EFSUMB Newsletter

European Federation of Societies for Ultrasound in Medicine and Biology

ECMUS Safety Committee Report

Can Antenatal Exposure to Ultrasound Affect Neuronal Migration in Mice?

Gail ter Haar

In view of its potential implications for the safe use of ultrasound in obstetrics, the EFSUMB safety committee (ECMUS) has taken a close look at a paper published by Ang and colleagues (Ang E, Gluncic V, Duque A, Schafer M, Rakic P. Prenatal exposure to ultrasound waves impacts neuronal migration in mice. Proceedings of the National Academy of Science 2006), and have produced the following critique:

This study indicates that exposure of the embryonic mouse to ultrasound for 30 minutes or longer can affect neuronal migration in the cerebral cortex and thereby prevent some neurons from attaining their final proper position.

Methods

Pregnant mice were injected on embryonic day 16 with a DNA-replication marker to label dividing proliferative zone cells destined for superficial cortical layers 2 and 3. Within the next 3 days, while these cells were migrating across the cerebral wall, the animals were exposed to multiple sessions of ultrasound. The total exposure ranged from 5 to 420 min. Control mice were subjected to identical procedures but without exposure to ultrasound. The pregnancies were brought to term (embryonic day 19), and euthanized on postnatal day 10. The brains of the pups were fixed, sectioned and stained. The labelled cells were located and counted by investigators who were blind to the experimental conditions.

Results

Analysis of over 335 animals revealed that, when exposed to ultrasound for a total of 30 min or longer, a small but statistically significant number of neurons failed to reach their proper position in the brain. The amount of faulty dispersion of labelled neurons increased with duration of exposure to ultrasound. However, the "dose-response" was not completely linear; there was a slightly smaller effect following 210 min exposure than following 60 min exposure. On the other hand, there was also an increase in abnormal cell migration in animals exposed to a 420-min sham experiment over that in normal controls. This might be due to the effect of stress experienced by pregnant animals

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during prolonged exposure to the experimental procedure. Shorter durations of sham exposure had no effect on cell migration compared to normal controls. Thus, humorally mediated stress resulting from the exposure of pregnant mothers to the experimental procedure, appears to play a role only in extended exposures (420 min).

In an independent sham-exposure experiment, ultrasound exposure did not affect oxygenation or body core temperature in pregnant mice, and thus the authors speculate that the mechanism for the disturbed neuronal migration resulting from ultrasound may be a nonthermal, noncavitational, mechanically mediated effect, perhaps involving radiation force or microstreaming, or shear effects on cellular walls. These mechanical effects might interfere with the delicate adhesion between the migratory neurons and the surface of migratory substrates, such as the radial glial shafts, which serve as guides. Ultrasound may also disturb exocytosis, essential for the extension of the leading tip of migrating neurons, or disrupt the cytoskeletal rearrangement essential for the translocation of the nucleus within its leading process.

What is the relevance of these mouse experiments to cortical development in humans?

Data supporting relevance for the human fetus

- The characteristics of the ultrasound beams and the ultrasound intensities used in the experiment are similar to those used in ultrasound examinations of human fetuses. The shortest exposure time (30 min) that resulted in a statistically significant effect on neuronal migration time is similar to that used in some medically indicated scans. Souvenir scans may last longer than 30 min. Moreover, during souvenir scanning, the examiner often concentrates on getting good images of the fetal face, and the ultrasound beam may therefore be directed towards the fetal head for rather long times.
- Ultrasound may have a similar or even greater impact on neuronal migration in the human fetal brain than in the mouse brain.
  - Firstly, migrating neurons in the human forebrain are only slightly larger than in the mouse, and the amount of energy absorbed within a comparable small volume of tissue during the ultrasound exposure may be the same as in the mouse embryo.
  - Secondly, in the human brain, the number of neurons migrating is much larger and their routes are more complex, thus increasing the chance of a cell going astray from its proper migratory course.
  - Thirdly, the settling pattern of neurons in primates is more precise than in rodents and so the tolerance to malpositioning may be less.

