UK due to staff shortages and increasing clinical demands. With both the Society and College of Radiographers (SCoR) and the Health and Care Professions Council (HCPC) advocating the use of professional supervision to support the health and social care workforce, this review explores the evidence around the use of professional supervision and how this may be beneficial to support sonographers. A literature search was conducted to identify research exploring professional supervision in the radiographer and sonographer workforce. No papers were identified, therefore search parameters were expanded to include allied health professionals. A literature review was conducted to explore the use of professional supervision in the allied health profession workforce. Professional supervision can be beneficial in providing support for emotional wellbeing, which can contribute to reduced levels of burnout and increased job satisfaction. Alongside positive wellbeing aspects, professional supervision can contribute to improved quality of care, professional development and discussion of evidence-based care. Whilst benefits are identified, there can be challenges to implementation of effective professional supervision including clinical pressures impacting on time available to conduct the professional supervision. This could impact the ability to implement it in the sonography workforce. Organisational pressures and the supervisory relationship can also have a negative impact. The literature demonstrates that there are clear benefits to professional supervision which could have a positive impact on the sonographer workforce; however, there can be significant challenges to implementation. Whilst there is clear identification of the benefits and the SCoR advocate the use of professional supervision, the guidance does not provide a clear structured framework. Further research is needed to explore the use of professional supervision in sonography practice in the UK due to the unique nature of the role.

Poster Exhibition 2022

General Medical

Audit of ultrasound guided percutaneous renal biopsies performed in a large teaching hospital

L Scoffield

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Abstract

This audit was undertaken to assess the sample diagnostic adequacy and safety / complication rates of ultrasound guided percutaneous renal biopsies performed in a teaching hospital. Data were collected retrospectively from a six-month period (September 2020-February 2021) from the Trust's electronic patient records and RIS. The sample adequacy for native renal kidneys was set at the presence of 10 or more glomeruli in the core biopsy, which was based on a previous audit cycle and Royal College of Radiologists audit template. The Banff Criteria – presence of 10 or more glomeruli and two or more arteries in the core biopsy – formed the standards for the transplant biopsies. Any subsequent complications or repeat biopsies were recorded. Data from 179 patients were included. 30 biopsies were targeted (at a focal lesion), 92 were native (non-targeted) and 57 were transplant biopsies. Operators included radiology registrars, consultant radiologists and sonographers. 89% of the targeted biopsies were diagnostic. 66% of the native biopsies were adequate (57% in the previous audit), with a 4% repeat biopsy rate (3% previously). 72% of the transplant biopsies were adequate (67% previously), with a 4% repeat biopsy rate (3% previously). There was a 4% minor complication rate (not previously assessed). One patient (0.6%) had a major complication of active renal bleeding requiring interventional radiological embolization. This audit cycle demonstrated that ultrasound guided percutaneous renal biopsy is a safe and effective procedure with a very low major complication rate and a high chance of obtaining a diagnostic sample for histopathological analysis.

The Hull and East Yorkshire Teaching Hospitals NHS Trust Rapid Diagnostic Service (RDS): Initial evaluation

M Hiles

The Hull and East Yorkshire Teaching Hospitals NHS Trust, Hull, UK

Abstract

In 2021 the Hull and East Yorkshire Teaching Hospitals NHS Trust (HUTH) introduced a Rapid Diagnostic Service (RDS) pathway in line with NHS England's faster diagnosis standard (FDS) to enable accelerated diagnosis for primary care patients experiencing nonspecific symptoms (NSS) concerning for cancer. Performance evaluations of NSS RDS pathways remain few and the efficacy of this model remains incompletely understood. Retrospective analyses of the electronic patient records (EPRs) of all patients referred onto the HUTH (NSS) RDS pathway between January 2021 and June 2023 is underway. Clinical history, patient demographics, prior laboratory work-up, cancer type and benign serious diagnoses are recorded to evaluate the initial performance of the service. Patient outcomes are being analysed and the distribution of new benign and malignant conditions and those with no significant findings will be presented. Particular attention will be made to reviewing mean referral to cancer diagnosis time, the range of cancers detected, staging and alternative benign but serious conditions identified. UK cancer survival rates are lower than some European countries. Almost half of cancer patients are diagnosed as late stage due to the lack of obvious red-flags and difficult to manage vague symptoms. In response to the long-term NHS plan, rapid diagnostic (NSS) services are expanding nationwide with full coverage expected by 2024. This study is focused on one of the largest NSS RDS services in the UK and these data illustrate its effectiveness through providing GPs with accelerated direct access to a tailored diagnostic service for patients experiencing vague symptoms that previously would not fit a traditional two week wait pathway.

Rectus abdominis muscle haematoma – Rare cause for acute right iliac fossa pain

E Smith

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Abstract

The objective of the investigation was to explain the cause for a young woman experiencing acute right iliac fossa pain of uncertain origin. Pain level was increasing and inflammatory markers nonspecific for likely cause, however, as with most female investigations in acute ultrasound, a cyst accident or appendix abnormality was suspected. Examination with ultrasound of the female pelvis will use a curvilinear low frequency transducer and vaginal transducer for gynaecological investigation. More

detail of structures requires examination with a 14 MHz linear transducer where bowel, lymph nodes and superficial tissue can be examined. Closer examination with the high frequency transducer revealed a rare cause for acute pain where a right rectus sheath haematoma had developed subsequent to a recent gym session. Rectus sheath haematoma is an uncommon cause of acute abdominal pain and is an accumulation of blood in the sheath of the rectus abdominis muscle secondary to rupture of an epigastric vessel or muscle tear often occurring spontaneously or perhaps after muscle trauma. Ultrasound report protocol defines a follow-up period and on this examination the haematoma was fully resolved at three months. Follow-up scan is essential to rule out other sinister pathologies requiring investigation and all scanning professionals should be aware of this safety strategy. This case shows that sonographers require enhanced skills to widen their expertise in musculoskeletal anatomy and common pathologies. Expect the unexpected pathologies and utilise specialist trained sonography education to widen skill mix in departments.

Scrotal ultrasound; it's not all about the testes! Pictorial review of common (and some uncommon) extra-testicular ultrasound findings

J Davies and N Ridley

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Abstract

Ultrasound is used as the primary imaging modality to assess the scrotum for both acute and chronic conditions. NICE (2022) recommends that patients be referred for ultrasound scans of the scrotum where there are unexplained testicular symptoms, or for scrotal swelling, where it cannot be determined whether it is intra- or extra-testicular. This is often when a patient has incidentally found something abnormal during self-examination or has experienced scrotal pain. These symptoms can often be extra-testicular in origin. A variety of appropriate extra-testicular scrotal ultrasound cases were identified, such as spermatocele, haematocele, scrotal hernia, scrotoliths and scrotal oedema. All cases were seen and assessed during 2021 to 2022 at the Great Western Hospital, Swindon. This poster aims to demonstrate a wide range of extra-testicular scrotal pathology and can be viewed as a guide for sonographers and clinicians with an interest in scrotal ultrasound showing some of the common extra-testicular findings that may be found.

High frequency ultrasound – Use in the Photo Dynamic Therapy Clinic

C Swift and L Foster

The Christie NHS Foundation Trust, Manchester, UK

Abstract

Basal cell carcinomas (BCC) are the most common form of skin cancer and make up more than 80% of skin cancers seen in the UK. They are primarily caused by exposure to ultraviolet light from the sun or sunbeds but also seen in individuals with certain genetic disorders such as Gorlin syndrome. Several treatment options for this condition are available including surgery, cryotherapy, radiotherapy, and photodynamic therapy (PDT). PDT has been shown to be an effective treatment having high clearance rates and excellent cosmetic outcomes. For PDT to be successful, the depth of the tumour should ideally be less than approximately 3 mm to ensure both sufficient penetration of the photosensitizing drug, and penetration of the activating light. High frequency ultrasound (HFUS) at 35 MHz has been used extensively within the PDT clinic to determine the extent of such tumours. BCCs are clearly defined on such scans having a different echogenicity to the normal surrounding tissue. Depth measurements of BCCs to be determined are an important factor as it will influence clinical decisions as to whether PDT is a suitable mode of treatment or if other treatment options may be more suitable. HFUS scans have been undertaken in multiple sites (up to 11) on 213 patients in the last year. The majority (184) were treated for BCCs, 18 for Bowen's disease and 11 for actinic keratosis. The HFUS scans have proven to be very useful in the monitoring of the effectiveness of the treatment and additionally tumour shrinkage, should repeat treatments be required. Its use in further applications in skin oncology in the Christie clinic is being explored.

A rare occurrence of Acute Lymphoblastic Leukaemia breast metastasis – sonography's role

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Abstract

Medullary and osseous metastases of haematological malignancies are common, however, mammary infiltration is extremely rare. Mammary manifestation in acute lymphoblastic leukaemia (ALL) is exceptionally

rare with <200 reported cases. ALL typically has high relapse rates and a young presentation thus precluding mammographic investigation. Therefore, sonography plays an important role in lesion detection and characterisation. Sonographic findings are non-specific requiring biopsy to consolidate findings. However, ultrasound can demonstrate both typically benign and malignant image features from which decisions to biopsy can be determined. It can also safely guide any subsequent biopsies, reducing post-biopsy complications. This poster discusses ultrasound's application in a case of leukemic mammary metastasis in a 34-year-old female with a solitary non-tender breast lump on a background of ALL. It highlights ultrasound's strengths and weaknesses in lesion assessment and demonstrates common yet non-specific sonographic appearances of leukemic deposits. Sonographic investigation revealed multiple bilateral lesions demonstrating hypoechogenicity with significant solid, echogenic components. Both irregular and well-defined lesion outlines were demonstrated. Heterogenous echotextures of cystic and solid appearances were identified with individual lesions demonstrating capsulation, acoustic shadowing and varied Doppler patterns. Variation in lesion appearances highlighted the non-specificity of this pathological process sonographically. While image findings were inconclusive, ultrasound permits its use to guide tissue sampling to accurately categorise lesions. The lesions were found to have leukemic infiltration attributable to ALL relapse. The patient underwent multiple multi-agent chemotherapy cycles to no avail and sadly passed away. The incidence of this case presentation is rare. While literature and research are sparse and common sonographic findings are non-specific, ultrasound remains a valuable modality in the assessment leukemic mammary infiltration. It allows lesion evaluation, especially in young and mammographically occult cases and guides biopsies for conclusive lesion diagnosis.

