

ULTRASOUND NEWS

May 2023

Liver Fat Quantification With Ultrasound

Depth Dependence of Attenuation Coefficient

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Received February 21, 2023, from the Department of Clinical, Surgical, Diagnostic and Pediatric Sciences, University of Pavia, Pavia, Italy (G.F., A.R.); Ultrasound Unit, Fondazione IRCCS Policlinico S. Matteo, Pavia, Italy (A.R., L.M., G.P.); Clinical Epidemiology and Biometric Unit, Fondazione IRCCS Policlinico S. Matteo, Pavia, Italy (A.D.S.); Center for Ultrasound Research & Translation, Department of Radiology, Massachusetts General Hospital, Boston, Massachusetts, USA (V.K.); and Department of Radiology, Northeastern Ohio Medical University, Rootstown, Ohio; Southwoods Imaging, Youngstown, Ohio, USA (R.G.B.). Manuscript accepted for publication April 16, 2023.

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Objectives—The primary aim was to estimate the influence of various depths on ultrasound attenuation coefficient (AC) of multiple vendors in the liver. The secondary aim was to evaluate the impact of region of interest (ROI) size on AC measurements in a subset of participants.

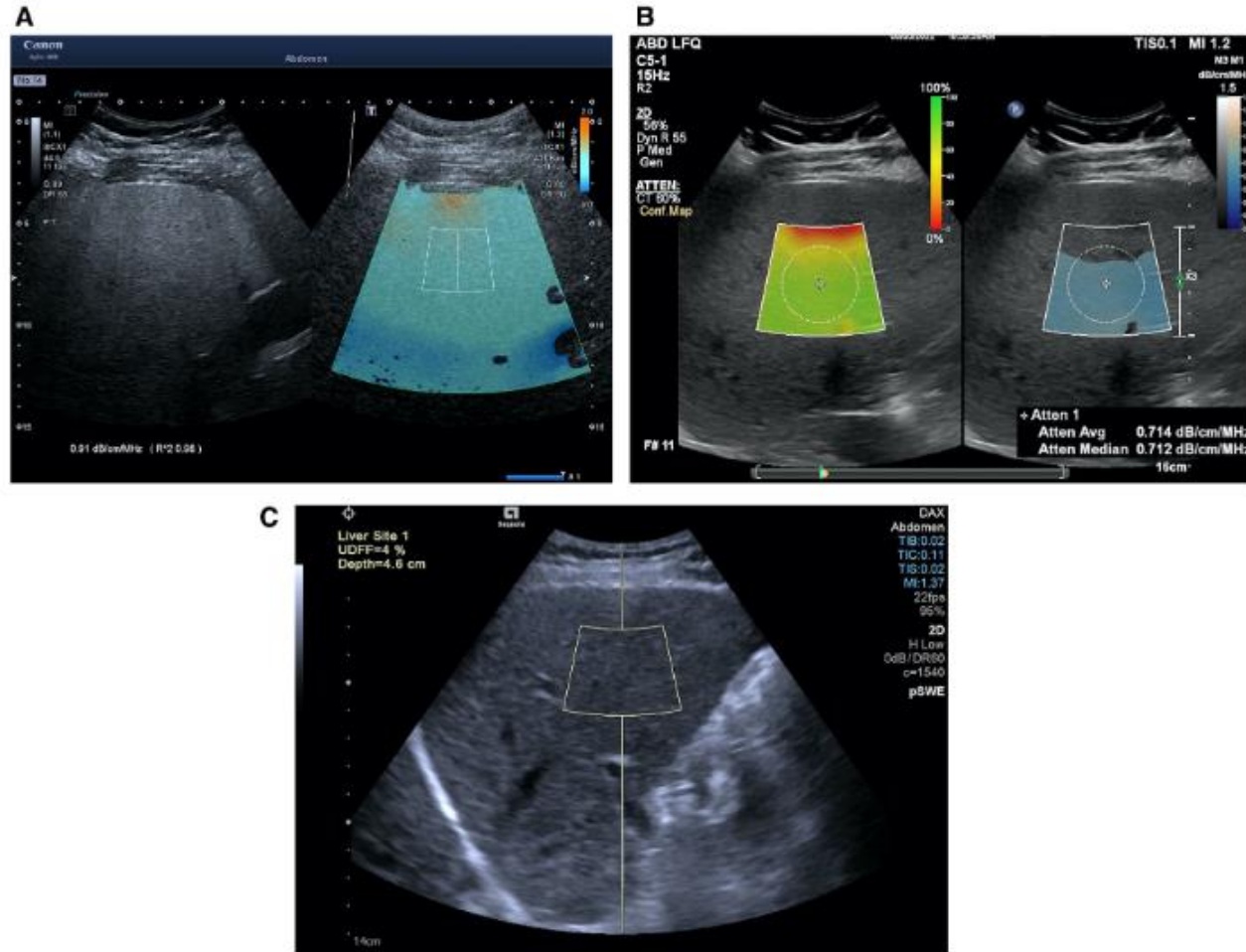
Methods—This Institutional Review Board (IRB)-approved Health Insurance Portability and Accountability Act (HIPAA)-compliant retrospective study was carried out in two centers using AC-Canon and AC-Philips algorithms and extracting AC-Siemens values from ultrasound-derived fat fraction algorithm. Measurements were performed positioning ROI upper edge (3 cm size) at 2, 3, 4, 5 cm from the liver capsule with AC-Canon and AC-Philips and at 1.5, 2, 3 cm with Siemens algorithm. In a subset of participants, measurements were obtained with 1 and 3 cm ROI size. Univariate and multivariate linear regression models and Lin's concordance correlation coefficient (CCC) were used for statistical analysis as appropriate.

