НЕВРОСОНОЛОГИЯ
И МОЗЪЧНА
ХЕМОДИНАМИКА

*Издание на Българската асоциация
по невросонология
и мозъчна хемодинамика*

NEUROSONOLOGY
AND CEREBRAL
HEMODYNAMICS

*Official Journal of the Bulgarian Society
of Neurosonology
and Cerebral Hemodynamics*

16th WORLD NEUROSONOLOGY MEETING
of the World Federation of Neurology

jointly with

8th Meeting of the Bulgarian Society of Neurosonology and Cerebral Hemodynamics

October 17–20, 2013 | Sofia, Bulgaria

Programme and Abstracts

Том 9/Брой 2
2013

Volume 9, Number 2
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Under the Aegis

Sofia Municipality
Bulgaria

Mayor of Sofia

Mrs. Yordanka Fandakova

Welcome Message

Dear Colleagues and Friends,

On behalf of the Neurosonology Research Group (NSRG) of the World Federation of Neurology and the Bulgarian Society of Neurosonology and Cerebral Hemodynamics we are honored to welcome you to the 16th World Neurosonology Meeting in Sofia from October 17th to 20th 2013. The participants from all over the world will have the opportunity to enjoy the history and the beauty of Sofia – one of the oldest capitals in Europe.

The objectives of the NSRG meetings are to offer a platform for experts from all over the world to discuss the present state of the art in Neurosonology, to standardize and advance teaching programs and to update and discuss guidelines and standards. We hope to continue the successful tradition of bringing together worldwide specialists who are interested in Neurosonology and application of therapeutic ultrasound in Neurology. We believe that this meeting will contribute to translation of the advanced ultrasound technology to clinical practice. During the meeting delegates will be given the possibility to acquire an International Certificate in Neurosonology.

Every NSRG meeting has its own character, diverse participants and consideration of different clinical applications of Neurosonology. The members of faculty of these meetings consisted of foremost experts in the field of Neurosonology as well as prominent neurologists from Europe and countries that host NSRG meetings. This makes NSRG society unique and meetings so exciting.

On behalf of the NSRG Executive Committee, the Local Organizing Committee and the Bulgarian Society of Neurosonology and Cerebral Hemodynamics, we welcome you in the beautiful European and Balkan capital Sofia!

Prof. Manfred Kaps

President
Neurosonology Research Group
of the World Federation of Neurology

Acad. Prof. Ekaterina Titianova

Meeting Chair
President of the Bulgarian Society of
Neurosonology and Cerebral Hemodynamics

TIMETABLE

Time	THU 17.10.2013		FRI 18.10.2013		SAT 19.10.2013		SUN 20.10.2013		Time
08.00–08.30	Credits: 16 European CME		Registration	Reception desk opening	Reception desk opening		Reception desk opening		08.00–08.30
08.30–09.00						International certification examination: theory			08.30–09.00
09.00–09.30				Teaching Course I	Furuhata Lecture – Treatment & Targeting		Muscle & Nerve		09.00–09.30
09.30–10.00									09.30–10.00
10.00–10.30									10.00–10.30
10.30–11.00				Coffee break	Coffee break		Coffee break		10.30–11.00
11.00–11.30				Teaching Course I	Translational Neurosonology – Implementation of Ultrasound in Stroke Management		Miscellaneous		11.00–11.30
11.30–12.00									11.30–12.00
12.00–12.30									12.00–12.30
12.30–13.00				Lunch	Lunch	NSRG Executive Meeting	Lunch		12.30–13.00
13.00–13.30					Poster Session 1		NSRG General Meeting		13.00–13.30
13.30–14.00				Teaching Course II					13.30–14.00
14.00–14.30		Registration			New Technologies in Neurosonology		ESNCH Joint Session		14.00–14.30
14.30–15.00									14.30–15.00
15.00–15.30				Coffee break					15.00–15.30
15.30–16.00	8th Meeting of the Bulgarian Society of Neurosonology and Cerebral Hemodynamics			Teaching Course II	Coffee break		Closing Ceremony		15.30–16.00
16.00–16.30		General Meeting of BSNCH			Latin American Chapter – Stroke Prevention	International certification examination: practical	Meeting of the New NSRG Executive Committee		16.00–16.30
16.30–17.00									16.30–17.00
17.00–17.30				Certification Committee Meeting	Poster Session 2				17.00–17.30
17.30–18.00		Coffee Break			Coffee break	Coffee break			17.30–18.00
18.00–18.30		Satellite Symposium of Actavis "Heart and Brain"	16th NSRG Meeting of the WFN Opening Ceremony & Key Note Lecture (NSRG Chairman)		Asian Chapter – Intracranial Disease & Hemodynamics				18.00–18.30
18.30–19.00	Credits: 7 Bulgarian CME								18.30–19.00
19.00–19.30			Welcome Reception & Exhibition						19.00–19.30
19.30–20.00									19.30–20.00
20.00		Dinner			Shuttle to Gala Dinner				20.00

Scientific Programme

TUESDAY – SUNDAY, 15–20 October 2013

Satellite Training and Networking Project

Ultrasound Technologies – Challenges Before Young Doctors

Project No BG13/A3.1.2/225/R2, funded with support from the Youth in Action Programme of the European Commission, administered in Bulgaria by the National Center European Youth Programmes and Initiatives.

THURSDAY, 17 October 2013

8th Meeting of the Bulgarian Society of Neurosonology and Cerebral Hemodynamics

(Park Hotel Moskva)

14.00 – 16.00		**Registration**
16.00 – 17.30		**General Meeting of BSNCH**
17.30 – 18.00		**Coffee Break**
18.00 – 18.15		**Opening Ceremony**
18.15 – 19.30		**Satellite Symposium of Actavis "Heart and Brain"** *Chairpersons: E. Titianova (Bulgaria), I. Petrov (Bulgaria)*
18.15 – 18.45		**Arterial Blood Pressure – When Becomes a Foe of the Brain?** *E. Titianova (Bulgaria)*
18.45 – 19.15		**Predictors of Vascular Events.** *I. Petrov (Bulgaria)*
19.15 – 19.30		**Discussion**
19.30 – 22.00		**Dinner**

FRIDAY, 18 October 2013

08.00 – 18.00		**Registration** *(5th Floor of the National Palace of Culture)*

NSRG Comprehensive Tutorial *(Hall 7)*

09.00 – 12.30		**Teaching Course I** *Chairpersons: M. Kaps (Germany), G.-M. von Reutern (Germany)*
09.00 – 09.40	T1	**Basics in Physics and Instrumentation of Diagnostic Vascular Ultrasound.** *M. Siebler (Germany)*
09.40 – 10.00	T2	**The Doppler Spectrum – its Relation to Device Setting, the Flow Field and Vessel Geometry.** *G.-M. von Reutern (Germany)*
10.00 – 10.30		**Discussion**
10.30 – 11.00		**Coffee break / Speakers Corner *(Hall 9)***
11.00 – 11.20	T3	**Hemodynamic Principles – How They Are Translated in US-Findings.** *A. Hetzel (Germany)*
11.20 – 11.40	T4	**Anatomy of Brain Supplying Vessels.** *W. Mess (Netherlands)*

11.40 – 12.10	T5	**Diagnosis of Occlusive Disease of the Carotid and Vertebral Artery System, Vessel Wall Pathology.** *K. Niederkorn (Austria)*
12.10 – 12.30		**Discussion**
12.30 – 13.30		**Lunch**
13.30 – 17.00		**Teaching Course II** *Chairpersons: T. Rundek (USA), F. Perren (Switzerland)*
13.30 – 13.50	T6	**Measuring the Degree of Carotid and Vertebral Artery Stenosis.** *F. Perren (Switzerland)*
13.50 – 14.10	T7	**Diagnosis of Atherosclerotic Occlusive Disease Involving the Intracranial Arterial System.** *E. Bartels (Germany)*
14.10 – 14.30	T8	**IMT: Methodology and its Clinical Value.** *T. Rundek (USA)*
14.30 – 15.00		**Discussion**
15.00 – 15.30		**Coffee break / Speakers Corner *(Hall 9)***
15.30 – 15.45	T9	**Monitoring the Critically Ill Patient.** *M. Mijajlovic (Serbia)*
15.45 – 16.55		**Live Demonstration of Pathologic Cases and Discussion. (All Participants and Speakers)** *E. Bartels (Germany), G.-M. von Reutern (Germany)*
16.55 – 17.00		**Closing Remarks. Certificate of Attendance.** *G.-M. von Reutern (Germany)*
17.00 – 18.00		**Certification Committee Meeting**

16th NSRG Meeting of the World Federation of Neurology

"Translational Neurosonology – Making Research Applicable for Patients"

18.00 – 19.30	**Opening Ceremony *(Hall 8)*** *E. Titianova (Bulgaria), M. Kaps (Germany)*
18.00 – 18.30	**Greetings from the Meeting President** *E. Titianova (Bulgaria)* **Greetings from the Mayor of Sofia** *Mrs. Yordanka Fandakova*
18.30 – 19.00	**Translational Neurosonology – Making Research Applicable for Patients.** *M. Kaps (Germany)*
19.00 – 22.00	**Welcome Reception & Exhibition *(Hall 9)***

SATURDAY, 19 October 2013

08.00	**Reception Desk Opening** *(5th Floor)*
08.30 – 19.00	**Exhibition *(Hall 9)***

NSRG Comprehensive Tutorial

Examination and Certification

08.30 – 10.30	**International Certification Examination in Neurosonology: Theory *(Hall 7)*** *G.-M. von Reutern (Germany), E. Bartels (Germany)*

16.00 – 18.00		**International Certification Examination in Neurosonology: Practical (Rooms)** *G.-M. von Reutern (Germany), E. Bartels (Germany)*
09.00 – 10.30		**Plenary Session I: H. Furuhata Lecture – Treatment & Targeting.** *Chairperson: G.-M. von Reutern (Germany), T. Shiogai (Japan)*
09.00 – 09.20	L1	**H. Furuhata – a Great Pioneer of Neurosonology.** *T. Shiogai (Japan)*
09.20 – 09.40	L2	**Sonothrombolysis: Uncertainties Represent Significant Hurdles for Approval.** *F. Tranquart, B. Petit, E. Bihel, Y. Bohren, F. Yan, E. Allemann, M. Arditi, J. M. Hyvelin (Switzerland)*
09.40 – 10.00	L3	**Ultrasound System Design for Sonothrombolysis with Microbubbles.** *J. Powers, R. Seip, W. Shi (USA)*
10.00 – 10.20	L4	**Which Study Design is Appropriate for Sonothrombolysis Trials? The ULTRAS Pilot Study.** *M. Del Sette, S. Ricci, E. Giorli, M. Cotroneo (Italy)*
10.20 – 10.30		**Discussion**
10.30 – 11.00		**Coffee Break / Speakers Corner *(Hall 9)***
11.00 – 12.30		**Plenary Session II: Translational Neurosonology – Implementation of Ultrasound in Stroke Management** *Chairpersons: K. Niederkorn (Austria), C. Levi (Australia)*
11.00 – 11.20	L5	**Review on Microembolus Detection.** *E. B. Ringelstein (Germany)*
11.20 – 11.40	L6	**Specific TCD Clinical Applications for Patients with Traumatic Brain Injury.** *A. Razumovsky (USA)*
11.40 – 12.00	L7	**Monitoring the Brain During Invasive Cardiovascular Examinations and Surgery.** *D. Russell (Norway)*
12.00 – 12.20	L8	**Clinical and Vascular Follow-up of Symptomatic Intracranial Stenosis Stenting.** *C. Vetta, S. Horner, H. Deutschmann, T. Gattringer, K. Niederkorn, (Austria)*
12.20 – 12.30		**Discussion**
12.30 – 14.00		**Lunch and NSRG EC Meeting**
13.00 – 14.00		**Poster Session 1**
14.00 – 15.30		**Plenary Session III: New Technologies in Neurosonology** *Chairpersons: W. Mess (Netherlands), R. Aaslid (Switzerland)*
14.00 – 14.20	L9	**Intracranial Pressure Dynamics Assessed by Transcranial Doppler.** *R. Aaslid (Switzerland)*
14.20 – 14.40	L10	**TCCD – CTA Fusion Imaging.** *C. Levi (Australia)*
14.40 – 15.00	L11	**Ultrafast Doppler and *f*Ultrasound Imaging.** *M. Tanter (France)*
15.00 – 15.15	L12	**Is Automatic Embolus Monitoring Ready for Real Life Application?** *W. Mess (Netherlands)*
15.15 – 15.30	O1	**Novel Probe Attached to the Cervix for Detection of Microembolic Signal at Carotid Artery.** *H. Mitsumura, T. Nomura, H. Shiba, Y. Yoshimori, J. Kubota, M. Hashimoto, H. Furuhata (Japan)*
15.30 – 16.00		**Coffee Break / Speakers Corner *(Hall 9)***
16.00 – 17.30		**Plenary Session IV: Latin American Chapter – Stroke Prevention** *Chairperson: A. Massaro (Brazil), T. Rundek (USA)*
16.00 – 16.20	L13	**Role of TCD in Sickle Cell Disease: Older and New Concepts.** *V. Zetola (Brazil)*

16.20 – 16.40	L14	**Subclinical Ultrasound Markers in the Prevention of Cerebrovascular Diseases.** *V. Demarin (Croatia)*
16.40 – 17.00	L15	**Change of Intima-Media Thickness in Prevention of Cardiovascular Events in Ischemic Stroke Patients with High Risk of Cerebral Haemorrhage (PICASSO).** *Y. Kim, J.H. Lee, W.G. Seo, S.U. Kwon (Korea)*
17.00 – 17.20	L16	**Predicting Coronary Artery Disease in Stroke Patients.** *N. Bornstein (Israel)*
17.20 – 17.30	O2	**Findings of Trans-Esophageal Echocardiography (TEE) in Ischemic Stroke Patients with HITS by TCD.** *K. Hanzawa, A. Morishita, T. Nishimatsu (Japan)*
17.30 – 18.00		**Coffee Break / Speakers Corner *(Hall 9)***
17.00 – 18.00		**Poster Session 2**
18.00 – 19.30		**Plenary Session V: Asian Chapter – Intracranial Disease & Hemodynamics** *Chairpersons: M. Yasaka (Japan), J.H. Lee (Korea)*
18.00 – 18.15	L17	**Early Hemodynamic Changes Post Intracranial Thrombectomy: a Sign of Vessel Wall Injury?** *I.M. Pignat, V. Mendes Pereira, F. Perren (Switzerland)*
18.15 – 18.30	L18	**Intracranial Waveform Changes After Cardiac Transplantation.** *A. R. Massaro (Brazil)*
18.30 – 18.45	L19	**TCD-EEG Monitoring in Paroxysmal Neurological Diseases.** *W. Xu (China)*
18.45 – 19.00	O3	**Comparative Study of Neurosonological Data Between Reversible Cerebral Vasoconstriction Syndrome (RCVS) and Other Forms of Headache.** *M. Alpaidze, N. Kurashvili (Georgia)*
19.00 – 19.15	O4	**Intraoperative Ultrasound to Control Resection of Brain Metastases.** *M. L. Oliveira, H. Picarelli, A. Blassioli Barbosa, S. Brasil Lima, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)*
19.15 – 19.30		**Discussion**
20.00		**Shuttle to Gala Dinner**

SUNDAY, 20 October 2013

08.00		**Reception Desk Opening** *(5th Floor)*
08.30 – 16.00		**Exhibition (Hall 9)**
09.00 – 10.30		**Plenary Session VI: Muscle & Nerve** *Chairpersons: M.Siebler (Germany), W. Xu (China)*
09.00 – 09.20	L20	**Space-time Neurosonology in Clinical Usage – Why and When?** *E. Titianova (Bulgaria)*
09.20 – 09.40	L21	**Myosonology: Clinical and Scientific Potentials.** *M. Siebler (Germany)*
09.40 – 10.00	L22	**Ultrasound-Guidance of Botulinum Toxin Injections in Dystonia and Spasticity.** *U. Walter (Germany)*
10.00 – 10.20	L23	**Ultrasonographic Evaluation of Cervical Nerve Roots in ALS.** *N. Takamatsu, H. Nodera, Y. Terasawa, A. Mori, M. Oda, Y. Izumi, R. Kaji (Japan)*
10.20 – 10.30		**Discussion**
10.30 – 11.00		**Coffee Break / Speakers Corner *(Hall 9)***

11.00 – 12.30		**Plenary Session VII: Miscellaneous** *Chairpersons: M. Del Sette (Italy), Y. Huang (China)*
11.00 – 11.20	L24	**Transcranial Doppler for Brain Death in Infants. The Role of the Fontanelles.** *E. Vicenzini (Italy)*
11.20 – 11.40	L25	**Parenchymal Findings in Neurodegenerative Disease.** *U. Walter (Germany)*
11.40 – 11.55	O5	**Relationship Between Blood Pressure Control and Arterial Stiffness, Carotid Artery and Retina Damages in Hypertensive Patients With and Without Type 2 Diabetes.** *E. Azevedo, S. Penas, C. Ferreira, L. Martins, A. Campilho, J. Polonia (Portugal)*
11.55 – 12.10	O6	**Hemispheric Lateralization of Language in Children with Deep Sensorineural Hearing Loss and Cochlear Implant: a Functional Transcranial Doppler Study.** *A. Chiti, N. Giannini, G. Carignani, P. Cristofani, G. Gialdini, E. Terni, A. Chilosi, G. Orlandi (Italy)*
12.10 – 12.30		**Discussion**
12.30 – 14.00		**Lunch**
13.00 – 14.00		**NSRG General Meeting *(Hall 8)***

14.00 – 15.30		**Plenary Session VIII: ESNCH Joint Session** *Chairpersons: M. Kaps (Germany), L. Csiba (Hungary)*
14.00 – 14.20	L26	**Clinical Implications of Venous Neurosonography.** *J. Valdueza (Germany)*
14.20 – 14.40	O7	**Counterproductive Results with the Use of an Emboli Protection Device in the Prevention of Microembolism Detected by Transcranial Doppler in Carotid Stent Placement.** *S. Tromp, M. Braat, J. van Heijden, M. van Egdom, P. Dekker, M. Haringsma, J. Vos (Netherlands)*
14.40 – 15.00	O8	**Publications of Particular Importance since the 15th NSRG Meeting in Beijing, 2011.** *E. Stolz (Germany)*
15.00 – 15.30	O9	**Selected Poster Presentations & Poster Prizes.** *K. Niederkorn (Austria), E. Titianova (Bulgaria)*
15.30 – 16.00		**Closing Ceremony** *E. Titianova (Bulgaria), TBA.*
16.00 – 17.00		**Meeting of the New NSRG Executive Committee**

Poster Sessions

SATURDAY, 19 October 2013

13.00 – 14.00 Poster Session I–1. Extracranial Arterial Disease

Chairpersons: F. Abd-Allah (Egypt), Z. Stoyneva (Bulgaria)

P1 **3D Blood Flow and Common Carotid Artery Hemodynamics in the Carotid Artery Bifurcation with Stenosis.**
N. Antonova, X. Dong, P. Tosheva, E. Kaliviotis, I. Velcheva (Bulgaria, China, UK)

P2 **Carotid Pathology in Cerebral Infarctions: Effects of Blood Pressure and Blood Viscosity.**
I. Velcheva, N. Antonova, E. Titianova, P. Damianov (Bulgaria)

P3 **Measurement of Carotid Plaque Volume with VOCALTMII Technique by 3-Dimensional Ultrasound.**
H. Xing, T. Wang, W. Sun, R. Liu, Q. Peng, K. Xu, Y. Huang (China)

P4 **Juxtaluminal Echogenicity as a Marker of Carotid Plaque Instability.**
T. Tegos, A. Petrakis, A. Valavanis, A. Safouris, A. Papadimitriou, A. Orologas (Greece)

P5 **Aftercare Management Based on Carotid Duplex Sonography for Patients with Stented Vessels Reaching the End of the Scheduled Three-Dimensional Enhanced Computed Tomography Angiography Follow-up Periods.**
H. Nagai, F. Nakagawa, H. Eda, S. Higiwara, M. Daisu, T. Uemura, T. Miyazaki, Y. Akiyama (Japan)

P6 **Diagnostic Role of Color-Coded Duplex Sonography in Following-up after Carotid Endarterectomy in Men.**
M. Staneva, Ts. Tsvetanov, V. Chervenkoff, D. Markov, P. Antova (Bulgaria)

P7 **Duplex Ultrasonographic Findings in Congenital Absence of the Internal Carotid Artery.**
I. Koh, J. Lee, J. Park, S. Han, S. Hwang, S. Suk (Korea)

P8 **Evaluation of Internal Carotid Arterial Dissection by Transoral Carotid Ultrasonography.**
M. Yasaka, Y. Wakugawa, M. Mori, Y. Nakanishi, Y. Okada (Japan)

P9 **Diagnostic Value of Color-Coded Duplex Sonography in Clinical Cases with Restenosis of Arterial Reconstructions at Supra-Aortic Arteries and Takayashu Arteriitis.**
M. Staneva, V. Chervenkoff, B. Minkova, G. Kirova, D. Markov, Ts. Tsvetanov, P. Antova (Bulgaria)

P10 **Duplex Ultrasonographic Findings of Right Aortic Arch with Isolated Left Brachiocephalic Artery.**
I. Koh, J. Lee, S. Hwang, S. Suk, J. Park (Korea)

P11 **Dissection of Carotid Artery. A Case Report.**
S. Andonova-Atanasova, F. Kirov, Ch. Bachvarov, V. Velinov (Bulgaria)

P12 **Technical Aspects for Ultrasound Visualization of Spinal Cord Vasculature.**
F. Abd-Allah (Egypt)

Poster Session I–2. Extracranial Arteries and Veins: Clinical Studies

Chairpersons: M. Lange (Brazil), V. Oliveira (Portugal)

P13 **Flow Velocities and Vessel Diameter of the Distal Internal Carotid Artery in Patients with Risk Factors.**
G.-M. von Reutern, I. Alpsoy, J. Allendörfer (Germany)

P14 **Relationship between Increased Common Carotid Artery Diameter and Aortic Aneurysm.**
Y. Asakawa, H. Takekawa, K. Suzuki, M. Yamamoto, M. Okamura, T. Nishihira, A. Iwasaki, K. Hirata (Japan)

