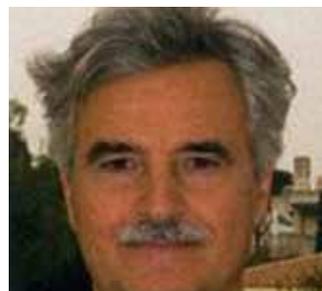


Greek center of excellence in ultrasound and elastography

The Diagnostic Echotomography/Echomed Day Clinic in Kifissia, Athens, Greece has a deserved and well-established reputation of being a center of excellence in the field of ultrasound and elastography imaging.

The Center has recently acquired a new Mindray elastography system. We wanted to find out more about the center in general and how the new elastography system was performing in particular, so we spoke to Dr Pavlos Zoumpoulis MD, PhD radiologist and director of the Day Clinic.



Dr Pavlos Zoumpoulis MD, Ph.D., is radiologist and director of the Echomed Day Clinic in Kifissia, Athens, Greece. email p.zoumpoulis@echomed.gr

Q *Let's start with your Center in general. How many patients do you see annually? From which geographical area do the patients come? Is your center associated with any particular hospital?*

Founded in 1985, Echomed is an independent medical company that is, as the name suggests, focussed on and specialized in ultrasound (US). We see approximately 20,000 patients per year in Echomed, and this number is steadily increasing year-on-year by about 10%. Our patients mainly come from all over Greece, but in addition we have a small number of patients who come from neighboring and Eastern European countries, such as Albania, the Former Yugoslav Republic of Macedonia (FYROM), Bulgaria, Kosovo, Ukraine and Moldavia).

Although Echomed is a stand-alone institute we have close working associations with the hepatology departments of the Laiko and Ippokrateio University Hospitals, both of which are in Athens and are specialized in all liver disorders. Likewise we have close relations with the oncology unit in the University Hospital of Patras to the west of Athens. This unit is specialized in prostate cancer.

We see 50-70 cases of Chronic Liver Disease (CLD) of different causes per week. Approximately 45% of those cases are suitable for incorporation in the many clinical trials we are running, requiring either a liver biopsy, a Fibroscan (classical elastography scan) or a Fibrotest (measurement of serum markers of liver disorders). We carry out 8-12 US/Shear Wave Elastography (SWE) -guided or US/MRI fusion-guided prostate biopsies per week. We also perform approximately 4-6 US-guided fine needle thyroid biopsies per week.

"...All this generates an exciting feeling that we are entering a spectacular new era in US imaging..."

Q *Now, what about the equipment you have in order to deal with all these patients — ultrasound of course but what about other imaging modalities?*

At Echomed we are entirely focussed on ultrasound — whether it be preventive, diagnostic or therapeutic US -guided interventions. We also have an endoscopy unit but, apart from the ultrasound and endoscopy, we don't have any other imaging modality. We have six examination rooms which are all interconnected so our medical teams always have the possibility of easily getting a second opinion on any challenging cases.

We have recently implemented a new RIS/PACS system, which we find particularly useful since the scientific module of the system helps us to store data for the protocols of the examinations we are carrying out and also for the clinical trials we are involved in. The RIS/PACS has a module for transmitting images, videos and reports to the referring physicians including dictated oral comments from the examiner.

It also includes a web-app that can be accessed by the patient via the patient's own mobile phone. This helps us in offering personalized services to our Echomed patients. The PACS/RIS of course also includes an archive of all exams performed in Echomed and allows easy comparison between new and prior images.

Q *And the personnel to run the equipment?*

We have a total of 11 doctors comprising six radiologists, two gastroenterologists, one cardiologist, one gynecologist, one pathologist and one anesthesiologist, each one dealing with a specific field of diagnostic and interventional US, e.g.. US/ MRI fusion-guided biopsies,

contrast-enhanced ultrasound (CEUS), cardiology, vascular, musculo skeletal imaging (MSK), urogenital/prostate, breast, thyroid/lymph nodes.

We also have an in-house software specialist who mainly deals with the RIS/PACS system support and Echomed's internet presence (websites, social media, etc.).

In addition there is a medical physicist who deals with our research activities, as well as with the communication and collaboration with the R&D departments of the US equipment constructors who are associated with Echomed. A Senior Data Scientist supervises the collection of data, especially for the clinical trials and research projects as well as collating our scientific publications. Our personnel numbers are rounded off by a nurse and all this structure is supported by five staff members dealing with the necessary administration.

Q *Let's turn more specifically to elastography. Since when have you had your system? What were the reasons for its purchase? Was there a significant learning curve? For what type of cases do you use it?*

We have been working in US Elastography for ten years now, during which period we have used many different elastography technologies. As for hepatology, we started off using Fibroscan and we are now continuing using the recent Shear Wave Elastography (SWE) applications. Regarding the prostate, we started using the first Strain Elastography technique that was introduced to the market but now are currently using the recent SWE applications for reliable guidance of prostate biopsies.

Q *So why this focus on — and investment in — elastography?*

Ever since the early years of US, we have accumulated a lot of experience with the technology and since then we have followed and evaluated many US-based innovations and applications. Some of these developments are of undoubted clinical value, some are important research tools, and some are only "gadgets" of doubtful value.

We have however thankfully progressed from the early days of the introduction of elastography, during which constructors generally claimed that elastography was the answer to all problems.

We are now confident that the recent SWE applications with dedicated transducers belong to the first category, namely that of the most clinically important group of technologies.

The precise usefulness of these applications varies depending on the different pathologies, e.g. cancer vs. chronic disease, and also on the organ being examined, e.g. superficial organs such as the breast or thyroid vs. more deeply situated organs such as liver, kidney, or prostate.

"...SWE has been added to the imaging arsenal of the physician and is here to stay..."