Data supporting lack of relevance for the human fetus

- There are huge differences in the number of neurons and the size of the cerebral cortex between mice and humans.
- The distance between the exposed cells and ultrasound transducer in the mice experiments is much shorter than for human ultrasound examinations, and the attenuation of ultrasound is likely to be much greater in the human.
- In the mouse experiment, the probe was held still, and so the same part of the mouse embryo – probably the whole mouse embryo – was continuously exposed to ultrasound. In a clinical examination of the human fetus, the ultrasound probe is continuously moved, and different parts of the fetus are exposed to ultrasound, the duration of the exposure of one particular part of the fetus being relatively short.
- The duration of neuronal production and the migratory phase of cortical neurons in the human fetus lasts at least18 times longer than in mice (migration in humans occurs over 18 weeks, i.e. between 6 and 24 weeks of gestation, with the peak occurring between 11 and 15 weeks as compared with over 1 week (between days 11 and 18) in the mouse). Thus, an exposure time of 30 min represents a much smaller proportion of the time dedicated to the development of the cerebral cortex in the human than in the mouse and, thus, could have a lesser overall effect, making human corticogenesis less vulnerable to ultrasound.

Future work needed

It is essential to examine the possible effects of ultrasound exposure on cortical development in non-human primates, where the duration of embryogenesis and the size and complexity of migratory pathways are more similar to those in humans.

Conclusion

It is not known whether, or to what extent, ultrasound exposure affects migrating neurons in developing humans, but there are numerous human neuropsychiatric disorders that are thought to be the result of the misplacement of cells as a consequence of abnormal neuronal migration. These results in pregnant mice support the EFSUMB warnings about the use of non-medically indicated, or commercial, prenatal ultrasound videos.

Prof Gail ter Haar
Chairman ECMUS Committee

This review, and those of the other papers recently reviewed by ECMUS1–4 are to be found on the ECMUS area of EFSUMB's website.

References

1 Kieler H, Haglund B, Cnattingius S, Palmgren J, Axelsson O. Does prenatal sonography affect intellectual performance? Epidemiology 2005; 16: 304–310
2 Stålberg K, Haglund B, Axelsson O, Cnattingius S, Hultman CM, Kieler H. Prenatal ultrasound scanning and the risk of Schizophrenia and other psychoses. Epidemiology 2007; 18: 577– 582.
3 Vykhodtseva N, McDannold N, Hynynen K. Progress and problems in the application of focused ultrasound for blood-brain barrier disruption. Ultrasonics. 2008;48:279–96.
4 Williams AR, Wiggins RC, Wharram BL, Goyal M, Dou C, Johnson KJ, Miller DL. Nephron injury induced by diagnostic ultrasound imaging at high mechanical index with gas body contrast agent. Ultrasound Med Biol. 2007; 33:1336–1344

ECMUS Literature Reviews

Kieler H, Haglund B, Cnattingius S, Palmgren J, Axelsson O. Does prenatal sonography affect intellectual performance? Epidemiology 2005; 16: 304–310

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This is a registry study of a possible association between exposure to ultrasound during pregnancy and intellectual performance among 18 years old males.

The information about intellectual abilities was retrieved from the Swedish National Service Register which includes the results of a battery of tests the men are submitted to when enrolling for military service at the age of 18 years. The test results are given as standard scores (maximum 9, mean 5, SD 2).

Data about the place of birth of a cohort of more than 200,000 individuals were available from the Swedish Medical Birth Register. After exclusions, two groups were compared – a group of 6026 men, supposedly exposed to ultrasound as fetuses, and a control group of 161,033 men. The exposure to ultrasound was assumed to have happened as the men of the index group were born in the Southern Swedish area served by the Malmö Department of Obstetrics and Gynecology that was the only unit in Sweden that offered an ultrasound examination as a routine for detection of multiple pregnancies and dating to all pregnant women during the years 1973–1978. Two additional comparisons were performed: the results of the index cohort were compared to the results of the period before introduction of routine ultrasound in Malmö and analyses were also performed on 15,540 pairs of brothers. The older brothers were born before, and the younger brothers after, the introduction of ultrasound examinations; in 456 of the pairs, the younger brothers were born in Malmö.