P15 **Relationship between Diameter of Brachial Artery and Common Carotid Artery in Stroke Patients.**
T. Nishihira, M. Yamamoto, H. Takekawa, K. Suzuki, Y. Asakawa, A. Iwasaki, M. Okamura, K. Hirata (Japan)

P16 **Acceleration Time Ratio for the Assessment of Extracranial Internal Carotid Artery Stenosis.**
H. Takekawa, K. Suzuki, T. Nishihira, A. Iwasaki, M. Okamura, Y. Asakawa, M. Yamamoto, R. Okabe, K. Hirata (Japan)

P17 **The Significance of Asymptomatic Carotid Stenosis and Dyslipidemia for TIA and Ischemic Strokes in Patients with Multiple Vascular Risk Factors – Population-Based Study.**
P. Mineva, D. Hadjiev, V. Tsoneva, Zh. Andreev (Bulgaria)

P18 **Changes in Dopplersonography Parameters of Vertebral Arteries and Evoked Potentials in Patients with Asymptomatic Ischemic Disturbances of Cerebral Circulation.**
S. Andonova-Atanasova, D Mintchev, M Novakova, R Georgiev (Bulgaria)

P19 **Intima-Media Thickness of the Carotid Artery in Obstructive Sleep Apnoe Syndrome Patients with Asymptomatic Ischemic Disturbances of Cerebral Circulation.**
S. Andonova-Atanasova, D. Petkova, M. Novakova, R. Georgiev (Bulgaria)

P20 **Carotid Blood Flow, Cardiac Function and Risk Factors for Cerebrovascular Disease – Correlative Clinical and Ultrasound Studies.**
E. Titianova, I. Velcheva, S. Karakaneva, K. Hristova, Z. Ramsheva, K. Ramshev (Bulgaria)

P21 **Correlation between Carotid Ultrasound and Exercise Stress Test for Assessing the Subclinical Vascular Diseases in Patients with Cardiovascular Disease.**
K. Hristova, L. Vladimirova, F. Nikolov, P. Nikolov, Tz. Katova (Bulgaria)

P22 **Internal Jugular Vein Thrombosis Due to Central Venous Catheter – Diagnosis and Clinical Significance.**
M. Staneva, P. Antova, Ts. Tsvetanov, G. Simeonov, B. Minkova, I. Staikov (Bulgaria)

P23 **Correlative Clinical and Neuroimaging Studies in Patients with Acute Spontaneous Intracerebral Hemorrhage.**
M. Danovska, B. Stamenov, T. Andreev, P. Stoev, M. Valkova, P. Stefanovski (Bulgaria)

Poster Session I–3. Transcranial Ultrasound – Experimental, Clinical and Functional
Chairpersons: N. Uzuner (Turkey), J. Villacura (Chile)

P24 **Cerebral Hemodynamic Assessment with Transcranial Color Duplex in Intracranial Hypertension Experimental Model.**
M. De Lima Oliveira, A. Ferreira De Andrade, A. Rodrigo Belon, W. Silva Paiva, M. Shimidt Soares, G. Cataxo Patriota, C. Nobrega Nascimento, J. Pinhata Otoch, B. Chian Ping Jeng, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

P25 **Cerebral Vasomotor Reactivity in Patients with Acute Ischemic Stroke.**
G. Tekgol Uzuner, N. Uzuner (Turkey)

P26 **Ultrasonography in Cerebral Arteriitis.**
M. Mijajlovic (Serbia)

P27 **Determining the Ideal Time Window for Angioplasty in an Unconscious SAH Patient with Severe Cerebral Vasospasm: a Multimodal Monitoring Approach.**
M. De Lima Oliveira, B. Lembo Conde De Paiva, R. Faria Simm, P. Henrique Pires Aguira, E. Bor-Seng-Shu (Brazil)

P28 **Transcranial Doppler and Oximetry Tissue Catheter Monitoring in Diffuse Brain Vasospasm.**
M. De Lima Oliveira, S. Paulo Brasil Lima, M. Kranyk De Azevedo, E. Santos Junior, L. Peraza, F. Lacerda Brambilla, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

P29 **Transcranial Doppler Evaluation of Bow Hunter Syndrome: Case Report and Review of Literature.**
M. De Lima Oliveira, K. Andrade Norremose, A. Negrao Esteves, B. Magalhaes Barbosa Leite, M. Ferreira Machado, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

P30 **Association between Pulsatile Index and Infarct Size in Acute Lacunar Stroke.**
O. Kim, S. An, S. Oh, J. Kim, W. Kim (Korea)

P31 **Microembolic Signals Detection during Routine Transcranial Doppler after Acute Subarachnoid Hemorrhage.**
M. De Lima Oliveira, M. Mendes Paschoal Junior, K. Almeida Lins, R. Carvalho De Nogueira, M. Krajnyk De Azevedo, E. Santos Junior, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

P32 **Cerebral Autoregulation in Patients with Orthostatic Intolerance: a Transcranial Doppler Sonography Monitoring.**
E. Titianova, I. Velcheva, S. Karakaneva (Bulgaria)

P33 **Cerebral Vascular Reactivity in Patients with Diabetes Mellitus Type 2.**
I. Velcheva, P. Damianov, K. Stambolieva (Bulgaria)

P34 **Cerebrovascular Autoregulation in Fulminant Hepatic Failure.**
M. De Lima Oliveira, M. Fernando Paschoal Junior, K Almeida Lins, R. Carvalho Nogueira, M. Jacobsen Teixeira, E. Bonr-Seng-Shu (Brazil)

P35 **Transcranial Doppler Monitoring during Hypothermic Circulation Arrest.**
T. Plotnikova, G. Nartsissova (Russia)

P36 **Brain Hemodynamic Improvement after Retrograde Ventriculo-Sinus Shunt in Hydrocephalus Patients.**
M. De Lima Oliveira, M. Fernandes De Oliveira, K. Andrade Norremose, S. Brasil Lima, F. Campos Gomes Pinto, H. Matsushita, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

17.00 – 18.00 **Poster Session II–1. Endovascular Procedures and Thrombolysis**
Chairpersons: P. Traubner (Slovakia), A. Razumovski (USA)

P37 **Sonographic Changes Before and After Stenting in Carotid Artery.**
J. H. Lee, H. K. Song, S. H. Hwang (Korea)

P38 **Cerebral Microembolic and Hemodynamic Events during Transfemoral Aortic Valve Implantation Procedure: Which Relationship with Clinical and Neuroradiological Findings?**
A. Chiti, N. Giannini, F. De Caro, G. Gialdini, E. Terni, E. Giorli, M. Puglioli, M. Cosottini, A. S. Petronio, G. Orlandi (Italy)

P39 **Does Stent Design Influence Embolisation Detected by Transcranial Doppler During Carotid Artery Stenting?**
S. Tromp, M. Braat, J. Van Der Heijden, M. Van Egdom, P. Dekker, M. Haringsma, J. Vos (Netherlands)

P40 **Recanalization and Stenting of Occluded and Nearly Occluded Carotid Stenoses.**
I. Petrov, L. Grozdinski, I. Tasheva, B. Zehirov (Bulgaria)

P41 **Supraselective Intra-Arterial Treatment in Acute Ischemic Stroke.**
I. Petrov, M. Klissurski, S. Sirakov, B. Zehirov, A. Mihaylov, D. Petkova, Ts. Pramatarova, T. Kmetski, G. Georgieva-Kozarova, L. Penev, L. Grozdinski (Bulgaria)

P42 **Safety Evaluation of Mid-Frequency Sonothrombolysis: Animal Brain Experiment.**
J. Shimizu, J. Kubota, T. Fukuda, A. Sasaki, T. Azuma, K. Sasaki, K. Shimizu, T. Oishi, S. Umemura, H. Furuhata (Japan)

P43 **Ultrasound-Enhanced Systemic Thrombolysis for Acute Ischemic Stroke.**
M. De Lima Oliveira, R. Nogueira, K. Andrade Norremose, A. Maria Negrao Esteves, F. Iuji Yamamoto, E. Faria Evaristo, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

P44 **Development of Thrombus-Targeting Bubble Liposome for Diagnostic and rt-PA Thrombolysis Acceleration.**
S. Yoshikazu, R. Suzuki, Y Oda, D Omata, K Maruyama (Japan)

P45 **Intraoperative Ultrasound in Patients with Arnold Chiari Type 1.**
M. De Lima Oliveira, R. Shimidt Brock, M. Augusto Taricco, S. Brasil Lima, M. Jacobsen Teixeira, E. Bor-Seng-Shu (Brazil)

P46 **Ultrasound Navigation in Neurosurgery – Fields of Application and Surgical Results.**
I. Todorov, T. Eftimov, I. Hadzhiangelov, V. Nakov, P. Simeonov, E. Stavrev, C. Ninov, K. Romanski, Al. Petkov (Bulgaria)

P47 **Ultrasonic Evaluation of Acetazolamide Vasoreactivity in Brain Tissue and Major Cerebral Arteries.**
T. Shiogai, M. Yamamoto, M. Koyama, K. Yoshikawa, M. Nakagawa (Japan)

Poster Session II–2. Non-vascular Ultrasound Neuroimaging and Laser Doppler
Chairpersons: E. B. Ringelstein (Germany), I. Velcheva (Bulgaria)

P48 **Substantia Nigra Echogenicity is Correlated with Nigrostriatal Impairment in Machado-Joseph Disease.**
M. De Lima Oliveira, J. Luiz Pedroso, P. Braga Neto, M. Ferreira Machado, R. Nogueira, O. Graziani Povoas Barsottin, E. Bor-Seng-Shu (Brazil)

P49 **A Semi-Quantified Evaluation of Substantia Nigra Hyperechogenicity in Parkinson's Disease and Parkinsonian Syndrome.**
A. Numao, K. Suzuki, H. Takekawa, M. Miyamoto, T. Miyamoto, M. Iwanami, E. Takada, K. Hirata (Japan)

P50 **Ultrasonography in Diagnosing the Cause of Papilloedema.**
C. Vidinova, L. Voinov (Bulgaria)

P51 **Ultrasound Imaging of Chronic Blast Eye Trauma: a Case Report of Charles Bonnet Syndrome.**
S. Nikolov, E. Titianova, S. Cherninkova, S. Karakaneva, P. Popov, K. Genova (Bulgaria)

P52 **Correlative Electromyographic and Multimodal Ultrasound Imaging Studies of Calf Muscle Lesions.**
R. Dimova, E. Titianova, S. Karakaneva, I. Daskalova (Bulgaria)

P53 **Clinical, Intraoperative and Multimodal Ultrasound Imaging Study of Facial Melanoma.**
E. Alexiev, K. Guirov, A. Mihova, B. Guirova, E. Titianova (Bulgaria)

P54 **Assessment of Microvascular Changes in Hand-Arm Vibration Syndrome.**
Z. Stoyneva (Bulgaria)

P55 **Reduced Cutaneous Microvascular Reactivity in Diabetes Mellitus Type 2.**
Z. Stoyneva (Bulgaria)

Satellite Poster Session – General Neurology

Chairpersons: T. Corona (Mexico), D. Pankov (Russia)

P56 **Epidemiological and Genetics Aspects of Multiple Sclerosis in Latin America.**
T. Corona (Mexico)

P57 **Dysregulation and its Clinical Significance.**
D. Pankov, T. Pankova (Russia)

P58 **Thrombolytic Therapy – Results and Problems.**
S. Andonova-Atanasova, F. Kirov, M. Petkova, P. Kirilova, E. Kalevska, V. Argirova, Zv. Zvetkov, M. Novakova, R. Georgiev, V. Georgieva (Bulgaria)

P59 **Our Experience with Endovascular Treatment of Brain Aneurysms and AVMs.**
S. Sirakov (Bulgaria)

P60 **Orthostatic Reactivity in Patients with Diabetic Neuropathy.**
D. Lubenova, E. Titianova, A. Dimitrova (Bulgaria)

P61 **Early Physiotherapy Intervention for Preterm Neonates with Hypoxic Impairment of the Central Nervous System.**
N. Gamakova, D. Lubenova (Bulgaria)

P62 **Functional Independence in Patients with Ischemic Stroke in the Chronic Period.**
D. Vasileva, D. Lubenova (Macedonia, Bulgaria)

P63 **Influence of Early Physical Therapy Program in Patients with Acute Ischemic Stroke.**
K. Grigorova-Petrova, D. Lubenova, A. Dimitrova (Bulgaria)

P64 **Correction and Evaluation of Motor Impairment in Multiple Sclerosis Patients using Biofeedback.**
A. Ryazantseva, V. Alifirova, N. Brazovskaya, A. Pribilskaya (Russia)

P65 **Comparison of Closed and Open Kinetic Chain Exercise in Patients with Parkinson's Disease.**
A. Dimitrova, D. Lubenova, Kr. Grigorova-Petrova (Bulgaria)

P66 **Web-based Interactive Simulation of a Clinical Case with Parkinson's Disease.**
G. Kossekova, T. Monova (Bulgaria)

P67 **Clinical Studies of the Effects of Artificial Technogenic Electromagnetic Radiation when Registering Brain Activity with an EEG.**
(Student Presentation)
D. Reznikov (Russia)

P68 **Spontaneous Spinal Epidural and Subdural Hematoma on Th_6-Th_{10}. A Case Report.**
(Student Presentation)
B. Ralcheva, K. Hadjolyan, S. Andonova (Bulgaria)

In Memoriam

HIROSHI FURUHATA, M.D., Ph.D.

Prof. Hiroshi Furuhata was born in Nagano, Japan, in 1944. He graduated from the Faculty of Engineering, Keio University in 1968, and joined Sophia University in 1968. He moved to the Medical Engineering Laboratory (ME Lab.) of the Jikei University School of Medicine in 1972, and was promoted to Assistant Professor, Associate Professor and Professor (Director) of the ME Lab. in 1977, 1983 and 2002, respectively.

Prof. Furuhata had two doctoral degrees: a Ph.D. and an M.D.

Recent Publications (2007-2013)

1. Furuhata H, Saito O. Comparative study of standing wave reduction methods using random modulation for transcranial ultrasonication. *Ultrasound Med Biol* **39**, 2013:1440-1450.
2. Shimizu J, Fukuda T, Abe T, Ogihara M, Kubota J, Sasaki A, Azuma T, Sasaki K, Shimizu K, Oishi T, Umemura S, Furuhata H. Ultrasound safety with midfrequency transcranial sonothrombolysis: preliminary study on normal macaca monkey brain. *Ultrasound Med Biol* **38**, 2012:1040-1050.
3. Wang Z, Fukuda T, Azuma T, Furuhata H. Safety of low-frequency transcranial ultrasound in permanent middle cerebral artery occlusion in spontaneously hypertensive rats. *Cerebrovasc Dis* **33**, 2012:23-29.
4. Sawaguchi Y, Wang Z, Furuhata H. Ultrasound control of the growth of thrombus – Potential for the embolus growth suppression & the reocclusion prevention. *Jpn J Med Ultrasonics* **38**, 2011:549-555.
5. Shiraishi K, Endoh R, Furuhata H, Nishihara M, Suzuki R, Maruyama K, Oda Y, Jo J, Tabata Y, Yamamoto J, Yokoyama M. A facile preparation method of a PFC-containing nano-sized emulsion for theranostics of solid tumors. *Int J Pharm* **421**, 2011:379-387.
6. Azuma T, Ogihara M, Kubota J, Sasaki A, Umemura S, Furuhata H. Dual-frequency ultrasound imaging and therapeutic bilaminar array using frequency selective isolation layer. *IEEE Trans Ultrason Ferroelectr Freq Control* **57**, 2010:1211-1224.
7. Manome Y, Furuhata H, Hashimoto A, Funamizu N, Suzuki R, Ishizawa S, Akiyama N, Kobayashi T, Watanabe M. Application of therapeutic insonation to malignant glioma cells and facilitation by echo-contrast microbubbles of levovist. *Anticancer Res* **29**, 2009:235-242.
8. Sugita Y, Mizuno S, Nakayama N, Iwaki T, Murakami E, Wang Z, Endoh R, Furuhata H. Nitric oxide generation directly responds to ultrasound exposure. *Ultrasound Med Biol* **34**, 2008:487-493.
9. Saguchi T, Onoue H, Urashima M, Ishibashi T, Abe T, Furuhata T. Effective and safe conditions of low-frequency transcranial ultrasonic thrombolysis for acute ischemic stroke. Neurological and histological evaluation in a rat middle cerebral artery stroke model. *Stroke* **39**, 2008: 1007-1011.
10. Wang Z, Moehring MA, Voie AH, Furuhata H. In vitro evaluation of dual mode ultrasonic thrombolysis method for transcranial application with an occlusive thrombosis model. *Ultrasound Med Biol* **34**, 2008:96-102.
11. Nakagawa K, Ishibashi T, Matsushima M, Tanifuji Y, Amaki Y, Furuhata H. Does Long-Term Continuous Transcranial Doppler monitoring Require a Pause for Safer Use? *Cerebrovascular Dis* **24**, 2007:27-34.

Prof. T. Shiogai
Department of Clinical Neuroscience,
Kyoto Takeda Hospital – Kyoto, Japan

Abstracts

NSRG Comprehensive Tutorial

T1

BASICS IN PHYSICS AND THE INSTRUMENTATION OF DIAGNOSTIC VASCULAR ULTRASOUND

M. Siebler

Mediclin / Essen Kettwig, Department of Neurorehabilitation / University of Duesseldorf – Essen, Germany

In this tutorial, we demonstrate physical principles, which are relevant in the practical routine in ultrasound diagnostics. Beside the interaction of ultrasound with the tissue, basics of the effects of frequency, propagation velocity, pulse repetition frequency, scattering and beam formation are illustrated. Practical examples and typical artifacts are discussed as well as influence on the machine settings (Beam focus, TI, MI, focus) on the quality of your analysis. The effects of data post processing (e.g. tissue harmonic imaging, rendering etc) will be demonstrated. Finally, the correct disinfection in clinical routine is presented.

Key words: *vascular ultrasound, basics in physics.*

T2

THE DOPPLER SPECTRUM – ITS RELATION TO DEVICE SETTING, THE FLOW FIELD AND VESSEL GEOMETRY

G.-M. von Reutern

Neurologische Praxis am Kardiologischen Zentrum – Bad Nauheim, Germany

The following topics will be discussed:
- Parameters of spectral analysis of Doppler recordings.
- Spectral analysis in case of undisturbed flow.
- Spectral analysis in case of disturbed flow.
- Technical influences on the Doppler spectrum.
- Measurement of velocity.
- Angle correction.

Key words: *angle correction, disturbed flow, Doppler spectrum, flow field, velocity estimation, vessel geometry.*

T3

HEMODYNAMIC PRINCIPLES – HOW THEY ARE TRANSLATED IN US-FINDINGS

A. Hetzel

Neurological Clinic Park-Klinikum – Bad Krozingen, Germany

Main topics with additional learning objects of this part of the NSRG teaching course will be:
1. Relationships of flow rate, pressure and flow resistance: flow rate is determined by pressure difference at the end of the vessel and flow resistance. The relationship is expressed analogous to Ohm's law.
2. Laminar and turbulent flow: mean flow velocity corresponds closely to flow rate under laminar flow conditions, narrowing of the lumen leads to a acceleration of blood flow. The proportional increase of the Reynolds number result to a critical value. Over this turbulent flow occur with irregular, disorganized blood flow in all directions.
3. Effect of vessel geometry on flow: flow separation with reattachment occurs at bifurcations and poststenotic or in curves. This phenomenon has to be distinguished from changes due to turbulence.
4. Flow waveform and indices for Doppler flow waveforms: it exists a close correlation between Doppler waveform and wave pressure curve. The waveform is determined by resistance flow and compliance flow. Commonly the resistance index R of Pourcelot and the pulsatility index (PI) of Gosling are used.
5. Hemodynamic effects of stenoses of the supraaortic arteries: poststenotic reduction of flow correlates closely to reduction of cross sectional area in case of high-grade stenoses (secondary hemodynamic effect). Combined with the intra-stenotic flow acceleration (primary hemodynamic effect) grade of stenosis can be determined by Doppler sonography. Further hemodynamic effects of arterial obstruction occur in collateral channels (tertiary hemodynamic effect)

The introduction to the hemodynamic principles should lead to a basic understanding of parameters that determine the cerebral blood flow velocity. Thus, a better interpretation of the findings raised by Doppler sonography of the brain supplying arteries should be possible.

Key words: *collaterals, effects of stenoses, flow waveform, hemodynamic principles.*

T4

ANATOMY OF BRAIN SUPPLYING VESSELS

W. Mess

University Hospital – Maastricht, Netherlands

This tutorial will cover the basic knowledge of the arterial blood supply of the brain. The extracranial anterior and posterior system, i.e. the carotid and the vertebral arteries will be discussed as well as the intracranial arteries. Special attention will be paid to the concept of endarteries versus collateral blood supply. The latter comprises of course the circle of Willis. Also, there will be a short reflection on the anatomical properties of the vessel wall, which are the prerequisite for their functional behaviour.
So, the participant will be able to learn the essential facts of the arteries that take care of the blood supply of the brain. The tutorial will focus on practically relevant aspects which are needed for the understanding of the physiology of the arterial cerebral circulation and the examination of both the extra- and intracranial vessels by means of ultrasound.

Key words: *blood vessels, cerebral circulation, circle of Willis.*

T5

DIAGNOSIS OF OCCLUSIVE DISEASE OF THE CAROTID AND VERTEBRAL ARTERY SYSTEM, VESSEL WALL PATHOLOGY

K. Niederkorn

Deprtment of Neurology, Section of Neurosonology, Medical University Graz – Graz, Austria

The following topics will be discussed:
- Diagnosis of stenosis and occlusion in the carotid system.
- Degree of Stenosis-NASCET and ECST grading systems and clinical implications.
- Carotid vessel wall pathology- plaque characterization.
- Vertebral artery pathology- steosisi, occlusion, collaterals.
- Follow-up ofter carotid and vertebral artery stenting.

Key words: *carotid occlusion, carotid stenosis, degree of stenosis, plaque characterization, stenting.*

T6

MEASURING THE DEGREE OF CAROTID AND VERTEBRAL ARTERY STENOSIS

F. Perren

HUG, University Hospital and Medical Faculty of Geneva, Department of Clinical Neurosciences, Neurosonology Unit – Geneva, Switzerland

Following aspects will be presented: brief introduction on: risk factors / strokes due to internal carotid and vertebral artery stenosis, epidemiological data, grading of the ICA/VA stenoses: methods and grading steps, assessment, hemodynamic effects, pitfalls, recommendations, review of the literature.

