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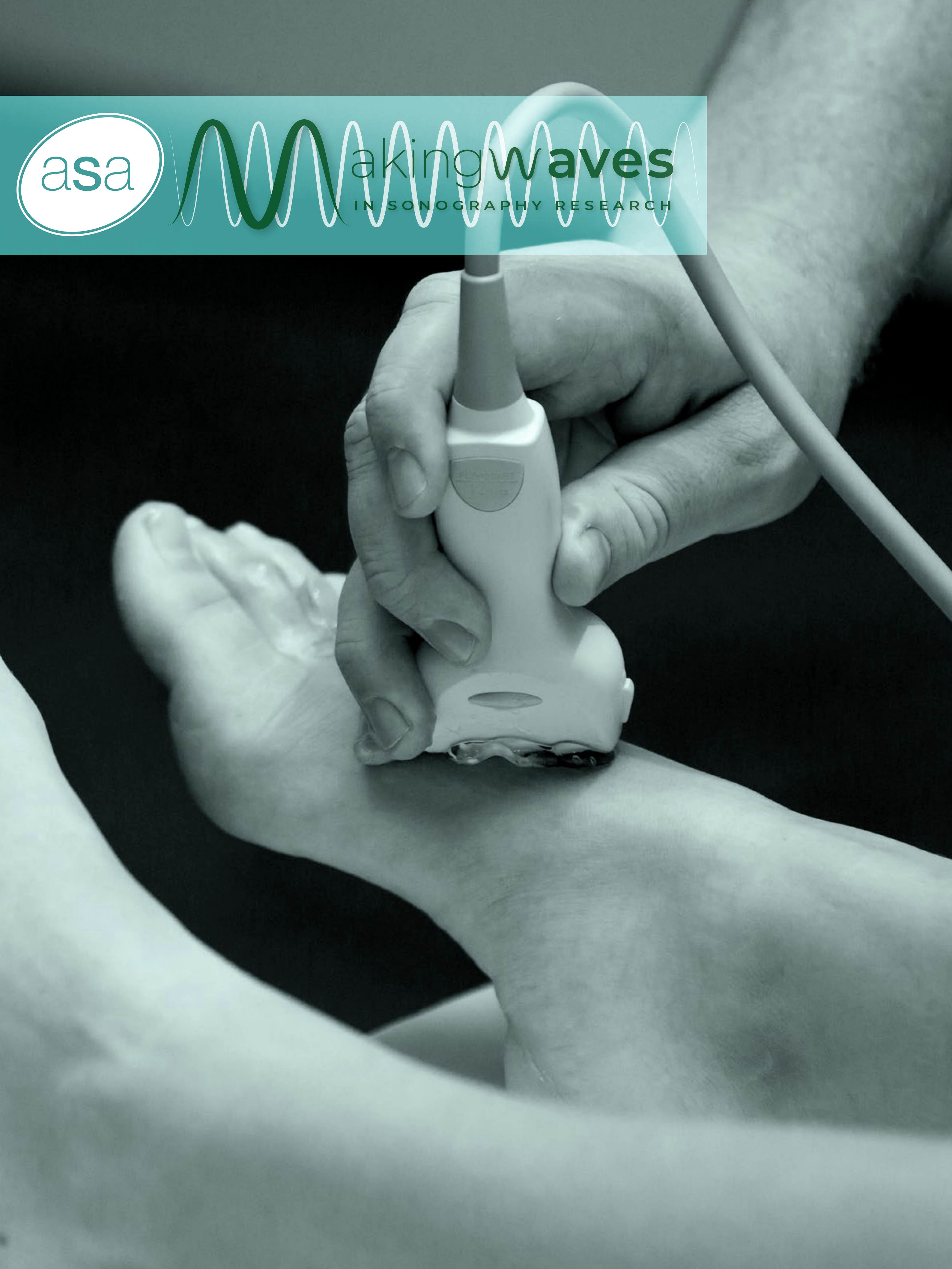
Making Waves

IN SONOGRAPHY RESEARCH



FEBRUARY 2021

contents

Descriptive statistics

REFERENCE
Kaur P, Stoltzfus J, Yellapu V.
International Journal of Academic Medicine. 2018;4:60–63
https://www.ijam-web.org/text.asp?2018/4/1/60/230853

REVIEWED BY
Afrooz Najafzadeh,
ASA SIG Research

WHY THE STUDY WAS PERFORMED

A great deal of importance is placed on statistics in medical literature and health sciences. Statistics is considered objective analysis of data and helps explain how important and how applicable the research evidence is that is generated through one's research activities or experiments. Descriptive statistics are a pertinent first step in any data analysis for quantitative research, setting the platform for additional statistical analysis. Since descriptive statistics condense data into a simpler summary, they enable healthcare decision-makers to assess specific populations in a more manageable form. This article aims to provide a better understanding of research results through giving them context with numbers.