Passive hepatic congestion - A forgotten cause of abnormal LFTs?

J Wild

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Abstract

Ultrasound practitioners are often faced with requests where the clinician is trying to determine the cause of abnormal liver function tests (LFTs). The most common pathology encountered in practice which can result in abnormal LFTs is that of fatty liver disease relating to either alcohol use or non-alcoholic fatty

liver disease (NAFLD).¹ Ultrasound has been shown to demonstrate a good sensitivity and specificity (84.8% and 93.6%) in the diagnosis of fatty liver disease.² Given the prevalence of fatty liver disease in the population and ultrasound's ability to diagnose fatty infiltration relatively easily, it is vital that ultrasound practitioners do not become complacent, and that other pathological processes are considered, especially when no clear cause for the abnormal LFTs is initially identified during the ultrasound examination. While there are a host of other causes of abnormal LFTs, passive hepatic congestion (PHC) is one cause of abnormal LFTs which can be overlooked in the pursuit for the more obvious and common fatty liver. PHC may be asymptomatic for a prolonged period of time with the only clue to suspect its presence being abnormalities in the LFTs.³ If not recognised, chronic congestion leads to hepatic injury, eventually resulting in fibrosis and cirrhosis.⁴ As with any pathology, proper understanding and recognition of the clinical presentation and imaging features are vital to a conclusive diagnosis. The poster aims to highlight a differential diagnosis for abnormal LFTs and provide information relating to the aetiology, pathophysiology and ultrasound features of PHC so that ultrasound practitioners are better equipped to recognise the pathology and be confident in their diagnosis, which can impact on the follow-up and treatment of a patient.

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Early experience of micro-ultrasound prostate imaging

P Parker

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Abstract

Technological advances within the last two to five years have potentially revolutionised the imaging assessment of the prostate gland. There is limited published evidence that the use of ultrasound may, indeed, have a useful role in the identification of prostate cancer (PCa).^{1,2,3} A meta-analysis by Zhang

et al.⁴ in 2019 assessed the sensitivity and specificity of micro-ultrasound detection of PCa. Micro-ultrasound (micro-US) utilises a transducer emitting a scanning frequency of 29 MHz compared to the 7 – 9 MHz employed in most standard frequency endorectal ultrasound probes. This provides exquisite imaging of the prostate that traditionally ultrasound has failed to deliver. Micro-US supplied by ExactVu™ is gaining traction within North America and Europe but there is limited real world practice within the UK. The first micro-US endocavity imaging unit was installed in Radiology at Hull Teaching Hospitals in September 2021. This poster provides a pictorial review of our early experience of this novel, and hopefully groundbreaking, technology and its use within the prostate cancer pathway.

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Can ultrasound simulation practice enhance practical skills and academic knowledge?

MH Qarib

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Abstract

The use of ultrasound simulators is becoming more popular in ultrasound training centres, it is important to evaluate if ultrasound simulator practice can enhance practical skills and academic knowledge of ultrasound trainees. The aim of this study was to evaluate the views of ultrasound trainees who were using the ultrasound simulator at the London North West University Healthcare NHS Trust Ultrasound Academy during their training programme and to determine if using an ultrasound simulator enhanced their practical skills and academic knowledge. A

questionnaire was designed to explore the views of 32 trainees who were using the Scan Trainer ultrasound simulator during their training. The completed questionnaires from 23 respondents were used for data analysis to evaluate if using the ultrasound simulator enhanced their practical and academic knowledge. The results showed that 100% of respondents thought that the ultrasound simulator enhanced their practical skills and academic knowledge at the beginning of their training, 43% agreed that ultrasound simulator practice enhanced their practical skills and academic knowledge at the middle of their training while only 13% thought it enhanced their practical skills and academic knowledge at the end of their training. This study also found that 20% agreed that trainees should use the ultrasound simulator on a daily basis for an average of 1.8 hours/day, 40 % agreed an average usage of 3.5 hours/week and 40% agreed an average usage of 10 hours/month. The majority (96%) agreed that ultrasound simulator practice cannot replace patient-based ultrasound practice. Using the ultrasound simulator can enhance practical skills and academic knowledge; it should be used regularly by all trainees who have access to an ultrasound simulator at the beginning and middle stages of their training. The majority of respondents agreed that simulation training cannot replace patient-based scanning.

Ultrasound past, present and exciting future

R Beese

Queen Elizabeth Hospital and Kings College Hospital,
London, UK

Abstract

The author dedicates the talk to Prof Cosgrove and Dr Hylton Meire who have recently passed. Their contribution to ultrasound cannot be understated, taking ultrasound in its infancy from the bench to the patient. Both doctors researched, pioneered, published books and papers, and taught ultrasound. The talk will concentrate on the history and evolution of ultrasound imaging and technology and will look to the future of this exciting versatile imaging modality. Different clinical settings of the use of ultrasound will be discussed from a perspective of austere and global locations.

Case report: Incidental finding of a peripheral nerve sheath sarcoma

S Dunne

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Abstract

A 30 year old female presented with a six month history of calf pain with foot drop and a recent intense calf pain and swelling with no history of trauma. Initial referral for an MRI scan of her foot and ankle reported suggested myopathic changes in several muscles. No follow-up treatment was given. The patient experienced difficulty walking and developed localised severe calf pain and was referred by her GP for an ultrasound of her leg veins to exclude DVT. On ultrasound examination there was no evidence of a DVT, however, in the popliteal fossa a well-defined, heterogeneous, intramuscular mass was visualised extending down the posterior calf with abnormal vascularity measuring 20 cm in length with a diameter of 6 x 6 cm. Images were reviewed immediately by a radiologist and referred for urgent MRI calf. MRI reported a well-defined elongated intermuscular soft tissue mass lesion in the calf closely related to the neurovascular bundle, suspicious for a tumour of neurogenic origin, possibly a malignant peripheral nerve sheath tumour or given its close relationship to neurovascular bundle possibly a leiomyosarcoma. The previous signal changes on the MRI foot could be due to denervation/compression of the posterior tibial nerve. The patient was referred to the specialist sarcoma team and underwent amputation and is undergoing chemotherapy. She has been hospitalized with sepsis twice since surgery. Malignant peripheral nerve sheath tumours (MPNST), also known as neurofibrosarcomas, can occur anywhere throughout the body, mainly in adults. MPNST is a rare malignant mesenchymal lesion that accounts for 5% to 10% of all soft tissue sarcomas. They are extremely aggressive with high local recurrence rate and poor survival. Early diagnosis of sarcoma increases the chance of successful treatment. Resection surgery with a margin is the main therapy for MPNST, radiation and systemic chemotherapy are also widely used despite their uncertain effect.

Case report: Granulosa cell tumour of the ovary**D Murphy**

University Hospital Southampton NHS Trust,
Southampton, UK

Abstract

A 48 year-old patient was referred by her GP to the Ultrasound Department for an urgent pelvic ultrasound scan querying ovarian pathology. The patient presented with abdominal distension and pain. Blood tests revealed suppressed FSH/LH but normal oestrogen levels. She also had been

experiencing irregular heavy bleeding over the past six months which she believed was associated with the menopause. Her ultrasound report revealed a thickened (23mm), inhomogeneous endometrium with multiple, interspersed cystic spaces. The endocervix also had an unusual appearance with evidence of multi-cystic change and endo-cervical expansion. A 162 x 102 x 116 mm avascular, multilocular ovarian cyst with appearances suggestive of a mucinous cystadenoma was identified in the left adnexa. A mixed solid and cystic vascular mass measuring 107 x 81 x 86 mm was identified in the right adnexa. Appearances suggested an ovarian malignancy. A CT scan was performed and reported a suspicious 113 mm solid right ovarian mass, marked endometrial thickening and an unusual cervical appearance. This raised the possibility of a secreting sex cord stromal ovarian tumour. A 170 mm multilocular minimally complex left adnexal cystic mass was also noted. No measurable lymphadenopathy or evidence of metastatic disease was seen. The patient was admitted and had an emergency hysterectomy, bilateral salpingo-oophorectomy and omentectomy. It was later confirmed that she had a granulosa cell tumour of the ovary, which secretes the female hormone oestrogen. This causes symptoms such as abnormal vaginal bleeding and endometrial hyperplasia, which was this patient's original presentation. Adult granulosa cell tumours are diagnosed in middle-aged and older women; typically occurring during the perimenopausal or postmenopausal years. They are slow growing malignant tumours that can spread locally within the peritoneum and may recur in 25% of patients.