Key words: *angle correction, atherosclerosis, grading of stenosis (ECST, NASCET), ICA, VA, Spencer curve, stroke.*

T7

DIAGNOSIS OF ATHEROSCLEROTIC OCCLUSIVE DISEASE INVOLVING THE INTRACRANIAL ARTERIAL SYSTEM

E. Bartels

Center for Neurological Vascular Diagnostics – Munich, Germany

In this lecture the typical ultrasonographic findings in cerebral occlusive disease will be presented.
Data concerning the sensitivity and specificity of TCCS in intracranial stenosis remain limited. Furthermore, limited criteria for the quantification of intracranial stenosis by TCCS are available. The classification is based on conventional TCD studies.
The degree of stenosis is estimated on the basis of the changes of the Doppler spectrum (increased flow velocities in the site of the stenosis, and flow disturbancies upstream and downstream from the lesion). TCCS provides information on the localization of the stenosis. Using the frequency dependent color-coding, the site of the stenosis can be more easily recognized due to the aliasing phenomenon.
Sonographic diagnosis of occlusion of a cerebral artery can be made when a color-coded signal cannot be obtained at depths of insonation corresponding to that artery, although neighboring arteries can be imaged well.
Criteria for the diagnosis of MCA occlusion include lack of detectable flow in the MCA, good visualization of the ipsilateral PCA, and detection of the collateral flow.

Key words: *collateral flow, degree of stenosis, intracranial occlusion, intracranial stenosis.*

T8

IMT: METHODOLOGY AND ITS CLINICAL VALUE

T. Rundek

Miller School of Medicine University of Miami – Miami, USA

Carotid atherosclerotic disease plays a large role in the etiology of stroke. B-mode carotid ultrasound has been widely used to detect subclinical carotid atherosclerosis by quantifying carotid intima–media thickness (cIMT) and carotid plaque (CP). Both cIMT and CP have been accepted surrogate imaging biomarkers of subclinical atherosclerosis until recently when it became increasingly clear that cIMT and CP may be genetically and biologically distinct atherosclerotic phenotypes with evidence of heterogeneous etiology. In addition, carotid atherosclerotic plaque burden, defined as the

two-dimensional total plaque area (TPA) or tree-dimensional total plaque volume is a powerful non-invasive imaging tool for vascular risk estimation and stronger predictors for future ischemic stroke than cIMT.
cIMT and CP have been associated with prevalent and incident atherosclerotic disease with variable effects. Whether cIMT and CP are distinct phenotypes or represent a single trait at a different stage of atherosclerotic lesion development is unclear. cIMT may represent adaptive changes to increased shear stress with aging and it may not be an indicator of atherosclerotic therefore the pathophysiological significance of arterial wall thickening with regard to transformation into plaque is questionable. Experimental and epidemiological studies have not yet clarified this dilemma. This presentation will discuss adaptive changes in the arterial wall with aging and how these changes are related to the development of atherosclerosis. The cross-sectional and prospective relationships between cIMT and plaque phenotypes (plaque thickness and area) will be presented using data from in an urban multi-ethnic stroke-free population of northern Manhattan.

Key words: *carotid atherosclerosis, carotid IMT, carotid plaque.*

T9

MONITORING THE CRITICAL ILL PATIENTS

M. Mijajlovic

Neurology Clinic, Clinical Center of Serbia and School of Medicine University of Belgrade – Belgrade, Serbia

Transcranial Doppler (TCD) is a relatively new, non-invasive tool, allowing for bedside monitoring to determine flow velocities indicative of changes in vascular caliber.
It has been frequently employed for the clinical evaluation of cerebral vasospasm following subarachnoid hemorrhage (SAH). To a lesser degree, TCD has also been used to evaluate cerebral autoregulatory capacity, monitor cerebral circulation during cardiopulmonary bypass and carotid endarterectomy, to diagnose brain death and for monitoring of cerebral hemodynamics in neurotrauma.
TCD is a suitable bedside method for daily assessment of the changes of intracranial pressure (ICP) by continuous monitoring of the changes of blood flow velocities and pulsatility index (PI), reflecting decreases in cerebral perfusion pressure due to increases in ICP.
Growing body of literature demonstrates the usefulness of transbulbar B-mode sonography of the optic nerve for detecting increased ICP in patients requiring neurocritical care.
TCD findings compatible with the diagnosis of brain death include systolic spikes without diastolic flow or with diastolic reversed flow, and no demonstrable flow in a patient in who flow had been clearly documented on a previous examination.
Assessment of cerebral autoregulation using TCD blood flow velocity has been previously validated to be predictive of outcome following traumatic brain injury.
The commonly used bedside methods of determining the status of autoregulation include the transient hyperemic response test, the leg-cuff deflation test and reaction to spontaneous blood pressure fluctuations.
TCD PI has emerged as a surrogate marker for ICP. The measurement of PI is also an useful adjunct to guide the use of hyperosmolar therapy in various conditions with intracranial hypertension.
However, some other important, confirmed utilities of TCD in neurocritical care are overlooked, including spontaneous emboli detection, right-to-left shunt identification, early diagnosis and treatment of acute stroke, and early prognosis after recovery of cardiac arrest.

Key words: *monitoring, neurocritical care, ultrasonography.*

Lectures

L1

H. FURUHATA – A GREAT PIONEER OF NEUROSONOLOGY

T. Shiogai

Department of Clinical Neuroscience, Kyoto Takeda Hospital – Kyoto, Japan

Professor Hiroshi Furuhata passed away aged 67 years old on August 11th 2012. He gave tremendous contribution to our Neurosonology Research Group of the World Federation of Neurology (NSRG-WFN). He served as the secretary-general of the 4th meeting held in Hiroshima in 1991 and edited the proceedings (Recent Advances in Neurosonology). Subsequently, he served as the chairman of our NSRG-WFN from 1991-1994, as the Honorary President of the 7th meeting (Winston-Salem) and 8th NSRG Meeting (Taipei), and was an executive committee and Advisory Board member from 2001. His extensive neurosonological research included hemodynamics, cardiovascular diseases, cerebrovascular diseases, sonothrombolysis, sonobiochemistry, and drug delivery systems. From this work we have to cite the following three very important contributions.

Firstly, the peripheral cerebral artery properties-analysis system by the development of the QFM system for the quantitative measurements of flow volume in the common carotid artery which was selected by the Science and Technology Agency as an invention of special attention in 1983.

Secondly, the clinical introduction of the Transcranial Color Doppler Image which was first presented at the 2nd International Conference on Transcranial Doppler Sonography, Salzburg Austria in 1988.

Thirdly, experimental and clinical sonothrombolysis research was his life`s work where his goal was the establishment of an integrated experimental and clinical system for transcranial sonothrombolysis treatment, utilizing less-invasive mid-frequency ultrasound. This project was selected as one of 24 innovative medical development research projects supported by the Japanese Government (the so-called Super Tokku) in 2008.

I would like to introduce this grant-funded sonothrombolysis research projects aimed for future establishment of acute ischemic stroke treatment.

Acknowledgements: *Jun Shimizu, M.D. and Ms. Mari Arakawa, Medical Engineering Laboratory, Jikei University School of Medicine.*

Key words: *Hiroshi Furuhata, history, sonothrombolysis.*

L2

SONOTHROMBOLYSIS: UNCERTAINTIES REPRESENT SIGNIFICANT HURDLES FOR APPROVAL

F. Tranquart[1], B. Petit[1,2], E. Bihel[1], Y. Bohren[1], F. Yan[1], E. Allemann[2], M. Arditi[1], J. M. Hyvelin[1]

[1]BRACCO SUISSE SA – Plan Les Ouates, Switzerland,
[2]School of Pharmaceutical Sciences, University of Geneva, University of Lausanne – Geneva, Switzerland

Rapid restoration of vascular flow is the primary goal of acute stroke treatment, while improvement in patient's outcome is the ultimate benefit of such treatments. Among different treatment schemes, sonothrombolysis has been used in in vitro tests, in preclinical trials and to a lesser extent in clinical trials, even though the exact underlying mechanism has not been fully clarified.

From a regulatory standpoint, any new therapeutic treatment must be proven safe before it can be widely used, especially in critical health conditions. In that objective, we have investigated in details some specific aspects of sonothrombolysis, such as the kinetics of the clot lysis in vitro.

In contrast to many authors who have used clot weight changes to characterize the effects of insonation, we have used a visual assessment with a camera allowing continuous monitoring over the treatment time. This allowed us to get more reproducible values and important information related to the rate of lysis, which can help in characterizing the effects of different pulsing sequences at various acoustic pressures.

More specifically, we have studied the respective roles of fibrinolysis and haemolysis in the observed clot lysis. In essence, our results indicate an absence of fibrinolysis at acoustic pressure levels up to 1.3 MPa per se but a pure haemolysis in the absence of rtPA. Conversely, at this acoustic pressure level, the presence of 3 μg/ml rtPA led to a significant fibrinolysis when combined with US and microbubbles.

These results will be further detailed with a translation in vivo to confirm the validity of the proposed approach of using moderate and acceptable US acoustic pressure levels in a clinical setting. Even though sonothrombolysis has been studied for more than 10 years, some key points remained unexplained, leading to a long delay in getting an approval for this treatment.

Key words: *fibrinolysis, haemolysis, in vitro, sonothrombolysis.*

L3

ULTRASOUND SYSTEM DESIGN FOR SONOTHROMBOLYSIS WITH MICROBUBBLES

J. Powers[1], R. Seip[2], W. Shi[2]

[1]Philips Ultrasound, Bothell – WA, USA, [2]Philips Research, Briarcliff – NY, USA

For many years existing ultrasound devices have been used for sonothrombolysis (STL) research in-vitro, in animals, and even in humans. These have included laboratory transducers, physiotherapy devices, and diagnostic ultrasound systems. None of these are optimal for STLsince they were designed for different applications. Therefore, we have been investigating the clinical requirements for an STL device for ischemic stroke and the influence of various system parameters on the lytic capabilities of ultrasound and microbubbles (MB).

The safety and efficacy of an STL treatment are influenced by the following key factors, among others: thromboembolic occlusion locations, temporal bone window sizes, transcranial beam patterns, steering coverage, power deposition, MB concentration and replenishment time, total treatment time, workflow, etc. These multiple dimensional factors present unique challenges to the system designer: for example, the cerebral bone window confines the available aperture size and bone attenuation limits the useable frequency range, which then constrain the ability to focus and steer the beam. Therefore, a system approach is needed for an integrated design of therapeutic array, pulsing (frequency, pulse length, amplitude, duty cycle etc.), scanning sequence, and array fixture. Additional system design considerations include the ability of the system to mesh with the existing stroke workflow for easier and faster adoption by clinicians, or in a point-of-care setting to start the treatment as soon as possible.

In designing such a system "Safety First" must be the guiding mantra. tPA, the only approved therapy for ischemic stroke increases the risk of hemorrhage ten-fold, so clearly some risk is unavoidable. This talk will describe some of these tradeoffs so that researchers may make more educated choices in their proposed research.

Key words: *microbubbles, sonothrombolysis, ultrasound.*

L4

WHICH STUDY DESIGN IS APPROPRIATE FOR SONOTHROMBOLYSIS TRIALS? THE ULTRAS PILOT STUDY

M. Del Sette[1], S. Ricci[2], E. Giorli[1], M. Cotroneo[3]

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Objective: sonothrombolysis (ST) can increase the penetration of circulating tPA into the thrombus, promote the breaking and cleaving of the fibrin polymers, and improve the binding affinity of tPA to fibrin. A recent Cochrane Review of all the randomized studies published on ST reported significantly more recanalizations and better clinical outcome, with no effect on mortality. The ultras study is a pilot study aiming at defining efficacy of ST in acute ischemic stroke.

Material and Methods: This is a multicenter, interventional, controlled, randomized study. Patients older than 18 years will be enrolled if presenting with acute IS within 4.5 of symptom onset. They will undergo to blood tests, ECG, brain CT, carotid US, TCCD or TCD. Patients should have an occlusion of the middle cerebral artery documented by TCD, TCCD or CTA. Exclusion criteria will be: cerebral hemorrhage on CT and dramatic spontaneous neurologic improvement. Informed consent will be obtained from all patients or their next of kin. Patients will be randomized to receive either tPA alone or tPA + US (1 hour exposure to US delivered by a 2-MHz TCD probe during tPA infusion).

Results: The primary endpoints will be clinical improvement assessed by NIHSS at 6, 12 and 24 hours from treatment. Clinical improvement will be defined as a change greater than 4 points in NIHSS at 24 hours after treatment. Secondary endpoints will be early (<6 h) recanalization rates, clinical outcome (modified Rankin Scale) at 3 months from stroke onset, frequency of cerebral hemorrhage (symptomatic and asymptomatic), mortality (assessed at 24 h and 3 months from treatment).

Discussion: ST is a promising tool for ischemic stroke treatment. ULTRAS pilot study will provide us further data to be added to previous study and basis for more effort in this promising direction.

Key words: *acute stroke, randomized trial, thrombolysis.*

L5

REVIEW ON MICROEMBOLUS DETECTION

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Microembolic signals (MES) detected by transcranial ultrasound have first been described in the 80ies by Merrill Spencer and have rapidly gained great importance for the exploration of the pathophysiology underlying various stroke etiologies. Finally, MES have been proven as a reliable biomarker concerning the prognosis of symptomatic and asymptomatic internal carotid artery (ICA) stenoses. Typical clinical indications for microembolus detection (MD), a time-consuming, investigator-dependent US technique, are monitoring of cardiac and carotid surgery, arterial interventions, detection of occult sources of embolism, defining the culprit in competing sources of embolism, development of less emboligenic surgical techniques and refined devices. MES detection can also be helpful to evaluate decompression illness and fat embolism. The number of observational or even randomised prospective studies on MD has reached the number of nearly 400 (according to PubMed). MD is increasingly applied to aggressive interventions, and often combined with DWI and Flair MR-imaging of the brain. Nearly all types of mechanical or biological valves of the heart have been tested by means of MD, as well as the corresponding surgical or transarterial interventions. In mechanical valves gaseous microbubbles due to microcavitation are frequent – and harmless. Amazingly,

only little is known about atrial fibrillation and MES. Three important randomised controlled trials, the CARESS, the ACES and the CLAIR-trial have been performed. They will also be reviewed, because they demonstrate the specific value of MD as surrogate endpoint for future strokes.

Key words: *microembolus, review, ultrasound.*

L6

SPECIFIC TCD CLINICAL APPLICATIONS FOR PATIENTS WITH TRAUMATIC BRAIN INJURY

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Critical care management of patients with traumatic brain injury (TBI) has undergone tremendous advances. Neurosurgeons, neurologists and neurointensivists, including military, have a large armamentarium of invasive monitoring modalities available to detect secondary brain injury and guide therapy. The primary goal monitoring is to prevent secondary insults to the brain, primarily cerebral ischemia due to the posttraumatic vasospasm (PTV), and intracranial hypertension (ICH). This lecture summarizes the advantages and the specific roles of transcranial Doppler (TCD) ultrasound to establish and monitor the presence of PTV and ICH.

Review of literature demonstrate that TCD is valid in predicting the patient's outcome of 6 months and correlates significantly with intracranial pressure when it is performed in the first 24 hours after event. Recently, there have been many research results in early judgment of PTV, and TCD studies are particularly prominent in this area. The prognosis is affected severely with regard to quality of life of patients, and earlier determination of the PTV becomes very important. TCD is non-invasive, fast, and reliable as an efficient ultrasound technology, especially in critically ill patients with PTV in an urgent examination. This means it that TCD has greater value and helps to improve the management of patients with TBI. Too often, the first sign is a neurologic deficit, which may be too late to reverse. However, use of TCD may predict PTV before clinical sequelae. TCD assists in the clinical decision-making regarding further diagnostic evaluation and therapeutic interventions and has become a regularly employed tool in neurocritical care. Accumulated today experience suggests that there is an important guiding significance in early diagnosis and treatment of PTV and ICH in TCD. Because PTV and ICH represent significant events in a high proportion of patients after wartime TBI, close daily TCD monitoring is recommended for the management of such patients.

Key words: *intracranial hypertension, posttraumatic vasospasm, transcranial Doppler ultrasound, traumatic brain injury.*

L7

MONITORING THE BRAIN DURING INVASIVE CARDIOVASCULAR EXAMINATIONS AND SURGERY

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Several non-invasive imaging modalities have shown their potential to identify unstable carotid artery plaques. Echolucent plaques are thought to be more unstable than echo-rich plaques. Images can be evaluated either visually or by computer-assisted gray-scale median (GSM) measurements. Visual evaluation of plaque echogenicity has only fair reproducibility, whereas objective characterization is more reliable and less observer dependent. Plaque irregularity on ultrasound has also been reported to be a risk factor for stroke in general but not for ipsilateral stroke alone.

Symptomatic patients with microembolic signals (MES), assessed by TCD, have been shown to be at high risk for developing ipsilateral stroke. Whether MES positive asymptomatic patients also are at increased risk has not been clarified. The use of ultrasound contrast agents may be helpful in determining plaque surface and plaque neovascularization.

Multisequence MRI is able to quantify carotid plaque components. The use of a contrast agent improves quantification of total plaque burden, and contrast between fibrous cap and lipid core. Dynamic contrast-enhanced MRI allows assessment of plaque neovascularization.

Currently, there are few in vivo human studies on functional imaging of carotid plaques. These initial studies have shown the potential of USPIO -enhanced MRI, 18F-FDG PET, IL2 scintigraphy, and low-density lipoprotein scintigraphy to identify inflammation, the potential of annexin A5 scintigraphy to identify cell death, and platelet scintigraphy to depict plaque thrombosis.

Biomarkers have been shown to improve prediction independent of conventional risk factors. High sensitivity C-reactive protein (hs-CRP) and lipoprotein-phospholipase A2 (PLA2) are two such candidates

It is at present undecided whether one imaging modality or a multimodality approach is most effective. Prospective clinical trials are needed to demonstrate if imaging methods do indeed result in an improvement in defining unstable plaques and if they can predict patient outcomes, particularly in asymptomatic subjects.

Key words: *atherosclerosis, inflammation, vulnerable plaque.*

L8

CLINICAL AND VASCULAR FOLLOW UP OF SYMPTOMATIC INTRACRANIAL STENOSIS STENTING

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Objective: Stenoses of intracranial arteries (IAS)are responsible for 10% - 15% of all ischemic strokes.The purpose of the present study was to retrospectively identify the outcome of endovascular treatments of IAS with Stent-PTA performed at the University Hospital Graz during the period of 2003 to 2012.
Material and Methods: Data from all patients who underwent interventional procedures during the period 2003–2012, caused by a symptomatic (transient ischemic attack or stroke) stenosis of a major intracranial artery, were extracted from a stent data base. Technical success, clinical outcome, the rate of instent restenosis (ISR) and recurrent stroke as well as prognosis were defined as primary objectives. Examinations were at 24 hours and 6 months after the procedure, as well as the last consultation of the stroke outpatient clinic.
Results: 89 patients (20 female, 69 male; mean age 67.3 years) with 93 symptomatic intracranial stenoses were treated by interventional procedures. Technical success rate was 98,9%. After a mean follow - up time of 2.6 years, 78.8% showed a good clinical outcome according to the modified Rankin Scale (mRS) scores of 0–2, while 15.7% were disabled (mRS 3–5). 5.6% deceased, none of them within the first 30 days after the initial intervention. A 24-hours post procedure ISR – rate of 7.5% (7 patients), a 6-months rate of 16.5% (14 patients) and a long-term rate of 13.0% (12 patients) was diagnosed. Ipsilateral stroke or transient ischemic attack occurred in 3.2% during the first 24 hours, in in 6.5% within 30 days, and in 15.1% until 12 months after intervention.
Discussion: Endovascular treatment of symptomatic IAS showed high rates of technical success and an acceptable number of instent restenosis and periprocedural ipsilateral stroke. However, the choice for optimal treatment has to be based on individual decision making by an experienced multidisciplinary team.

Key words: *intracranial artery stenosis, restenosis, stent PTA, ultrasound.*

L9

INTRACRANIAL PRESSURE DYNAMICS ASSESSED BY TRANSCRANIAL DOPPLER

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Objective: Earlier attempts at non-invasive determination of ICP used ABP and TCD waveforms to estimate critical closing pressure (CCP). However, the CCP was found to be strongly influenced by vascular tone and a poor indicator of absolute ICP levels.
Material and Methods: An important effect of raised ICP is a decrease in intracranial compliance. This, in turn, causes the pulsations in the ICP waveform to increase. These pulsations are primarily caused by the changes in cerebral blood volume (CBV) throughout the heart cycle. We investigated a relatively simple model of the cerebral circulation where the relative changes in CBV were determined by integrating the difference between the arterial flow velocity (FV) waveform as recorded by TCD, and the venous outflow which we assumed to be non-pulsatile.
Results: In patients with good quality waveform recordings, we found that this simple model gave a good representation of the ICP waveform; in particular it could predict the phase shift between the ABP and the ICP waveforms. We also hypothesized that the shape of the FV waveform was primarily determined by the difference between the ABP and ICP waveforms.
Discussion: The model was used to estimate the cerebrovascular pressure transmission (CPT) in patients with increased ICP. We found a good agreement between the estimated and the measured CPT.

Key words: *intracranial pressure dynamics, transcranial Doppler.*

L10

TCCD – CTA FUSION IMAGING

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L11

ULTRAFAST DOPPLER AND *f*ULTRASOUND IMAGING

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In the last fifteen years, the concept of plane wave transmissions rather than line by line scanning beams broke the conventional limits of ultrasound imaging. By using such large field of view transmissions, the frame rate reaches the theoretical limit of physics dictated by the ultrasound speed and an ultrasonic map can be provided typically in tens of micro-seconds (>1000 frames per second). Interestingly, this leap in frame rate is not only a technological breakthrough offering completely new ultrasound imaging modes and open new application, but at such frame rates, it becomes possible to track in real time transient vibrations – known as shear waves – propagating through organs and provides quantitative maps of tissue stiffness whose added value for diagnosis has been recently demonstrated in many fields of radiology.
For blood flow imaging, ultrafast Doppler permits high-precision characterization of complex vascular and cardiac flows. It also gives ultrasound the ability to detect very subtle blood flow in very small vessels. In the brain, such ultrasensitive Doppler paves the way for fUltrasound (functional ultrasound imaging) of brain activity with unprecedented spatial and temporal resolution compared to fMRI. Examples such as the functional imaging of cerebral blood volume during epileptic seizures will be presented and ill emphasize the potential of this new imaging modality.
fUS technology could open new avenues in neuroscience. For therapy, localizing the epileptic focus using fUS during surgery could be a major application. Functional imaging on newborns will also be of major interest in order to increase our knowledge

in cognitive science. Beyond clinical application, it will be a fantastic tool for people in neuroscience working on small animals. This technology should help them answer unsolved questions. We will also emphasize how fUS combined with ultrasonic neurostimulation could lead to first extracorporeal brain machine interfaces.

