A brief report on EFSUMB Guidelines and Recommendations for elastography and contrast-enhanced ultrasound in non-hepatic applications

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The importance of ultrasound is well recognized all around the world, and for the past two decades, innovative technologies found their way in this field. Among the most important, ultrasound elastography and contrast enhanced ultrasound (CEUS) are undoubtedly a major breakthrough in the evolution of ultrasonography.

Basic principles of elastography have not been changed since the first time they were described. Moreover, since 2003 when transient elastography (TE) was proposed as a tool in assessing liver fibrosis, other approaches for evaluating the stiffness of the liver have been tried in predicting the evolution of chronic liver disease [1]. Given the growing general interest indicated by the scientific evidence in this field and the novel proposed technical approaches, it is important to have a comprehensive understanding of the various techniques of elastography, a guidance for clinical applications that can promote consistency among clinicians and high-quality education. Regarding CEUS, the interest in this technique has grown for the past 20 years and it has reshaped the role of ultrasound in clinical practice. This concept dates back in the late 1960s [2] and it regained the specialists’ attention 20 years later [3], numerous papers published in the last 30 years have been confirming its value and potential for more extended future applications.

For the first time, in 2013, a group of experts from the European Federation of Societies of Ultrasound in Medicine and Biology (EFSUMB) published the elastography guidelines. These were updated for the liver in 2017 and will be updated for non-hepatic applications in 2019. The first guidelines for CEUS were published by EFSUMB in 2004, followed by updates in 2008 and 2012. In 2013, the World Federation for Ultrasound in Medicine and Biology (WFUMB) and EFSUMB released the worldwide "CEUS in the liver" guidelines and updated them in 2017 for non-hepatic applications, as well as for use in pediatric applications. These guidelines provide a comprehensive understanding of the current clinical status of each commercially available technology for elastography and CEUS applications. Also, the guidelines offer educational support on the basic physical principles and technology, practical advantages and disadvantages for each technique, guidance for the scanning technique, image interpretation and specific artefacts [4-6].

Many papers on ultrasound elastography and CEUS focused mainly on liver applications showing great advances in the field of hepatology. This approach made it possible for the clinicians to take fast decision for their patients, in terms of management and disease progression, and more importantly to decrease the number of liver biopsies. But these ultrasound technologies hold a great potential for non-hepatic application as well, for the characterization and the detection of focal lesions in organs like pancreas, spleen, kidney, thyroid, breast and other systems.

Three approaches can be used to assess the elastographic properties of the pancreas: transabdominal, endoscopic and intraoperative, all of them with their own advantages and disadvantages. In acute pancreatitis, the pancreatic parenchyma becomes stiffer, although the use of this technique is questionable in some studies.
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raphy cannot distinguish chronic pancreatitis from ma-
lignant tumors, although it can be used as an additional
imaging tool for diagnosis and grading. In characterizing
solid pancreatic lesions, transabdominal ultrasound is not
indicated, but endoscopic ultrasound elastography can
be used as a complementary imaging tool. For non-hepatic
applications, the pancreas is another organ of interest
for CEUS, providing a clear distinction between solid
and cystic lesions and a differentiation between cystic
neoplasms and pseudocysts. Solid pancreatic lesions de-
tected on conventional ultrasound can be characterized as
ductal adenocarcinoma by CEUS, evaluating the lesion
as typically hypo-enhancing in all phases, compared to
neuroendocrine tumors that are hyper-enhancing lesions
in the arterial phase. CEUS can be used to assess the le-
sion size, the margins of a pancreatic lesion and the rela-
tion to the peripancreatic vessels, as well as to differenti-
ate vascular from avascular components of a pancreatic
lesions [5,6].

Bowel wall lesions can be investigated using strain
elastography (SE) and shear wave elastography (SWE),
but most of the studies are based on SE, with main fo-
cus on the distinction between fibrous and inflammation
strictures in Chon’s disease (CD) and also in distinguishing
rectal adenoma from adenocarcinoma. EFSUMB rec-
ommends SE for the characterization of the bowel wall
lesions in CD, with ultrasound elastography as an add-on
to endoscopic rectal ultrasound, and magnetic resonance
imaging for improving rectal cancer staging. CEUS of
the gastrointestinal tract can provide important vascular
information, evaluating the vascularity of the gastroin-
testinal wall or tumor. In inflammatory bowel disease,
CEUS can estimate more adequate than Power Doppler
between disease activity stages, discern between fibrous
and inflammatory stricture in CD, as well as monitoring
the effect of treatment. Moreover, in CD it can be used
to detect abscesses and to confirm and track the route of
fistulæ [5,6].