HOW THE STUDY WAS PERFORMED

This is a review of literature in fundamental biostatistics and has summarised the important points and, in effect, has produced a glossary of common descriptive statistical terms for a novice researcher.

WHAT THE STUDY FOUND

The following common descriptive statistical terms are described in detail.

- The types of variables and the differences between continuous (also known as quantitative or numerical) and categorical (further categorised into nominal, ordinal, or dichotomous) variables.
- The measure of frequency (Table 1), including the description of absolute frequency (the number of times a particular value occurs in the data) and relative frequency (the number of times a particular value occurs in the data relative to the total number of values for that variable).
- The three primary measures of central tendency i.e. the mean, median, and mode.
- The measure of dispersion/variation (range, variance and standard deviation). The measure of position (percentile and quartile range).

Table 1. Types of descriptive statistics[1]

Measure	What does it include?	How is it used?
Measures of frequency	Frequency, ratio, rate, proportion, percentage	Shows how often a value occurs
Measures of central tendency	Mean, median, mode	Indicates the distribution of values
Measures of dispersion/ variation	Range, variance, standard deviation	Identifies the spread of values
Measures of position	Percentile ranks, quartile ranks	Describes where values fall in relation to each other

RELEVANCE TO CLINICAL PRACTICE

Descriptive statistics help summarise the collected data, describing the relationship (if any) between many variables extracted from a study population. It provides greater understanding of patient population or the range of diagnostic techniques used and, in essence, helps us better understand research results through giving them a context with numbers. Descriptive

Descriptive statistics *cont.*

statistics help to present results of a research or experiments by charts, graphs and tables and can be used to describe a trend or pattern in a large volume of data as well as describing correlations and the relationship between various variables. Therefore, as part of good research practice, it is essential that the researcher reports the most appropriate descriptive statistics using a systematic approach to reduce the likelihood of presenting misleading results.

"The appropriate use of descriptive statistics allows healthcare administrators and providers to more effectively weigh the impact of health policies and programs."

Breast masses in children and adolescents

REFERENCE
Siegel MJ, Chung E. *Appl Radiol*. 2017;46(9):12–17. https://appliedradiology.com/Communities/PediatricPaediatric-Imaging/breast-masses-in-children-and-adolescent

REVIEWED BY
Allison Holley,
ASA SIG Paediatric

WHAT THE ARTICLE LOOKED AT

Breast masses in the paediatric population are not uncommon, and while they can occur at any age, the two main age groups are infancy and adolescents. Due to the breast size, patient's cooperation capacity and the dense nature of paediatric breast tissue, ultrasound imaging is the gold standard for investigation of these masses. Ultrasound is also the preferred method due to the known effect of radiation in this age demographic. Most breast masses presenting in the paediatric and adolescent age group are benign, self-limiting and can be managed conservatively, with adolescents being the largest cohort due to increased hormonal activity during puberty. While most masses are benign, it is vital to detect and differentiate those rare lesions with malignant potential. It is also important not to judge/read these lesions according to adult criteria as this will lead to inaccuracies causing undue stress and financial burden. The article provided a pictorial essay of the commonly encountered paediatric breast masses and assists with combining the ultrasound criteria imaged with the clinical details provided to determine the relevant age-appropriate diagnosis.

WHAT THE ARTICLE COVERS

This article systematically delivers the ultrasound appearances and classifications of common breast masses as well as covering the developmental variants that commonly occur, particularly in the infant period. The authors also provide details of associated clinical findings and histories to help with the diagnostic differentiation.

The article discusses normal breast development with ultrasound images of the three main stages of change in appearance. It then goes on to discuss the developmental variant presentations of primary thelarche in girls and gynecomastia in boys, again with good ultrasound representation of these variants.

The article covers a comprehensive list of non-neoplastic cystic lesions, benign neoplastic lesions and then finishes with the very rare cases of paediatric primary and metastatic breast lesions.