Key words: *fUltrasound, functional imaging, ultrasound, ultrafast imaging.*

L12

IS AUTOMATIC EMBOLUS MONITORING READY FOR REAL LIFE APPLICATION?

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It has been shown for different patient categories that the detection of microembolic signals (MES) in the middle cerebral artery helps to estimate the risk of future cerebrovascular events. The strength of the evidence for this relationship differs for the different clinical situations. So, the question whether automated MES detection should be applied in the daily clinical context depends not only on the adequacy of the detection system. However, a properly functional system is a prerequisite for its succesful clinical application. This comprises not only the correct identification of MES in the transcranial Doppler signal but also the ease of use. Only if both criteria are fulfilled automated MES detection is likely to be used in clinical practice.

Several automated MES detection systems are currently commercially available. The latest addition is a portable system allowing for recordings of several hours. With the exeption of one system that is installed on an external computer attached to any Doppler machine, all other solutions are build into a given Doppler machine. Few data are available on the reliability of the detection algorithms. All systems are suited for MES within a given dynamic range. In daily practice, very high intensity gaseous bubbles are likely not to be captured, especially not when appearing in clusters. Most systems will produce a list of possible MES - ie. short segments of Doppler signals containing an intensity increase, which have to be checked manually. Especially in patients with an expected low number of MES this approach is reasonable and will result in an enormous saving of time.

So, when taking the clinical circumstances and the properties of a given system into account, automated MES detection can be a reasonable adjunct to daily patient care.

Key words: *embolus detection, evidence based medicine, transcranial Doppler.*

L13

ROLE OF TCD IN SICKLE CELL DISEASE: OLDER AND NEW CONCEPTS

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Stroke is an important complication of sickle cell disease. Approximately twenty-four percent of patients have a stroke by the age of 45 years. Blood transfusions decrease stroke risk in patients deemed high risk by transcranial Doppler (TCD) by evidence of elevated intracranial internal carotid or middle cerebral artery velocity. A follow-up of neurologically symptomatic and asymptomatic sickle cell patients increased other factors were significant in the identification of patients at risk that could include: velocity in the ophthalmic artery > that of the ipsilateral MCA, maximum velocity in the posterior cerebral (PCA), vertebral, or basilar arteries > maximum velocity in the MCA, turbulence, PCA visualized without the MCA. These news observations in TCD exams have been included in a practical way and will be discussed. TCD screening itself only stratifies stroke risk, but does not prevent stroke; stroke prevention depends on the implementation of chronic transfusion therapy. However, access to vascular laboratories appears to be a barrier to the implementation of this highly effective stroke prevention strategy, even among children with comprehensive health insurance. The difficulties in performing the examination, differences in imaging and nonimaging techniques, and interpretation guidelines are the main problems. This review describes the practical procedure, the strategies to improve the TCD utilization like task force works and illustrates with the Brazilian guidelines a prevalent place for this disease.

Key words: *sickle cell disease, stroke prevention, transcranial Doppler, thrombosis.*

L14

SUBCLINICAL ULTRASOUND MARKERS IN THE PREVENTION OF CEREBROVASCULAR DISEASES

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Cerebrovascular diseases (CVD) represent conditions which occur as a result of changes in blood vessels of the brain, as well as the vessels supplying the brain. The most common types of CVDs are ischemic stroke, transient ischemic attack, hemorrhagic stroke and vascular dementia. CVDs affect millions of people worldwide, regardless of age, and represent a group of very important medical and social problems. Therefore, their prevention is becoming an imperative. Risk factors, such as age, gender, genetic factors, hypertension, diabetes mellitus, hypercholsterolemia, atrial fibrillation, orlifestyle,are causing changes of vessel walls which lead to CVD. Early changes of the blood vessel wall can be detected by early ultrasound screening methods which allow us to detect changes before the disease becomes clinically evident. Intracranial hemodynamics can be assessed by Transcranial Doppler Sonography (TCD), functional TCD with various functional tests, and TCD detection of cerebral emboli. Extracranial circulation (carotid and vertebral arteries) can be assessed by means of color Doppler flow imaging (CDFI). Novel ultrasound technology enables us non-invasive, bedside detection ofearly vascular changes such as arterial stiffness,

measurement of the intima-media thickness (IMT), pulse-wave velocity, or endothelial dysfunction in order to obtain information necessary to closer determine the relation between vascular risk factors and disease development, so that the evolution of CVD could be prevented or at least postponed. Early disease detection enables on-time management of vascular risk factors, and studies have shown that careful control of vascular risk factors can postpone or even reverse disease progression.

Key words: *cerebrovascular diseases, prevention, ultrasound markers.*

L15

CHANGE OF INTIMA-MEDIA THICKNESS IN PREVENTION OF CARDIOVASCULAR EVENTS IN ISCHEMIC STROKE PATIENTS WITH HIGH RISK OF CEREBRAL HEMORRHAGE (PICASSO)

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Objective: It is reported that the occurrence of cerebral hemorrhage tends to increase in cases of accompanying lacunar infarction which occurs more frequently in Asians than in Westerners, or periventricular ischemic change which increasingly occurs with ageing. Accordingly, the point is that the occurrence of cerebral hemorrhage should be primarily considered in the treatment of cerebral infarction, along with the phenomenon of an ageing population both in Asian countries including Korea. Nevertheless, so far there has been no clinical research regarding secondary prevention of stroke, particularly considering the risk of occurrence of hemorrhage in cerebral infarction cases. However, according to a recent study, when phosphodiesterase inhibitors including cilostazol are used independently, or in combination with aspirin, secondary prevention can be improved without increasing the occurrence of hemorrhagic side effects.
Material and Methods: The primary hypothesis of this study is; cilostazol alone or with probucol will reduce the risk of cerebral hemorrhage without increase of cardiovascular events compared to aspirin in the ischemic stroke patients with symptomatic or asymptomatic old cerebral hemorrhage. Intima-Medial-Thickness (IMT) will be measured every year during follow-up period and the results will be compared with the baseline data. The change of IMT will be analyzed with the occurrence of cardiovascular events.
Results: This study is currently recruiting participants. We will present the IMT study protocol and characteristics of baseline data.
Discussion: Considering this, if it is proved that the agent, cilostazol, could decrease the risk of occurrence of stoke, along with no significant increase in the risk of occurrence of hemorrhagic side effects, by selecting a patent group with a high risk of cerebral hemorrhage, cilostazol may be recognized as an unique antiplatelet agent applicable to old-aged patient with cerebral infarction who have a certain risk of cerebral hemorrhage.

Key words: *cerebral haemorrhage, cerebral infarction, intima-media thickness.*

L16

PREDICTING CORONARY ARTERY DISEASE IN STROKE PATIENTS

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Approximately 13 million deaths per year are caused by vascular diseases, ischemic heart disease and stroke account for 22.3% of the total yearly deaths in the world, 12.2% and 9.7% are due to ischemic heart disease and stroke respectively. Myocardial infarction is the leading cause of long-term mortality in stroke surviving patients, although stroke is the leading cause of disability in the world. Atherosclerotic carotid artery disease is the cause of ischemic ischemic stroke in about 20% of cases.
The aim of this lecture is to present the possibilities of predicting coronary artery disease in stroke patients.
The diagnosis of coronary artery disease (CAD) is often too late, because myocardial infarction or even death might be the first sign of CAD. In contrary to carotid artery disease where severity of the stenosis is the main player, rupture-prone plaques in coronary artery disease cause acute myocardial infarctions and sudden cardiac deaths.
About 68% of patients with acute myocardial infarction have a mild degree (<50%) of coronary artery stenosis. Approximately 76% of sudden cardiac deaths are caused by the rupture-prone plaque and only 24% by severe stenosis.
Asymptomatic carotid bruit increases the risk of myocardial infarction and cerebrovascular deaths. The noninvasive and reliable diagnostic tool for evaluating carotid artery atherosclerosis plaque or stenosis (CAS) is an ultrasound including measurement of intimal-media thickness (IMT) which represents mainly medial layer hypertrophy. IMT is usually measured in the common carotid artery and the internal carotid artery. In recent years, automated and semi-automated measurements of IMT were developed. According to Manheim consensus conference, measurement of IMT should be done on the far wall of the common carotid artery, with quality index greater than 0.5 (13, 14). IMT, plaque and stenosis should be regarded as distinct phenotypes, with distinct biological aspects and determinants.

Key words: *coronary artery disease, prediction, stroke.*

L17

EARLY HEMODYNAMIC CHANGES POST INTRACRANIAL THROMBECTOMY: A SIGN OF VESSEL WALL INJURY?

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Objective: Stent retrievers are new devices that can be also used to perform mechanical intracranial thrombectomy. They have revolutionized endovascular treatment of acute ischemic stroke with good recanalization and acceptable safety. However, previous animal studies have shown that mechanical thrombectomy may cause endothelial injury of the arterial wall leading to myointimal hyperplasia.
Material and Methods: Acute ischemic stroke patients suffering from acute intracranial single large artery occlusion in which mechanical thrombectomy using stent retrievers was performed were studied. Only those with complete vessel recanalization as assessed by post-procedural DSA and in whom MRA and transcranial duplex sonography (TDS) were performed were retained. Complete revascularization was defined as modified TICI 2b or 3. Patients treated with intra-arterial thrombolysis or stenting of these arteries were excluded.
Results: 20 acute ischemic stroke patients (10 women; mean age 63.7 years) due to arterial occlusion (19MCA;1BA) showed complete recanalization post thrombectomy. All of them received acetylsalicylic acid. DSA post thrombectomy and post acute MRA confirmed complete recanalization without residual stenosis or vasospasm. However, in 18/20 patients TDS (mean 3.8 days after thrombectomy) showed segmental acceleration of blood flow velocities in the affected segments of these arteries (MCA PSVmax at least > 35% as compared at same depth with the controlateral side; BA PSVmax > 40% as compared to velocities measured in the same vessel). None of them showed clinical deterioration.
Discussion: This pilot study is the first showing with transcranial duplex sonography early very focal acceleration of blood flow velocities in intracranial arteries after thrombectomy with stent retrievers. In the absence of residual stenosis or vasospasms, this might be a sign of vessel wall i.e. intimal injury in humans. Whether this is due to local inflammatory agents, neothrombosis or myointimal hyperplasia is not yet clear.

Key words: *acute ischemic stroke, stent retrievers, thrombectomy, transcranial duplex ultrasound.*

L18

INTRACRANIAL WAVEFORM CHANGES AFTER CARDIAC TRANSPLANTATION

A. R. Massaro

Brazill

L19

TCD-EEG MONITORING IN PAROXYSMAL NEUROLOGICAL DISEASES

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Objective: We aim to investigate the feasibility of real-time TCD-EEG monitoring in patients with paroxysmal neurological diseases.
Design and Methods: This is an on-going single-center observational study. Six hours Real-time TCD-EEG (Delica NSD-8100) is performed in pre-surgical patients with refractory epilepsy and pre-surgical patients with Moyamoya disease and transient ischemic attacks. The TCD-EEG monitoring includes 10-20 system 16 channels EEG and bilateral middle cerebral artery blood flow velocity (CBFV) monitoring. To further investigate TCD value in the localization of epileptogenic focus, SPECT is performed, if available, in patients with seizure attacks for comparative analysis. To induce transient ischemic attacks, 3 minutes hyperventilation is performed in patients with Moyamoya disease. In patients with seizure attacks, we observe: 1) the synchronicity between CBFV changes and epileptic discharges;2) the consistency between CBFV changes and SPECT findings; 3) the relationship between CBFV changes and epileptogenic focus as defined by EEG and SPECT;4) the correlation between TCD-EEG findings and prognosis after operation. In patients with Moaymoya disease, we observe: 1)the EEG and CBFV changes during hyperventilation; 2) the synchronicity between clinical symptoms and TCD-EEG findings;3) the correlation between TCD-EEG findings and prognosis after operation. We expect to enroll 60 patients for each group in one year (2013-2014).
Results: Three patients with epilepsy and six patients with Moyamoya disease have been enrolled for a pilot study. CBFV ipsilateral to epileptic discharges increased by 40% in two patients with epilepsy which lagged behind EEG discharges for seconds. The CBFV curve was not available for analysis in one patient due to artifacts during seizure attacks. TCD-EEG showed heterogeneous changes in patients Moayamoya disease during hyperventilation.
Conclusion: Although the technique of TCD-EEG monitoring requires modifications, it has showed promising value in patients with paroxysmal neurological diseases.

Key words: *monitoring, paroxysmal neurological diseases, TCD-EEG.*

L20

SPACE-TIME NEUROSONOLOGY IN CLINICAL USAGE – WHY AND WHEN?

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Objective: Space-time ultrasound application in adult Neurology is limited and not well investigated. The presentation aims to demonstrate its diagnostic abilities in clinical settings.
Material and Methods: Patients with carotid pathology, neuro-ophthalmic syndromes, neuropathy, myopathy, cervical tumors, calf muscle trauma and chronic spastic paralysis were studied by multimodal 2D/3D/4D sonography. The results were compared to the findings from other diagnostic methods.
Results: Normal structures (carotid vessels, eye and muscles) have typical 2D/3D/4D images. In presence of plaques, aneurysms or stents the 4D imaging gave additional information for their dimension, surface and structure. In contrast to the normal optic disc image (with a smooth and sharp contour without swelling), papilledema was presented as a hyperechoic prominence into the vitreous, retinal detachment – as a hyperechoic undulating membrane, retinal neovascular degeneration – as a hyperechoic membrane behind the retina. A typical calf muscle architectonics was found in relation to the location, type and severity of triceps surae lesions, muscle fibers contractility, degree of muscle atrophy, fat tissue infiltration and fibrosis.
Discussion: Space-time (3D/4D) ultrasound imaging is additional to the routine 2D neurosonology. It improves diagnostic abilities of ultrasound methods by giving more detailed information for dimension, structural changes and functional characteristics of the target areas. Why and when to use it depends on the level of competency of each neurosonology unit.

Key words: *neurology, space-time (3D/4D) ultrasound.*

L21

MYOSONOLOGY: CLINICAL AND SCIENTIFIC POTENTIALS

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Objective: By means of ultrasound (US) methods structural and functional properties of the muscle tissue could be detected in patients in real time and non-invasively. Using tissue velocity imaging (TVI) we are able to investigate the dynamics of movements in identified muscles. We tested whether this method could be applicated to measure the forearm muscle motions in order to monitor rehabilitation therapies and pharmacological effects.
Material and Methods: The voluntary movement of hand opening (M.ext. digitorum) and closing (M.flexor digitorum) was analyzed in healthy subjects (n=30) and stroke patients (n= 31) using the B-mode and tissue velocity imaging (TVI). TVI is based on the Doppler effect to record slow movements of the tissue and was adapted on a 6-8 MHz probe. We recorded synergistic contractions or dephasing (non-synchronous muscle activity) and quantified velocity of contraction and relaxation as well as there repetition frequency.
Results: Normal subjects displayed a synchroneous activation of the muscles with a contraction velocity of 4.1 cm/s, relaxation velocity of 4.3 cm/s and a repetition frequency of 4.5 cm/s, respectively (mean values). In stroke patients, a significant reduction of these parameters are found on the lesion side (1.1 cm/s; 1.2 cm/s; 1.2/s). A significant decrease was also found on the contralateral healthy side (2.5 cm/s; 2.6 cm/s; 2.5/s) which is also significant different to healthy controls. After 2 weeks rehabilitation exercises these parameters improved in a wide range (up to normal) on both sides. L-Dopa (n=3 patients) improved substantially the parameters within 1 week.
Conclusion: This US technique is a simple and bedside method which allows to analyze and quantify the movement kinetic of identified muscles. This allow to monitor disease progression and treatment effects and may be thereby an appropriate tool for clinical application e.g. in stroke rehabilitation.

Key words: *myosonology, tissue velocity imaging, ultrasound.*

L22

ULTRASOUND-GUIDANCE OF BOTULINUM TOXIN INJECTIONS IN DYSTONIA AND SPASTICITY

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Botulinum neurotoxin (BoNT) injection has been increasingly used for treating muscular spasticity and dystonia. Unlike other techniques of precision targeting such as electromyography or computed tomography that have been described to minimize undesirable BoNT effects, B-mode ultrasound allows immediate and high-resolution imaging of the injection needle position within the target region. Visual identification of muscles and depth control of needle placement are the key features of ultrasound-guided injection that lead to improved targeting and safety of BoNT injections. Ultrasound may be helpful to validate already established injection techniques or when learning the correct injection technique. Ultrasound-guided BoNT injection has been recommended as a standard procedure in treatment of lower leg spasticity in children with cerebral palsy. In recent years, this technique has been increasingly used also for the exact targeting of BoNT injection in single forearm muscles (e.g. the flexor digitorum superficialis or the flexor digitorum profundus muscle of single fingers) of patients with writers cramp or with mild post-stroke spasticity. An emerging application is the ultrasound-guided BoNT injection into deep cervical and nuchal muscles in patients with cervical dystonia, such as the scalene muscles, the longissimus cervicis muscle, and the obliquus capitis inferior muscle. The upcoming MRI-ultrasound fusion imaging techniques that are available already today with advanced ultrasound systems allow the ultrasound-guided targeting also of small deep muscles such as the longus colli muscle in patients with antecollis, and the piriformis muscle in patients suffering from the piriformis syndrome.

Key words: *botulinum neurotoxin, deep cervical muscles, dystonia, ultrasound guided injection.*

L23

ULTRASONOGRAPHIC EVALUATION OF CERVICAL NERVE ROOTS IN ALS

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Objective: Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease mainly affecting the upper and lower motor neurons. Because reinnervation may preserve muscle strength and a motor action potential in its early stage, a sensitive measure to reflect the axon loss is needed for early diagnosis and follow-up. The aim of the study was to assess the degeneration of the nerve roots in ALS by ultrasonography.
Material and Methods: Twenty-four patients (16 men, 60±11 years) who met the diagnostic criteria of ALS (Awaji criteria) and 20 normal control individuals (10 men, 50±8 years) received sonographic evaluation of the C6 root (more symptomatic side for ALS, left side for control). A cross-sectional area was evaluated and compared.
Results: The data from the control individuals showed that the age or gender had no significant effects on the root area. There was significant reduction of the cross-sectional areas in the ALS patients than the control individuals (5.5±1.6 mm^2 vs. 7.6±1.5 mm^2; $P<0.01$). There was negative correlation between the disease duration of ALS and the cross-sectional area of the root (i.e., the longer the disease duration, the thinner the area).
Discussion: The present data revealed the sonographic evidence of atrophy of the cervical nerve root in ALS that likely represents axonal degeneration. Although the present data were similar to the previous presentation assessing the peripheral nerve (Cartwright, et al) in ALS, the evaluation of the nerve root can further utilize the ultrasonographic assessment to the motor nerves innervating the proximal musculature. The sonographic evaluation of the nerve root can become a useful measure for progression of ALS.

Key words: *ALS, nerve degeneration, nerve root.*

L24

TRANSCRANIAL DOPPLER FOR BRAIN DEATH IN INFANTS. THE ROLE OF THE FONTANELLES

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Objective: Transcranial Doppler is sensitive technique for the diagnosis of cerebral circulatory arrest in brain death, when specific patterns such as reverberant flow and short systolic spikes are observed in intracranial arteries. These patterns are related to the occurrence of brain swelling in the inextensible skull, resulting in transformation from a normal "low-resistance" into a "high-resistance" brain parenchyma. In infants, the non-ossified fontanelles initially compensates for intracranial hypertension. We describe TCD patterns in infants with brain death, different from adults, with the hemodynamic modifications induced by anterior fontanelle compression.
Methods: Transcranial Doppler was performed in infants with brain death admitted to the neonatal intensive care unit.
Results: Transcranial Doppler showed a large peak, atypical "reverberant" flow, with a high peak systolic velocity and a consistent retrograde component, away from the brain. The observation of this pattern may be misleading for the final diagnosis. Compression on the anterior fontanelle induced, at first, a reduction of the systolic flow with the subsequent appearance of the adult characteristic short systolic spikes. Upon compression removal, a brief increase of the systolic flow was observed, before the prompt reappearance of the reverberant flow.
Conclusion: Transcranial Doppler for brain death diagnosis should be done cautiously in infants with the non-ossified skull because non-typical patterns could be observed. Reverberant flow in intracranial arteries, even if with a large and long duration peak and with a high peak systolic velocity, may be indicative of cerebral circulatory arrest in these cases. Large fontantelle compression for few seconds may reproduce the classical TCD patterns of brain death observed in adults, supporting the diagnosis of cerebral circulatory arrest in infants with brain death.

Key words: *brain death, infants, transcranial Doppler.*

L25

PARENCHYMAL FINDINGS IN NEURODEGENERATIVE DISEASE

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Transcranial B-mode sonography (TCS) is a non-invasive, low-cost, short-duration neuroimaging method that allows high-resolution imaging of deep brain structures in patients with inflammatory and degenerative brain diseases. Hyperechogenicity of the substantia nigra (SN), a TCS findings present in about 90% of patients with idiopathic Parkinson's disease (PD), is already present in presymptomatic disease stages. SN hyperechogenicity has been demonstrated to correlate with iron accumulation in a number of brain disorders but also with microglia activation. The results of recent longitudinal studies suggest that TCS of SN may serve as a screening tool for detecting subjects at risk of later developing PD. In a large study we could show in addition that the combination of TCS with simple olfaction and motor tests already at very early disease stages discriminates PD from other parkinsonian disorders. In turn, normal SN echogenicity in combination with lenticular nucleus hyperechogenicity indicates an atypical Parkinsonian syndrome rather than PD with a specificity of more than 95%. TCS detects characteristic

basal ganglia changes also in other movement disorders such as lenticular nucleus hyperechogenicity in idiopathic dystonia and Wilson's disease and caudate nucleus hyperechogenicity in Huntington's disease. Reduced echogenicity of midbrain raphe is frequent in depressive disorders and was found to correlate with responsivity to serotonin reuptake inhibitors. An elegant application of TCS is the intra- and postoperative localization of deep brain stimulation electrodes in patients with movement disorders. The detection of changes of deep brain structures on TCS in multiple sclerosis patients was found to have a predictive value for further disease progression.