The men born in Malmö were found to have lower intellectual performance scores (mean difference -0.16; 95% confidence interval [CI] -0.21 to -0.11) and an increased risk of subnormal performance (odds ratio [OR] 1.28; CI 1.18–1.38) as compared with the control group. However, when analysing the period before the introduction of ultrasound examinations, the men born in Malmö also had lower intellectual performance and the difference was of similar magnitude. In addition, there were no differences within brother pairs, when comparing the younger brothers, assumed to have been exposed to ultrasound, and the unexposed older brothers. Thus, the authors concluded that there was no association between ultrasound examination during pregnancy and intellectual performance in young adults. The present study is large, and the information was collected prospectively in the registries. Nevertheless the study has limitations; possible confounding factors are largely unknown, the intellectual test used at enrolment may be questioned, and the exposure information is assumed, based only on information about the place of birth. This is adequately discussed in the paper. The results do not suggest a negative influence of ultrasound examination in pregnancy on the intellectual development in males.

Stålberg K, Haglund B, Axelsson O, Cnattingius S, Hultman CM, Kieler H. Prenatal ultrasound scanning and the risk of Schizophrenia and other psychoses. Epidemiology 2007; 18: 577–82

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Prenatal ultrasound exposure has been associated with increased prevalence of left-hand or mixed-hand preference and has been suggested to affect the normal lateralization of the fetal brain. Atypical lateralization is more common in patients with schizophrenia. Thus, a study on the possible association between prenatal ultrasound and schizophrenia is welcomed. This cohort study assesses ultrasound exposure from aggregate data. The University Hospital in Malmø was the first hospital in Sweden to use ultrasound scans as part of standard antenatal care. Children born in Malmø in 1973–78 were considered exposed to ultrasound. They were compared with children born in 1973–78 at other Swedish hospitals that had not yet introduced ultrasound. Those children were considered unexposed to ultrasound. The Swedish Medical Birth Register (information on place of birth) was linked to the Hospital Discharge Register and the Cause of Death Register.

In all, 370,945 individuals were included in the study, of whom 13,212 were assumed to have been exposed to ultrasound. The exposed group demonstrated a tendency toward a higher risk of schizophrenia (crude incidence rate among men = 1.58, 95% CI 0.99-2.51, and among women = 1.26, 95% CI 0.62-2.55). However, men and women born in several other tertiary level hospitals without ultrasound scanning facilities also had higher risks of schizophrenia compared with those born in other hospitals. For other psychoses there were no differences between groups. The authors concluded that there were no clear associations between prenatal ultrasound exposure and schizophrenia or other psychoses. Other factors related to place of birth might have influenced the results.

Comment

The authors found a borderline statistically significant association in men. Being a cohort study, there might be bias or confounding factors involved in explaining the association. There is no doubt that the simplistic method of assigning ultrasound exposure (on the basis of place of birth) has misclassified some of the individuals in the study. The authors validly argue that this misclassification bias will lead to an underestimation of the association and reduce the possibility to find an existing relation between exposure and outcome.

This is an important study with a well-founded conclusion, that there is probably no association between prenatal ultrasound and schizophrenia or other psychoses later in life. However, the present study addressed US devices in clinical use in 1973–1978. It is a well-known fact that intensity output levels from modern devices may be 10–15 times higher. Thus, the study may be of limited relevance for current obstetric ultrasound scanning.