How accurate is ultrasound in diagnosing molar pregnancy?**A Rourke**

Nottingham University Hospitals, Nottingham, UK

Abstract

Diagnosing molar pregnancy with ultrasound is challenging. The project aim was to assess the accuracy of Trust A's ultrasound service in diagnosing molar pregnancy. The objectives were to find how many histologically proven cases of molar pregnancy were suspected after ultrasound examination, and analyse the data collected to determine whether current practice at Trust A needs to be adapted. This project is a retrospective single centre study with a descriptive design. A literature review, including critical appraisal of literature, demonstrated the relevant previous research and provided a clear rationale for the project. Data were collected from

1 January 2015 to 31 December 2021. All cases of histologically diagnosed molar pregnancy at Trust A were found. The ultrasound report for these cases was accessed to determine if a molar pregnancy was suspected after ultrasound examination. An image review was performed to assess whether pre-determined sonographic features of molar pregnancy were demonstrated in cases of partial molar pregnancy (PMP) where a molar pregnancy was not diagnosed on ultrasound examination. Data collection found 108 participants with a histologically proven molar pregnancy. 34% were complete molar pregnancy (CMP) while 66% were PMP. 92% of CMP were diagnosed at the ultrasound examination while 27% of PMP were detected on ultrasound. The image review found that 84% of the cases where a PMP was undiagnosed by ultrasound had sonographic features of the condition. The results showed that Trust A's ultrasound detection rates are consistent with the studies found in the literature. However, the diagnoses of PMP were at the lower end of the range when compared to previous research. This suggests that diagnosing a PMP with ultrasound could be operator dependent, an argument supported by the image review, and that practice at Trust A could be adapted to improve detection rates.

Interesting cases of the three-dimensional (3D) uterus/endometrium in patients with suspected infertility

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Abstract

NICE [2017] identifies 1 in 7 heterosexual couples are affected by infertility;¹ furthermore, WHO [2020] estimates that globally, 48 million couples and 186 million individuals live with infertility.² It is imperative that infertility is addressed, as individuals and couples have the right to a family. Although sometimes unexplained, multiple factors can affect fertility including uterine disorders and endometrial pathology. Two-dimensional (2D) ultrasound is one of the first diagnostic tests to be requested in suspected infertility. Assessing the uterus/endometrium with the addition of 3D ultrasound gives further detail and accuracy, aiding the ultrasound practitioner to make a diagnosis. Our pictorial review identifies multiple pathologies including an endometrial polyp, submucosal fibroid, septate uterus, arcuate uterus and adhesions. All patients included in the review attended the ultrasound department for a pelvic ultrasound examination (transabdominal and

transvaginal) due to primary/secondary infertility. After initially suspecting pathology by 2D ultrasound, the uterus and endometrium were further assessed using 3D ultrasound. The review makes a comparison of the 2D and 3D images. Technique for obtaining the optimal image including settings and knobology is also discussed. Ultrasound is one of the first tests requested in patients with suspected primary/secondary infertility. Its role in assessing the uterus and endometrium is crucial. The addition of 3D ultrasound provides further detail and accuracy when an initial anomaly or pathology is suspected by 2D ultrasound. An ultrasound practitioner must recognise the appearances of pathology/anomalies on 3D assessment to give further information to the referring clinician. Appropriate training should be given by application specialists or from senior staff who are proficient in this technique.

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'Is three-dimensional ultrasound or magnetic resonance imaging more effective in the diagnosis of congenital uterine anomalies?'

M Bual

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Abstract

Congenital uterine anomalies (CUAs) are embryological malformations of the uterus. Infertility, recurring miscarriage, and fetal intrauterine growth restriction are common symptoms of CUAs. Accurate diagnosis of the type of CUA is vital for patient management. The Royal College of Obstetrics and Gynaecologists (RCOG) considers three-dimensional transvaginal ultrasound (3D TVS) to be the gold standard for diagnosing and classifying CUAs because it is more reproducible and less invasive than other imaging and surgical diagnostic modalities.¹ Trust A currently only indicates Magnetic Resonance Imaging (MRI) when diagnosing CUAs. However, 3D TVS may provide a more accessible and cost-effective pathway for patients. A systematic literature search has been conducted using the seven most relevant healthcare databases: Cinahl Complete, Directory of Open Access Journals (DOAJ), EBSCO Medical Databases, Embase,

Medline, Science Direct and Scopus. Boolean search operators were utilised and results were refined to the past six years (2016–2022) to increase relevance to practice and generalizability. This resulted in three primary articles. Three-dimensional ultrasound is a viable alternative to pelvic MRI, it is less expensive than MRI and patients tolerate it better. 3DTVS has been reported to have strong diagnostic agreement with MRI, with one study suggesting that 3D ultrasound is superior in identifying and categorising CUAs. The literature review demonstrated that the RCOG recommended practice is substantiated by current research. By utilising 3DTVS, local gynaecology services can assist, manage and share the workload of the imaging department, making these services more beneficial for both the patient and the practitioner. Sonographer progression would be aided by increased work responsibilities. Trust A should integrate 3D ultrasound into the CUA patient pathway to improve patient care by supplying more accurate diagnostic equipment. More research on larger cohorts with more challenging CUAs is still required.

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The role of a standardised ultrasound reporting template to report and diagnose deep infiltrative endometriosis

R Bird

Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK

Abstract

Endometriosis affects up to 1 in 9 females and can take on average 8 years to diagnose.^{1,2} The most common symptoms of endometriosis include chronic pelvic pain, painful bowel movements and infertility. Whilst NICE guidelines advise an ultrasound scan for when symptoms become severe or when intervention is unsuccessful,³ there is no national guidance on how practitioners should scan for endometriosis. This study aimed to evaluate the use of a structured investigation and reporting template when diagnosing patients for potential endometriosis with ultrasound. Diagnostic yields of both pre- and post-template assessments for sonographers and consultant radiologists were compared and analysed. Their experiences of using the template were recorded and discussed. In total, 355 patients were included

in the study and statistical analysis calculated to evaluate reliability of the results. Diagnostic yields were improved following the implementation of the template. There was no statistical correlation between age and prevalence of endometriosis without or with the template ($P = 0.166$ and 0.58 respectively). There was statistical correlation between increased age and prevalence of adenomyosis either without or with the template ($P = 0.00069$ and $P = 0.000074$ respectively). The template increased confidence in diagnosing endometriosis, but caused time pressures. Sonographers' diagnostic yields increased with the use of a structured scan method and report template. They did, however, feel time pressure in using these, so adjustments would be needed to scanning lists as well as further training and familiarisation with the template.

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Case report: Pelvic phleboliths as a diagnostic challenge for the ultrasound specialist

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Abstract

Phleboliths are calcified intravenous blood clots that may result from changes in coagulation or fibrinolytic activity, from local venous damage, or a combination of these factors. They may mimic ureteric calculi, and are also encountered frequently in venous malformations. The purpose of our presentation of the clinical case is to highlight the value of ultrasound in the differential diagnosis of pelvic phleboliths. Ultrasound examination was performed on a Canon Aplio machine using B-mode, Doppler, convex, linear and endocavitary probes. A 72-year-old woman was admitted to hospital with suspected stones in the distal left ureter. There were no significant medical conditions. Her history included varicose veins

of the lower extremities, post thrombophlebotic syndrome and analysis of urine without changes. Transabdominal examination using a convex probe did not identify dilatation of the urinary collecting system, and urine was present in the bladder. Transvaginal examination showed both distal ureters were empty, but the pelvic venous plexus on the left contained several hyperechoic round inclusions (ring-calcified lesion) with acoustic shadowing and approximate diameters of 3 to 7 mm. Polypositional scanning and Doppler examination allowed us to reliably verify the presence of phleboliths. According to the literature, such a finding is diagnosed incidentally and does not require treatment. These lumps are more common in women aged over 40 and are associated with constipation and straining, which can damage pelvic veins, diverticulosis, varicose veins, and pregnancy. Histologically, phleboliths are composed of small blood clots in a vein that harden over time due to formation of laminated fibrous tissue and calcification. There are many cases of diagnostic errors and repeated examinations for the differential diagnosis of phleboliths and stones in the urinary tract. Transvaginal or transrectal visualisation is a highly specific method for clarification and a good alternative to X-ray, MRI and CT examination.

Adenomyosis: What the sonographer needs to know

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Abstract

Adenomyosis is a benign gynaecological condition defined as growth of endometrial tissue within the myometrium.¹ It is a condition with varying symptoms resulting in a challenging clinical and imaging diagnosis. Ultrasound is the first line imaging modality for adenomyosis. Technological advances within ultrasound have led to an increase in diagnosis compared with the formerly invasive diagnosis based on histopathology. Whilst transabdominal ultrasound has a limited role to play, transvaginal ultrasound (TVUS) has the capability in the hands of an experienced operator.¹ There is no consensus amongst published literature regarding the pathogenesis of adenomyosis.¹ Patients can present with abnormal uterine bleeding, infertility and pelvic pain, however, in a small proportion it can be asymptomatic. The clinical bimanual examination accompanied with a detailed history raises suspicion of adenomyosis. Most physicians subsequently look to confirm their suspicions with ultrasound. TVUS allows for a dynamic scan assessing organ mobility and

patient pain. Sonographic appearances suggestive of adenomyosis are the following: globular uterus, myometrial cysts, myometrium thickening (focal or diffuse), "venetian blind shadowing", heterogenous myometrium, echogenic striations and poor endometrial-myometrial junctional zone. The presence of increased vascularity of the myometrium and translesional vascularity can be seen in patients with adenomyosis. Adenomyosis can also be evident with comorbidities such as endometriosis or fibroids.² MUSA's (Morphological Uterus Sonographic Assessment) goal was to provide standardisation for assessing and reporting adenomyosis. Whilst there is still no consensus regarding the most specific sonographic sign for adenomyosis, there is agreement the more sonographic signs evident increases the predictive value.¹ There is a need for continued awareness of the condition amongst sonographers and its associated sonographic signs.