Results—Three different cohorts were studied. Sixty-three participants (34 females; mean age: 51 ± 14 years) were studied with AC-Canon, 60 (46 females; mean age: 57 ± 11 years) with AC-Philips, and 50 (25 females; 61 ± 13 years) with AC-Siemens. There was a decrease in AC values per 1 cm increase in depth in all. In multivariable analysis, the coefficient was -0.049 (-0.060 ; -0.038 $P < .001$) with AC-Canon, -0.058 (-0.066 ; -0.049 $P < .001$) with AC-Philips and -0.081 (-0.112 ; -0.050 $P < .001$) with AC-Siemens. AC values with 1 cm ROI were significantly higher than those obtained with 3 cm ROI at all depths ($P < .001$) but the agreement between AC values obtained with different ROI size was excellent (CCC 0.82 [0.77–0.88]).

Conclusions—There is depth dependence in AC measurement that affects results. A standardized protocol with fixed ROI's depth and size is needed.

Key Words—ATI; attenuation coefficient; fat quantification; liver steatosis; NAFLD; ROI depth; ROI size; UDFP

Figure 1. A, Attenuation coefficient obtained with the Canon algorithm at a depth of 2 cm (upper edge of the region of interest, which is the rectangle with white borders inside the large, color-coded field of view). The value, in decibel/centimeter/megahertz, is shown on the left bottom side of the image together with the R^2 value that is a quality factor and shows high quality of the acquisition. **B,** Attenuation coefficient obtained with the Philips algorithm at a depth of 2 cm (upper edge of the region of interest—dotted circle). The value, in decibel/centimeter/megahertz, is shown on the left bottom side of the image. The confidence map (rejection algorithm) is listed in the left upper image. In this case the confidence threshold (CT) is 60%. The algorithm evaluates the quality of the image and assigns a value between 0 and 100% with 0% meaning no confidence and 100% high confidence. This is used to remove artifacts from the image. **C,** Ultrasound derived fat fraction (UDFF) algorithm available on Siemens Sequoia ultrasound system. The UDFF value is given as percentage of fat and is shown on left upper side of the image. The depth shown below the UDFF value (4.6 cm) refers to the distance between the transducer and the center of the region of interest. The upper edge of the region of interest is positioned at 1.5 cm below the liver capsule as per the manufacturer recommendation.