Vykhodtseva N, McDannold N, Hynynen K. Progress and problems in the application of focused ultrasound for blood-brain barrier disruption. Ultrasonics. 2008; 48: 279–96

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Do you know what the major feature of the blood brain barrier is? The endothelial cells of brain capillaries are uniquely bound to their neighbours by tight junctions which restrict the passage of drugs into the brain to small molecules and some lipophilic drugs such as narcotics. No other drugs can enter the brain and reach a site of action. Two methods have

succeeded in disrupting the blood brain barrier over the last decades, intra-arterial infusion of hyperosmolar mannitol and focused ultrasound, yet these have never progressed beyond an initial experimental stage. Some time ago, researchers in Boston found a new way of disrupting the blood brain barrier locally by adding contrast agent to ultrasound. They have recently summarised the current state of their research in a review article [1]. The major findings were, in brief:

1. Ultrasound disrupted the blood brain barrier transiently. The barrier was open for one or 2 hours and was closed again 4 hours after sound application.
2. Morphological examination of the brain showed little damage with only few focal extravasations of red blood cells and no damage to neurons. This contrasted to previous experiments where haemorrhage with focal neuronal death had been found.
3. A standard animal experimental system was established to allow investigation of blood brain barrier opening. To facilitate sound entry through the skull, a piece of skull bone was removed and rabbit and rat brains were exposed through a cranial window. Magnetic resonance imaging with an otherwise impermeable gadolinium containing contrast agent delineated regions where the blood brain barrier was open.
4. Experiments on the impact of ultrasound exposure parameters on blood brain barrier opening revealed that
   - a Lower frequencies opened the blood brain barrier more efficiently. When 260 and 690 kHz were compared with 1.62 and 2.07 MHz, larger areas of local blood brain barrier opening were found with the 2 low frequencies. In addition the number of extravasated red blood cells was lower at the low frequencies.
   - b The pressure thresholds for producing blood brain barrier opening at these frequencies rose accordingly from 0.25 MPa at 260 kHz to 0.69 MPa at 2.1 MHz.
   - c Determination of the mechanical index (MI) at these pressures and frequencies revealed a threshold MI of 0.46 where blood brain barrier disruption began [1].
   - d Rabbit brains were originally exposed to 20 ultrasound bursts of 10 or 100 ms duration at 1 Hz . Shortening the burst length to 1 and 0.1ms produced an inferior result [2]. Doubling the speed of burst application from 1 Hz to 2 Hz made no difference.
5. A closer look at the ultrastructure of tight junctions in the brain revealed that their molecular structure was transiently disassembled [3]. Antibodies against the tight junction proteins occludin, claudin-5 and ZO-1 produced less staining during disassembly one and 2 hours after sonication. In addition a marker protein passed through endothelial cells and also along open endothelial clefts. Four hours after ultrasound the tight junctions were reassembled.
6. As to the size of molecule able to pass the blood brain barrier, small molecules such as trypan blue and contrast agents passed, as did large molecules such as 40 kDa peroxidise, 180 kDa antibodies and nanoparticles.
7. To demonstrate the potential to deliver a drug locally into the brain, the monoclonal antibody Herceptin, a humanized anti-human epidermal growth factor receptor 2 monoclonal antibody, was transferred at 260 kHz ultrasound into rabbit brains [4]. Immunostaining verified its localisation in endothelial cells.

In summary, a new type of access to the blood brain barrier is described, causing minimal histological damage and enabling the transfer of drugs across it. This method may represent a powerful technique for the delivery of macromolecular agents such as antibodies to treat patients with diseases of the central nervous system.

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Williams AR, Wiggins RC, Wharram BL, Goyal M, Dou C, Johnson KJ, Miller DL. Nephron injury induced by diagnostic ultrasound imaging at high mechanical index with gas body contrast agent. Ultrasound Med Biol. 2007; 33: 1336–1344

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Ultrasound contrast agents are micrometre sized gas bubbles with a phospholipid or protein shell which can pass through capillaries without getting stuck. Their use for diagnostic imaging has increased explosively in the last years and has started to replace more expensive CT and MRI investigations. As it passes through a capillary, ultrasound excites a gas bubble to resonate; its diameter enlarges and the shell breaks up. When this happens in a capillary, its wall may be torn and red blood cells spill over into the interstitial space generating petechial haemorrhage. In a previous literature review, up to 40 % of the surface of rat kidneys was covered with petechial haemorrhages when ultrasound was applied at a diagnostic level [1]. Important questions were investigated such as the dependence of petechiae on MI, frequency, frame rate, insonation time, and microbubble dose.