RELEVANCE TO CLINICAL PRACTICE

This article is an excellent resource to have close at hand when doing paediatric breast imaging. It systematically works through all the developmental variants and common breast pathologies with good descriptions and good ultrasound examples of each of the pathologies. Its pictorial nature will assist differentiating normal from abnormal and is recommended for the general sonographer or those sonographers who specialise in adult breasts and who occasionally get asked to scan a paediatric breast. This article should become their new 'go to' source of paediatric breast work.

"Because of its lack of radiation, ultrasonography is the ideal imaging study to identify, characterise and guide treatment of breast lesions in a young population."

Color Doppler splay: A clue to the presence of significant mitral regurgitation

WHY THE STUDY WAS PERFORMED

This study describes a previously unreported transthoracic echocardiogram (TTE) colour Doppler signal that can be associated with a more significant mitral regurgitation (MR) jet. Horizontal 'splay' of the colour Doppler signal of MR may indicate a more significant regurgitation grade when the MR jet otherwise appears benign. A variety of technical, body habitus or pathological reasons exists that may cause an MR jet to be suboptimally demonstrated. This could lead to an underestimation of the MR severity. Doppler splay could be helpful in such settings to alert the sonographer and reporting cardiologist to assess the mechanism and the severity of MR more critically.

HOW THE STUDY WAS PERFORMED

This was a retrospective study divided into two parts.

The first analysis identified patients with moderate to severe or severe MR established on transoesophageal echo (TOE), but that was reported as less than moderate on the preceding TTE. One hundred and twenty patients were identified for analysis to establish if Doppler splay was present. Studies were performed on a range of ultrasound machines.

The second analysis took 100 consecutive TTE studies reported with severe MR and 100 with mild MR. The presence of splay was recorded, including the width and depth of the signal. Machine settings like colour scale, colour gain, and transducer frequency were also recorded.

WHAT THE STUDY FOUND

The first analysis found that 10 out of 32 misclassified MR have the splay MR signal present.

The second analysis group identified splay in 81% of the scans with severe MR, regardless of vendor machine, ejection fraction or MR aetiology. Splay was more evident in wall hugging jets. Only 16% of patients with mild MR had splay and it was on fewer frames per clip and had smaller dimensions when compared with severe MR. Colour scale did not differ between subjects with and without splay, but the colour gain was higher when splay was present.

Machine settings were further explored in a single subject with prominent splay: increasing transducer frequency reduced splay, while increasing colour gain increased it.

RELEVANCE TO CLINICAL PRACTICE

MR splay may be clinically useful when:

1. the MR may be mild on TTE, though in the presence of MR splay, a closer assessment of MR is recommended as this can be more severe than it appears at first
2. other TTE MR parameters are equivocal; a splay signal may support the MR as being severe and warrant further investigation like TOE.

The sonographer needs to pay attention to colour gain (over gained) and colour scale (lower frequency) as they can increase the splay artefact signal.

REFERENCE

Wiener PC, Friend EJ, Bhargav R, Radhakrishnan K, Kadem L, Pressman GS. *J Am Soc Echocardiogr.* 2020; 33(10):1212–19e1. https://www.onlinejase.com/article/S0894-7317(20)30292-3/fulltext

REVIEWED BY

Nikolas Jin Wang and Anthony Wald
ASA SIG Cardiac

NOT OPEN ACCESS

> "Horizontal splay may be a clue to the presence of severe MR when the main body of the jet is out of the imaging plane."

Diagnostic differentiation between arrhythmogenic cardiomyopathy and athlete's heart by using imaging

REFERENCE
D'Ascenzi F, Solari M, Corrado D, Zorzi A, Mondillo S. *JACC: Cardiovascular Imaging*. 2018; Sept 11(9):1327–39. https://doi.org/10.1016/j.jcmg.2018.04.031

REVIEWED BY
Richard Allwood,
ASA SIG Cardiac

WHY THE STUDY WAS PERFORMED

Distinguishing between physiological adaptation and cardiac pathology in an athlete can be challenging, particular in high level endurance athletes. This study describes the physiological adaptation of the right ventricle (RV) to exercise, with a focus on specific echocardiographic parameters that can be used to distinguish between athlete's heart (AH) and arrhythmogenic right ventricular cardiomyopathy (ARVC).

