European Federation of Societies for Ultrasound in Medicine and Biology

Prize winners at EUROSON 2024, Naples, Italy

EFSUMB Best Case of the Month report: Ulrich Kaiser, Germany

Best Published Paper
Prize: Gert Weijers

Best Case Reports
First Prize: Magdalena Kryger
Second Prize: Andrea Balbinot

STUC prizes
Young Talent Award: Mariana Carolina Beatriz von Müller, Dresden, Germany

First prize in Sono battle: Alma Reuter, Berlin, Germany

Second prize in Sono battle: Florian Fussi, Linz, Austria

Third prize in Sono battle: Ranya Dafi, Hamburg, Germany

Young Investigator Awards
Best technical presentation: Gabrielle Laloy-Borgna, The Netherlands. Ultrasound imaging in bones: tissue characterization, anatomical images and blood flow measurements
Best clinical presentation: Martin Garset-Zamani, Denmark. Office-based Transoral and Transcervical Ultrasound for Detecting and Staging Oropharyngeal Cancers

Winning YIA Abstracts
Best technical presentation: Gabrielle Laloy-Borgna, The Netherlands

Ultrasound imaging in bones: tissue characterization, anatomical images and blood flow measurements

Abstract

Introduction

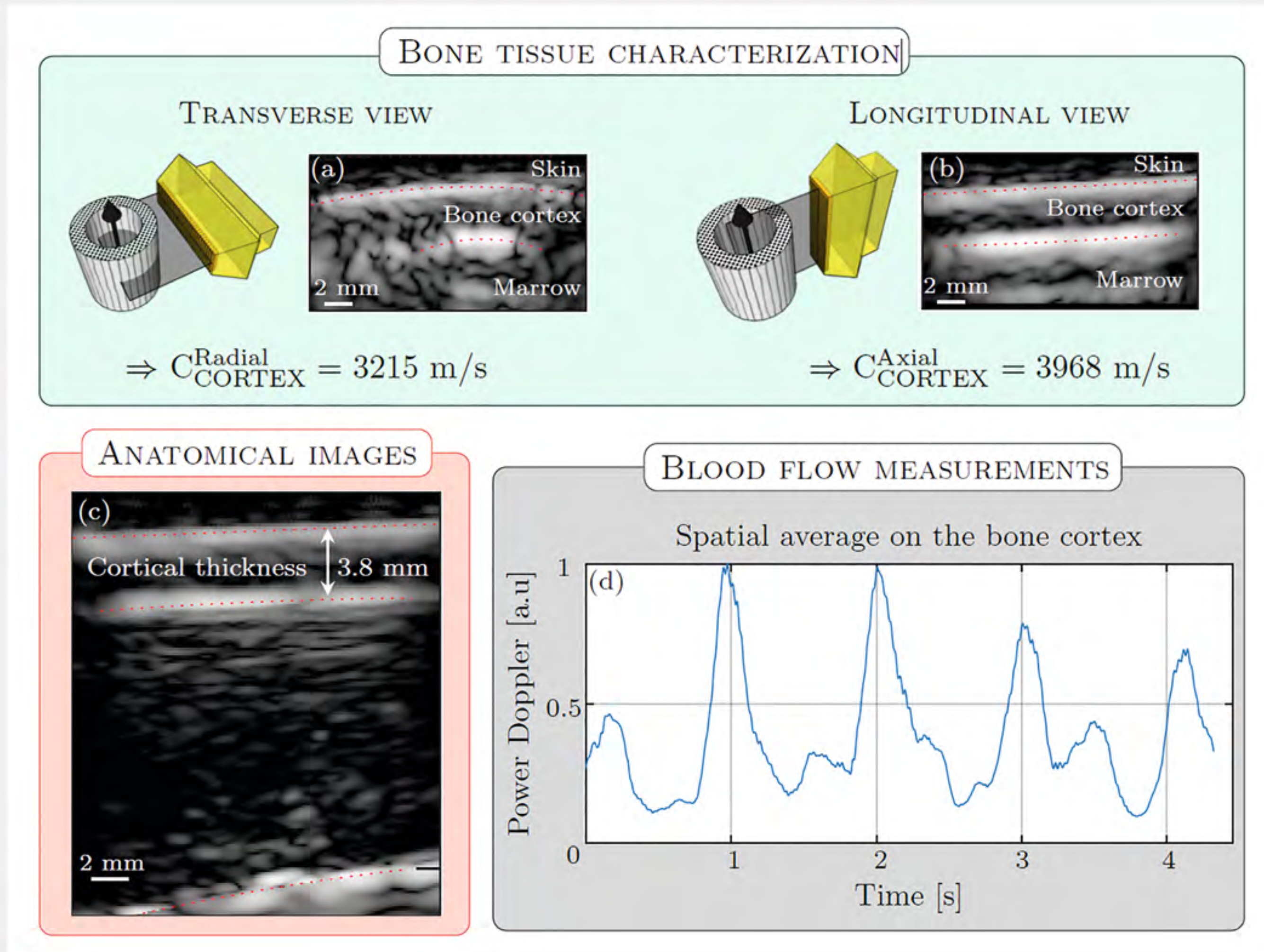
Ultrasound imaging inside bones has long been considered unfeasible, because clinical scanners do not consider the complex wave physics in bone tissue. However, the low costs, its portability, non-invasiveness and blood flow measurement ability of ultrasound make it an attractive imaging modality to study bone physiology and disorders.