Depth ^a (cm)	AC Value (dB/cm/MHz), Mean (Standard Deviation)	AC Value (dB/cm/ MHz), Range
AC-Canon (63 cases, ROI 3 cm)		
2.0	0.71 (0.14)	0.50–1.00
3.0	0.67 (0.14)	0.44–0.95
4.0	0.61 (0.14)	0.35–0.88
5.0	0.55 (0.10)	0.36–0.77
AC-Philips (60 cases, ROI 3 cm)		
2.0	0.70 (0.08)	0.55–0.99
3.0	0.64 (0.09)	0.40–0.93
4.0	0.57 (0.11)	0.30–0.90
5.0	0.53 (0.13)	0.26–0.87
AC-Siemens (50 cases, ROI 4 cm)		
1.5	0.82 (0.19)	0.43–1.12
2.0	0.76 (0.19)	0.38–1.08
3.0	0.70 (0.20)	0.40–1.06

AC, attenuation coefficient; dB/cm/MHz, decibel/centimeter/megahertz.

^aIt is referred to the distance from the liver capsule of the upper edge of the measurement box.

Table 1. Characteristics of the Three Study Cohorts

Variable	AC-Canon	AC-Philips	AC-Siemens
Center	Site 1	Site 2	Site 1
Sample size	63	60	50
Sex, female (%)	34 (54)	46 (76.7)	25 (50.0)
Age, years (SD)	51 (14)	57 (11)	61 (13)
BMI, kg/m ² (SD)	28.3 (4.3)	30.3 (6.5)	26.9 (5.9)
Waist circumference, cm (SD)	98.1 (12.2)	—	—
Diabetes (%)	5 (7.9)	14 (23.3)	4 (8.2)
Skin-to-liver capsule distance, cm (SD)	2.1 (0.4)	2.5 (0.6)	2.0 (0.6)
AST, IU/L (SD)	24.4 (10.9)	—	—
ALT, IU/L (SD)	28.4 (18.5)	—	—
Glycaemia, mg/dL (SD)	92 (12)	—	—
Cholesterol, mg/dL (SD)	194 (42)	—	—
Triglycerides, mg/dL (SD)	111 (71)	—	—
Steatosis (%)	32 ^a (50.8)	28 ^b (46.7)	18 ^a (36.0)
Liver stiffness, kPa (SD)	5.5 (2.0)	7.2 (2.4)	8.1 (6.5)

AC, attenuation coefficient; SD, standard deviation; BMI, body mass index; AST, aspartate transaminase; ALT, alanine transaminase; kPa, kilopascal.

^aAssessed with B-mode ultrasound.

^bassessed with magnetic resonance imaging proton density fat fraction in 30 participants and with hepato-renal index in the other 30

In conclusion, there is a depth and an ROI size dependence in measuring the AC obtained in the liver. This can substantially affect the results. A standardized acquisition protocol with a fixed depth and size of the ROI needs to be developed to minimize differences in AC measurements and to assess changes in serial measurements reliably.

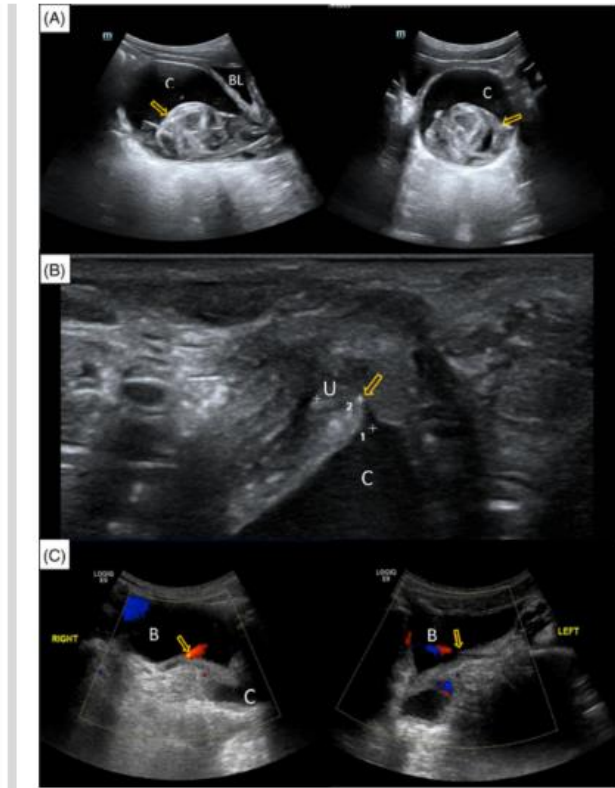
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CASE IMAGE