Key words: *deep brain stimulation, movement disorders, substania nigra, transcranial sonography.*

L26

CLINICAL IMPLICATIONS OF VENOUS NEUROSONOGRAPHY

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The cerebral venous outflow has been neglected for many years in neurology. Considering Neurosonology a first interest started with primarily venous disorders, e.g. cerebral venous and sinus thrombosis. In the last few years venous ultrasound analysis was performed in a variety of other neurological disorders like dural fistulas, transient global amnesia and even in acute arterial stroke. In multiple sclerosis a chronic impaired cerebral venous outflow has claimed to be the starting point of a cascade leading to the disease. This concept has not been reproduced by groups with a longstanding experience in venous duplex sonography. However, the debates increased the scientific interest on the venous side of the cerebral circulation and its outflow.

Aim of the lecture is 1) to present the main principles of the cerebral venous outflow (postural dependency, intraspinal venous system route, intracranial valveless, extracranial internal jugular valve, right-sided predominance of outflow), 2) to give an overview about the ultrasound examination of the extracranial and intracranial venous vessels using color-coded duplex sonography, and, 3) to show clinical implications.

Key words: *brain venous system, clinical implications, neurosonography.*

Oral Presentations

O1

NOVEL PROBE ATTACHED TO THE CERVIX FOR DETECTION OF MICROEMBOLIC SIGNAL AT CAROTID ARTERY

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Objective: Transcranial Doppler (TCD) is useful for detection of micro embolic signal (MES), however, it is insufficient for Japanese patients without temporal bone window. So we developed a novel probe attached to the cervix for detection of MES at carotid artery which can be evaluated in almost all of the patients. Our purpose of this study is to evaluate clinical availability of this probe.
Methods: Novel probe was 2MHz which had equal property with TCD, and the shape of probe was thin and square modified for attachment to the neck. 1) We measured MES using novel probe in the original circulation circuit model with artificial emboli. 2) We measured sonogram of carotid artery using novel probe attached to the cervix in healthy volunteers for 30 minutes, and then evaluated fixation ability and comfortability.
Results: 1) MES of artificial emboli were measured by novel probe stably for two hours. The count number of MES was somewhat small in comparison with other TCD device. 2) In all three volunteers, we could measured stable sonogram of carotid artery for 30 minutes. There was no skin trouble and discomfort of the cervix during monitoring. Fixation time of novel probe attached to the cervix was within a few minutes, which was fast and easy.
Discussion: Novel probe attached to the cervix was easy to apply and had a stable fixation ability. It will be necessary to improve algorithm for detection accuracy of MES, and to evaluate the influence of motion or voice artifact.

Key words: *carotid artery, micro embolic signal, new probe.*

O2

FINDINGS OF TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY (TEE) IN ISCHEMIC STROKE PATIENTS WITH HITS BY TCD

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Objective: When we perform TEE in the patients with cerebral infarction, there are tandem lesions, such as both strand and aortic lesion. We attempted to clarify which findings relate HITS by TCD and determine the risk of embolic source.
Subjects and Methods: Subjected were 60 patients with symptomatic or asymptomatic cerebral infarction. All patients had performed TEE and detected HITS by TCD.
Results: HITS were detected in 25 patients. The number of HITS was 4.5±5.6 / 30 min (1-19). The number of HITS in patients with left atrial appendage (LAA) thrombus by TEE was 8.8±7.9 / 30 min. That in those with strands was 3.4 ± 2.8 / 30min. That in those with aortic ulcerative lesion was 2.9 ± 1.7 / 30 min. That in those with papillary fibro-elastoma (PFE) was 1.3 ± 2.8 / 30 min. The number of HITS in all the patients decreased or vanished by adding or increasing dose of anticoagulants.
Discussion: LAA thrombus can be most dangerous source of embolism. Strands and PFE are thought to be the same origin. PFE is like a benign tumor collected many strands. Since PFE has more possibility of source of embolism than strands, HITS in patients with strands may indicate coagulability of blood. Embolic risk of patients with strands or aortic ulcerative lesion with HITS may decrease by anticoagulant. The present results showed that detection of HITS is important to evaluate the risk and to select the treatment of intra-cardiac or aortic lesion determined by TEE.

Key words: *HITS, LAA thrombus, strands, TEE.*

O3

COMPARATIVE STUDY OF NEUROSONOLOGICAL DATA BETWEEN REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME (RCVS) AND OTHER FORMS OF HEADACHE

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Objective: RCVS is a cerebrovascular disorder associated with multifocal arterial constriction. The primary clinical manifestation is recurrent sudden-onset and severe headache. Diagnosis requires cerebral angiography confirmation and ultrasound monitoring. Our aim is to determine the difference of ultrasound data and clinical manifestation between RCVS and different forms of headache.
Material and Methods: 84 patients (age range 20-60 y., 55-female, 29-male) underwent sonography examination using TCD and TCCD methods. Group I-18 patients had RCVS typical acute-onset severe headaches, namely thunderclap headaches reaching peak intensity within 1 min. Group II-19 patients-migraine in anamnesis, with 1-2 attacks monthly (ultrasound examinations were performed in attack free period), Group III- 37 patients with severe headache for 1-3 hours, the period

1-3 months. This group was divided into subgroups: III-a) 17 patients -after attack felt confusion, anxiety and problems with concentration. III-b)-20 patients- during attack felt dizziness, nausea, vomiting, blurred vision, after attack-depression and cognitive dysfunctions. Group IV-10 controls.
Results: Group I - the mean maximum (MM) V(MCA) (120,5±22.8 cm/s), V(CS) (77,3±14,7 cm/s). Lindegaard Index (LI) (2.3±0.8). Group II- the MM V(MCA) (118,4±26,7 cm/s), V(CS) (74,35±15,6cm/s). Group III-a-the MM V(MCA) (117,8±27,6cm/s), V(ACA) (106±24,6 cm/s), V(BAS) (60,9±12,5 cm/s). Group III-b-the MM V(MCA) (109,8±28,6 cm/s), V(ACA) (98,3±21,5 cm/s), V(BAS) (76,8±11,7 cm/s). The averaged LI (2.6±0.7) is increased. All groups exceeded of controls – V(MCA) (63.2±9.5 cm/s), LI (1.5± 0.2), p<0.001) and revealed vasospasm.
Discussion: Obtained data showed no significant difference between typical RCVS and other headache groups with different etiologies and clinical manifestations. Despite the extensive knowledge concerning RCVS and headache types described above, many uncertainties still exist, resulting from our incomplete understanding of the underlying pathophysiology. Recognition of the syndrome is important due to the serious complications and relevant treatment, but neurosonological patterns persuasive similarity with other types of headaches, makes this challenge more difficult.

Key words: *arterial constriction, headache, RCVS, vasospasm.*

O4

INTRAOPERATIVE ULTRASOUND TO CONTROL RESECTION OF BRAIN METASTASES

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Objective: Radical resection of brain metastases can be associated with better outcome. The gold standard intraoperatory method to detect residual tumors is magnetic resonance (RM). However this method requires long image acquisitions time, intravenous contrast (gadolinium) to disclose residual lesions and is restrict to some neurosurgical centers. Among the image methods, intra operatory ultrasound (IOUS) has been a reliable tool for assessing residual lesions after macroscopic tumor excision.
Material and Methods: Thirty six patients with presumed diagnosis of brain metastases (BM) were underwent a surgery with IOUS to pint point tumors, delineate their margins and intra operatory control resection. A total 46 lesions were removed by microscopic surgeries. IOUS was performed in all operations. A prospective study compared the last 2D IOUS control after tumor resection with pos operatory magnetic resonance (MRI) and enhanced contrast tomography (CT) in terms of quality in residual lesion detection. Control MRI and enhanced CT were performed in 75% of patients. Control CT and MRI were considered when it was performed until five months after surgery.
Results: IOUS was generally concordant with control MRI and CT in 89,6% and 80% of cases respectively. When IOUS was positive or negative for the presence of tumor, the concordance with MRI was 80% and 89,5% respectively. When IOUS was negative for tumor the control CT concordance was 94%. Positive IOUS for tumor had control CT concordance in just 28,6% of cases.
Discussion: IOUS is a practical supporting method for the control of intraoperative resection BM, but further studies comparing this method with other intraoperative exams are needed to evaluate its validity.

Key words: *brain metastasis resection, control magnetic resonance, control tomography, ultrasound.*

O5

RELATIONSHIP BETWEEN BLOOD PRESSURE CONTROL AND ARTERIAL STIFFNESS, CAROTID ARTERY AND RETINA DAMAGES IN HYPERTENSIVE PATIENTS WITH AND WITHOUT TYPE 2 DIABETES

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Objective: Diabetes mellitus (DM) leads to accelerated progression of arteriosclerosis in comparison to non-diabetic patients (non-DM). Retinopathy is a major microvascular complication of DM remaining a leading cause of blindness. Aortic stiffness and an increase in carotid artery intima-media thickness (IMT) are macrovascular complications that are associated with increased cardiovascular morbidity-mortality. It has been suggested that in DM blood pressure levels are more determinant than glycemic control of macrovascular lesions whereas retinopathy is more dependent on glycemic control.
Material and Methods: We compared the macrovascular damages – aortic stiffness by pulse wave velocity (PWV) and carotid plaques and IMT by duplex ultrasound – and hypertensive retinopathy lesions (early and late stages) by fundus photograph between type 2 DM and non-DM hypertensive subjects with similar age and 24h-ambulatory BP values.
Results: Hypertensive patients with DM (n=26, 10 female) and non-DM (n=33, 17 female) did not differ for age (62±8 vs 58±13 y), BMI (29.6±4.0 vs 29.1±5.3 kg/m^2), 24h BP (144/84±15/11 vs 137/82±16/10 mm Hg) and for PWV (11.7±2.0 vs 11.1±1.7 m/s) and IMT max (0.92±0.16 vs 0.86±0.19 mm) IMT average (0.77±0.13 vs 0.72±0.17 mm) and presence of carotid plaques (73% vs 53%) (all p>0.19). In contrast DM showed a higher percentage of indices of late stage hypertensive retinopathy than non-DM subjects (65.4% vs 33.4%, p<0.03). Significant correlations were found between PWV and 24h-SBP (0.330, p< 0.02) and between IMT and 24h pulse pressure (r=0.330, p<0.02) but no association was found between 24h BP values and retinopathy lesions.
Discussion: In DM macrovascular damage is particularly dependent on blood pressure levels, whereas the severity of hypertensive retinopathy is clearly related with DM condition.

Key words: *arterial hypertension, carotid intima-media thickness, diabetes mellitus, retina.*

O6

HEMISPHERIC LATERALIZATION OF LANGUAGE IN CHILDREN WITH DEEP SENSORINEURAL HEARING LOSS AND COCHLEAR IMPLANT: A FUNCTIONAL TRANSCRANIAL DOPPLER STUDY

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Objective: To study hemispheric lateralization of language in a group of children with deep hearing loss and cochlear implant (CI) and in a control group (CG) by functional transcranial Doppler (fTCD).

Material and Methods: CI (N=14; 9 female, mean age 6 years, range 4-13) were divided by age of implant in 'early' (ECI, 6 subjects, implant <30 months) and 'late' (LCI, 8 subjects, implant > 30 months). CG included normal-hearing subjects matched for sex, age and hand preference. Traces obtained from fTCD (whose task consisted in description of a cartoon, with 30 trials, each lasting 38 sec) were processed by Average software that provided a lateralization index (LI) which, if positive, indicated a left hemisphere language lateralization.

Results: The hemispheric dominance in CI was atypical versus CG, with increased frequency of right hemispheric lateralization (50%). In 71% of cases CI had been implanted to the contralateral ear. 15% of subjects in CG was lateralized to the right, 7% bilateral and 78% to the left. CI presented a distribution of LI which differed in two subgroups: ECI included a single bilateral case (17%), two (33%) with left and three (50%) with right lateralization, while LCI presented in 50% of cases a lateralization to the right and in 50% to the left.

Discussion: fTCD is a useful tool to get a LI of linguistic function in patients with both typical and atypical development. Its versatility allows for easy use in children and put it as an elective method in children with CI. Physiopathological findings deriving from fTCD, integrated with clinical and linguistic data, may have relevant consequences on management of patients with hearing loss candidates to CI.

Key words: *cochlear implant, functional TCD.*

O7

COUNTERPRODUCTIVE RESULTS WITH THE USE OF AN EMBOLI PROTECTION DEVICE IN THE PREVENTION OF MICROEMBOLISMS DETECTED BY TRANSCRANIAL DOPPLER IN CAROTID STENT PLACEMENT

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Objective: This study was conducted to determine if the use of an emboli protection device prevented distal embolisation in carotid stenting procedures.

Material and Methods: We retrospectively analyzed data of 837 carotid stent procedures between December 1997 and January 2012. Cerebral embolisation was monitored using transcranial Doppler of the ipsilateral middle cerebral artery. Isolated microembolic signals and microembolic showers (cardiac cycles with too many embolisms to count separately) were counted.

Results: 76% of the patients were male. 493 patients were asymptomatic. In >90% of the patients the carotid stenosis was >70%.

A protection device was used in 426 procedures (51%). In the unprotected group a median of 106 isolated embolisms (interquartile range: 69-143) and 16 microembolic showers (4-28) were determined and in the protected group 188 (110-266) and 58 (10-106), respectively (p<0.001).

Separate analysis of the stent deployment and post-dilation phases also showed more embolisation when a filter was used (p<0.001).

To correct for the stent-design, the number of isolated embolisms and showers was compared for each stent-type separately. Four different designs were used: Easy Wall (n=126), Carotid Wall (n=296), Acculink (n=271), and Precise (n=144). For all stent-types a significantly higher number of embolisms and showers were found in the group with the use of a filter, for the total procedure as well as for the phases in which filter placement or removal was not involved.

Discussion: In carotid stent procedures a higher number of microembolic signals were detected with transcranial Doppler of the middle cerebral artery when emboli protection devices were used. This was independent of the stent-type used.

Placement and removal of the filters induces embolisms and showers, which might explain our findings. However, even when the embolisms and showers during filter placement and removal were not included, the difference in embolisation remained significant (p<0.001) for the entire population and for the different stent-designs separately.

Key words: *carotid artery stenosis, microembolisms, stent, transcranial Doppler.*

Poster Sessions

Poster Session I–1. Extracranial Arterial Disease

P1

3D BLOOD FLOW AND COMMON CAROTID ARTERY HEMODYNAMICS IN THE CAROTID ARTERY BIFURCATION WITH STENOSIS

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Objective: The aim of the study is to perform 3D numerical analysis of blood flow in the carotid artery bifurcation with and without stenoses.
Material and Methods: The analysis is based on the numerical simulation of Navier-Stokes equations. Four cases of carotid bifurcation are considered: common carotid artery (CCA) bifurcation without stenoses, with one, two and three stenoses are presented too. The analysis is performed considering one pulse wave period and it is based on the finite volume discretization of the Navier-Stokes equations.
Results: The structures of the flow around the bifurcation from CCA to the internal (ICA) and external carotid artery (ECA) are obtained considering characteristic time points for one pulse wave period. The axial velocity distribution and wall shear stress (WSS) distribution and contours are presented. The results manifest unsteady blood flow in the carotid bifurcation and dependence of the flow disturbances on the time and type of the stenoses. The recirculation zone behind the stenosis is the area of low WSS. Comparison of the peak WSS for the four different cases shows that it reaches the maximum value of about 6.7Pa at the characteristic point of T=0,2s for the cases with two and three stenoses.
Discussion: The obtained distribution of the WSS around the bifurcation allows a prediction of the probable sites of stenosis growth. The use of imaging investigation with mapping of WSS distribution in the carotid arteries in parallel with numerical analysis could help to demonstrate the risks of embolism or plaque rupture posed by particular plaque deposits.

Key words: *blood flow 3D numerical analysis, carotid bifurcation, stenosis, wall shear stress.*

P2

CAROTID PATHOLOGY IN CEREBRAL INFARCTIONS: EFFECTS OF BLOOD PRESSURE AND BLOOD VISCOSITY

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Objective: To assess the complex influence of blood viscosity and blood pressure on the neurosonographic parameters in the common carotid artery (CCA) in patients with chronic unilateral cerebral infarctions (CUCI).
Material and Methods: Thirty two patients with CUCI, 58 patients with risk factors (RF) for cerebrovascular disease (CVD) and 25 controls were included in the study. The blood flow velocities (BFV), the internal diameters (D) and the vessel wall intima-media thickness (IMT) in the CCA were recorded by color duplex sonography. Systolic (SBP) and diastolic (DBP) blood pressure were measured and mean blood pressure (MBP) was calculated by the formula of Wiggers. Additional division of the patients in subgroups with MBP < 100 and ≥ 100 was performed. The blood flow velocities (BFV), the internal diameters (D) and the vessel wall intima-media thickness (IMT) in the CCA were recorded. Whole blood viscosity (WBV) at the shear rate of 94,5 s^{-1} was measured on the day of the Doppler ultrasound examination and the wall shear stress (WSS), the circumferential wall tension (T) and the tensile stress (τ) were calculated.
Results: The main RF in the patients` groups were hypertension and hyperlipidemia. Heterogenous atherosclerotic plaques, greater IMT and larger diameters of the CCA were measured. The SBP and WBV were significantly higher in the patients with CUCI and RF for CVD in comparison to controls. Lower systolic WSS, τ and higher T were established in the patients with CUCI. Significant correlations of WBV with the carotid diameters predominating in the subgroups with MBP ≥ 100 were revealed. The IMT correlated with WSS and τ.
Discussion: The study confirms the complex influence of the changes in WBV and blood pressure for the development of carotid atherosclerosis.

Key words: *blood pressure, blood viscosity, cerebral infarctions, color duplex sonography, common carotid artery.*

P3

MEASUREMENT OF CAROTID PLAQUE VOLUME WITH VOCALTMII TECHNIQUE BY 3-DIMENSIONAL ULTRASOUND

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Objective: Measurement of carotid plaque volume and its progression are important tools for research and patient management. In this study, we investigate the observer reproducibility in the measurement of plaque volume as determined with VOCALTMII technique by 3-dimensional (3D) ultrasound (US). We also investigate the effect of plaque size and position on measurement reproducibility.
Material and Methods: Sixty five 3D US patient images of plaques (range, 53.5 to1008.5 mm^3) were measured by VOCALTMII technique. The intraclass correlation coefficient (ICC) was applied to determine observer variabilities.
Results: Intra-observer variability was small as reflected by ICCs of 0.985 and 0.957 for 2 observers. The ICC value generated between the 2 readers was 0.931, indicating that inter-observer variability was small, too. Subgroup analyses showed that inter-observer variability was lower for CCA plaques than ICA plaques (ICC 0.998 VS 0.882).
Discussion: Intra- and inter-observer variabilities were small for measurement of Carotid Plaque Volume with VOCALTMII technique by 3-Dimensional Ultrasound.

Key words: *carotid plaque volume, 3-dimensional ultrasound.*

P4

JUXTALUMINAL ECHOGENICITY AS A MARKER OF CAROTID PLAQUE INSTABILITY

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Objective: Previous studies concluded that symptomatic carotid plaques are echolucent on ultrasound, whereas asymptomatic ones are echogenic. The aim of this study was to determine whether juxtaluminal plaque echogenicity (juxtaluminal 25% plaque area) constitutes a better discriminator of the symptomatic and asymptomatic status, as compared to global plaque echogenicity, in various degrees of stenosis.
Material and Methods: Analysis involved imaging by duplex of 100 carotid plaques of more than 50% stenosis (86 patients, 50 symptomatic and 50 asymptomatic plaques), capturing, digitisation and normalisation in a computer in a standard way. The global plaque Grey Scale Median (GSMglobal) was evaluated to distinguish dark (low GSM) from bright (high GSM) plaques. Subsequently, juxtaluminal 25% plaque area GSM (GSMjl25%) was evaluated semi-quantitatively in the same computer software. Stenosis was evaluated on duplex.
Results: In the group of plaques with 50-70% stenosis (n=40), the symptomatic ones were associated with median GSMglobal of 10 whereas the asymptomatic of 34 (p=0.0001). The corresponding values for median GSMjl25% were: 0 for symptomatic plaques and 47 for asymptomatic ones (p=0.0001). ROC curves failed to demonstrate an ability of GSMjl25% over GSMglobal in separating symptomatic from asymptomatic plaques (difference between areas: 0.068, p=0.172). In the group of plaques with 71-99% stenosis (n=60) the corresponding values were: median GSMglobal (symptomatic: 4, asymptomatic: 29), median GSMjl25% (symptomatic: 0, asymptomatic: 44). ROC curves demonstrated a more adequate ability of GSMjl25% over GSMglobal in separating symptomatic from asymptomatic plaques (difference between areas: 0.141, p=0.002).
Discussion: Our results suggested that juxtaluminal 25% plaque echogenicity might have a more adequate ability over global plaque echogenicity in separating symptomatic and asymptomatic carotid plaques, only in the presence of significant stenosis. This position might be solidified in natural history studies of asymptomatic individuals with carotid plaques, having as an end point the development of stroke.

Key words: *carotid, plaque, stroke, ultrasound.*

P5

AFTERCARE MANAGEMENT BASED ON CAROTID DUPLEX SONOGRAPHY FOR PATIENTS WITH STENTED VESSELS REACHING THE END OF THE SCHEDULED THREE-DIMENSIONAL ENHANCED COMPUTED TOMOGRAPHY ANGIOGRAPHY FOLLOW-UP PERIODS

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Objective: In-stent restenosis (ISR) is a major problem that can occur during long-term follow-up after carotid artery stenting (CAS). Patients who undergo CAS are usually followed using three-dimensional enhanced computed tomography angiography (3D-CTA) for two years after the procedure, and with carotid duplex sonography (CDU) thereafter. However, it is not clear which factors serve as predictors of late-onset ISR or how to use data from CDU to make subsequent management decisions. Therefore, we compared the differences between patients without ISR (no-ISR group) and patients with high-grade ISR (defined as more than 40% stenosis according to the NASCET method).
Material and Methods: Among 70 carotid arteries that had undergone CAS at our institution, patients who were evaluated with a final 3D-CTA at two years of CAS and who subsequently underwent CDU were analyzed in this study. A total of 22 vessels met the study's inclusion criteria at the date of IRB approval (Study#1171).
Results: No significant difference was observed due to small number, when comparing the no-ISR group and the high-grade ISR group. However, more patients in the ISR group had a history of cancer than did those in the no-ISR group. The in-

stent max intima-media thickness (IMT) of 3D-CTA correlated with that of CDU. The result was suggested that there was no ISR in the IMT of CDU less than 1.0mm.
Discussion: We found the cancer-history as the risk factor of late-onset ISR. The in-stent max IMT of CDU was a predictor of late-onset ISR. We advocated aftercare management by CDU for the stented patient.