Aims and Methods

Seismology-inspired methods were employed to characterize the direction-dependent ultrasound wave velocity (anisotropy) in the bone cortex. In a study on the tibia of healthy volunteers (approved by Ethics Committee [CPP Sud-Est II] and French Health Authorities [NO ID RCB: 2023-A02 403-42]), single-element transmissions were generated with a clinical cardiac probe connected to a fully programmable ultrasound scanner. From a transverse view of the tibia, the ultrasound wave velocity in the skin and the radial wave velocity in the bone cortex can be estimated (panel [a]). Then, using a longitudinal view of the bone cortex (panel [b]), the velocity of a wave guided by the skin/cortex interface called head-wave was measured, leading to an axial wave velocity estimation in the bone cortex. Once the wave velocity model is determined, delay-and-sum image reconstruction considering refraction and wave velocity anisotropy was used to reconstruct an anatomical image showing the different tissue layers (panel [c]): skin, bone cortex, marrow, and bone cortex. Finally, dedicated Doppler processing was applied to extract the pulsatile blood flow signal in the bone cortex, relying on the repeated transmission of diverging waves. Hence this method allows to retrieve 3 types of biomarkers from one single ultrasonic scan: [1] tissue elasticity and micro-structure characterization, [2] anatomical images enabling the measurement of the cortical thickness and [3] Doppler signal to estimate the flowing blood volume. Our method differs from the previously developed approaches [1] using ultrasound for bone characterization since it is an imaging-based technique.

Results

The parameters governing ultrasound wave velocity in the bone cortex were measured *in vivo* with a $<1\%$ precision. They are related to structural anisotropy, tissue elasticity and porosity [2], and could become valuable biomarkers of osteoporosis. In addition, B-mode images provided anatomical information such as the cortical thickness (2.5–4 mm) which is associated with fracture risk [3, 4]. Finally, we measured the time-varying blood signal power inside the cortical bone (panel [d]). Such a measure-



► **Fig. 1** Ultrasound imaging of a human tibia in vivo. Beforehand, several methods inspired from seismology are used to determine the anisotropic wave velocity model in cortical bone (**a–b**). These parameters are used to reconstruct a B-mode image of a tibia (**c**), accounting for refraction at tissue interfaces, then allowing to measure a power Doppler signal in the bone cortex (**d**).

ment is unprecedented and unreachable with other imaging modalities. Imaging and characterization of intra-osseous blood flow has multiple applications [5], like detecting bone marrow lesions (regions with higher blood flow) involved in osteoarthritis, or studying its coupling with bone remodelling in the context of physiology in microgravity.