The confusing pelvic cystic mass: A case of giant prostatic utricle cyst diagnosed by ultrasound

Jing-Fang Cao MD, Chao Wang BS, Bin Xiao MD, Zhi-Jiang Wang BS, Ju-Lan Duan BS, Shuang Zheng MD, Pei Hu MD

First Published: 2 May 2023



The giant prostatic utricle cyst, located behind the bladder with removable irregular mixed echo, communicating with the urethra at the level of the seminal colliculus, was diagnosed by ultrasound and verified by pathology and surgery.

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

CASE IMAGE

Fetal giant liver hemangioma: Ultrasound, magnetic resonance imaging, three-dimensional reconstruction findings and perinatal outcomes of two cases

Pedro Teixeira Castro, Gerson Ribeiro, Tatiana Fazecas, Fernando Maia Peixoto-Filho, Edward Araujo Júnior PhD, Heron Werner

Pages: 652-655 | First Published: 11 November 2022



In this case report, we present two cases of fetal liver giant hemangioma assessed using ultrasound, magnetic resonance imaging and three-dimensional reconstructions with their respective postnatal outcomes.

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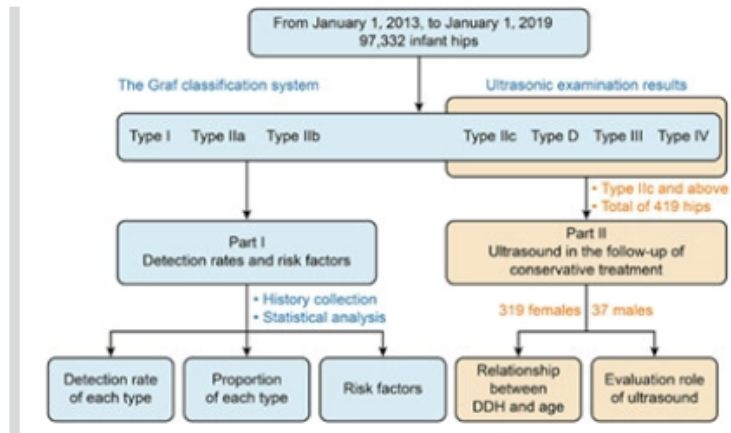
RESEARCH ARTICLE

Analysis of the results of hip ultrasonography in 48 666 infants and efficacy studies of conservative treatment