Key words: *carotid artery stent, carotid duplex ultrasound, in-stent restenosis.*

P6

DIAGNOSTIC ROLE OF COLOR-CODED DUPLEX SONOGRAPHY IN FOLLOWING-UP AFTER CAROTID ENDARTERECTOMY IN MEN

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Objective: To examine native carotid artery without stenosis and carotid artery after endarterectomy (CEA) without restenosis by Color-coded Duplex Ultrasound (CDU) in men, to compare the ultrasound findings and derive ultrasound criteria for postoperative follow-up.
Materials and Methods: We have followed-up two groups of patients: first group - 40 men, mean aged 66,8 years who had CEA mean 2,1 years. Second – group of controls – 40 men, mean aged 68,3 years without cerebrovascular desease. We have evaluated the diameter of the arteries (mm) (common carotid artery (CCA), bifurcation of the CCA (CCAbif), distal internal carotid artery (ICAdist); beginning, center and end of the patch), the peak systolic (PSV) and the end diastolic (EDV) velocities (cm/s) at the same points by using CDU.
Results: We found the following mean diameters: CCA - 7,1 mm, CCA after CEA - 7,7 mm; CCAbif - 8,1 mm, center of the patch – 11,5 mm; ICAdist – 5,1 mm, ICAdist after CEA – 6 mm ($p>0.05$). PSVmean (CCA)=64,61 cm/s; PSVmean (CCA after CEA)=61,7 cm/s; EDVmean (native CCA)=18,38 cm/s; EDVmean (CCA after CEA)=13,55 cm/s); PSVmean (CCAbif)=61,39 cm/s; PSVmean (center of the patch)=57,41 cm/s; EDVmean (CCAbif)=18,61 cm/s; EDVmean (center of the patch)=12,04 cm/s; PSVmean (ICAdist)=84,96 cm/s; PSVmean (ICAdist after CEA)=88,97 cm/s; EDVmean (ICA dist)=27,68 cm/s; EDVmean (ICAdist after CEA)=29,87 cm/s, ($p>0.05$).
Discussion: Color-coded Duplex ultrasound is a very accurate, noninvasive method that can be repeated at any time for grading carotid stenosis. This research have shown that there is no statistically significant difference in ultrasound findings between native carotid artery without stenosis and carotid artery after CEA without restenosis. Ultrasound criteria for evaluation of native carotid artery can be applied in following-up after CEA.

Key words: *carotid endarterectomy, color-coded duplex ultrasound.*

P7

DUPLEX ULTRASONOGRAPHIC FINDINGS IN CONGENITAL ABSENCE OF THE INTERNAL CAROTID ARTERY

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Background: The absence of the internal carotid artery (ICA) is a rare congenital anomaly, occurring in<0.01% of the population. Although many of these cases remain asymptomatic and go undetected, their recognition is of more than trivial interest.
Case Report: Case 1: A 47-year-old woman with a history of hypertension visited the hospital with a 3-day history of headache. The results of physical and neurological examinations were unremarkable. Color-coded duplex ultrasonography performed to evaluate the carotid and vertebral arteries revealed a normal configuration on the right side. No significant stenotic flow or plaque formation was observed in the right CCA, ECA, or ICA. However, ultrasonography revealed a left CCA of diminished caliber that terminated in the ECA, with no remnant of a cervical ICA. The MR angiographic findings were consistent with the ultrasonographic findings. The left CCA terminated into the ECA with no identifiable remnant of the ICA.
Case 2: A 61-year-old woman with a history of hypertension visited the hospital with a 3-month history of vertigo. The results of physical and neurological examinations were unremarkable. The MR angiography showed a normal configuration on the right CCA, ECA, or ICA. However, the left CCA terminated into the ECA with no identifiable remnant of the ICA. The patient's symptoms resolved spontaneously
Discussion: The ultrasonographic findings revealed absence of the ICA, with a CCA of diminished caliber that terminated in the ECA. Color-coded duplex ultrasonography appears to be an effective and sensitive method for detecting absence of the ICA.

Key words: *absence of the internal carotid artery.*

P8

EVALUATION OF INTERNAL CAROTID ARTERIAL DISSECTION BY TRANSORAL CAROTID ULTRASONOGRAPHY

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Objective: We attempted ultrasonographic evaluation of the distal extracranial internal carotid artery (ICA) in patients with extracranial ICA dissection by using the transoral carotid ultrasonography (TOCU).

Material and Methods: The subjects consisted of 5 healthy volunteers (33 ± 5 years old) and 5 extracranial ICA dissection patients (45 ± 4 years old). Examinations were performed using a color Doppler flow imaging system equipped with thin and long convex array transducers (9-5 MHz). We inserted a probe covered with thin gum transorally, touching the tip to the pharyngeal postero-lateral wall. We then attempted to detect the ICA and measure ICA diameter and flow velocity of the distal extracranial ICA by TOCU.
Results: TOCU was successfully performed in all subjects without any difficulty. In the healthy volunteers, the ICA was identified at a depth of 2.2±0.6 cm and visualized as a vertical linear vessel 2.9±0.3 cm in length and bent slightly backwards (Yasaka M, et al.: Stroke 1998; 29;1383-8). The diameter and mean flow velocity of the distal extracranial ICA was 4.7±0.2 mm and 50±7 cm/s, respectively. In the ICA dissection patients, some remarkable findings were obtained, including dilatation of ICA (7.8±2.2, ranging from 6.8 to 10.0 mm, $p<0.01$), visualization of true and false lumens and improvement of the affected ICA by following TOCU performed 2-4 weeks later.
Discussion: TOCU seems useful in evaluation of extracranial ICA dissection.

Key words: *dissection, internal carotid artery, transoral ultrasonography.*

P 9

DIAGNOSTIC VALUE OF COLOR-CODED DUPLEX SONOGRAPHY IN CLINICAL CASES WITH RESTENOSIS OF ARTERIAL RECONSTRUCTIONS AT SUPRA-AORTIC ARTERIES AND TAKAYASHU ARTERIITIS

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Objective: Takayashu arteriitis (TA) is a necrotizing and obliterative segmental, large-vessel panarteriitis of unknown cause, involving elastic arteries including tha aortic arch and its branches.The disease has a strong female predilection with peak incidence in the third decade of life. Two specific forms are reported in the literature – Japanease,involving the thoracic aorta and its branches and Indian, affecting the abdominal aorta and renal arteries.
Case Reports: We present two clinical cases-patients are over 50 years of age after vascular reconstruction of supra-aortic arteries with risk factors for atherosclerosis - arterial hypertension, dyslipidemia, stress, family history. Due to recurrence of symptoms after a clinical exam and Color-coded Duplex Ultrasound (CDU) was performed and restenosis of the arterial reconstructions was found. On this occasion Multidetector Computed Tomography (MDCT) of supra-aortic cerebral arteries was performed. The first patient (a 62 years old man) had involvement of major supra-aortic vessels and restenosis -1.5-2.5 years after the procedure. The other patient (a 52 years old woman) – the vascular lesions included supra-aortic arteries, small and medium-sized cerebral, coronary and tibial arteries. In her case it was observed early restenosis of supra-aortic and coronary reconstructions. With MDCT and immunological tests in these patients TA was diagnosed.
Discussion: In case of early or multiple restenosis of arterial reconstructions of supraaortic arteries TA is one of the major differential diagnosis to atherosclerotic lesions. Color-coded Duplex Ultrasound is a reliable modality to diagnose and follow-up of patients.

Key words: *color-coded duplex ultrasound, restenosis, Takayashu arteriitis.*

P 10

DUPLEX ULTRASONOGRAPHIC FINDINGS OF RIGHT AORTIC ARCH WITH ISOLATED LEFT BRACHIOCEPHALIC ARTERY

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Objective: Isolated left brachiocephalic artery and common carotid artery with right aortic arch(AA) is extremely rare congenital anormaly. This malformation can cause subclavian steal phenomenon.
Case Report: A 22-year-old female patient with dizziness visited the hospital. She has felt non-whirling type dizziness since she was twelve, and the symptom was aggravated about 3 months ago. Color-coded duplex ultrasonography revealed complete flow reversal of left vertebral artery(VA) with dampened systolic flow of left CCA. Percutaneous catheter aortogram showed right AA with normal brachiocephalic trunk and no connection with great vessels of left side. Left transradial subclavian angiogram showed isolated left SA and left CCA with competition flow of left VA
Discussion: This case demonstrated a right AA with only one functional branch arising from the aorta. This patient's symptoms might be secondary to inadequate blood flow which is same mechanism of subclavian artery steal phenomenon and ultrasonographic findings were consistent with this.

Key words: *isolated left brachiocephalic, subclavian steal phenomenon.*

P11

DISSECTION OF CAROTID ARTERY. A CASE REPORT

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Objective: The term dissection refers primarily to an elevation or separation of the intimal lining of an artery from the subjacent media and, less frequently, to separation of the media from the adventitia. Dissection is usually accompanied by hemorrhage into the arterial wall. According to the literature serious vascular injurie to the neck may be asymptomatic or masked by other life-threatening conditions.
Material and Methods: We observed one patient - 44 years old men, with multiple trauma to the neck and left leg, three months before the hospitalization, suffering from acute ischemic stroke. There were no risk factors for cerebrovascular disease. CT angiography was obtained by Spiral Scanner with reconstructions and interpretation by a radiologist. Color-coded duplex sonography was used to determine the extracranial blood flow velocity and the wall of carotid arteries.
Results: Angiographic examination revealed a dissection of left common (distal part) and left internal carotid artery (proximal part) - 6.5 cm long. Considerably higher peak systolic velocity (PCV) and asymmetry PSV left/right ratio of common carotid artery was found.
Discussion: According to our study CT angiography of the carotid arteries and color-coded duplex sonography in cervical trauma may be used as an accurate decisive tools for a needed surgical intervention. More studies with larger number of patients and comparison with angiography and sonography are needed.

Key words: *acute ischemic stroke, color coded duplex sonography, CT angiography, dissection of carotid artery.*

P12

TECHNICAL ASPECTS FOR ULTRASOUND VISUALIZATION OF SPINAL CORD VASCULATURE

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Objective: A noninvasive method of visualization of the spinal cord vasculature such as ultrasound that can be utilized in different clinical setting of spinal cord ischemia. We assessed the feasibility of imaging and characterizing blood flow in the anterior spinal artery using Ultrasound with concurrent validation using a cadaveric model.
Material and Methods: We developed a protocol for ultrasonographic assessment of anterior spinal artery based on anatomic, morphologic, and physiologic characteristics of anterior spinal artery and determined the feasibility in 24 healthy research participants using high frequency probe (3-9 MHz) through the left lateral paramedian approach in the area between T8 and T12. We ascertained the detection rate, depth of insonation, and flow parameters, including peak systolic velocity, end diastolic velocity, and resistivity indexes for both segmental arteries and anterior spinal artery within the field of insonation. We validated the anatomical landmarks using simultaneous spinal angiography and simulated anterior spinal artery flow in a cadaveric set-up.
Results: We detected flow in all segmental arteries at different levels of our field of insonation with mean depth (± standard deviation) of insonation at 3.9±0.7 cm identified by characteristic high resistance flow pattern. Anterior spinal artery was detected in 15 (62.5%) research participants at mean depth (± standard deviation) of 6.4 ± 1.2 cm identified by characteristic low resistance bidirectional flow. Age, gender, and body mass index were not correlated with either the detection rate or depth of insonation for anterior spinal artery. Simultaneous spinal angiography and simulated anterior spinal artery flow in a cadaveric set-up confirmed the validity of the anatomic landmarks by demonstrating concordance with results obtained from volunteer research participants.
Discussion: The current study describes a technique for noninvasive imaging of spinal vasculature using ultrasound which may enhance our diagnostic capabilities for spinal cord ischemia.

Key words: *spinal cord vasculature, ultrasound.*

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P13

FLOW VELOCITIES AND VESSEL DIAMETER OF THE DISTAL INTERNAL CAROTID ARTERY IN PATIENTS WITH RISK FACTORS

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Objective: Poststenotic peak systolic velocities (PSV) of < 50 cm/s of the distal internal carotid A. (ICA) were introduced as one of the main criteria to differentiate 70% vs 80% stenosis (NASCET definition) (NSRG consensus Stroke. 2012;43:916-921). There is only a sparse evidence for this threshold. Therefore we examined the PSV in patients with risk factors and arteriosclerosis (<50%). With reduced velocities the diameter of the ICA is reducing, a possible additional parameter for grading a stenosis.
Material and Methods: 100 consecutive patients (mean age

65,4 y, range 40-93, male 52%) were examined (GE Logic 7). PSV was measured as distal as possible, at least 2 cm distal to the origin. Due to the variable anatomy the exact distance was not prescribed. The distal diameter of the ICA was measured in systole, if possible with B-Mode, or B-flow imaging for its good spatial resolution.
Results: ICA PSV on the left (right) side was 64,1 (62,7) cm/s, range from 34 to 114 (40-118) cm/s, SD 13,3 (11,9) cm/s, Mean side to side difference was 11% (range 0-59%), 95% of values were.
Discussion: ≥ 50 cm/s PSV of the distal ICA is a valuable threshold to classify ICA without hemodynamic relevant lesions. In this group the diameter can be expected to be ≥ 3,7 mm. The next step in validating these criteria will be to perform the same measurements in patients with high degree stenosis. Beside the absolute threshold side to side differences of PSV, pulsatility and diameter will be of interest.

Key words: *grading carotid stenosis, internal carotid artery, velocity.*

P14

RELATIONSHIP BETWEEN INCREASED COMMON CAROTID ARTERY DIAMETER AND AORTIC ANEURYSM

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Objective: Dilatation of common carotid artery (CCA) has been indicated as an independent risk factor for thoracic and abdominal aortic aneurysm (AA); however, it has not been yet established in Japanese patients with AA. This study aimed to identify CCA diameter of preoperative patients with AA.
Material and Methods: We evaluated 40 AA patients and 40 controls. External and internal diameters of bilateral CCA during diastolic phase were measured in each group. Mann-Whitney U test was used to compare differences between two groups, and receiver operating characteristic curve (ROC) was used to evaluate optimal sensitivity and specificity for diagnosing the co-morbidity of AA.
Results: There were no significant differences in background characteristics of the two groups. With regard to findings of ultrasonography, all diameters were significantly larger in group AA than control group. Based on ROC, the area under curve of the right side external diameter, right side internal diameter, left side external diameter and left side internal diameter were 0.702, 0.675, 0.667 and 0.668, respectively. The sensitivity and specificity of right side external diameter using a cutoff level of 9.4mm were 42.9% and 90.5%, respectively and using a cutoff level of 8.6mm were 64.3% and 64.3%, respectively.
Discussion: This finding suggests that the increased right side external diameter of CCA during the diastolic phase is associated with AA co-morbidity.

Key words: *aortic aneurysm, common carotid artery diameter.*

P15

RELATIONSHIP BETWEEN DIAMETER OF BRACHIAL ARTERY AND COMMON CAROTID ARTERY IN STROKE PATIENTS

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Objective: Recent studies have suggested increased diameters of the brachial artery may be a useful indicator for subclinical coronary artery diseases, and central artery dilation such as common carotid artery are associated with arteriosclerosis. However it remains unclear in patients with cerebral infarction. The present study aimed to investigate the relationship between the diameters of brachial artery (BAD) and common carotid artery (CAD) in patients with cerebral infarction.
Material and Methods: Thirty-three patients with acute atherothrombotic brain infarction (group ATBI), 33 cardiogenic cerebral embolism (group CE) and 31 normal controls (group NC) were enrolled. BAD and CAD at the end-diastolic phase were measured in each group by ultrasonography. Kruskal-Wallis test followed by Scheffe's post-hoc test was used to compare differences among three groups.
Results: With regard to the ultrasonographic findings, BAD was significantly higher in the group ATBI than group CE and NC (median value; 5.3mm, 4.4mm and 4.5mm, respectively), and CAD was also significantly higher in the group ATBI than group CE and NC (median value; 8.5mm, 8.1mm and 7.1mm, respectively). In addition, the CAD was higher in the group CE than group NC.
Discussion: Based on these results, greater BAD may reflect subclinical atherosclerosis and BAD can be used as a useful parameter for differentiating ATBI from CE.

Key words: *brachial artery diameter, common carotid artery diameter, differential diagnosis.*

P16

ACCELERATION TIME RATIO FOR THE ASSESSMENT OF EXTRACRANIAL INTERNAL CAROTID ARTERY STENOSIS

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Objective: The Doppler indices, such as systolic acceleration time (AcT) have been used as parameters for peripheral arterial stenosis. However, to our knowledge, the AcT ratio has not routinely been used to evaluate the degree of internal carotid artery (ICA) stenosis. To apply the AcT ratio in the assessment of carotid artery sonography as an additional marker for diagnosing ICA stenosis.
Material and Methods: Carotid artery sonography was performed in 140 consecutive patients with atherothrombotic brain infarction to evaluate extracranial ICA stenosis. The AcT ratio

was calculated as the AcT of the internal carotid artery divided by the AcT of ipsilateral common carotid artery and compared with linear stenosis as calculated according to the European Carotid Surgery Trial criteria. Simple regression analysis was used to examine the relationship between the AcT ratio and ICA stenosis. The receiver operating characteristic (ROC) curve was used to calculate the optimal cutoff values of the AcT ratio for ICA stenosis (> 65%).

Results: There was a significant correlation between linear stenosis and the acceleration time ratio. The ROC curve revealed an AcT ratio cutoff level of 1.5, with 90.0% sensitivity and 93.5% specificity for internal carotid artery stenosis greater than 65%.

Discussion: The peak systolic velocity (PSV) is a useful parameter for determining the severity of stenosis at the origin of the ICA. However, PSV can be unreliable in the presence of acoustic shadow with arterial wall calcification. The presence of a long, calcified lesion and a high degree of bifurcation also cause difficulty with PSV measurement at the ICA when performed with a linear-array probe alone. As in our study, the combined use of a linear-array probe and convex-array probe, which allow us to evaluate distal ICA at a lower frequency than the linear array, may be helpful.

Key words: *acceleration time ratio, internal carotid artery, stenosis.*

P17

THE SIGNIFICANCE OF ASYMPTOMATIC CAROTID STENOSIS AND DYSLIPIDEMIA FOR TIA AND ISCHEMIC STROKES IN PATIENTS WITH MULTIPLE VASCULAR RISK FACTORS – POPULATION-BASED STUDY

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Objective: The aim of this population-based study was to analyze the prevalence and correlations between the well-documented vascular risk factors (VRF) – asymptomatic carotid stenosis (ACS) and dyslipidemia, and their significance for the incidence of cerebral ischemic events.

Materials and Methods: A total of 500 randomly selected volunteers, 200 men and 300 women, without signs or symptoms of cerebrovascular disease, aged 50-79 years, were enrolled in the study in the University town of Stara Zagora. All participants underwent Duplex scanning of internal carotid arteries, structured questionnaires, a physical and neurological examination and a battery of laboratory tests.

Results: The most frequent single VRFs in this population were elevated LDL cholesterol level (61.5%) – (LDL-C), arterial hypertension (44.2%) – (AH) and ACS (61%). The prevalence of ACS<50% was 54.6%, 6.4% for ACS≥50%, from which 0.4% was severe ACS – 80%-99%. Three and more VRFs (multiple VRFs – MVRFs) were found in 52% of the participants. This selected group revealed an increased frequency of elevated LDL-C level (78.1%), AH (65.8%) and ACS≥50% (8.8%). The volunteers with MVRFs who reached to the end points of the study (TIA and ischemic strokes - IS) were with markedly elevated frequency of AH (85.7%), increased LDL-C level (71.4%), ACS≥50% (28.6%) and especially of ACS – 80%-99% (100%). Logistic regression analyses have revealed that only ACS≥50% as a single VRF, as well as the combination of ACS≥50% and elevated LDL-C level (OR=11.11; 95% CI, 1.58-78.29; p=0.0156) were significantly relate to the end points (OR=4.74; 95% CI, 1.24-18.16; p=0.008).

Discussion: ACS and elevated LDL-C level are treatable, well-documented VRFs for TIA and first IS and their prevalence differs among various populations. Our study has shown that for patients with MVRFs, screening for ACS is well-grounded. The management of all VRFs may contribute to decreasing TIA and IS incidence.

Key words: *asymptomatic carotid stenosis, dyslipidemia, multiple vascular risk factors, ischemic stroke.*

P18

CHANGES IN DOPPLERSONOGRAPHY PARAMETERS OF VERTEBRAL ARTERIES AND EVOKED POTENTIALS IN PATIENTS WITH ASYMPTOMATIC ISCHEMIC DISTURBANCES OF CEREBRAL CIRCULATION

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Objective: The aim of this study is to find the initial changes of brain hemodynamic using color duplex sonography and evoked potentials - brainstem auditory and visual by patients with asymptomatic ischemic disturbances of cerebral circulation.

Material and Methods: By 40 elderly individuals (mean age – 65,7 years) with asymptomatic ischemic disturbances of cerebral circulation – diagnosed with MRI of the brain, was measured a blood flow velocity (BFV) and cerebral vasomotor reactivity (CVR) in the vertebral arteries using color coded duplex sonography. MRI was done at the beginning of the study and at 24 months to measure the severity of white matter changes. Evoked potentials – brainstem auditory and visual were also performed and evaluated in dynamics. It was analysed the latency, configuration and amplitude of the waves.