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Imaging of urethral and sub-urethral masses - The University Hospitals of North Midlands NHS Trust experience

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Abstract

Swelling around the urethra and vagina is a common clinical presentation in females and can represent a range of differentials including female urethral diverticulum and periurethral masses. Patients often present with non-specific signs and symptoms and physical examination can be unreliable. Although distinguishing between urethral and vaginal wall masses can be clinically challenging, it impacts on whether a gynaecology or urology referral is indicated and hence completely alters the patient's future management. Therefore, being familiar with optimal imaging techniques as well as identifying the key imaging features of urethral and periurethral disease in female patients is an increasing requirement for radiologists. Imaging the female urethra with magnetic resonance imaging has improved greatly and provides high resolution multiplanar images, allowing for greater diagnostic accuracy. However,

there is currently emerging technology using 3D endovaginal ultrasound (EVUS) to assess and evaluate the structures of the pelvic floor and related pathology. In our centre, 3D EVUS is used with a high-frequency (12-16 MHz) endocavity transducer that provides automatic 360° image acquisition. Providing high 3D resolution and diagnostic ability, we have found that it has, at times, negated the need for costly and time consuming MRI. As the use of 3D EVUS is poorly documented in the literature, the objective of this presentation is to discuss ultrasonographic techniques and its advantages in imaging females with sub-urethral masses.

Case report: Haematocolpos

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Abstract

A 17-year-old patient was referred to the Ultrasound Department by her GP because despite starting normal puberty development several years previously, she had not yet had a period. The patient did not suffer from any pelvic pain but occasionally noticed a painless swelling that would disappear after a few days. She had been investigated for an eating disorder despite having stable weight and normal BMI. The GP requested an ultrasound scan for primary amenorrhoea. A transabdominal pelvic ultrasound scan was performed, and demonstrated a distended vagina, containing diffuse low-level echoes measuring approximately 18 × 10 × 11 cm. Appearance suggested a haematocolpos. An MRI scan was also performed and reported that the vagina was grossly distended measuring approximately 20 × 10 × 10 cm. The report confirmed a haematocolpos showing good agreement with the ultrasound scan. The patient was admitted for a procedure to open the hymen or hymenotomy in order to allow normal menstruation. Examination under general anaesthetic revealed a thick transverse vaginal septum. This was excised and approximately 1000 ml of old retained menstrual blood was drained. The consultant reported the reconstruction went well. This resulted in a complete resolution of her symptoms. Further management advised follow up with physiotherapy for vaginal dilation consideration if needed to maintain the vaginal entrance. Haematocolpos is a rare medical condition where the vagina is filled with menstrual blood. It is usually caused by a combination of menstruation with an imperforate hymen. Abnormalities in the development of the Müllerian ducts result in imperforate hymen.

Head and Neck

Sonographer led one-stop neck lump clinic – 3 year review

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Abstract

A sonographer led one-stop neck lump clinic was introduced three years ago to support patient flow, improve two week wait times and provide quicker access to fine needle aspiration (FNA). The clinic was designed with a biomedical scientist support to provide immediate results regarding FNA adequacy. The objective of the audit was to provide an overview of the service and to identify any further areas of development. A retrospective audit was performed of all patients who attended the one-stop neck lump clinic within the 3-year period. CRIS records were used to obtain details of the scan type, any pathology identified, who performed the scan and whether FNA was performed. Histology of all FNAs was reviewed to form part of the final diagnosis and provide results on adequacy. Each 12-month period was reviewed and compared; special consideration was made to see if the service had been affected by COVID-19. Numbers attending the clinic over the 3-year period have remained similar with no impact due to COVID-19 other than the initial reduction in the first two weeks of the first 'lockdown'. The number of patients attending who had significant/malignant pathology also remained stable over the three years (approx. 20% of all attendees) although there seems to have been a shift with more thyroid pathology in year 3. The clinic was not significantly impacted by COVID-19 and is continuing to provide a good level of service to support the ENT team with quick access to FNA also enabling discharge of patients with benign findings at the same appointment.

Can a sonographer be trained to be proficient in head and neck ultrasound with fine needle aspiration cytology? The implementation of a head and neck sonographer and the impact on the service

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Abstract

Ultrasound-guided fine-needle aspiration cytology (FNAC) is a commonly performed procedure and often

the first line of diagnostic testing for patients presenting with a head and neck swelling. This technique yields a high accuracy rate and is recommended by NICE guidance. The head and neck ultrasound waiting list, consequently, has always highlighted capacity issues and this became more pronounced during Covid-19 due to the temporary cancellation of clinics. The aim of training a sonographer was to reduce the ultrasound waiting list and allow the radiologists more time in other areas, such as reporting cross-sectional imaging. The aim of this study was to document how training was undertaken, and whether FNAC success rates were comparable to those performed by radiologists. In-house training was undertaken over a 12-month period by three consultants in an acute and outpatient setting. A retrospective audit was performed of FNAC outcomes, comparing sonographer and radiologist non-diagnostic rates over an 18-month period. Statistics of the ultrasound waiting list were also analysed over this period. 250 FNAs performed by a sonographer were analysed. Results showed a 71% conclusive rate. This was compared to a previous 4-year audit, undertaken by radiologists within the department. The comparison study analysed 1222 FNAC samples and demonstrated a non-diagnostic sample of 27.2%. This was compared with the RCR live audit, which expects a 70% diagnostic rate for FNAC samples of the thyroid. This study demonstrated comparable FNAC results between a sonographer and consultant radiologist. Statistics also showed a decrease in the ultrasound waiting list, from 310 patients to 114 patients in the past 18 months. It is possible to train a sonographer to become proficient in head and neck scanning with FNAC and for cytology rates to be comparable to that of a radiologist. The study showed a positive impact on the ultrasound waiting list.

Thyroid U-scoring and subsequent fine needle aspiration cytology: A quality improvement project

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Abstract

The British Thyroid Association (BTA) 2014 guidelines recommend assigning a U-score to thyroid nodules based on their sonographic characteristics and advise which nodules require ultrasound-guided fine needle aspiration cytology (FNAC) based on the U-score. They also recommend which sampled nodules require further management, including repeat FNAC, based on their cytology results (Thy-score). This has implications in terms of time, cost and on the

two-week rule pathway. This quality improvement project assessed compliance with these guidelines. Thyroid ultrasound reports were reviewed for a U-score and whether FNAC was subsequently performed in the appropriate patients based on the U-score in line with the current BTA 2014 guidelines. A change was proposed by educating sonographers and placing laminated educational U-scoring guidelines with corresponding ultrasound examples in all ultrasound rooms to increase compliance with the guidelines with a target of 100% of ultrasound reports to include a U-score and FNAC to be performed in U3-U5 nodules only. Before the intervention, 61 out of 132 scans (45%) included a U-score and 9 out of 12 patients had FNAC when radiologically indicated. Three patients who did not have FNAC died or were needle phobic. After the intervention, 44 out of 78 scans (56%) included a U-score. 11 out of 11 patients either had or were referred for FNAC when radiologically indicated. The 100% target was not met but there was an increase in reports with U-score suggesting more compliance with the BTA 2014 guidelines. FNAC are performed in appropriate patients.

Case report: The role of ultrasound in a radiolucent ingested fish bone

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Abstract

A 56 year old man presented to A&E two weeks after the ingestion of a fish bone with throat pain, swelling and systemically unwell. He underwent a CT neck and chest which did not demonstrate any radiopaque foreign body (FB) but did show an infrahyoid collection, inseparable from the left thyroid lobe. An ultrasound performed at the time also did not demonstrate a FB but showed a large organised collection within the thyroid, and suppurative thyroiditis was confirmed on cytology. The patient was managed conservatively and improved; however, a follow-up ultrasound demonstrated a linear hyperechoic lesion within the left thyroid lobe, thought to be a fish bone. A fish bone sitting on top of the left thyroid lobe adjacent to the left vagus nerve was confirmed during surgery. Traditionally, plain film radiography and cross-sectional imaging is the choice of investigation for ingested foreign bodies, but we are able to demonstrate how the use of ultrasound can help in complex cases where the ingested foreign body is radiolucent. We would also like to discuss the relative radiopacity of common UK fish bones and why there is a difference in radiopacity.

Hamstring muscle architecture using wide field of view ultrasound: A reliability study

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Abstract

The prevalence of hamstring strain re-injury is high among field sport athletes, and ranges from 14%-34% within the same competitive season. Ultrasound is the most commonly used medical imaging modality to assess the architectural characteristics of skeletal muscle. However, acquisition of hamstring muscle architecture is challenging and operator dependent. The aim of this investigation was to assess the reliability of wide field of view (WFOV) ultrasound (US) to quantify the muscle architecture of the hamstring muscles. Twenty male athletes were sonographically assessed on two separate occasions. Static ultrasound images were collected by a single sonographer using a 92 mm linear transducer to assess the architectural characteristics (muscle length, fascicle length, pennation angle and muscle thickness) from two distinct locations of the BFLh and SM of the left limb. Muscle length and thickness were assessed in the BFsh and ST muscle of the left limb. Intra-class correlation assessed intra-rater reliability. Both muscle (ICC = 0.99; SEM = 4.3-6.6 mm) and fascicle (ICC = 0.92-0.98; SEM = 1.1-2.4 mm) length were measured with excellent intra-rater reliability. Muscle thickness was measured with excellent reliability (ICC = 0.9-0.96; SEM = 0.91 mm-1.4 mm) for all hamstring muscles except for the proximal segments of the BFsh (ICC = 0.85; SEM = 0.84 mm) and ST (ICC = 0.88; SEM = 0.82 mm) which measured good reliability. Pennation angle was measured with good reliability (ICC = 0.77 - 0.87; SEM = 1-1.6). Static WFOV is a reliable ultrasound technique to quantify the architectural characteristics of the hamstring muscles.