Jingnan He, Tao Chen, Xuemin Lyu

Pages: 656-662 | First Published: 15 February 2023

[↻ This article relates to:](#) ▼



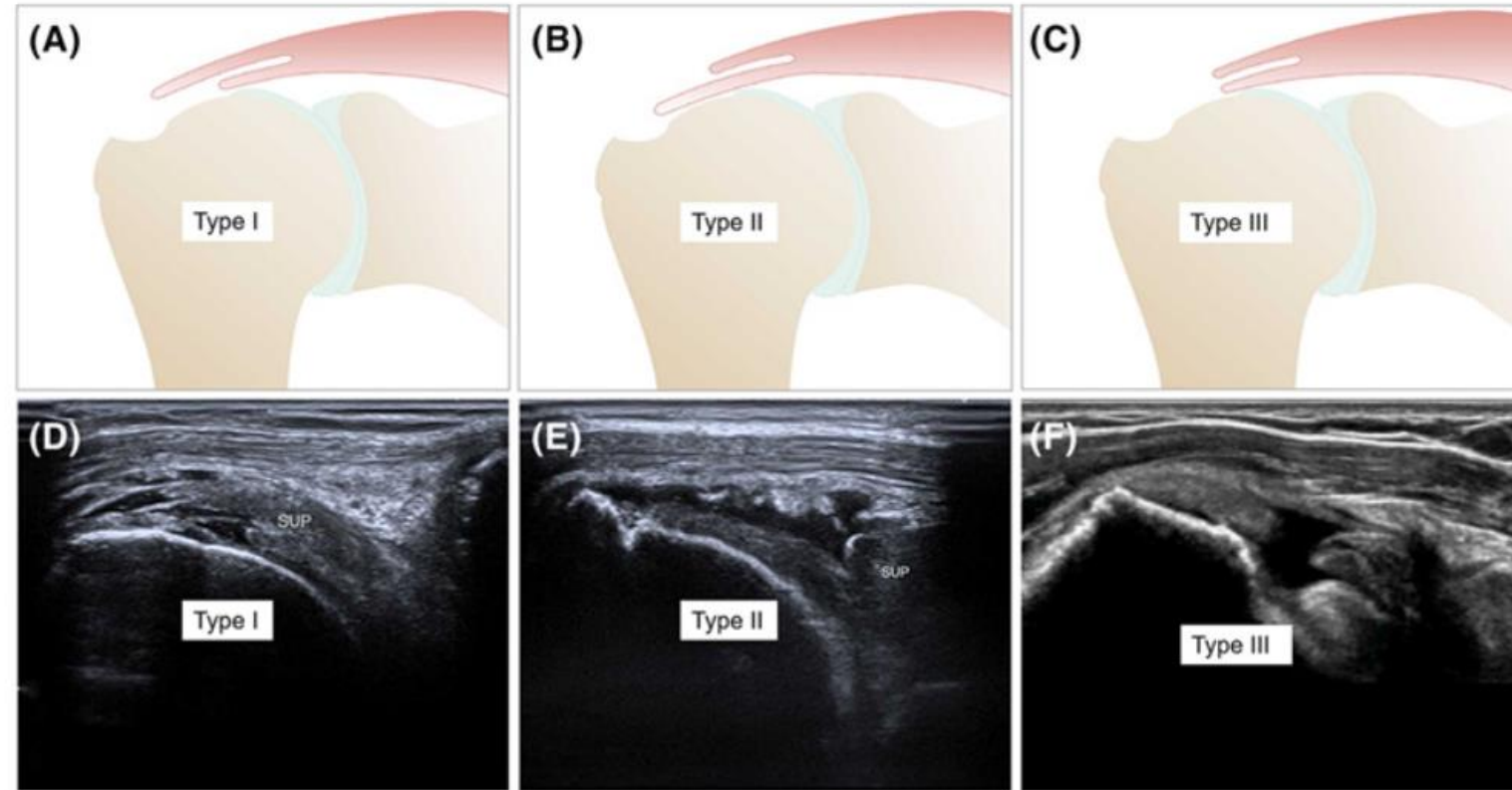
The prevalence of developmental dysplasia of the hip (DDH) varies widely in domestic and international studies, and data on the incidence or detection rate of DDH in local district are still lacking. This study was based on nearly 90 000 hips. In this study, the detection rate and distribution characteristics of the cases were investigated objectively. The results provide a basis for evidence-based medicine.