Spleen stiffness assessed by elastography correlates
well with hepatic vein portal gradient, recommended as
an additional non-invasive method to evaluate portal hy-
pertension. Conventional US has a low accuracy in the
diagnosis of splenic solid lesions, whilst CEUS improves
the detection of focal abnormalities, as well as the identi-
fication of benign lesions with a persistent enhancement
pattern in the late phase. Like other parenchymal organs,
CEUS can also be used for diagnosing splenic infarction
[5,6].

Renal elastography has limited applications, SE be-
ing used only for superficial kidneys, a situation encoun-
tered in renal transplantation. It would be of a great help
as a non-invasive test, in order to avoid repeated biopsies
for assessing histological lesions. Current recommenda-
tion is to be used as an additional tool in the diagnosis of
chronic allograft nephropathy. On the other hand, CEUS
can characterize focal renal lesions and it has similar de-
tection rates of renal ischemia as CT imaging. EFSUMB
recommends the use of CEUS to differentiate between re-
nal tumors and "pseudotumors" whenever conventional
US is equivocal, to characterize complex cysts, indeter-
minate renal lesions and renal abscesses in complicated
acute pyelonephritis. Also, CEUS can offer informations
in non-surgical renal lesions follow-up [5,6].

The use of CEUS and elastography for focal lesions
has decreased the drastic approach in testicular pathol-
ogy. CEUS represents a solution to differentiate between
hypovascular and avascular lesions, providing a practical
solution in segmental testicular infarction and in discrim-
inating non-viable regions in testicular trauma. CEUS
may be a convenient method to exclude prostate malign-
nancy by distinguishing vascular from non-vascular le-
sions. It brings no additional information in pathologies
such as spermatic cord torsion and it has a limited use
in extratesticular intrascrotal focal lesions. Testicular
elastography is recommended to be adjunctive to other
ultrasound techniques, as there is an overlap in findings
between benign and malignant neoplasms [5,6].

Regarding the prostate, some studies reported im-
provement in biopsy guidance when using SE, but it was
invalidated by others. The recommendation is for using
transrectal ultrasound elastography to identify the sus-
picious target region for biopsy, increasing the rate of
positive biopsy cores. CEUS cannot be recommended
for clinical use in the detection and diagnosis of prostate
cancer [5,6].

SE and SWE are used as add-ons to conventional B-
mode examination in characterizing breast lesions, and
thus increasing diagnosis confidence. In addition, BI-
RADS 3 lesions should be considered for biopsy if they
appear stiffer on breast ultrasound elastography. Numerous
studies investigated CEUS in differentiating breast
masses, but no specific pattern could indicate malignancy
and at this moment it cannot be recommended for clini-
cal use. For assessing the status of axillary lymph nodes,
CEUS was used by injecting the ultrasound contrast
agent intradermally, but it is still being studied and it is
not recommended for clinical use [5,6].

Elastography, particularly the semi-quantitative
methods, used for assessing thyroid abnormalities,
should be used as a complementary tool to B-mode US.
The assessment could provide additional information of
thyroid nodule characteristics and thus supports the clini-
cal decision of fine-needle aspiration biopsy. The use of
CEUS in the diagnosis of thyroid malignancy is still an
active research as there are several limitations in the interpretation of tumor microvascularity, due to the overlapping data between quantitative and qualitative evaluation. Therefore, it cannot be recommended for clinical use [5,6].

Currently, CEUS is not recommended to assess lymph nodes in clinical practice but elastography can be used as an additional tool to differentiate between benign and malignant lymph nodes, in both superficial and mediastinal lymph nodes. Another recommendation is to use ultrasound elastography to help clinicians make decisions on targeted fine-needle aspiration biopsy of the most suspicious lymph nodes and/or suspicious areas within the lymph nodes [5,6].

Current advances in ultrasound technology have dramatically changed the management in various areas, especially by reducing the number of biopsies, whilst newer technologies emerge with a range of applications that are currently being investigated. This high pace might seem inciting but at times it can be overwhelming for the clinician and thus, the need of guidelines is essential. This strategy could increase the quality of care by reducing the costs of a final diagnosis and by answering rapidly and accurately to a clinical question.

References