Renal haemorrhage induced by ultrasonic contrast agent has recently been re-examined in a study in which 30 rat kidneys were exposed for one minute to 1.5 MHz ultrasound during contrast agent infusion. The organ was examined a short time after treatment and additionally one, 2 or 3 days later. Shortly after treatment, the renal surface was covered with petechiae as expected, yet kidneys examined one or more days later had fewer petechiae – so where was the blood? It had simply drained out of the glomerulus and drained via the tubular system. Urine samples of treated rats confirmed microhaematuria. Histology showed glomerular fibrin deposits, focal cell necrosis and red blood cell and hyaline casts in tubuli, a picture well known from treatment with extracorporeal shock waves for renal stone fragmentation.

A good outcome, sonographers and newsletter readers might suppose, glomerular damage will be repaired and the integrity of the nephron with its blood supply will be restored. Yet this conclusion might be grossly misleading. The experiment's shortcoming is that it did not examine whether glomerular haemorrhage was repaired. The alternative is that glomerular haemorrhage is an irreversible event, the

nephron dies and glomerulosclerosis ensues. This is known from other forms of intervention, along with microhaematuria. Experiments involving longer observation periods, sequential studies with histological documentation and adequate animal numbers are needed to clarify whether haemorrhage into Bowman's space is a repairable accident and if nephron function is restored or the renal filtration unit is lost.
The question whether haemorrhage is repaired has implications for the future use of ultrasound contrast imaging in the kidney. Multiple examinations with ultrasound contrast agent in a patient with pre-existing renal disease might aggravate his disease.

1 EFSUMB Newsletter September 2003 page7: Wible JH, Galen KP, Wojdyla JK, Hughes MS, Klibanov AL, Brandenburger GH. Microbubbles induce renal hemorrhage when exposed to diagnostic ultrasound in anaesthetised rats. Ultrasound Med Biol. 2002 Nov-Dec;28 (11–12): 1535–46.

Dear Ultrasonographer

Christoph F. Dietrich

"The case of the month" which is published on the EFSUMB website (http://www.efsumb.org) has been in operation since March 2008. This site has approximately 10.000 visitors' hits on a regular basis. Please feel free to submit "your image (or technique) of the month" to the EFSUMB Secretariat: efsumb@efsumb.org or directly to christoph.dietrich@ckbm.de. This is also an opportunity to discuss interesting cases on a well known platform.

Cordially,
Christoph F. Dietrich
Honorary Secretary of EFSUMB

Instructions for authors

General The EFSUMB Case of The Month and Techniques Library is an online-only supplement dedicated entirely to case studies and ultrasound techniques. Articles appearing in this section are freely and permanently accessible online immediately upon publication at http://www.efsumb.org/case-month.

Submission Manuscripts are submitted through EFSUMB efsumb@efsumb.org or directly to christoph.dietrich@ckbm.de.

Format Articles should not contain more information than listed below.

Abstract The case of the month section does not have abstracts.

Main document

Title page Showing full title, names of all authors with initials only of forenames, main affiliation of each author, plus the name and full address of the corresponding author (with fax and E-Mail details).

Text Maximum 300 words. The text should not be subdivided. The text should include the key point of the image or technique of the month.

Figure legends and video legend Please include these in the main document and ensure that they are cited in the text.

References Maximum of 3 references listed in order of citation and in the Ultraschall reference style, Dietrich CF, Mertens JC, Braden B, Schuessler G, Ott M, Ignee A. Contrast-enhanced ultrasound of histologically proven liver hemangiomas. Hepatology 2007; 45(5):1139–1145.

Figures A minimum of one and maximum of three images, with short legends. For example, the maximum three images might comprise one figure with three images (Figures 1a, 1b, 1c), or two (or three) separate images (figures).

Videos Should you wish to submit a video clip to illustrate your article, the following formats are acceptable: *.avi, *.mov and *.mpg. The maximum length of the clip should not exceed one minute. Please also include a legend of no more than 40 words per video or per sequence to accompany it.