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Delamination of rotator cuff tears: Real-time dynamic ultrasound findings

Xiaodan Wang, Qiang Teng, Guiting Fang, Haiyan Fang, Luyv Zhao, Xiaofei Zheng, Xing Zhong

Pages: 680-686 | First Published: 29 March 2023

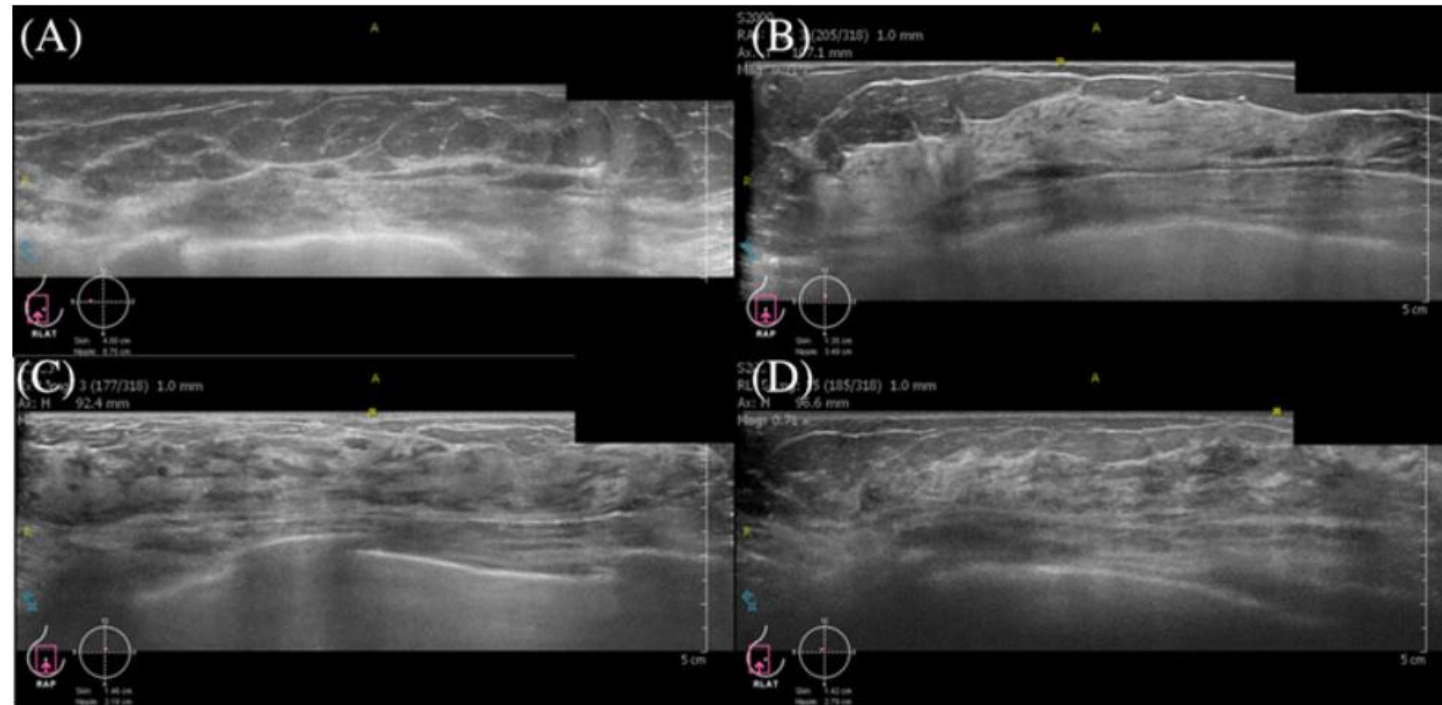


In present study, 47 cases of delaminated tear were analysed and the real-time dynamic ultrasound was proven that it was a practically technology used for diagnosing delamination of rotator cuff tears with medium sensitivity and high specificity.

Analysis of background echotexture on automated breast ultrasound using BI-RADS and modified classification: Association with clinical features and mammographic density

Eun Jung Choi MD, PhD, Hyemi Choi PhD, Jung Hee Byon MD, PhD, Ji Hyun Youk MD, PhD