Results: The comparative study of velocity in vertebral arteries in the patients with asymptomatic ischemic disturbances of cerebral circulation and changes in brainstem evoked potentials reveals significant correlation in comparison to the stage of MRI changes. The hemodynamics investigation reveals significant decrease of blood flow velocity in patients with stage 3 changes on MRI by patients with asymptomatic ischemic disturbances of cerebral circulation. By visual evoked potentials was obtained the statistical relevant increase of latency and decrease of amplitude of P100 wave in the same group of patients with asymptomatic ischemic disturbances of cerebral circulation.

Discussion: The findings in our study shows, that there is a correlation between initial dysfunction of cerebral blood flow

velocity and evoked potentials. The study confirm the clinical impact of doppler sonography and evoked potentials by patients with asymptomatic ischemic disturbances of cerebral circulation, which can be used as objective criteria, regarding the diagnosis and therapy strategy.

Key words: *asymptomatic ischemic disturbances, color coded duplex sonography, evoked potentials, MRI.*

P19

INTIMA-MEDIA THICKNESS OF THE CAROTID ARTERY IN OSAS PATIENTS WITH ASYMPTOMATIC ISCHEMIC DISTURBANCES OF CEREBRAL CIRCULATION

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Objective: To evaluate the change of intima-media thickness of the carotid artery in patients suffering by obstructive sleep apnea (OSAS) and asymptomatic ischemic disturbances of cerebral circulation.
Materials and Methods: The participants of the study are divided into 2 groups: 12 patients suffering from OSAS and asymptomatic ischemic disturbances of cerebral circulation (mean age 50.7±8.4 years), and a control group of 10 participants (mean age 50.4±8.4 years), having risk factors (RF) for cerebrovascular diseases (CVD) and asymptomatic ischemic disturbances of cerebral circulation but not OSAS. The morphology of the artery wall – the thickness of the intima media complex (IMT) of the common carotid arteries (CCA), the presence of atherosclerotic plaques, their magnitude, echogenicity and stability- are determined by a color-coded duplex sonography of the main arteries of the head.
Results: In the OSAS group, CCA-IMT was significantly increased when compared with the non-OSAS patients and asymptomatic ischemic disturbances of cerebral circulation, having risk factors (RF) for CVD and asymptomatic ischemic disturbances of cerebral circulation, which correlated with night hypoxemia level. Additionally, the formation of plaques was more pronounced and carotid stenoses were more common in the OSAS patients.
Discussion: These findings are in favor of an independent influence of obstructive sleep apnea on carotid artery atherosclerosis and asymtomatic changes of the brain in performet MRI.

Key words: *asymptomatic ischemic disturbances, intima-media thickness, obstructive sleep apnea, MRI.*

P20

CAROTID BLOOD FLOW, CARDIAC FUNCTION AND RISK FACTORS FOR CEREBROVASCULAR DISEASE – CORRELATIVE CLINICAL AND ULTRASOUND STUDIES

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Objective: To study the relationship between carotid pathology, cardiac function and risk factors (RF) for cerebrovascular diseases (CVDs).
Material and Methods: Color duplex sonography of carotid arteries was performed in 924 patients: 368 with RF for CVDs, 126 with transient ischemic attacks (TIAs), 287 with chronic unilateral infarction (CUI) and 143 with multiple infarctions. The intima media thickness (IMT) of the common carotid (CCA) and internal carotid (ICA) arteries was measured by B-mode and M-mode scanning. Nonmodifiable (age and sex) and some modifiable (hypertension, diabetes mellitus, atrial fibrillation or other cardiac conditions, dyslipidemia, carotid artery stenoses and obesity) RF for CVDs were evaluated. In 67 subjects with RF, 57 patients with CVDs (31 with TIAs and 26 with CUI) and 16 healthy volunteers correlative clinical, neurosonographic and echocardiographic investigations were performed.
Results: Arterial hypertension was the most common RF in all patients. An asymmetrical hypertrophy of the left ventricle of the heart and a decrease of its contractility were found as a typical cardiac dysfunction in most of them. Mild ICA stenoses predominated in all groups while moderate and severe carotid stenoses were relatively rare. Symptomatic ICA thromboses were seen in 4.5% from the patients with CUI. IMT of the ICA on the side of infarction correlated positively with the arterial blood pressure ($r=+0.60$, $p<0.05$). A positive correlation was established between CCA diastolic blood flow and cardiac ejection fraction in patients with TIAs and CUI. In the group with CUI the increase in mean arterial blood pressure correlated with the frequency of the non-stable ICA plaques on the infarcted side.
Discussion: The study confirms the multifactorial pathogenesis of CVDs where the clinical impact of carotid pathology alone or its association with other RF is under consideration.

Key words: *carotid duplex sonography, cardiac function, cerebrovascular diseases, risk factors.*

P21

CORRELATION BETWEEN CAROTID ULTRASOUND AND EXERCISE STRESS TEST FOR ASSESSING THE SUBCLINICAL VASCULAR DISEASES IN PATIENTS WITH CARDIOVASCULAR DISEASE

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Objective: To study the relationship between carotid pathology and exercise stress-test in patients with new onset symptoms for cardiovascular diseases (CVDs).
Material and Methods: Exercise stress-test (EST) and echocardiography were performed in 503 patients (mean age 54±17 years) with symptoms for CVD in two cardiological centers. Based on EST the patients were classified in three groups - with positive, negative or questionable results. Color duplex sonography of both carotid arteries was performed in transverse and longitudinal planes and intima media thickness (IMT) of the common carotid (CCA) and internal carotid (ICA) arteries was measured. No modifiable (age and sex) and some modifiable (hypertension, diabetes, atrial fibrillation, dyslipidemia, carotid stenosis, obesity, hemorheological variables – leucocytes (Leuc) hemoglobin (Hb), hematocrit (Ht), FR for CVD were evaluated. The pts with positive EST were on PTCA undergone and pts with questionable EST the decision for PTCA was taken after severity of carotid pathology and clinical exam.
Results: Arterial hypertension (AH) was the most common risk factor (RF) in 75% of all patients, dyslipidemia - in 64% and diabetes mellitus - in 28%. A symmetrical hypertrophy of the left ventricle and a decrease of its contractility was found as typical diastolic dysfunction. Mild ICA stenoses predominated in all groups while the moderate or severe carotid stenoses were relatively rare, especially with positive EST. ICA symptomatic thromboses were seen in 4,5% with positive EST. The IMT of the ICA correlated positively with the AH ($r=+0.60, p<0.05$). In the group with positive EST (32%) were found significant carotid disease (28%) and significant coronary anatomy– one, two or multivessel coronary disease. The multivariable analysis confirms that AH, positive and questionable ESTs correlated very fair with moderate and mild carotid pathology and significant coronary diseases in pts with positive ESTs. There were fewer subjects with signifcant plaques in lower risk group (2%) and more subjects with plaques in the high risk group (60%).
Discussion: The study confirms the clinical impact of carotid pathology alone and its association with other RF. The application of carotid ultrasound in CVD is sensitive method for assessment of coronary pathology.

Key words: *intima-media thickness, stress test.*

P22

INTERNAL JUGULAR VEIN THROMBOSIS DUE TO CENTRAL VENOUS CATHETER – DIAGNOSIS AND CLINICAL SIGNIFICANCE

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Objective: The ain of this prospective study is to define the clinical significance of diagnosis partial or complete thrombosis of Internal jugular vein (IJV) after insertion of a central venous catheter (CVC) in patients in intensive care unit (ICU).
Materials and Methods: Central venous catheter in IJV is implanted to 233 patients for the period 03.2013 to 05.2013. From all the patients 135 are men, 98 are women, mean age 60,6 years. The IJV is evaluated with Color-coded Duplex Ultrasound (CDU), before insertion of the CVC and at the 7th post procedure day, for the existence of partial or complete thrombosis. Some of the patients with trombosis were symptomatic of thet, other – were asymptomatic. Degree of thrombosis was: incomplete small (less than 50% of the lumen); incomplete high (more than 50% of the lumen) and complete thrombosis. While staying in ICU were used to prophylaxis thrombosis low-molecular-weight heparin and antibiotics.
Results: At the 7th day thrombosis is diagnose at 77 (33%) patients with CDU, 41 (53%) are men and 36 (47%) are women ($p>0,05$). Asymptomatic thrombosis are 67 (87%), and symptomatic-10 (13 %), $p<0,05$. Incomplete small thrombosis is diagnosed in 56 (73%) patients, incomplete high-14 (18%) and complete thrombosis - 7(9%) patients, ($p<0,05$).
Discussion: The thrombosis of IJV is an important complication, which increases hospital stay and worsens the patient's condition. The majority of them remain undiagnosed. The frequency of symptomatic stenosis is low, and asymptomatic frequency is high. Color-coded duplex sonography is a method of choice to examine IJV in the extracranial segment and for diagnosing thrombosis.

Key words: *color-coded duplex ultrasound, internal jugular vein, thrombosis.*

P23

CORRELATIVE CLINICAL AND NEUROIMAGING STUDIES IN PATIENTS WITH ACUTE SPONTANEOUS INTRACEREBRAL HEMORRHAGE

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Objective: To assess the prognostic value of some clinical, ultrasound and neuroradiological parameters on the 30-th day clinical outcome of patients with acute spontaneous

intracerebral hemorrhage (sICH).
Material and Methods: We examined 88 patients with sICH admitted to the Neurology clinic of UMHAT "Dr Georgi Stranski", Pleven within 48 hours after the symptoms onset. The neurological deficit was assessed by the Glasgow Coma Scale (GCS) and National Institute of Health Stroke Scale (NIHSS) on admission. Clinical outcome on the 30-th day of sICH was evaluated by the Glasgow Outcome Scale (GOS) and modified Rankin Scale (mRS). Hemorrhage volume was measured on computed tomography (CT) by a simplified formula for the volume of an ellipsoid, (AxBxC)/2. All the patients underwent ultrasound examination of the carotid arteries.The statistical analysis was performed with the Statistical Package for Social Sciences version 19.0 (SPSS) and Statgraphics plus 4.1 for Windows.
Results: We found that neurological deficit assessed on admission by GCS and NIHSS, hematoma volume and location are significantly correlated with the clinical outcome on the 30-th day of the sICH onset. Age, vascular risk factors and ultrasound parameters were not significant factors for the clinical outcome. Male patients had better outcome on the 30-th day as compared with the female ones.
Discussion: GCS and NIHSS scores on admission, hematoma volume and location are reliable predictors of clinical outcome on the 30-th day of the sICH that could be used for patient stratification and optimization of the individual therapeutic approach.

Key words: *neuroimaging, outcome, sICH.*

Poster Session I–3. Transcranial Ultrasound – Experimental, Clinical and Functional

P24

CEREBRAL HEMODYNAMIC ASSESSMENT WITH TRANSCRANIAL COLOR DUPLEX IN INTRACRANIAL HYPERTENSION EXPERIMENTAL MODEL

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Objective: The image of the real-time ultrasound combined with pulsed Doppler system is a noninvasive and bedside method that allows the cerebral blood flow velocity and evaluation and flow resistance measurement in intracranial hypertension patients. The intracranial hypertension is an important clinical condition and represents high risk to patients with acute brain injury. In this study, we describe in an experimental model, application of cerebral duplex to evaluate changes in pre and post-intracranial hypertension.
Material and Methods: An experimental study, using 30 crossbred Landrace and Duroc pigs weighing approximately 18–20 kg and aged 2months. Prior to surgery, pigs were starved for 12 h but had free access to water. We co-administered intramuscular ketamine at dose of 15mg/kgand xylazine at a dose of 2 mg/kg. The experimental hypertension was performed with an intracranial balloon. At each intervention we performed a neurological assessment of the pupils and Doppler exam (Ultrasound color duplex SonoSite-Micromax). Continuous intracranial pressure measurement by intraparenchymal and extradural catheters was also performed. The animals underwent to a baseline measurement, a pre-balloon insufflation, a post-balloon insufflation before and after saline solution infusion. The association of the results of duplex was compared with ICP and systemic monitoring. In complementary we measured optic nerve sheath diameter by ultrasound in each phase.
Results: All animals were closely observed for changes for 1.5 h after the start of the expansion, and then the mock clinical intervention was made (3% hypertonic saline solution). The model allows the determination of a decrease in intracranial compliance by refractory IH. A sudden change in mean MBP lead to a simultaneous change in cerebral blood flow velocities and pulsatilite index initially.
Discussion: In our model was possible to perform the evaluation of brain hemodynamic changes with TCD without problems in all tested animals.

Key words: *animal model, intracranial hypertension, transcranial color duplex.*

P25

CEREBRAL VASOMOTOR REACTIVITY IN PATIENTS WITH ACUTE ISCHEMIC STROKE

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Objective: We assessed the motor stimulus to blood flow velocity (BFV) changes of bilateral middle cerebral arteries (MCAs) by transcranial Doppler (TCD) sonography in patients with acute ischemic cerebrovascular events and normal subjects.
Material and Methods: Fourty-three patients (20 female, 23 male; aged 55.6 years) with acute territorial stroke in the MCA territory, 38 patients (11 female, 27 male; aged 57.6 years) with acute lacunar stroke in the MCA territory, and 19 control subjects (9 female, 10 male; aged 53.5 years) were investigated. Bilateral TCD sonography from both MCAs were monitored during 10 cycles of 20 seconds when subjects are performing hand gripping with a frequency of one per second, and subsequently 20 seconds when they are rest to assess BFV changes on activated cortical motor areas. BFV increase was calculated off-line for each subjects.

Results: There is no significant age and gender difference between patients and controls. Relative flow velocity increase was significantly lower ($p<0.05$) on the lesion side in the patients with territoral stroke (12.8±1.2) than those of lacunar stroke (21.5±1.2) or controls (19.0±2.2). However, in patients with territoral stroke non-lesion side the relative flow velocitiy increase was slightly lower (15.2±1.2) than those of lacunar strokes (23.5±1.7) or controls (19.6±1.9).
Discussion: Our results suggest that motor cortex was activated bilaterally even if one hemisphere was involved more or less. Cerebrovascular reactivity was preserved in patients with lacunar stroke in contrast to territorial stroke in the acute stage. Therefore, TCD sonography by means of vasoneuronal coupling may be use as a diagnostic tool in patients with acute ischemic stroke.

Key words: *blood flow velocity, transcranial Doppler sonograph, vasoreactivity, ischemic stroke.*

P26

ULTRASONOGRAPHY IN CEREBRAL ARTERITIS

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The use of transcranial Doppler (TCD) is well established in the evaluation of many neurovascular conditions; however its use in cerebral vasculitis is less well documented.
Ultrasound has the highest resolution among the imaging techniques that are in use for the diagnosis of vasculitis. High-frequency probes provide an axial and a lateral resolution of 0.1 mm. Ultrasound depicts well the artery wall and provides information about blood flow characteristics.
Large-vessel vasculitis involves arteries that consist of intima, media and adventitia. Temporal- (TA) and Takayasu-arteritis (TYA) are well-recognized entities.
Ultrasonography is being used increasingly for the diagnosis of TA. Color Doppler ultrasound (CDU) shows hypoechoic (dark) oedematous wall swelling in acute TA that disappears with corticosteroid treatment. In addition, stenoses of short segments are typical for acute TA.
TCD is a valuable noninvasive bedside tool to monitor cerebral blood flow velocities and therapy response in patients with cerebral vasculitis, if large arteries are involved. A nonpulsatile cerebral (hypo) perfusion indicates severe hemodynamic impairment and is partially reversible by a surgical bypass graft. TCD/CDU seems to be useful to detect "high-risk" patients and to follow up in TYA.
CDU can be also used to discriminate different causes of sudden monocular blindness. Presence of the ''spot sign'' helps to discriminate embolic from vasculitic occlusion of the central retinal artery.
Observed association of microembolis signals (MES) with neurolupus may support the possible contribution of MES to the complex pathophysiology of this syndrome. More importantly, detection of MES on TCD monitoring might suggest a high risk of involvement of the central nervous system in neuropsychriatric lupus.
TCD/CDU has several advantages: it is noninvasive, relatively non-expensive, readily performed at the bedside, repeatable, and readily available. Safety and relative reproducibility make them attractive techniques for diagnosis and follow up of some forms of cerebral arteritis.

Key words: *cerebral arteritis, diagnosis, treatment, ultrasonography.*

P27

DETERMINING THE IDEAL TIME WINDOW FOR ANGIOPLASTY IN AN UNCONSCIOUS SAH PATIENT WITH SEVERE CEREBRAL VASOSPASM: A MULTIMODAL MONITORING APPROACH

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Objective: Cerebral vasospasm following SAH is one of the main causes of secondary brain injury. The incidence peak is between the 7th and 14th day after bleeding. The management of cerebral vasospasm is based on the triple H therapy, although this therapy may not be enough to control the vasospasm complications. In these cases, mechanical or pharmacological angioplasty on the affected vessel may be indicated if neurological deterioration occurs. Sedated or comatose patients make clinical evaluation difficult and limited. Combining different brain monitoring techniques can provide valuable information that help physicians to identify patients before clinical deterioration.
Material and Methods: A 42 year-old male patient, Caucasian, presented with aneurysmal SAH Fisher IV, Hunt Hess IV, underwent embolisation and surgical clipping later on. At the 3rd day mild vasospasm developed, which became severe at the 5th day. The patient was sedated and underwent multimodal monitoring at the neurological ICU.
Results: The assay of data from cerebral blood flow velocities, Lindegaard index and response to transient hyperemia test (RTHT) obtained by transcranial Doppler along with data from ICP, CPP and PbtO2 enabled to determine a better time window to perform angioplasty in this case. At that time signs of vasospasm worsening was detected by TCD associated with reduced response to RTHT, increases in ICP and decreases in PbtO2; we decided to indicate angioplasty with good results in terms of the monitored brain physiological variables.
Discussion: Multimodal brain monitoring, including transcranial Doppler monitoring can provide real-time brain physiological data which allow to detect brain physiological deterioration in unconscious patients; this enables more precise indication of angioplasty for cerebral vasospasm

Key words: *angioplasty brain vasospasm, oximetry catheter, transcranial Doppler, transient hyperemia test.*

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TRANSCRANIAL DOPPLER AND OXIMETRY TISSUE CATHETER MONITORING IN DIFFUSE BRAIN VASOSPASM

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Objective: Intracranial vasospasm is an important cause of brain ischemia when associated to subarachnoid hemorrhage. Multimodal monitoring can detect brain flow decrease and patients with high risk to develop brain ischemic lesions. TCD can detect and measure vasospasm intensity in the large intracranial arteries. Usually the oximetry catheter is implanted in the area most likely to occur vasospasm, which is near of brain bleeding. It can measure brain tissue oxygen (PtiO2) in areas with oligoemia associated to vasospasm. They give support to plane treatment to improve brain blood flow in patients suffering brain vasospasm.
Case Report: A 48 years old woman with subarachnoid hemorrhage (Hess IV) and intracranial brain hemorrhage at right side in cranial tomography (CT)(Fisher IV). She was underwent a middle cerebral artery aneurism clipping, intracranial pressure (ICP) catheter implantation and catheter to measure brain parenchyma $PtiO_2$ close to the bleeding area. Serial TCD exams disclosed diffuse brain vasospasm, which were more intense at left side. Despite treatment with 3H therapy, we noted ischemic areas in brain CT at opposite side of bleeding (left side), when $PtiO_2$ values maintained in normal range close to the hemorrhage area (right side), nine days after the hemorrhage. At this time ICP was normal. Unfortunately, after 14 days, the patient developed refractory ICP and circulatory arrest.
Discussion: Brain vasospasm can be focal or diffuse. In this case TCD suggested more intensity vasospasm at opposite side of bleeding; ischemic areas were disclosed by CT exam in this side, confirming TCD findings. Brain oxymetry catheter can monitor a small area of brain tissue so it is not reliable as a isolated monitor method in patients with subarachnoid hemorrhage and diffuse vasospasm.

Key words: *brain ischemia, brain oximetry, diffuse vasospasm, subarachnoid hemorrhage.*

P29

TRANSCRANIAL DOPPLER EVALUATION OF BOW HUNTER SYNDROME: CASE REPORT AND REVIEW OF LITERATURE

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Objective: Bow Hunter´s syndrome (BHS) reflects a perturbation of blood flow provoked by changes in the position of head. Symptoms include syncope, dizziness, vertigo, visual blurriness, drop attacks, tinnitus, hypoacusis, and sensory or motor deficits. Here we describe the application of Transcranial Doppler (TCD) in diagnosis of BHS.
Case Report: The subject is a 86-year old female presenting with sudden loss of consciousness lasting few seconds after flexing neck. After the episode the patient remained with dizziness and vertigo. Her previous medical history displayed hypertension. At admission, she presented with right apendicular ataxia and left homonymous hemyanopsia. She performed skull computadorized tomography (CT), which revealed a large ischemic zone in right cerebellar hemisphere and ipsilateral occipital lobe. TCD was then performed before and during mechanical maneuvers. The vessel chosen was the posterior cerebral artery. There was an important amplitude in mean flow velocity: 38 cm/s before maneuver, 20 cm/s during cervical flexion and rotation maneuver (reduction of 48%); 50 cm/s after assuming neutral position (increase in 24% – reactive hyperemia). It was also noted the passage of an arterial embolus during examination in neutral position. A vertebrobasilar vascular insufficiency was diagnosed and an angiogram was performed which revealed a dominant right vertebral artery associated with a hypoplasic left vertebral artery also characterized by critical stenosis in V2 segment.
Discussion: TCD may be very useful as an initial diagnostic tool because of low costs, reproducibility, ease of use, and the possibility of performing a real-time correlation between the PCA velocities and symptoms.

Key words: *Bow Hunter, dizziness, transcranial Doppler, stroke.*

P30

ASSOCIATION BETWEEN PULSATILE INDEX AND INFARCT SIZE IN ACUTE LACUNAR STROKE

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Objective: Lacunar infarction was considered due to occlusion of small penetrating artery and disease of small cerebral arteriole. Transcranial Doppler (TCD) pulsatile index (PI) has been interpreted as a marker for distal vascular resistance and reflects microangiopahty in cerebral arteries. Therefore, we hypothesized that increased PI might be associated with more large infarct size due to progressed underlying microangiopathy in patients with acute lacunar stroke.
Material and Methods: We included 69 patients with acute lacunar stroke who completed TCD. We used mean PI value of both MCA for analysis. Infarct size was a maximal diameter of acute lesion based on diffusion weighted MRI.
Results: There was significant correlation between PI and infarct size (r=0.251, p=0.037, by Spearman`s correlation). After adjustment for sex, age, hypertension, diabetes mellitus and hypercholesterolemia, the significant correlation remained

significant between of them (r=0.336, p=0.007).
Discussion: This study suggested that underlying microangiopathy contribute the degree of cerebral ischemic damage in acute stroke.