Please find below one example which has been recently published on http://www.efsumb.org.

Focal nodular hyperplasia

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Sustained enhancement in the late portal venous phase characterizes most benign solid liver lesions [1]. They can be further characterized by enhancement patterns during the arterial phase: e.g. enhancement of the whole lesion (typical of focal nodular hyperplasia (FNH)) or initial peripheral globular-nodular enhancement (haemangioma) [2]. Focal nodular hyperplasia (FNH) and hepatocellular adenoma (HCA) are two benign, mostly incidentally discovered hepatic neoplasia, which occur predominantly in young and middle-aged women. FNH is typically an iso-echoic tumour of variable size, with a central scar and calcifications. Typically, colour Doppler imaging reveals a (arterially) hyper-vascularised tumour with characteristic (para-) central arterial blood supply and wheel-spoke phenomenon. This typical pattern of vascularity is by no means obligatory and is reported only in about 50 -70% of patients. It could also be shown that inter-observer reliability in recognising the wheel-spoke appearance is low.

Hepatic adenomas are frequently seen in adult patients with glycogen storage diseases, but their pathogenesis is not completely understood. Differentiation diagnosis is essential because of different therapeutic approaches: HCA at least with a size > 50 mm is an indication for surgery because of the risk of haemorrhage and potential malignant transformation; in contrast, FNH can be managed conservatively. Like FNH, an adenoma exhibits arterial hypervascularity (predominantly marginal). However, this vascular pattern can also be encountered in hepatocellular carcinomas and hyper-perfused metastases, and is therefore not pathognomonic. It has to be taken into account that histologically no portal veins (and in addition, no bile ducts) are present in adenomas [3].

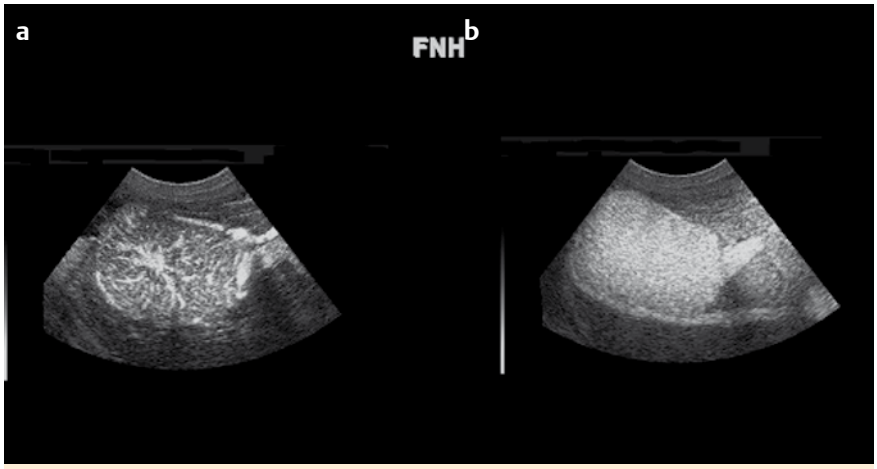

Fig. 1 Key point 1 The examination of the hepatic arterial and portal venous and late phases by contrast-enhanced ultrasound allows for reliable differentiation between FNH and HCA. This important finding could be explained by the lack of portal veins in HCA, in contrast to FNH which presents arteries (a) and (atypical) portal veins (b).

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International Course

Contrast Enhanced Ultrasound

Part II Update: Liver & extra-hepatic use of US contrast agents, new developments

27th – 29th November 2009
Hannover, Germany
Central Ultrasound Department
Klinikum Region Hannover,
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Course Director: HP Weskott
Pre-Course 26th November 2009

Dear colleagues,
After the successful CEUS course Part I in November 2008, I would now like to invite you to attend the follow up course, to be held in Hannover from November 26th until November 29th 2009.
Never before has a new technique changed the field of ultrasound in such a radical way as the use of ultrasound contrast media has done. The International CEUS Course Part II is aimed at achieving two goals: to deepen the understanding of CEUS in liver diseases and renal imaging as well as to demonstrate the wide range of extra-hepatic indications for using US contrast agents. Once again, well known European radiologists and internists in this field will give lectures and train small groups of attendees in hands on sessions. During this course there will again be time for individual training on the US machines and to work on clinical cases – from easy through to difficult ones to interpret. At the end of each day there will be a dedicated session to discuss any cases with the experts which you have either brought with you or forwarded to us by mail. Additionally, on the pre-course day, representatives from the industry will update you about latest and future technical developments followed by hands on sessions on the most up-to-date US devices.