Pages: 687-695 | First Published: 04 April 2023



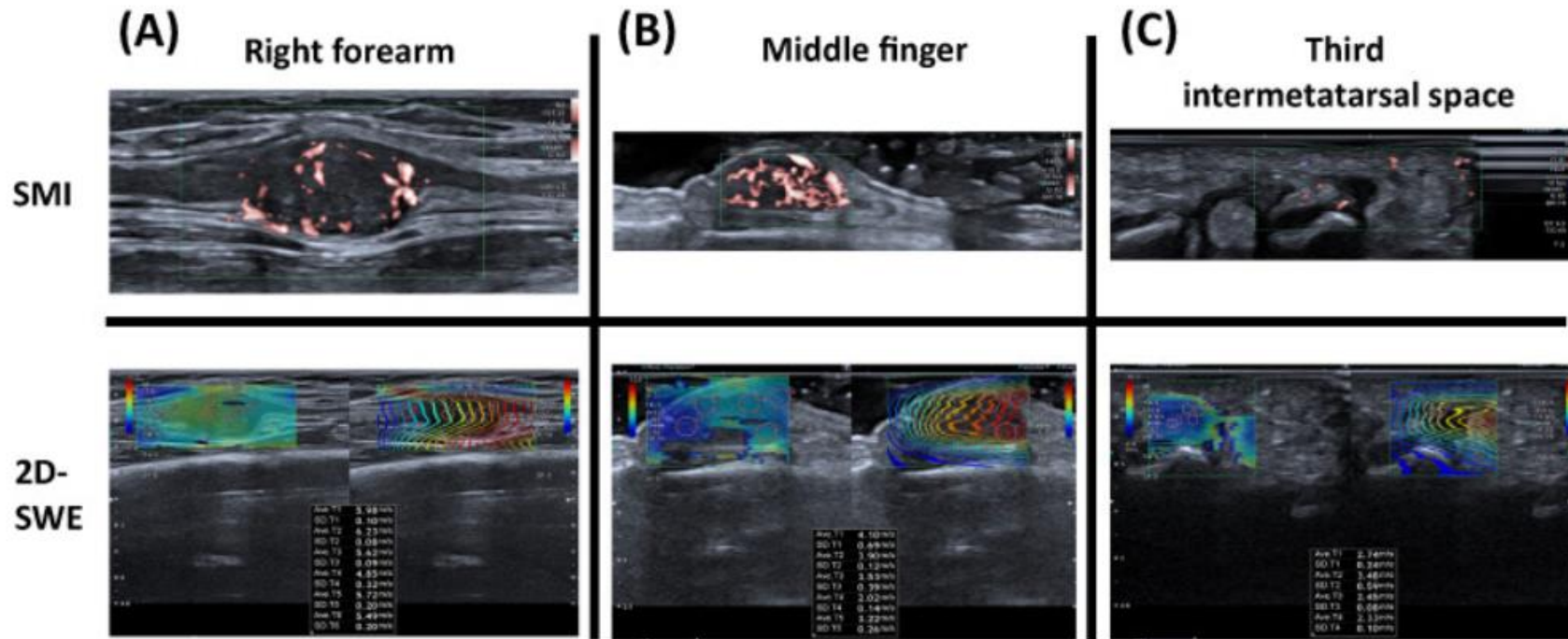
Representative ABUS images of breast background echotexture (BE): (A) homogeneous BE based on both the modified classification and BI-RADS (B) mild-heterogeneous based on the modified classification, while homogeneous-fibroglandular BE based on BI-RADS (C) moderate-heterogeneous BE (D) marked-heterogeneous BE based on the modified classification and heterogeneous BE based on BI-RADS (C, D).

CASE IMAGE

Multiparametric ultrasound images of three different cases of schwannoma of the peripheral nervous system