ARVC is one of the leading causes of sudden cardiac death in youth and athletes. With highly trained endurance athletes, prominent RV remodelling can occur, which can raise concern of underlying RV pathology such as ARVC. The distinction between physiological and pathological RV remodelling is essential, as high intensity exercise training can cause acceleration of ARVC disease and worsen its prognosis.

HOW THE STUDY WAS PERFORMED

A comprehensive literature review was performed by D'Ascenzi et al.

WHAT THE STUDY FOUND

Listed in Table 1 and Table 2 are echocardiographic findings and clinical parameters that can be used to differentiate between ARVC and athletes.

Table 1: Dimensional and functional parameters obtained by echocardiography in ARVC versus athlete's heart

Echocardiography and differential diagnosis between ARVC and athlete's heart		
ARVC	Findings	Athlete's heart
	Size	
+	Marked dilation of RVOT	-
-	Moderate increase in RV main body with mild increase in RVOT	+
+	Disproportionate RV/LV (< 0.90)	-
-	Regression of RV dilatation after detraining	+
	Function	
+	RV wall motion abnormalities akinesia, dyskinesia, aneurysms, bulging	-
+	Reduced RV function (FAC < 32%)	-
+	Reduced RV longitudinal strain (< 20%)	-
+	Reduced RV S' velocity (< 0.10 m/s)	-
+	Reduced RV function by CMR	-
+	RV and/or LV tissue abnormalities (fat infiltration and LGE) at CMR	-

+: more likely. -: less likely. RVOT: right ventricular outflow tract. RV: right ventricle. LV: left ventricle. FAC: fractional area change. CMR: cardiac magnetic resonance. LGE: late gadolinium enhancement.

Diagnostic differentiation between arrhythmogenic cardiomyopathy and athlete's heart by using imaging *cont.*

Table 2: How to distinguish between athlete's heart and ARVC

Athlete		ARVC
Negative	Family history	Sudden death or ARVC
Absent	ECG abnormalities	QRS abnormalities, T-wave inversion
Mainly main body	RV dilatation	Mainly RVOT
< 1	RV/LV ratio	> 1
Absent (or mild)	RV dysfunction	Present
Absent	RV regional wall motion abnormalities	Present
Absent (or only junctional)	Late enhancement at CMR	RV and/or LV LGE with nonischaemic distribution
Absent	Ventricular arrhythmias	Present

RV: right ventricle. RVOT: right ventricular outflow tract. LV: left ventricle. CMR: cardiac magnetic resonance. LGE: late gadolinium enhancement.

RELEVANCE TO CLINICAL PRACTICE

Traditional echocardiographic parameters in the 2010 revised Task Force Criteria for ARVC have been found to be poor discriminators to differentiate between physiological and pathological adaptation in AH and ARVC.

Performing a comprehensive echocardiographic examination, including advanced imaging, is essential when traditional parameters are abnormal and further clarification is needed to distinguish between physiology and pathology.

Although cardiac imaging is an important part of distinguishing between AH and ARVC, a systematic and comprehensive diagnostic approach is required when applying the diagnostic criteria which should include: clinical history and physical examination, familial evaluation, 12-lead electrocardiogram (ECG), Holter monitoring, exercise stress testing and cardiac magnetic resonance imaging.

"... integrating these findings with ECG, clinical signs and symptoms, family history, and occurrence of arrhythmia is crucial, particularly in borderline cases."

Ultrasound-based techniques for the diagnosis of liver steatosis

REFERENCE

Ferraioli G, Soares Monteiro LB. *World J Gastroenterol.* 2019; Oct 25(40):6053–62. https://www.wjgnet.com/1007-9327/full/v25/i40/6053.htm

REVIEWED BY

Chris Lewis, ASA SIG General

WHY THE STUDY WAS PERFORMED

Non-alcoholic fatty liver disease (NAFLD) is an increasingly dominant cause of liver disease worldwide. The progressive subtype non-alcoholic steatohepatitis (NASH) is a leading indication of liver transplantation and HCC. The overall prevalence of NAFLD is on the rise, in children as well as adults. The increasing volume of patients with advanced liver disease leads to an increased burden on overstretched health resources and budgets.

Ultrasound provides a low cost and effective window into the liver that is well accepted by young and old patients. This literature review by Ferraioli and Soares Monteiro provides a comprehensive insight into developing applications of ultrasound aimed at identifying early liver changes, specifically fatty changes or steatosis, that can lead to NAFLD.