Obstetrics

Case report: Live interstitial ectopic pregnancy

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Abstract

An ectopic pregnancy occurs when a fertilised ovum implants outside the uterine cavity. 96% of all ectopic pregnancies will be located in the

fallopian tube. Rarely, 3-5% of ectopic pregnancies may present in other locations such as abdominal, cervical, interstitial or ovarian. An interstitial ectopic pregnancy occurs when the fertilised ovum implants in the proximal portion of the fallopian tube located within the myometrium. Transvaginal ultrasound scanning (TVUS) is a good method for early pregnancy assessment due to the increased image quality. Three-dimensional transvaginal ultrasound (3DUS) may be of benefit and aid diagnosis due to its increased image resolution. A 37-year-old pregnant patient was referred to the early pregnancy assessment unit with vaginal bleeding and back ache. Ultrasound revealed a normal endometrial thickness measuring 4 mm, with no evidence of an intrauterine or ectopic pregnancy. In view of the ultrasound findings and the positive hCG levels, the patient underwent a diagnostic laparoscopy to assess for an ectopic pregnancy, which showed no evidence of an ectopic pregnancy. The patient re-presented four weeks later as her pregnancy test remained positive. TVUS again revealed a normal endometrial thickness, however, at the right lateral border of the uterus a live ectopic pregnancy was identified. Due to the rarity of interstitial pregnancies, this form of ectopic pregnancy can be misdiagnosed as a viable intrauterine pregnancy. Having highly trained sonographers scanning the patient will help reduce misdiagnosis. 3DUS can improve general diagnosis due to the increased image quality. However, in this case there was no sign of pregnancy at the initial ultrasound scan, therefore at this stage using 3DUS would not change the clinical diagnosis. On follow up TVUS, the pregnancy had developed and thus was visible and demonstrated classical signs of an interstitial ectopic pregnancy. Using 3DUS would not have added to the clinical diagnosis.

POPS2 Patient and Public Involvement (PPI): Avoiding tokenism and gathering meaningful feedback to shape research delivery

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Abstract

The importance of PPI (public and participant input) is widely recognised and enables participants to shape research. Continuous PPI is often a requirement of funders and ethical bodies. The challenge for study delivery is finding a way to undertake PPI in a meaningful way. The aim of this study was to collate the views of POPS2 (Pregnancy Outcome Prediction Study 2) participants to identify areas of good practice, and those requiring improvement to enhance the

participant experience. POPS2 is a prospective study of nulliparous women with a singleton pregnancy which uses ultrasound scans and biochemistry to determine whether screening and intervention for preeclampsia or fetal growth restriction at term can correctly identify women at increased risk of complications and improve the outcome for mother and infant. Feedback from participants was collected by a participant experience survey. The survey was given to 50 consecutive participants following their final study visit in late 2021. Views on waiting times, environment, ease of access and interactions with sonographers were sought. Responses were overwhelmingly complimentary; however, the following learning points were identified: (i) Women needed reassurance that reporting of third trimester growth is not indicated in low-risk pregnancies; (ii) Research scans should be co-ordinated with clinical scans; (iii) Communication about upcoming appointments should be improved. The findings of the survey were disseminated to study staff. In response to the learning points identified, additional staff training, as well as changes to consent messaging and pre-appointment text messages were implemented in 2022. The survey will be repeated in the summer 2023 to monitor the impact of these changes and identify any new issues that may have arisen. By adopting a cyclical approach, it is anticipated the study PPI will remain meaningful for both participants and study team throughout the study and avoid it becoming a tokenistic exercise.

Paediatrics

Audit of patients for right iliac fossa pain with clinical concern for appendicitis referred for ultrasound: Do the ultrasound findings correlate with surgical findings?

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Abstract

The aim of the study was to determine whether ultrasound findings correlated with surgical findings comparing to contemporary research findings. Abdominal pain is a common complaint in children with multiple pathologies ranging from malrotation to Meckel's diverticulum. Appendicitis is a common surgical complaint, with 8%¹ of all people having lifetime risk, peaking between the ages 10 and 30 years.² Accurate diagnosis can be challenging.³ First line investigation in children, other than blood tests, includes ultrasound. Many research studies show varying sensitivity and specificity, however, many of

these research studies include adult patients. This was a retrospective audit carried out between 1st January 2020 and 31st December 2021. The sample comprised 132 patients aged between 0 and 16 years. These children all had an ultrasound scan and were then followed up by a surgical review which consisted of clinical correlation to determine whether to proceed to surgery. Of the 132 children, 29 children had surgical findings of appendicitis. 21 of these patients also were reported as having ultrasound findings of appendicitis (true positive). 8 patients had a negative ultrasound, i.e. not having imaging appearances suggesting appendicitis, but were found to have surgical findings of appendicitis (false negative). There was one false positive and 102 true negatives, giving a sensitivity of 72% and specificity of 99%. This audit has shown that there is a high specificity (99%) for diagnosis of appendicitis on ultrasound and a sensitivity of 72%. This range corresponds to studies ranging from specificity of 85% – 98% and sensitivity between 55 – 96%.^{4,5,6} Over a 12 month period 29 children were found to have appendicitis.

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Give it a whirl: Sonographic signs to look out for in intermittent testicular torsion

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Abstract

Testicular torsion is a medical urological emergency and one of the most common causes of acute paediatric scrotal pain. Testicular torsion is defined as twisting of the spermatic cord resulting in testicular perfusion disruption. There are different types of torsion:

complete, partial or intermittent.¹ For intermittent testicular torsion, clinical presentation includes acute unilateral scrotal pain with spontaneous resolution. The cause of intermittent testicular torsion is usually intravaginal and caused by the bell clapper deformity. The bell clapper deformity is a condition where the tunica vaginalis envelopes the testicle, epididymis and distal spermatic cord. As a result, there is no posterolateral attachment of the testicle to the scrotal wall allowing the testicle to freely twist.² Sonographic diagnosis of intermittent testicular torsion using colour Doppler proves very difficult as a patient may have preserved or only subtly decreased intratesticular blood flow. Sonographic appearances that are suggestive include the “whirlpool sign” (a spiral twist of the spermatic cord) and presence of a pseudomass. This sign is highly suggestive even in a testicle with normal blood flow. It can also be seen in complete torsion. A testicular volume discrepancy or abnormal horizontal lie of the testicle along with the patient’s clinical history can additionally raise suspicions. The probability of salvaging the testicle and sonographic appearances are directly proportional to the onset of clinical symptoms.² Ultrasound diagnosis is very useful in the differential diagnosis of acute paediatric scrotal pain. When a diagnosis of intermittent testicular torsion is made, patients undergo surgical exploration for detorsion and orchiopexy.³ It is important to identify any type of testicular torsion as rapidly as possible due to ischemic changes and associated testicular damage.

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Physics

A modified Edinburgh Pipe Phantom to quantify the effect of slice thickness on the imaging performance of curvilinear probes

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Abstract

We have previously demonstrated the usefulness of the Edinburgh Pipe Phantom (EPP) to measure the imaging performance of over 350 clinical and preclinical ultrasound transducers over a frequency range from 2.5-55 MHz using the concept of the resolution integral (R). Recently, we have demonstrated the impact of slice thickness on the imaging performance of linear and matrix arrays and shown that R increased by a factor greater than 2.5 when slice thickness effects were removed. This study describes the manufacture and testing of a modified EPP to quantify the effect of slice thickness on R for curvilinear probes. A phantom was constructed of two identical wedges of tissue-mimicking material (TMM) of height 250 mm and width 100 mm. The incline of the face of each of the wedges was at 40°. The wedges were placed in a plastic box of degassed water and separated from each other using strips of polypropylene at distances between 0.42 mm and 2.5 mm creating water-filled slots of these dimensions. Since the width of the wedges (100 mm) was greater than the probe slice thickness the ability to image the slots was dependent primarily on the probe’s axial and lateral resolution. For each probe, the measurement of R obtained from the wedge phantom was compared to that obtained from the EPP. Two curvilinear probes were tested: Siemens Acuson S2000 6C1 HD (1-6 MHz) and 4C1 (1-4 MHz). R increased by a factor of 3.3 (6C1) and 3.5 (4C1) when measured using the wedge phantom compared to the EPP. This increase illustrates the impact of slice thickness on the imaging performance of curvilinear ultrasound transducers and highlights the need for elevational focusing of transducers to improve imaging performance.

Point of Care Ultrasound

How to use ultrasound for vascular access

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Abstract

NICE guidelines state that wherever possible ultrasound should be used to guide vascular access when there is no visible vein for access. We present how to use ultrasound to guide vascular access. Special reference is made to the needle, probe, and image orientation. A reference to homemade phantoms and models for practice will be made.

Point of care Echo

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Abstract

Ultrasound is excellent at examining the heart. We present how to use ultrasound in an acute setting such as ITU and resus A&E. Point of care ultrasound echo can quickly and accurately determine left ventricular function, right heart dilatation for pulmonary emboli and the presence of a pericardial effusion. In an acute setting this information adds to the clinical picture and is of great benefit to the doctor and patient.