Enrico Maria Zardi MD, PhD, Camilla Chello MD

Pages: 745-747 | First Published: 17 March 2023



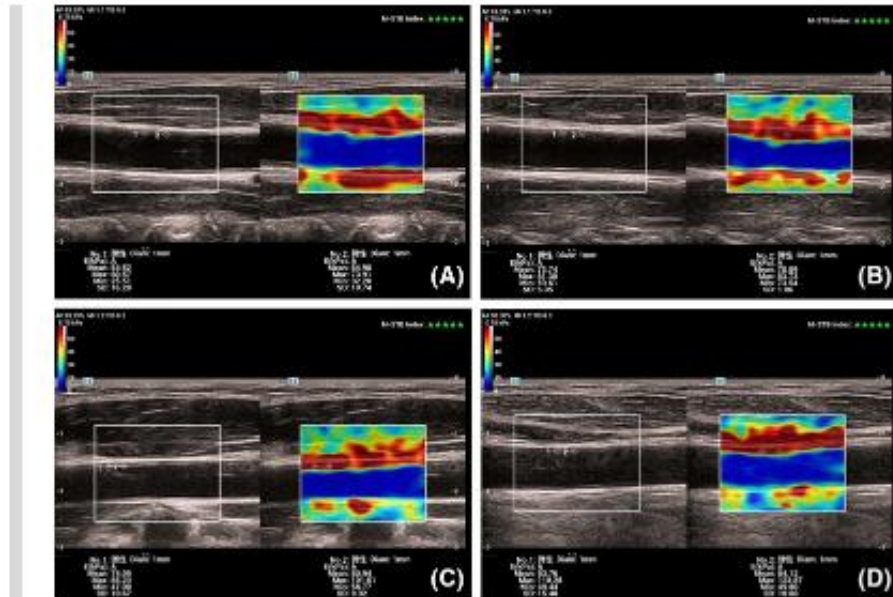
This case image illustrates the importance of new sonographic applications such as superb microvascular imaging and shear wave elastography; as showed, they improve the diagnostic recognition of peripheral nerve lesion thanks to a better definition of vascularity and measure of stiffness.

RESEARCH ARTICLES

Shear wave elastography to evaluate carotid artery elasticity in long-term drinkers with varying degrees of alcoholic fatty liver disease

Xiya Li, Zhen Li, Mengmeng Zhang, Guangsen Li PhD, Tingting Yu MD

Pages: 696-702 | First Published: 16 November 2022



We evaluated carotid artery elasticity in long-term drinkers with varying degrees of alcoholic fatty disease(AFLD) by shear elastography(SWE), SWE-related parameters obtained by shear wave elastography. A, group A (the control group); B, group B (without AFLD); C, group C (mild AFLD); D, group D (moderate-severe AFLD).

Review Article–Urology | [Published: 25 April 2023](#)

Ultrasound elastography in chronic kidney disease: a systematic review and meta-analysis

[Maurizio Cè](#) , [Paolo Florent Felisaz](#), [Marco Alì](#), [Giulia Vanessa Re Sartò](#) & [Michaela Cellina](#)

[Journal of Medical Ultrasonics](#) (2023) | [Cite this article](#)

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Abstract

Ultrasound elastography (USE) is a noninvasive technique for assessing tissue elasticity, and its application in nephrology has aroused growing interest in recent years. The purpose of this article is to systematically review the clinical application of USE in patients with chronic kidney disease (CKD), including native and transplanted kidneys, and quantitatively investigate differences in elasticity values between healthy individuals and CKD patients. Furthermore, we provide a qualitative analysis of the studies included, discussing the potential interplay between renal stiffness, estimated glomerular filtration rate, and fibrosis. In January 2022, a systematic search was carried out on the MEDLINE (PubMed) database, concerning studies on the application of USE in patients with CKD, including patients with transplanted kidneys. The results of the included studies were extracted by two independent researchers and presented mainly through a formal narrative summary. A meta-analysis of nine study parts from six studies was performed. A total of 647 studies were screened for eligibility and, after applying the exclusion and inclusion criteria, 69 studies were included, for a total of 6728 patients. The studies proved very heterogeneous in terms of design and results. The shear wave velocity difference of -0.82 m/s (95% CI: $-1.72-0.07$) between CKD patients and controls was not significant. This result agrees with the qualitative evaluation of included studies that found controversial results for the relationship between renal stiffness and glomerular filtration rate. On the contrary, a clear relationship seems to emerge between USE values and the degree of fibrosis. At present, due to the heterogeneity of results and technical challenges, large-scale application in the monitoring of CKD patients remains controversial.