Liver examination using SWE. The Shear Wave Elastography technology of Mindray's Resona 7 system is based on the company's exclusive Ultra Wide Beam Tracking for faster and more precise imaging. It realizes real time imaging with comprehensive quantification metrics for enhanced diagnostic confidence.

The investment we have made in elastography is directly related to the importance we attribute to its use in a number of crucial SWE applications:

1. **Liver.** Staging and grading of CLD and Non Alcoholic Steatohepatitis (NASH)
2. **Breast.** Down-grading borderline lesions seen in mammography
3. **Prostate.** Improved biopsy guidance by applying elastographic criteria to tumor-suspicious lesions. In this application elastography can play an important role in differentiating types of prostate adenocarcinoma. Such differential diagnosis is important not just to optimize the patient's well-being and outcome but also for the emotional and socio-economic consequences of the over-diagnosis and over-treatment frequently associated with prostatic adenocarcinoma.
4. **Thyroid and Lymph nodes.** Discrimination of the suspicious "hard" segment of a nodule and appropriate guidance of the biopsy needle.
5. **MSK/Skin.** Guiding therapeutic or cosmetic interventions.

Thus, now that we are convinced of the realistic uses and benefits of SWE in the above applications, we are in a position to be able to invest in appropriate elastography technology, equipment and probes. Choosing the equipment is not easy since various constructors propose several different elastography solutions in the respective anatomical application.

Finally and taking into account the B-Mode, Color Doppler and Elastography performances we opted for the Mindray's Resona 7.

Q *What were the reasons for that choice?*

The criteria we applied were the ability of the system to routinely handle the above anatomy/pathology applications for the organs we are interested in, namely, liver, breast, prostate, thyroid, & MSK.

There are currently a small number of specialized US machines on the market on which one can depend for reliable answers to crucial questions concerning the stiffness of certain specific tissues with different properties and in different anatomical situations.

But what we were looking for was a heavy-duty, multi-purpose US equipment able to carry out all US exams of the whole body, from head to toe. SWE alone can provide stiffness measurements in a number of organs.

We are no longer in the era of the single-line, non-guided elastography measurement offered by Fibroscan.

In stark contrast to the old Fibroscan, with modern high-end US/SWE machines a physician or clinician can, with the same system, acquire:

1. High-definition B-Mode images for a precise anatomical morphologic visualization of all organs
2. High quality color and pulsed Doppler images for reliable hemodynamic evaluation of the vasculature of the organs.

“...B-mode and Color Doppler are crucial, and related, aspects of the underlying technology. Elastography can now be added as the third, vital facet...”

These two features, i.e. B-Mode & Color Doppler, are crucial, and related, aspects of the same underlying technology. Elastography can now be added as the third vital facet.

However for SWE to be in practice applicable to every organ and in all anatomic regions — some of which can be technically difficult — it must come in an US/SWE machine with solid B-Mode and Color Doppler functionality. The three components together form a powerful multiparameter US/CD/SWE imaging tool.

To realize the full potential of SWE and its applications there is however a learning curve to be climbed. This can be long, depending mainly on the level of already acquired US education and training. We find that courses on the theory and physical principles behind SWE are vital since an understanding of the actual production of Shear Waves helps the practitioner considerably in the acquisition of reliable diagnostic images. In our experience, we have found that a six-months training course with the system carrying out 4-6 SWE exams every day under the supervision of an experienced practitioner is sufficient to attain an appropriately high level of expertise.

We at Echomed fully acknowledge that there can be complex educational and training issues associated with elastography. Our response to this need is the organization of theoretical and practical elastography courses which are in practice carried out by Echonet, our affiliate company. Echonet uses Echomed’s teaching and training facilities in order to achieve its educational purpose.

Q *And the future? How do you see technological or other developments in the future?*

SWE has been added to the imaging arsenal of the physician and is here to stay. SWE has already been shown that it can provide useful information in the imaging of many, if not all organs that are accessible by US. We are already working on prototypes for imaging in MSK, vessels and the kidneys. All this generates an exciting feeling that we are entering a spectacular new era in US imaging.

However as regards innovation in US, it shouldn’t be considered that SWE is the only new area of development:

In fact, B Mode US is now pushing new frontiers regarding the quality of the US image. Likewise, SW image analysis can in many organs now provide more detailed information concerning their fat, fibrotic tissue and heavy metal content. The technology of Color Doppler is also progressing rapidly, particularly with the involvement of, and collaboration between specialized clinicians on the one hand and

medical physicists and biomedical engineers on the other. Such collaborative approaches have already generated promising results on the hemodynamic characterization and behavior of all organs. The technology of CEUS and its applications are also expanding dramatically.

US alone, or with SWE as a hand-in-hand companion, is already becoming the “*sine qua non*” diagnostic tool for all health professionals, including doctors of all specialties. This trend, along with the continued miniaturization of the instrumentation looks set to keep US at the leading edge of all health services, ranging from the patient’s bedside at home to the advanced surgical operating room of a university hospital. Hand-held equipment and mobile based wireless US transducers may produce crucial preventive, diagnostic and therapeutic analysis of symptoms.

One of the central guidelines for the education of medical students, nurses

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and midwives has to be the inclusion, early in the study curriculum, of appropriate training in US. Recognizing this, the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) has initiated the implementation of traditional and web-based courses to meet the need.

The broad expansion of US could also be accelerated with the onset of the era of “Big Data” and Artificial Intelligence. The implementation of “Real World Data” could revolutionize the field of medical health, not just in terms of research but also for improving the outcomes of almost all acute or chronic medical conditions. Machine Learning technologies, along with the revolution of the “Internet of Things”, is in general making knowledge ever-more accessible.

In particular this should promote US even further as a key factor in improving the cost-effectiveness of medicine in the years to come.