Ultrasound B-mode imaging allows the subjective estimate of the degree of fatty infiltration in the liver. The grading of liver steatosis is usually obtained using features that include liver brightness, contrast between the liver and the kidney, appearance of the intrahepatic vessels, liver parenchyma and diaphragm. Steatosis grading ranges from S0 for normal to S3 for severe.

This paper outlines the move to improve ultrasound specificity and sensitivity, particularly in detecting early signs of steatosis. It covers the more subjective 'semi-quantitative' B-mode methods of judging a fatty liver to the more recent quantitative, radiofrequency (RF) methods.

The semi-quantitative methods include:

1. **the Hamaguchi score:** liver/kidney interface, bright liver, deep attenuation, vessel blurring
2. **ultrasound fatty liver indicator (US-FLI) score:** liver/kidney, attenuation, vessel and GB wall blurring, difficult visualisation of diaphragm, focal fatty sparing
3. **hepato-renal sonographic index (HI):** liver/kidney cortex echogenicity ratio. HI requires a software package available on *Hitachi Unites* only.

*All of the above lack validation with large studies, according to this paper.

Quantitative RF methods include:

1. **backscatter coefficient:** estimated by using a computer algorithm and a reference phantom, therefore reducing sources of variability due to ultrasound systems or operators
2. **controlled attenuation parameter (CAP):** dedicated device added to *Fibroscan* systems only. CAP measures beam attenuation as it passes through the liver. Evaluated together with liver stiffness, using the same RF data. Not an imaging device
3. **quantifying beam attenuation combined with B-mode imaging:**
    a. attenuation imaging, ATI, *Toshiba*
    b. ultrasound guided attenuation parameter, UGAP, *GE*
    c. attenuation, ATT, *Hitachi*

    In these techniques, the RF data of the backscattered ultrasound signals are used; therefore, the measurement is not affected by the post-processing of the acquired data or by the settings of the ultrasound system. Vessels and strong artifacts are filtered out

4. **sound speed estimation (SSE):** *Aixplorer*. As fat in liver increases, the speed of sound decreases. Grades hepatic steatosis using an ultrasound fat index based on the patient's SSE.

Not to be confused with elastography, the paper provides a valuable evidence-based analysis of the evolving methods for using ultrasound to detect early signs of liver changes that can lead to NAFLD.

HOW THE STUDY WAS PERFORMED

Providing the clinical background and summary of peer reviewed studies and contemporary methods using sonography for the assessment of hepatic steatosis. Reference standards using MR-PDFF (proton density fat fraction) and liver biopsies were used to evaluate and compare various ultrasound techniques.

WHAT THE STUDY FOUND

Quantitative techniques combining B-mode ultrasound offer a favourable diagnostic test for liver steatosis. Sensitivity levels ranged from 72–100% and specificity levels 72–90% across the normal to severe steatosis gradings when compared to MR PDFF and liver biopsy. Importantly, reported intra and inter-observer agreement ranges from 0.91 to 0.98.

RELEVANCE TO CLINICAL PRACTICE

This paper highlights the ability of ultrasound to add another attractive option that will assist clinicians managing the growing incidence of NAFLD. In addition to the many other advantages of ultrasound, this software allows the modality to readily deliver a quantifiable steatosis grading that is easy to apply, interpret and reproduce, along with being cost-effective.

> "Preliminary results from two studies performed in small series of subjects show that the quantification tools available on ultrasound systems seem more accurate than CAP."

Practical ultrasonographic technique to precisely identify and differentiate tendons and ligaments of the elbow at the level of the humeral epicondyles: anatomical study

REFERENCE
Omoumi P, Gondim Teixeira PA, Ward SR, Trudell D, Resnick D. *Skeletal Radiol.* 2020 Dec 11. https://link.springer.com/article/10.1007/s00256-020-03693-5

REVIEWED BY
Deb Carmody,
ASA SIG MSK

WHY THE STUDY WAS PERFORMED

The anatomy in the medial and lateral epicondyles is complex. The aim of the study was to develop a practical step-by-step technique to identify and differentiate the tendons and ligaments attaching to the humeral epicondyles. The researchers did this by first developing technique on cadavers, then applying this technique to healthy volunteers.