Ultrasound in A/E resuscitation

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Abstract

We present the use of ultrasound in the resuscitation room. We have found ultrasound useful to examine acute medical patients including imaging the heart for left ventricular function, right heart dilatation and pericardial effusion, imaging the abdominal aorta and imaging the chest in the relevant patients. We present case examples. Also, at our hospital we have taught A/E doctors to use ultrasound having regular teaching sessions and mentoring. We have found ultrasound useful to give important information and improve patient care in the acute setting.

Professional Issues

Acoustic Times or . . . Scan you believe it! - A quality publication. Ultrasound governance: communicating standards during a pandemic

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Abstract

Introducing new governance processes into a multi-site ultrasound department during a pandemic led to the re-thinking of the models of communication used to share governance objectives. The introduction of peer review audit can be challenging for staff. Clear communication is vital to ensure staff are not threatened by the process and are able to use it as a learning opportunity to shape their practice and development, thereby improving patient safety. A

monthly newsletter "Acoustic Times" was introduced to explain the processes and changes giving the opportunity to provide the evidence base and links to national guidance. Peer review audit and learning meetings were introduced and held virtually across sites to identify and share any individual or group learning points. Processes and documents were either re-designed or introduced, with supporting rationale and evidence provided through the newsletter including: evidence based protocols; standard setting; peer review audit, including supporting learning outcomes and CPD; actionable reporting; preceptorship; service user feedback; and equipment QA. Further supported learning was provided on critical reflection, specific focus on technical aspects of clinical examinations, sharing of external learning events, CPD and in-house ultrasound training. Benefits of the newsletter include: more focus on improving consistency of practice and setting standards; faster reporting of audit findings and re-audits; and improved engagement with consultant colleagues. It also provides an accessible record of the development of governance processes which has been shared with sonographers in other organisations. Setting and communicating clearly defined quality standards and protocols is key to the design of safe working practices and patient safety in healthcare environments.¹ Open and honest governance processes with clear, accessible and useable documentation are key in staff engagement and ownership of quality improvement.

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The role of ultrasound simulation in increasing clinical placement capacity for BSc Radiography students – How did the students feel?

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Abstract

A radical reform of diagnostic services has been recognised in both the NHS Long Term Plan (2019) and the Richards report (2020).^{1,2} Subsequently, a recommendation was made to train an additional 4,000 radiographers above those training posts already facilitated. Radiography training requires minimum clinical placement hours (1300) to meet the criteria for Health and Care Professions Council

registration to facilitate employment in the NHS. With a limited number of clinical placements available and demand for radiographers increasing, educational establishments need innovative practical training to meet these requirements. Simulation can assist with this challenge. The advent of reasonably priced handheld transducers makes ultrasound a suitable area for simulation, freeing up placement time in the hospital environment and potentially increasing student capacity. This study examines student perceptions of ultrasound simulation. This was a quantitative and qualitative study using Likert scales and open-ended questions to demonstrate the impressions of second and third year radiography students at Keele University, examining the role of ultrasound simulation to complement or potentially replace ultrasound training in the hospital environment. Following simulation training, 100% of students considered simulation training met expectations, increased knowledge and would recommend to their peers. 80% of students responded with training complementing placements with 50% of students considering university ultrasound training could replace this provision in hospital environments. Ultrasound simulation training within the university has the potential to partially replace current clinical training in the hospital environment. With increased demand for clinical placements, this could be an option to increase capacity.

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Integrating flipped/blended learning into the ultrasound clinical governance session

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Abstract

Education and training is one of the pillars of clinical governance that helps to maintain and improve the quality of patient care within the NHS. The impact of COVID-19 has disrupted the delivery of governance sessions. Original large departmental face-to-face sessions have changed because of social distancing, staff sickness or staff having to isolate. Furthermore, part-time staff often miss

clinical governance sessions and do not have the opportunity to maintain training compared to full time staff. The need to deliver education and training is still crucial for staff development and optimising patient care and safety. This poster explores how flipped learning combined with blended learning that is used within academic institutions can also be used to deliver clinical governance within the ultrasound department. Considering the IMPALA framework and its components, the following format is an alternative provision that could be used to deliver governance: online presentation including a video/audio clip; self-directed study/activity; face to face or online session. The format would ideally suit new guidelines being introduced into a department, for example the applying O-RADS to images. Similarly, the format would suit education and training in case studies, protocols and even departmental quizzes or discussion forums. Including video/audio allows staff to feel in touch and be included with their peers despite circumstances potentially not allowing all to be present. Pillars of governance are crucial to deliver optimal patient care. The education component is also very important to ultrasound practitioners. CPD is continuous and staff should be provided with equal opportunities despite working patterns or absence. Alternative methods to deliver governance sessions should be used as well as the traditional departmental/face to face session. The given format allows the ultrasound department to give education and training to all staff maintaining staff CPD and optimal patient care.

Everybody hurts - What can physical health professionals learn about how mental health professionals support their own emotional resilience and mental health?

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Abstract

The physical aspects of ultrasonography, difficult posture with prolonged pressure exertion, have been extensively researched and addressed with advances in machine ergonomics, operator awareness of posture and positioning and workplace tools to identify musculoskeletal problems. The mental stresses are less well recognized and have only recently started getting investigated. Ultrasonography is a mentally challenging activity requiring long periods of intense concentration, empathy and communication of complex and often difficult information to patients

and clinicians, all of which carries an emotional toll. Practitioners are also under increasing time and caseload pressures exacerbated by COVID recovery and chronic fatigue from two years of pandemic. A survey of UK obstetric sonographers showed 92.1% and 91.0% met the burnout thresholds for exhaustion and disengagement, respectively).¹ While many Trusts provide training to support physical health, few radiology departments educate their staff on emotional resilience or offer regular support to either promote or maintain mental wellbeing. Training, when available, is often focused on the receiver and not on the impact of vicarious traumas experienced as a result of repeatedly discovering/delivering difficult outcomes to patients on a regular and prolonged basis. Few health professionals are face-to-face with their patient at point of significant discovery whether that information is imparted to the patient or not. Mental health professionals have adopted a trauma-informed stance into their working practices. This has not only informed the direct clinical work with patients but is also evident in the way the workforce is supported by the trust. Regular supervision, reflective practice and debriefs are required and monitored by the trust, based on research in clinical psychology to inform best practice. Some of these practices could be applied to physical health professionals to address some of the emotional burdens experienced as part of day-to-day delivery of care.

Reference

1. Skelton E, Harrison G, Rutherford M, et al. UK obstetric sonographers' experiences of the COVID-19 pandemic: Burnout, role satisfaction and impact on clinical practice. *Ultrasound* 2023; 31: 12-22.

The impact of the COVID-19 pandemic on clinical guidance, risk assessment and support for UK obstetric sonographers

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Abstract

UK obstetric sonographers adapted their working practices during the COVID-19 pandemic in response to new guidance issued by professional organisations, and requirements for on-going departmental risk assessments. This study aimed to provide an insight into the implementation of this guidance, completion of risk assessments and perception of support within UK obstetric ultrasound departments during the pandemic period. Obstetric sonographers working in the UK (n=138) used the Qualtrics XM™ platform

to complete an anonymous, online, cross-sectional survey about their working experiences during the pandemic. Participants responded to closed questions about national guidance, risk assessments and their perception of support whilst providing fetal ultrasound screening services. Respondents provided additional detail about their experiences in these areas via free-text boxes. Over 90% of respondents were aware of, or had read guidance issued by professional organisations, although sonographers rated the overall usefulness of new guidelines at an average of 5.2/10 (where 0 = not useful at all, and 10 = extremely useful). Challenges for the implementation of guidance in departments were also identified, mostly related to the clinical working environment, including limitations of physical space (76.3%), time constraints (67.5%) and ventilation (61.3%). Most sonographers (77.2%) were aware that a departmental risk assessment had been undertaken, with waiting areas, scan rooms and clinically vulnerable staff highlighted as the most concerning factors. Sonographers felt most supported by their ultrasound colleagues (83.5%) and line managers (41.2%). They felt least supported by senior management and leadership personnel (60.8%), other antenatal colleagues (51.5%) and professional organisations (41.2%). Whilst most sonographers were aware of published COVID-19 guidance, challenges for its implementation in clinical departments were identified. Local risk mitigation strategies often did not prioritise the scan room environment, despite it being highlighted as a concern. Support from the wider, senior service team and professional organisations will be essential to facilitate post-pandemic recovery of the workforce.

Our journey from the Peripatetic Ultrasound Trainers to the Ultrasound Training Academy – HEE (South East)

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Abstract

In 2016, an innovative project of three ultrasound trainers evolved to support multi-professional trainees in Obstetric and Gynaecology ultrasound across the Wessex region. The aim of the project was to deliver a high-quality ultrasound training programme. One of the project's successes resulted in establishing the Sonographer Training Network Forum which allowed ultrasound leads from seven Trusts to meet and share ideas, which ultimately led to the development of regional ultrasound guidelines.

From 2016 to early 2020, we have supported 75 trainees in O&G ultrasound. The vision was to create a dedicated ultrasound training centre to support trainees in a safe environment. Late 2019, with the support and funding from Health Education England South-East, the plans were set in motion to create the first Ultrasound Training Academy in the South-East Region. A briefing paper was submitted to the Trust Investment Group for approval. Approval from TIG acknowledged the Trust's support in the project as well as supporting the sonography workforce. This began the search for space that would accommodate the academy. Frustratingly, COVID stopped all activities, however, with reflection, COVID gave us the time to plan accordingly for the Ultrasound Training Academy. Without the normal pressure of a time frame, it was an opportunity to find an ideal location as well as purchasing the required equipment befitting the academy. The Ultrasound Training Academy – HEE (South-East) is based in the Princess Anne Hospital (University Hospital Southampton NHS FT). The advantages based within a hospital setting allowed the academy to follow the Trust's governance as well as absorbing some of the capacity from the ultrasound department. We have two ultrasound rooms and a dedicated space for simulation training. We have plans to create a third ultrasound room. We have supported 24 trainees since opening in April 2021.