We hope you will benefit from attending this course – a European School project which is supported by EFSUMB once again.
I would like to wish you a successful educational course and a pleasant stay in Hannover

Dr. Hans-Peter Weskott, Course Director

For further information and registration: see our website: **www.CEUS-Course.eu**

EFSUMB Newsletter meets Germany

Prof Dieter Nürnberg

The interview with President of DEGUM Prof Dieter Nürnberg by Chairman of EFSUMB Publications Committee Professor Michael Bachmann Nielsen took place in August 2009.

Dieter Nürnberg is the President of the DEGUM, the German Ultrasound society, since 2008. Living and working in the small town of Neuruppin just north of Berlin, Dieter Nürnberg is a gastroenterologist and the chief of the department for gastroenterology and oncology in the district hospital (800 beds), a teaching hospital of the Charite-Berlin "I started to work with ultrasound in the GDR in 1982".

How ultrasound is organized in Germany

In Germany most medical specialties are using ultrasound and it is part of the medical training curriculum. Accreditation for performing ultrasound in a general practice is given by the association of the German statutory health insurance (SHI). "An estimate would be that in Germany nearly 50,000 doctors use US in their private clinic and the same numbers of doctors use it in their hospital."
DEGUM with its almost 8000 members is the biggest interdisciplinary medical scientific society in Germany. The majority of members are medical doctors, engineers, physicists, other scientists and also veterinaries. "In Germany we do not have technicians, because the law requires that to perform ultrasound you have to be a medical doctor."

Population: 82 million

Capital city: Berlin

EFSUMB Members: 7850

DEGUM-Echo

DEGUM has its newsletter "DEGUM-Echo" printed in every issue of Ultraschall in der Medizin. " In this way each member will receive the newsletter every second month."

US training in Germany

The DEGUM created the three-step system of ultrasound certification and education. DEGUM organizes courses in all specialties from basic levels to advanced levels. The courses are composed of 50% practical work and 50% lectures and the course instructors are qualified.
"The young doctors take part in the courses and they utilise their newly learnt experience in their daily routine in their own hospital. If the doctors want to use US in their own practice they have to pass a test performed by the Resident Doctors Association (Kassenärztliche Vereinigung). "

Website

"In our website www.degum.de, you will find information about the organization, courses and additional education material. The website is at the moment in the process of updating."

National congresses – Dreiländertreffen

Every autumn we have our annual ultrasound congress called "Dreiländertreffen". The name represents the joint meeting of the German, Austrian and Swiss ultrasound societies (DEGUM, ÖGUM and SGUM). The location rotates between the 3 countries and between 1000 and 2000 participants attend each meeting. "This year we´ll meet us in Salzburg in Austria and the 2010 meeting will be in Mainz in Germany." "The DEGUM-members are organized in sections and interdisciplinary study groups. The biggest sections are gynecology, internal medicine and radiology. But also the pediatrics, urologists or cardiologists have their own groups."

EUROSON and WFUMB meeting in 2011 in Vienna

In 2011 the Dreiländertreffen will be held in conjunction with the Euroson and WFUMB in Vienna. "The Austrian Society is the organizer but we help them in the committee-work and in congress organisation. There is an academy of the Dreiländertreffen consisting of experts from the three countries, who are integrated in the organisation work.
The WFUMB 2011 meeting will be August 26-29 in Vienna.

Special hobby of DEGUM president is **sonorun,** first time 2007 in Euroson Leipzig initiated by Volker Keim

EUROSON 2009

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