HOW THE STUDY WAS PERFORMED

The first part of the study was to develop a technique on cadavers. The researchers used ten fresh frozen cadavers of the elbow joint (including the wrist, forearm, elbow joint and distal half of the upper arm) from seven cadavers. Two MSK radiologists examined the arms using a Philips iU22 system with a high frequency (17-5 MHz) transducer, in a semi-flexed position. The flexor and extensor muscles were first located at the wrist and followed proximally towards their insertions at the humeral epicondyles. To differentiate the tendons, they used three sets of signs: bony landmarks, hypoechoic or hyperechoic lines and differences in echogenicity.

The two radiologists then followed the same technique developed on the cadavers and applied it to 12 healthy volunteers using the same ultrasound system and transducer. They graded the visibility of the structures on the four views from not visible, visible but poorly defined, to visible and well-defined.

WHAT THE STUDY FOUND

A sonographic step-by-step technique was developed based on the recognition of bony landmarks and using sonographic signs to differentiate overlapping structures. The authors validated this study by first developing a protocol on cadavers, then applying it to healthy volunteers. There are four views developed for lateral epicondyle and four views for medial epicondyle.

The technique allowed them to differentiate the lateral collateral ligamentous complex (LCL) and medial collateral ligamentous complex (MCL) in 100% of cases, the ECRB/EDC tendons in up to 80% of cases and the PT muscle and FCR tendon attachments in 90% of cases.

The extensor carpi radialis brevis (ECRB) and extensor digiti minimi (EDM) tendons have a conjoint tendon with the extensor digitorum communis (EDC) tendon, which meant that the ECRB and EDM tendons were only properly visualised in 50% and 30% of volunteers respectively.

RELEVANCE TO CLINICAL PRACTICE

This study provides a step-by-step approach to accurately identify and differentiate the tendons and ligaments at the humeral epicondyles. Correctly differentiating these structures can help to accurately determine the extension of pathology in these structures. This understanding of anatomy can help to confirm the diagnosis in refractory or doubtful cases of lateral epicondylitis, to guide therapeutic injections and to monitor therapy.

“Further studies are necessary to fully assess the differentiation of these structures in a larger cohort of subjects.”

Ultrasound assessment of skin thickness and stiffness: the correlation with histology and clinical score in systemic sclerosis

REFERENCE
Chen C, Cheng Y, Zhu X, Cai Y, Xue Y, Kong N, et al. *Arthritis Res Ther.* 2020 Aug 26;22(1):197.
doi: 10.1186/s13075-020-02285-x

REVIEWED BY
Sharmaine McKiernan
ASA SIG MSK

WHY THE STUDY WAS PERFORMED

Systemic sclerosis (SSc) is an autoimmune disease characterised by progressive fibrosis affecting the skin and internal organs. The skin sclerosis leads to decreased mobility, flexion contracture and, ultimately, severe functional impairment. The extent of skin involvement is a predictive marker of survival, lung function and heart involvement.

The aims of this study were to investigate skin thickness and stiffness ultrasound measurements and to validate them against histological skin thickness.

HOW THE STUDY WAS PERFORMED

A total of 22 patients with diffuse cutaneous SSc, 22 with limited cutaneous SSc and 22 age and gender matched healthy controls, were investigated. Skin thickness and stiffness were measured with a 4–15 MHz linear transducer on the bilateral fingers and hands. In 13 patients with newly diagnosed and untreated SSc, their dorsal forearms were also imaged, followed by skin biopsy in the same area.

The ultrasound transducer was maintained perpendicular to the skin without pressure. Total skin thickness was defined as the distance from the outermost epidermis to the interface between the dermis and the subcutis. To quantify skin stiffness, the SWE colour coded elastogram represented the elastic modulus, and higher elastic modulus reflected higher tissue stiffness. When stable colour was obtained, the epidermis and dermis area was traced, defining total skin elasticity as the mean elastic modulus value of the trace area. All measurements were made in triplicate and averaged.

For intra-observer variability assessment, all SSc patients were examined twice by the same sonographer, 2 to 4 hours apart. For inter-observer variability assessment, 20 SSc patients were examined by a second sonographer on the same day.

WHAT THE STUDY FOUND

Compared with controls, ultrasound measured skin thickness and skin stiffness were significantly higher in patients with SSc ($p < 0.001$). No correlation was found between ultrasound measured skin thickness and stiffness. Ultrasound measured skin thickness correlated well with histological skin thickness ($r = 0.6926$, $p = 0.009$). No linear correlation was found between histological skin thickness and ultrasound measured skin stiffness ($r = 0.1448$, $p = 0.200$).