Conclusion

Dedicated methods were developed to describe the physics governing ultrasound propagation in bone tissue, to unlock ultrasound imaging inside bones [6]. They provide 3 types of biomarkers: bone tissue characterization related to its microstructural quality; as well as anatomical images; and blood flow inside bone.

References

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[2] Granke M et al. Change in porosity is the major determinant of the variation of cortical bone elasticity at the millimeter scale in aged women. Bone 2011; 49: 1020–1026

[3] Cappelle SI et al. Discriminating value of HRpQCT for fractures in women with similar FRAX scores: A substudy of the FRISBEE cohort. Bone 2021; 143: 115613

[4] Nishiyama KK, Macdonald HM, Buie HR et al. Postmenopausal women with osteopenia have higher cortical porosity and thinner cortices at the distal radius and tibia than women with normal aBMD: An in vivo HR-pQCT study. Journal of Bone and Mineral Research 2010; 25: 882–890

[5] Lafage-Proust MH et al. Assessment of bone vascularization and its role in bone remodeling. BoneKEy Reports 2015; 4. doi:10.1038/bonekey.2015.29

[6] Salles S, Shepherd J, Vos HJ et al. Revealing Intraosseous Blood Flow in the Human Tibia With Ultrasound. JBMR Plus 2021; 5: e10543

Best clinical presentation
Martin Garset-Zamani, Denmark
Office-based Transoral and Transcervical Ultrasound for Detecting and Staging Oropharyngeal Cancers

Introduction

Distinction between asymmetric palatine tonsils and oropharyngeal squamous cell carcinoma (OPSCC) is difficult with current clinical and radiographic work-up. Furthermore, human papillomavirus (HPV) induced OPSCC can present with nodal metastasis and undetected small primary cancers i. e. as unknown primary (CUP). Ultrasound (US) of the oropharynx may improve the outpatient work-up of these patients. We aimed to compare the diagnostic accuracy for oropharyngeal tumor detection using US and magnetic resonance imaging (MRI). Secondly, to compare tumor staging between these modalities.

Methods

This was a multicenter, prospective, clinical trial with paired comparison between US and MRI. Patients with suspected OPSCC or neck lumps were assessed clinically by head and neck surgeons. If an oropharyngeal tumor or neck metastasis was suspected, patients were offered inclusion. Exclusion criteria were prior history of head and neck cancer, MRI, or positron emission tomography/computed tomography (PET/CT) within 3 months, and prior oropharyngeal biopsy results. After clinical exam, surgeon-performed transoral and transcervical US of the oropharynx was performed prior to biopsy results and cross-sectional imaging. MRIs were performed afterwards (including PET/CTs if suspected metastasis from CUP) and these were assessed blinded to US and histopathology. The primary outcome was the sensitivity and specificity for oropharyngeal tumor detection with transoral and transcervical US and MRI. Secondly, we compared T-staging between US, MRI, and CT.

Results

We included 162 patients with available MRI, transoral US, and transcervical US (105 [65 %] male; median age 63 years [IQR, 55–71 years]); 65 (82 %) of 80 HPV-tested OPSCCs were HPV-positive). A full transoral US exam could be completed in 78 % of cases. Compared to MRI, transoral US had similar sensitivity (86 % vs. 92 %, $P = .11$) but significantly higher specificity (79 % vs. 46 %, $P < .001$). Transcervical US had significantly worse sensitivity compared to MRI (70 % vs. 92 %, $P < .001$). For patients with CUP ($n = 40$), a completed transoral US exam ($n = 27$) resulted in equal 83 % sensitivity as PET/CT. For T-staging, US had high accuracy in T1, T2, and T4 tumors (87 %, 66 %, and 74 % agreement with final T-stage, respectively).

Conclusion

Surgeon-performed transoral US has the potential to improve the work-up of patients with OPSCC or CUP by providing point-of-care imaging comparable to cross-sectional scans.