Education and mentoring - Increasing and improving student throughput

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Tips to maximize student training capacity. Tips to aid student training outside of having a hand on a probe. Training Hubs - facilities and benefits

The value of participatory ergonomics in reducing work related pain in sonographers

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Abstract

Work related musculoskeletal disease (WMSD) has a high prevalence in sonographers globally. In the

Western New South Wales Local Health District, Australia (WNSWLHD), which has a geographical area of 246,676 square kilometres, similar to the size of Britain, sonographers reported a musculoskeletal pain prevalence of 95%. Sonographers in five departments across the district collaborated to identify high risk practices in the workplace and implement potential solutions. The aim of this study was to compare the prevalence of WMSD in a cohort of sonographers before and after implementation of ergonomic changes that were driven by recommendations from the sonographers themselves, using a participatory ergonomics approach. This observational mixed methods study analysed the impact of ergonomic changes on musculoskeletal pain in a small cohort of sonographers employed within the WNSWLHD. Ergonomic changes were made in five workplaces based on identified risks. Pre- and post-intervention musculoskeletal pain surveys were completed by ten sonographers over a period of 18 months and short interviews were conducted to ascertain their perception of the changes in their musculoskeletal pain. Several interventions including job rotation, installation of patient monitors and use of ergonomic scanning techniques were perceived responsible for reported decreases in musculoskeletal pain in the right shoulder and the neck. No interventions were believed responsible for reported increases in pain in the wrists. This was attributed to several work practices including increasing workload and scanning immobile and obese patients. The use of participatory ergonomics was a valuable process to identify high risk work practices and possible solutions. Use of ergonomic scanning techniques is a change which sonographers can implement individually, whereas job rotation and installation of patient monitors would require management support. Participatory ergonomics should be utilised to create a safer work environment for sonographers.

Optimisation of ultrasound equipment using a phantom as part of the Annual Quality Assurance Program (QA)

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Abstract

The UHL Ultrasound Physics Quality Assurance (QA) Annual Program performs a complete set of tests using a test phantom to check for deterioration of equipment performance. However, this testing does not optimise the probes pre-set for its clinical applications. Here, we present a different QA approach where an ultrasound phantom was used to

optimise and measure the performance of ultrasound probes used for vascular applications, enabling the best resolution required for its clinical use and providing measurements to inform uncertainty of measurement parameters. Several probes and machines were tested individually. Settings including pre-set application, gain, focus, TGC and probe working frequency were optimised to achieve the best quality image. The resolution testing was undertaken by the UHL Medical Physics staff for ultrasound QA, with pre-set optimisation and consensus from three AVS clinical vascular scientists using a tissue-mimicking ultrasound phantom (CIRS Multi-Purpose Multi-Tissue Ultrasound Phantom Model 040GSE). The testing was performed under normal ultrasound room conditions with dimmed lighting and reference images saved to PACS. The caliper accuracy routinely checked at annual QA was determined with specific attention to the most detailed measurements performed clinically for temporal artery imaging using the L8-18 hockey-stick probe. Optimised settings for each ultrasound machine and probe were recorded and saved for routine clinical use. Recording the specific axial and lateral resolutions enabled the definition of the smallest structures that can be visualised as a separate individual structure and therefore measurable. This assures that clinically significant small measurements fall within an achievable resolution range. An ultrasound phantom can be a useful tool helping to achieve the best performance of the ultrasound system and ensure that units in clinical measurements are achievable, with a known value for the uncertainty of measurement, therefore improving the quality of the diagnostic service provided to patients.

Case report: Pitfall in ultrasound scanning of the abdominal aorta

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Abstract

Atherosclerosis is a potential cause of abdominal aortic stenosis, which is typically linked to hypertension. The abdominal aortic atheroma, which is frequently calcified, appears echogenic with posterior acoustic shadowing. Some studies have identified that a significant portion of the abdominal aorta is inadequately visualized during the ultrasound scan due to elevated BMI or bowel gas. A 49-year-old female presented with left iliac fossa pain radiating to the flanks. The patient was a smoker. The patient

had a raised white blood cell count of 13.7 and was hypertensive. In the previous ultrasound examination, it was concluded that the aorta was obscured by bowel gas. However, a subsequent Computed Tomography scan showed atherosclerosis with calcified plaques and stenosis of the infrarenal aorta. An ultrasound examination was ordered for further evaluation of the abdominal aorta. Atheroma and calcification were noted from the origin of the superior mesenteric artery down to the distal abdominal aorta. High-grade stenosis greater than 90% with increased peak systolic velocity of 258 cm/s and 305 cm/s were observed in the mid-abdominal aorta and superior mesenteric junction respectively. Both common iliac arteries appeared atheromatous with increased peak systolic velocities of 157 and 140 cm/s respectively. Referral to the vascular surgeon was organized. The calcified aortic atheroma has a strong echogenic appearance with posterior acoustic shadowing, simulating the presence of bowel gas. Furthermore, Doppler ultrasound may assist to assess the vascular lumen and the presence of atherosclerotic plaques which may result in abdominal aortic stenosis, hence evaluating the haemodynamic parameters. With the advancements in contrast-enhanced sonography techniques, microbubbles can now clearly display the adventitia that feeds atherosclerotic arteries and intraplaque neovascularization. Before concluding that the aorta cannot be demonstrated, it is crucial to distinguish between posterior acoustic shadowing and bowel gas.

Vascular

A service evaluation to assess whether referrals into the community deep vein thrombosis ultrasound service meet the agreed criteria and local guidelines

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Abstract

The purpose of this service evaluation was to gain a greater understanding of the community deep vein thrombosis pathway. The three aims were to evaluate whether incoming referrals met the agreed criteria in the local pathway, to determine the positive detection rate of deep vein thrombosis in referrals that did and did not meet the agreed referral criteria and to determine the positive pick-up rate of causative pathology in cases of unprovoked deep vein thrombosis. The referrals were compared against the local agreed criteria which are derived from

National Institute for Health and Care Excellence guidelines. Retrospective data were collected from a radiology database of lower limb venous ultrasound examinations performed in the community setting from March 2019 to March 2020. A sample size of 500 was collected from a database of 1800 examinations. Data analysis was performed to calculate difference in percentages, 95% confidence intervals and significance level. 76.2% of referrals met the agreed criteria and 23.8% did not. In 28.5% of cases, rescans were performed. Positive detection rate of deep vein thrombosis was 9.9% in the referrals that met the criteria and 5.0% in referrals that did not. There was found to be no significant difference between the referrals that did and did not meet the agreed criteria in terms of positive detection rate of deep vein thrombosis. In cases of unprovoked deep vein thrombosis, all patients received an abdominal and pelvis ultrasound, however, no causative pathology was found. This service evaluation found almost a quarter of incoming referrals did not meet the agreed criteria, therefore, sonographers involved in the vetting process require training to reduce poor quality referrals. No causative pathology was identified by performing an abdominal and pelvis ultrasound in cases of unprovoked deep vein thrombosis and this guideline may need review.

Validation of a standardised duplex ultrasound classification system for the reporting and grading of peripheral arterial disease

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Abstract

Duplex ultrasound (DUS), a non-invasive means of arterial mapping, allows for reliable diagnosis of peripheral arterial disease (PAD). One of our authors developed a standardised DUS-based scoring system, devised for rapid detection and reporting of PAD. The purpose of this study is to validate this system, determining diagnostic performance both overall, and per disease severity. 250 participants were recruited, based on diagnosis (N = 125), or absence of PAD (N = 125) from GP registers. Right and left legs per subject were handled as independent readings, determining actual PAD status via ABPI <0.9, and then further grading disease severity using suggested ABPI ranges. Data were excluded if no corresponding ABPI value was obtained per DUS-determination, or if the ABPI reading was >1.4, owing to risk of false negatives due to incompressible vessels. Diagnostic sensitivity and specificity were obtained overall, and

per severity classification. Furthermore, interrater agreement between ABPI- and DUS-determined PAD severity was determined by linear weighted Cohen's Kappa. The sensitivity and specificity in the detection of disease overall was 81.0% (95% CI 73.4 - 87.2%) and 86.3% (95% CI 82.3 - 89.8%), respectively. From mild to severe PAD, sensitivity increased from 71.1% (95% CI 55.7 - 83.6%) to 89.3% (95% CI 71.8 - 97.7%). Furthermore, a Cohen's Kappa value of 0.63 (95% CI 0.57 - 0.69) was obtained, indicating moderate agreement between the two diagnostic methods. Findings in this study validate the diagnostic performance of the standardised DUS scoring system, as well as its capacity to grade severity of disease, offering a potential tool for the identification of PAD in the community / research settings following initial screening methods. Confirmatory work could include a comparison of DUS-determined disease with gold-standard methods of non-invasive angiography, and novel tools such as toe-flex NIRS and multi-site photoplethysmography.