For both thickness and stiffness assessment, the intra-observer and inter-observer reproducibility were good, with ICCs reaching 0.9 and 0.8 respectively.

RELEVANCE TO CLINICAL PRACTICE

Ultrasound can be used as a reliable tool for quantifying skin thickness in SSc. It has the ability to discriminate subtle skin differences, so it is useful for early diagnosis and monitoring of SSc patients. Shear wave elastography might be a good disease severity parameter to quantifying skin fibrosis.

> “We unveil for the first time a strong correlation between the ultrasound-measured skin thickness and the corresponding histological thickness.”

Classification and treatment of endothermal heat-induced thrombus: Recommendations from the American Venous Forum and the Society for Vascular Surgery

REFERENCE
Kabnick LS, Sadek M, Bjarnason H, Coleman DM, Dillavou ED, Hingorani AP, et al. *J Vasc Surg Venous Lymphat Disord*. 2021 Jan;9(1):6–22 doi: https://doi.org/10.1016/j.jvsv.2020.06.008

REVIEWED BY
Daniel Rae
ASA SIG Vascular

WHY THE PAPER WAS WRITTEN

The paper suggests that chronic venous insufficiency has a significant impact on the population, both quantitatively and qualitatively. The treatment techniques that have undergone the most significant evolution are endovenous laser ablation and radiofrequency (RF) ablation; these have revolutionised the treatment of superficial vein reflux.

Although the presence of superficial thrombus within the treated venous segment is considered to be a normal ultrasound finding, its propagation into the deep vein may pose a risk of the development of DVT or pulmonary embolism (PE).

The term 'endothermal heat-induced thrombus' (EHIT) is defined as 'the propagation of thrombus into the deep vein contiguous with the ablated superficial vein'. EHIT rates post laser and RF ablation range from 0–3%.

Ultrasound-based classification systems have been developed for EHIT, but there is a clear lack of standardisation among them. Ultimately creating a unified EHIT classification will help standardise reporting of the disease in clinical practice.

HOW THE PAPER WAS PERFORMED

The American Venous Forum guidelines committee, in collaboration with the Society for Vascular Surgery, created a writing group to analyse the available literature on EHIT to gauge the quality of clinical evidence and provide guidance on its diagnosis and treatment.

WHAT THE PAPER SUGGESTS

It suggests the standardisation of the classification systems used for the assessment of EHIT. Given the heterogeneity in reporting and outcomes, the authors propose to unify the Kabnick and Lawrence classification systems under a combined single classification system (Table 1).

Table 1. American Venous Forum (AVF) endothermal heat-induced thrombosis (EHIT) classification

Class	Definition
I	Thrombus without propagation into the deep vein
	a. Peripheral to superficial epigastric vein
	b. Central to superficial epigastric vein, up to and including the deep vein junction
II	Thrombus propagation into the adjacent deep vein but comprising < 50% of the deep vein lumen
III	Thrombus propagation into the adjacent deep vein but comprising > 50% of the deep vein lumen
IV	Occlusive deep vein thrombus contiguous with the treated superficial vein

- **EHIT 1** refers to a benign condition whereby management is not altered. Subdivisions (a) and (b) have been added for data purposes as it is unknown whether termination of the thrombus peripheral or central to the superficial epigastric veins bears any clinical significance.
- **EHIT 2** remaining the most commonly identified of the various categories. Treatment ranges from anticoagulant or antiplatelet therapy until thrombus regresses, to serial ultrasound observation.
- **EHIT 3** comprises a more severe form of nonocclusive thrombosis.
- **EHIT 4** the consensus currently is that EHIT 4 is considered an acute DVT and treated accordingly.

The paper also suggests that diagnostic ultrasound examinations be performed in either the supine or standing position, although there is a greater incidence of false-positive results in the supine position. Measurements should be taken in the transverse, axial and orthogonal positions to determine the relationship and distance between the EHIT thrombus and the vein wall, as well as the presence, absence, and extent of protrusion into the deep system lumen.

RELEVANCE TO CLINICAL PRACTICE

With the increased number of patients choosing laser and RF ablation for the treatment of saphenous vein reflux, the postoperative ultrasound surveillance will increasingly fall within the scope of general sonography. Having a greater understanding of the assessment of EHIT and how to report it will place surgeons in the best position to manage and treat this complication.

“The reporting of the EHIT phenomenon in a consistent way is essential to all other aspects of diagnosis, prevention and treatment.”