Veterinary

A case of canine large cell alimentary lymphoma; ultrasound appearances

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Abstract

Canine lymphoma is the malignant transformation of the lymphocyte population and is the most common malignancy observed in dogs. Lymphoma is classified into anatomic forms including multicentric, alimentary, mediastinal, and cutaneous forms. Lymphoma is a systemic disease and therefore chemotherapy is the most appropriate modality for its treatment. Lymphoma cells are sensitive to chemotherapy and complete remission rates are high when patients are administered conventional chemotherapy. Dogs that are treated and achieve full remission can go on to maintain a good quality of life, long term. This case study looks at a 3-year-old neutered male, dachshund who presented at his GP surgery with a history of diarrhoea for a couple of weeks with some occasional mucous and fresh blood noted. Demeanor was normal and he was bright, with no reported vomiting, coughing or any weight loss demonstrated. Upon abdominal palpation, a caudal abdominal mass was identified, and radiographs and a full abdominal ultrasound were undertaken. Ultrasound examination revealed a mass in the ileum measuring 35 × 31 mm in overall diameter with loss of normal

wall layering, and a very narrow intestinal lumen was demonstrated through the mass. The mass was predominantly hypoechoic and mildly heterogenous in echotexture. Chemotherapy was started and full remission was achieved after receiving a combination of cyclophosphamide, doxorubicin, vincristine and prednisone (CHOP-25 protocol). He has now been in remission for over a year. He still receives regular focal ultrasound scans of the gastrointestinal tract to ensure there is no ultrasonic evidence of relapse.

The impact of occupational stress and burnout on retention of sonographers – a scoping review

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Abstract

Within the National Health Service (NHS), sonography is associated with staff shortages, which appear to have worsened since 2013. There is substantial literature assessing the impact occupational stress/burnout has on professions such as nursing, however, literature investigating ultrasound is limited. With vacant ultrasound posts estimated to be as high as 25% in England, sonographers are facing increasing pressure to cover shifts to cope with staff sickness, contributing to exhaustion. This scoping review aims to explore whether occupational stress/burnout contributes to poor sonographer retention. Establishing why staff retention is poor may identify reoccurring themes to inform targeted improvement. A systematic search was carried out using keywords and Boolean searches to identify relevant literature published between 2012 and 2021. Eligible papers discussed levels of occupational stress, burnout, and professional disengagement. Articles that could not be accessed through King's College London institutional credentials were excluded due to time restrictions. Twenty-three papers were retrieved. Five peer-reviewed articles met the eligibility criteria. The largest of these studies conducted an online survey with 121 participants in Australasia. The remaining four articles were of United Kingdom origin and smaller sample groups. Three key themes were apparent throughout these five papers: 1) professional exhaustion due to increasing demand on services; 2) Increasing work-related anxiety because of patient expectations and exposure to bad news in obstetrics; 3) Increase in professional burnout due to insufficient training and poor communication from management. Identifying key themes influencing poor retention may improve services and understand the effects occupational stress has on disengagement and job

satisfaction. Current literature only considers smaller sample sizes and mostly obstetric sonographers. No study has assessed opinions across the entire profession; therefore, further primary research is required.

Case report: Testicular torsion with secondary suture granuloma

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Abstract

Testicular torsion is a medical emergency caused by twisting of the testicle on its spermatic cord leading to a compromised vascular supply. If left untreated, necrosis of testicular parenchyma will ensue. Failure to untwist the testis within six hours can result in loss of testicular viability, often leading to orchiectomy. Sonographic features of testicular torsion include increased testicular size and heterogeneous echotexture. Absence of intra-testicular flow may be a key sonographic feature to yield a diagnosis for testicular torsion. Suture granuloma is a rare benign complication of orchiectomy. On ultrasound, hyperechoic suture material is seen within a hypoechoic inflammatory capsule. A 26-year-old male presented to an emergency department with severe right scrotal swelling and raised C-reactive protein. He was treated with intravenous antibiotics for suspected epididymo-orchitis. One day later, as his inflammatory markers continued to rise, ultrasound of the testis was performed. The right testicle appeared enlarged with a heterogeneous echotexture throughout the testicular architecture. Intratesticular vascularity was absent on colour Doppler, which was suspicious for testicular torsion. The patient underwent a right orchiectomy. At a follow-up appointment, a small lump at the surgical site was scanned using ultrasound. The lesion appeared hypoechoic with a hyperechoic capsule surrounding it. Echogenic material was visualised within the hypoechoic capsule, indicative of remnants of suture material from surgery. The lesion later increased in size causing discomfort. This case describes classical sonographic appearances of testicular torsion and subsequent suture granuloma secondary to orchiectomy, which was later confirmed using histology. Ultrasound diagnosis of suture granuloma can prevent unnecessary excision of benign lesions. Sonographer's knowledge of the sonographic features of both torsion and suture granulomas is significant for a prompt detection and an accurate diagnosis. Ultrasound is an integral diagnostic imaging tool in confirming suture granuloma preventing unnecessary surgical intervention.

Case report: Paget-Schroetter syndrome in athletes

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Abstract

Paget-Schroetter syndrome (PSS) is a self-induced deep-vein thrombosis (DVT) of the subclavian and axillary veins. The subclavian vein passes through a narrow space between the clavicle and the first rib. Repetitive over-the-head exercise compresses the vein and causes microtrauma to the endothelial layer of the vessel. This can result in thrombus formation and it is commonly seen in athletes. A 21-year-old male presented to the accident and emergency department with a two-week history of pain and swelling in his (dominant) right upper limb. The patient had a Wells score of 3 and his D-dimers were 1.28. This patient was an avid basketball player. B-mode imaging revealed a small amount of mural thrombus within the brachiocephalic vein and an occlusive thrombus within the right subclavian and axillary vein. Both veins did not compress when pressure was applied confirming a thrombus was lodged within. Colour Doppler revealed no flow in the right subclavian and axillary vein despite a reduced PRF and increased colour gain. This confirmed that the thrombus was occlusive. This patient was positive for a right DVT. The subsequent computed tomography examination revealed that the patient had no abnormal anatomy or a mass that was causing this DVT. Considering that this patient was an avid basketball player and the dominant arm was affected, PSS was diagnosed. Treatment varies depending on the presentation time of symptoms. This patient underwent heparinization as he presented two weeks after the first onset of symptoms. He was advised rib resection which he refused. The patient was put on anticoagulation for six months and was advised not to play basketball during this time. Paget-Schroetter syndrome is a rare venous condition. However, it has the potential for significant morbidity and can cause a potentially fatal complication. Timely, accurate clinical recognition of the sign is vital.

Case report: Musculoskeletal trouble: A rare case of quadriceps tendon rupture

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Abstract

The quadriceps tendon (QT) is a large composite tendon of the quadriceps muscles (vastus medialis, vastus

intermedius, rectus femoris and vastus lateralis) that attaches to the patella. Quadriceps tendon rupture is an uncommon acute injury, accounting for approximately 1.3% of all musculoskeletal injuries. If not diagnosed promptly, changes to the tendon can manifest as irreversible and have serious consequences on normal locomotion. Ultrasound is an efficient imaging modality to detect and diagnose quadriceps tendon rupture. A 54-year-old male presented to the emergency department with a history of a fall on a flexed knee. The patient had an elevated body mass index and a history of type II diabetes. Ultrasound was the radiological modality of choice to evaluate the injury. The ultrasound examination revealed a transverse hypoechoic intratendinous defect to the quadriceps tendon. This hypoechoic defect was located at the quadriceps tendon's insertion point at the patella. On dynamic scanning the entire quadriceps tendon's architecture was not fully disturbed, sonographically confirming a partial thickness tear. The associated myotendinous junction and muscle architecture of the quadriceps muscle complex group were unremarkable. Quadriceps tendon rupture can often be a clinical diagnosis in the emergency department, however, ultrasound is an effective tool to determine partial tears from full thickness tears. Dynamic sonographic evaluation of the quadriceps tendon is paramount to permit prompt and accurate diagnosis. Ultrasound is an accurate imaging modality to diagnose quadriceps tendon tears that contributes to the pathway for a return to normal locomotion.

Case report: Ultrasound appearance of a retroperitoneal endometrioma complicated by haemorrhage

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Abstract

Endometriosis is an inflammatory gynaecological disorder where functional endometrial tissue is deposited outside of the uterus, producing adhesions and fibrotic scarring. Ultrasound is the first-line imaging modality for investigating endometriosis, due to its cost-effectiveness, accessibility and non-invasiveness. When presenting with certain "classical" features – a well-defined cystic structure with low-level homogenous echogenic contents, often deposited on an ovary – endometriosis is diagnosable on ultrasound. However, a spectrum of alternative appearances can confound diagnosis. In the case presented below, the appearances

were uncharacteristic, preventing a diagnosis by means of ultrasound alone. An 18-year-old female presented to the emergency department with acute abdominal pain and vomiting post-pareunia. Initial ultrasound identified free fluid in the pelvis; a CT scan revealed a large pelvic mass, suspected to be a torsed ovary. Laparoscopy identified what was believed to be a large, ruptured haematoma. Further ultrasound scans also identified what appeared to be a haematoma, which did not reduce in size over time, which was noted to be unusual. Histology of samples removed during initial laparoscopy later revealed endometrial tissue. The patient has been referred to the endometriosis MDT for evaluation. Endometriosis may present with a variety of non-specific clinical symptoms, significantly delaying

diagnosis. Laparoscopy combined with histology remains the gold standard for diagnosis, but the spectrum of non-specific presentations also means a lot of women are subjected to this invasive surgical procedure unnecessarily. Ultrasound provides a non-invasive alternative preliminary investigation, as endometriosis can have a characteristic, readily-distinguishable appearance. However, some presentations can be diagnostically confounding. For example, in cases of substantial internal haemorrhage (as in this case), retroperitoneal endometriomas can present as a large haematoma. It is hoped that an awareness of the spectrum of possible presentations of endometriosis on ultrasound may assist in future identification of the disease and hasten correct diagnosis.