Key words: *lacunar stroke, pulsatile index, transcranial Doppler.*

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MICROEMBOLIC SIGNALS DETECTION DURING ROUTINE TRANSCRANIAL DOPPLER AFTER ACUTE SUBARACHNOID HEMORRHAGE

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Introduction: The cerebral vasospasm is considered one of the most common and serious complications of Subarachnoid hemorrhage (SAH) can be a cause of neurological ischemic transient or permanent, and contributes to increased rates of morbidity and mortality of patients. Previous studies suggested that intracranial aneurysms can act as sources of distal embolization. Spontaneous thrombus can be observed within the aneurysmal sac, presumably because of turbulence and slow flow. The aim of this study was to describe the detection of some MES during routine vasospasm monitoring by transcranial Doppler (TCD).
Material and Methods: From 2010 to 2011 patients with SAH admitted to the neurology and neurosurgery departments at Hospital das Clínicas, University of São Paulo Medical School (HC/FMUSP), Brazil were investigated in a prospective study. This study was approved by the ethics committee of the HC/FMUSP.
Results: During the study, 105 patients with SAH were admitted, of whom 04 patients entered the study, which detected vasospasm and spontaneous MES. The average age of the patients (mean ± standard deviation) was 59.5 ± 8.34 (range 49-68), and the number of females prevailed with 75 % (3/4). 50% (2/4) were grade II on the Hunt-Hess clinical scale and 75% (3/4) were grade 2 on the Fisher CT scale.
Discussion: TCD ultrasound can detect presence of microembolic signals in patients diagnosed with SAH. Although detection of emboli was relatively rare in this study (4 of 105), rates of emboli occurrence may increase if systematic monitoring is used. The detection MES after SAH surgery may be an indicator for prophylactic antithrombotic treatment.

Key words: *brain vasospasm, microembolic signals, subarachnoid hemorrhage, transcranial Doppler.*

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CEREBRAL AUTOREGULATION IN PATIENTS WITH ORTHOSTATIC INTOLERANCE: A TRANSCRANIAL DOPPLER SONOGRAPHY MONITORING

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Objective: To study the orthostatic adjustment of cerebral hemodynamics in orthostatic intolerance (OI), based on classification of Thulesius (1976).
Material and Methods: Hemodymanic changes associated with orthostatic challenge were studied in 20 volunteers and 30 patients with OI using a specially designed protocol (E. Titianova and J. Nader, 1999) – a passive 70-degree tilt of the upper part of the body followed by a passive 90-degree whole body tilting and an active stand-up (each one lasting 10 minutes and followed by return to the lying position) were applied. Mean blood pressure (MBP), heart rate and mean blood flow velocity (BFV) of both middle cerebral arteries (MCA) were determined after 10 minutes of rest and after 1, 5 and 10 minutes of each orthostatic position.
Results: The pattern of orthostatic adjustment of the cerebral and systemic hemodynamics depended on the topic of the lesion, the type ("passive" or "active") of the orthostatic challenge and the antigravity efficacy of the peripheral muscle pump. A paradoxical cerebral vasoconstriction due to hyperventilation was found in patients with postural tachycardia syndrome. In cases with pure autonomic failure the cerebral autoregulation seemed to be preserved if the MBP was maintained within the limit for brain autoregulation. During the induced neurally mediated syncope the selective loss of diastolic BFV and the increase in Pulsatility index were typically observed.
Discussion: TCD monitoring of cerebral autoregulation is an important approach for topical diagnosis of the orthostatic intolerance and may help for selecting the best therapeutic strategies.

Key words: *orthostatic intolerance, orthostatic tests, peripheral muscle pump, TCD monitoring.*

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CEREBRAL VASCULAR REACTIVITY IN PATIENTS WITH DIABETES MELLITUS TYPE 2

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Objective: To study the changes of the cerebral vascular reactivity after different stimuli in patients with diabetes mellitus type 2.
Material and Methods: Twenty patients with diabetes

mellitus type 2 (age range 45-67years) and 10 presumed healthy age and sex matched controls were included in the study. Simultaneous transcranial Doppler, blood pressure and heart rate monitoring was performed at rest and after cold stress, deep breathing and head-up tilt. The systolic (SBP), diastolic (DBP) and mean blood pressure (MBP) were measured and the blood flow velocity (BFV) parameters of the middle cerebral artery (MCA) were recorded. Comparison of the effects of the different stimuli on the blood pressure and BFV was performed.

Results: At rest the SBP, DBP and MBP were higher in the patients with diabetes, while BFV did not show substantial differences. The postural challenge and the deep breathing caused decrease of BFV and it was stronger in the diabetic patients. The cold stress induced increase of the BFV, predominating in the controls. Similar SBP, MBP and DBP responses to the applied stimuli were observed. All three stimuli provoked increase of the vascular resistance, which was more expressed in the diabetes group.

Discussion: The assessment of the impaired vascular reactivity after different stimuli is useful for the evaluation of the cerebral hemodynamics in diabetes.

Key words: *cerebrovascular reactivity, cold stress, diabetes mellitus, head-up tilt.*

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CEREBROVASCULAR AUTOREGULATION IN FULMINANT HEPATIC FAILURE

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Objective: The clinical course of patients with fulminant hepatic failure (FHF) is often worsened by loss autoregulation of cerebral blood flow (CBF), which leads to cerebral edema and intracranial hypertension. The development these complications is an important event in patients with FHF that needs intensive care and urgent liver transplantation. To evaluate the hemodynamic and cerebrovascular autoregulation capacity of patients with fulminant hepatic failure before and after liver transplantation and those not undergoing transplantation.

Material and Methods: We evaluated 25 patients with diagnosis of FHF admitted to the Intensive Care Unit of liver transplantation in Hospital das Clinicas, Sao Paulo University Medical School, of whom 17 patients were evaluated before and after liver transplantation. The cerebral hemodynamics was evaluated by cerebral blood flow velocity in the middle cerebral arteries, using a device transcranial Doppler, equipped with a 2 MHz probe. Assessment of cerebral autoregulation was evaluated by the ratio of static autoregulation that takes into account the effects of increased PAM on cerebral blood flow velocity. For this, promoted the increase in MAP (20 mmHg to 30 mmHg) after infused with norepinephrine.

Discussion: The results of this study demonstrate that impaired autoregulation is present in most patients diagnosed with FHF before liver transplantation as well as in most cerebral autoregulation is restoring the first 48 hours after transplantation.

Key words: *brain vascular autoregulation, fulminant hepatic failure, transcranial Doppler.*

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TRANSCRANIAL DOPPLER MONITORING DURING HYPOTERMIC CIRCULATION ARREST

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Objective: The estimate cerebral blood flow with trascranial doppler in right brachial artery perfusion during hypotermic circulation arrest during the correction of aortic arch aneurysms and dissections.

Material and Methods: Ten patients (mean age of 52±8,3 years) were monitored. We monitored maximum blood flow velocities of bilateral middle cerebral arteries using the transcranial doppler (Multi-Dop T, Oxford Medical) at four periods: after induction of anestesia, during cardiopulmonary bypass, during antegrade cerebral perfusion and after termination of cardiopulmonary bypass. Also we used trascranial doppler monitoring with embol detection.

Results: Maximum blood flow velocity decreased symmetrical in all patients during cardiopulmonary bypass and antegrade cerebral perfusion of hypotermic circulation arrest.

Vmax composed 82±13,7 cm/s after induction of anestesia, during cardiopulmonary bypass – 33±5,8 cm/s, during antegrade cerebral perfusion – 46±11,6 cm/s, after termination of cardiopulmonary bypass – 80±10,9 cm/s. During cardiopulmonary bypass maximum blood velocity decreased significantly. No neurologic deficit was observed in any patient after operation.

Discussion: Transcranial doppler monitoring is important method of assessment the cerebral blood flow in operation on aortic arch during hypotermic circulation arrest.

Key words: *cerebral perfusion, transcranial monitoring.*

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BRAIN HEMODYNAMIC IMPROVEMENT AFTER RETROGRADE VENTRICULO-SINUS SHUNT IN HYDROCEPHALUS PATIENTS

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Objective: Treatment of hydrocephalus is still a challenge to medicine. Currently, the retrograde ventriculo-sinus

shunt (RVSS) is proposed in order to solve the question of ventricular catheterization complications related to siphoning. Transcranial Doppler can evaluate intracranial hypertension relief after this surgical procedure measuring brain blood flow velocities, pulsatility and resistivity index.
Material and Methods: We have applied RVSS in 6 patients with myelomeningocele correction, whom have shown progression of hydrocephalus with less than 6 months old. Mean age was 3 months. The blood flow velocity, pulsatility and resistivity index were measured in the middle cerebral artery before and after RVSS by transcranial Doppler. Transfontanel echography and Doppler of the superior sagittal sinus were also performed. The surgical technique involves 2 skull burr-holes under the same arcuate incision in the scalp: one in the posterior parietal bone (point Frazier) and another in the middle third of the sagittal suture. After opening the parietal dura, lateral ventricle was punctured and then a small opening was made in the superior sagittal sinus. Then the catheter was inserted approximately 2 cm in the retrograde blood flow direction.
Results: In 4 patients, cephalic perimeter percentil (CPP) improved with statistical significance, followed by clinical improvement. Doppler ultrassound evaluation revealed increase in mean velocity in the middle cerebral artery after procedure associated with decrease in pulsatility and resistence index, which were still present 1 year after the procedure. In 2 patients, continuous high pulsatility index and CPP forced a revision. Blood flow in the superior sagittal sinus was preserved after surgical procedure in all patients.
Discussion: Although still preliminary, improved hemodynamic encephalic demonstrated by transcranial Doppler was compatible with the clinical improvement of patients. Therefore, this method may be a useful tool for assessing the pre post operative brain hemodynamic in patients with hydrocephalus.

Key words: *brain artery velocities, hydrocephalus, transcranial Doppler, ventricle sinus shunt.*

Poster Session II–1. Endovascular Procedures and Thrombolysis

P37

SONOGRAPHIC CHANGES BEFORE AND AFTER STENTING IN CAROTID ARTERY

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Objective: Carotid arterial stenosis becomes more common and important risk factor for stroke patients in Asian area. We reviewed stroke database to investigate changes of carotid duplex sonographic findings which reflects hemodynamic changes before and after carotid stenting.
Material and Methods: Stroke patients of which carotid stenting have been done when admitted at the National Health Insurance Service Ilsan Hospital from January 2007 to December 2012 with available carotid ultrasound study that was done before and after carotid stenting formed the analysis cohorts. Retrospective review was performed.
Results: A total of 26 patients were included during that period. By duplex ultrasound, common, internal and external carotid arteries were examined and the degree of stenosis was graded by five groups; < 50%, >50% and < 75%, >75% and < 95% stenosis, subtotal occlusion and occlusion. Average follow-up period between before and after stenting was 18 months. 16 patients among 26 patients showed no change of adjacent carotid stenosis degrees between before and after stenting. 5 patients among 26 patients showed changes in the stenosis degree of ipsilateral adjacent carotid and another 5 patients showed changes in the stenosis degree of contralateral adjacent carotid arteries.
Discussion: Between before and after carotid stenting, the flow of adjacent carotid arteries were changed in patients of about one third and another two thirds showed no change. The hemodynamic changes of carotid flow can be dynamic after carotid stenting and the clinical significance of them needs to be further investigated.

Key words: *carotid sonography, stent, stroke.*

P38

CEREBRAL MICROEMBOLIC AND HAEMODYNAMIC EVENTS DURING TRANSFEMORAL AORTIC VALVE IMPLANTATION PROCEDURE: WHICH RELATIONSHIP WITH CLINICAL AND NEURORADIOLOGICAL FINDINGS?

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Objective: The risk of transient ischemic attack and stroke following transfemoral aortic valve implantation (TAVI) is 2-10% and is even higher considering silent ischemic brain injury. Periprocedural microembolic signals (MES) and hemodynamic changes (HC) may be considered physiopathological markers of such events. We show neurosonological and neuroradiological data about a patient submitted to TAVI.
Material and Methods: A 78-year-old man underwent TAVI. During the procedure, continuous monitoring of right middle

cerebral artery was performed by transcranial Doppler (TCD), in order to reveal MES and HC (left acoustical temporal bone window was inadequate). Moreover, patient underwent brain magnetic resonance with diffusion-weighted sequences (MR-DWI) before and after TAVI.
Results: 1103 MES were detected: 116 (10.5%) during the crossing of the native valve by guidewire and pigtail catheter, 50 (4.5%) during valve predilatation with balloon, 29 (2.6%) related to passage of device (CoreValve) in the aortic arch and its positioning in the valve, 693 (62.9%) during release of the prosthesis, 215 (19.5%) in the phase of catheter removal. As for HC, peak systolic velocity reduction (from 82 cm/s to 38 cm/s) and heart rate increase (from 66 to 156 beats per minute) were observed in a period of 8 seconds during predilation. Post-procedural brain MR-DWI detected two recent-onset signal abnormalities in the right emisphere. Patient remained asymptomatic during hospital stay.
Discussion: TCD monitoring may provide useful and real-time data on the physiopathological mechanisms underlying the risk of ischemic brain injury during TAVI, identifying phases at higher risk. Further research is needed to validate these findings.

Key words: *aortic valve implantation, ischemic brain lesion, transcranial Doppler.*

P39

DOES STENT DESIGN INFLUENCE EMBOLISATION DETECTED BY TRANSCRANIAL DOPPLER DURING CAROTID ARTERY STENTING?

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Objective: We studied effects of stent design on embolisation detected by transcranial Doppler during carotid artery stenting.
Material and Methods: We studied 711 carotid stent procedures performed between December 1997 and January 2012. Three stent-types were studied: open-cell (Acculink: free cell area 11.48 mm^2, n=271), semi-closed cell (Precise: 5.89 mm^2, n=144) and closed-cell (Carotid Wall: 1.08 mm^2, n=296). Cerebral embolisation was measured by transcranial Doppler of the ipsilateral middle cerebral artery. Isolated microembolisms and microembolic showers (cardiac cycles with too many emboli to count separately) were counted.
Results: 77% of the patients were male, 419 were asymptomatic (59%) and 67% had a >90% carotid stenosis. Emboli protection devices were used in 377 procedures (53%). The use of these filters differed over the stent-types ($p<0.001$). The number of unprotected procedures were: Acculink 21 (8%), Precise 117 (81%), and Carotid Wall 196 (66%). Protected and unprotected procedures were separately analyzed. Without filter, Acculink led to a median number of 134 isolated microembolisms and 14 showers, Precise to 116 and 25, and Carotid Wall to 107 and 13, respectively. There was no significant difference in the number of isolated microembolisms between stent-types, but there was in the number of showers during the whole procedure and during stent-deployment ($p<0.000$); the lowest number with Carotid Wall, and the highest in the Precise group. In the protected group, Acculink led to a median number of 180 microembolisms and 64 showers, Precise to 203 and 50, and Carotid Wall to 201 and 38, respectively. Again, there only was a significant difference in the number of showers during the whole procedure and during stent-deployment; the lowest number with Carotid Wall, and the highest with Acculink.
Discussion: Independent of the use of a filter, the lowest number of embolic showers was induced in the middle cerebral artery when using the Carotid Wall stent, which has the smallest free cell area.

Key words: *carotid artery stenosis, microembolisms, stent, transcranial Doppler.*

P40

RECANALIZATION AND STENTING OF OCCLUDED AND NEARLY OCCLUDED CAROTID STENOSES

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Objective: Occluded and nearly occluded internal carotid arteries have lower risk of subsequent stroke, because antegrade flow no longer exists. Still, cervical ICA occlusion is associated with an annual risk of 6 to 20% of ipsilateral recurrent stroke. Extracranial-to-intracranial (EC-IC) artery bypass failed to reduce the risk of ischemic stroke. Occlusion/ near occlusion of internal carotid arteries has long been definitive contraindication for endovascular treatment but several small series showed that endovascular recanalization and stenting of occluded and near occluded carotids is feasible. Data are still controversial. To analyze and present the results of percutaneous recanalization and stenting of total and subtotal carotid stenoses for a 10 years period.
Material and Methods: Between 2002 and 2012 51 occluded and subtotally stenosed carotid arteries were stented. They represent 8 % of the total 632 CAS procedures in this period. Five (9.8%) of them were chronic carotid occlusions and 46 (90.2%) subtotal carotid stenoses. In all but one distal filter protection was used.
Results: A successful stenting was achieved in 50 cases (98%). There early periprocedural complications were: one ipsilateral stroke (1.9%), one transient ischemic attack, one myocardial infarction (1.9%), one death (1.9%) and one local bleeding. The combined incidence of stroke/death/MI was 3.9%. The results were not significantly different compared to the "non-occlusion" group. In the follow-up period were found 1 stroke, 1 death and 1 in-stent restenosis.
Discussion: The decision to revascularize a patient with a carotid string sign remains complex and should be made after careful deliberation. Most of these patients, particularly asymptomatic patients, do not require revascularization. Therapy should be tailored to the individual patient. Recurrent or crescendo symptoms warrant treatment.
Carotid occlusion and near occlusion is an under-recognized

condition, and CAS seems to be beneficial when performed by an experienced neurointerventional team.

Key words: *carotid occlusion, carotid stenting, distal protection.*

P41

SUPRASELECTIVE INTRA-ARTERIAL TREATMENT IN ACUTE ISCHEMIC STROKE

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Objective: To report the clinical, radiological, and haemodynamic data of three patients with AIS who underwent IAT.
Material and Methods: Two men and one woman, mean age of 61.6, two with MCA occlusion and one with posterior AIS, were treated. Clinical outcome was assessed according to NIHSS and mRS on day 1, 30 and 90. Neuroimaging included non-contrast CT or MRI, diffusion and angio MRI. All patients underwent cerebral angiography and met criteria for endovascular TL. Transcranial duplex scanning was used for haemodynamic assessment of the occlusion and recanalization. Actiyse was infused supraselectively via microcatheter in a mean dose of 38.3 mg. TICI score was documented at the end of the procedure. Post-procedural I.V. 24 h heparin infusion was given to one patient with poor TICI result.
Results: All patients had embolic AIS. Mean time from symptoms onset to start of IAT was 175 min. Mean initial NIHSS was 14.6. Diffusion MRI demonstrated large MCA territory lesion > 1/3 in 1 patient, and small zones in 2 other. TICI scores were 2b, 3, 1. None of the patients had iatrogenic haemorrhage. Ultrasound monitoring showed recanalization immediately after the procedure in 2 patients, and 3 hours later in 1 patient. On control vascular imaging, that result was stable on the second day. Control CT revealed an infarct area with edema only in one patient. Mean NIHSS score on day 7 was 6, on day 30 was 4.6. Mean mRS on day 7 was 3, on day 30 was 2.
Discussion: Important determinants for success were time to IAT, stroke severity, and age. We observed excellent early ultrasound results and clinical outcome in 2 patients, as well as mild to moderate in one. No serious complications were noted despite non-consensus type of treatment. Future research and protocol improvement of IAT is needed to validate the best individual treatment approach.

Key words: *endovascular therapy, intra-arterial treatment, stroke, thrombolysis.*

P42

SAFETY EVALUATION OF MID-FREQUENCY SONOTHROMBOLYSIS: ANIMAL BRAIN EXPERIMENT

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Objective: We are developing mid-frequency sonothrombolysis, however, hemorrhagic complication in TRUMBI trial is a fence at these frequency. We evaluated safety in primate with a developed 490 kHz continuous waveform (CW)-US probe and investigated 400 kHz burst waveform (BW)-US emission for rabbit.
Material and Methods: 1.We applied a developed probe to Macaca monkey brain via sonication of the MCA through a temporal window. Each three cynomolgus monkeys were maintained for 1 day and 7 days after sonication. And more two elder rhesus monkeys were sonicated under the alteplase (0.9 mg/kg) i.v., and maintained for 7 days. An automatic switching circuit operated a therapeutic US (T-beam) generator for thrombolysis (490 kHz; CW-US, Ispta 0.72 W/cm2) and diagnostic TC-CFI (D-beam; 2.5 MHz; Ispta 0.20 W/cm2). A 15-min protocol, comprising 4 repeats of a sequence of 120-s T-beam followed by 30-s D-beam and then 5-min T-beam deactivation monitoring with D-beam, was repeated 4 times. 2. The three male rabbits were made a 2.5 cm of craniotomy window. 10days after surgery, they received the 15-min of transcutaneous BW-US (400 kHz, DC 20%, Ispta 0.70 W/cm2) from the craniotomy window. All animal brains were estimated histologically.
Results: 1.None of the monkeys showed neuropathological damage after sonication. 2. In rabbit, amyloid precursor protein positive axons in white matter and alpha-B crystallin positive astrocytes in cortex were observed which was similar to a diffuse axonal injury.
Discussion: One of the hemorrhagic causes in the TRUMBI trial is high effective mechanical index (eMI) over 2.0. There was no brain damage in monkey brain by developed probe at eMI=0.42. According to McDannold, the eMI threshold of the disruption in rabbit BBB by BW-US is 1.38. In our rabbit study, the similar traumatic change appeared at the eMI=1.56 by BW-US. It suggests that high eMI at brain induce traumatic damage.

Key words: *mechanical index, neuropathology, safety, sonothrombolysis.*

P43

ULTRASOUND-ENHANCED SYSTEMIC THROMBOLYSIS FOR ACUTE ISCHEMIC STROKE

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Objective: It is supposed that Transcranial Doppler ultrasonography (TCD) during thrombolysis may help to expose thrombi to tissue plasminogen acPvator (t-PA). The aim of this study is to determine if TCD can safely enhance the thrombolyPc acPvity of t-PA.
Material and Methods: Patients with acute ischemic stroke which fufill current criteria to intravenous t-PA treatment were randomly assigned to receive continuous 2 MHz TCD (the target group) or placebo (the control group). In follow up analysis, outcomes are defined as good (as indicated by a score of 0 to 2 on the modified Rankin scale) or favorable (scores of 0 to 1 on modified Rankin Scale).
Results: A total of 108 patients were enrolled to receive continuous ultrasonography (57 patients) or placebo (51 patients). The mean age was 64 in TCD group and 63 years in control group. Mean NIHSS score at admission was 13 in TCD group and 17 in control group. Good outcome was observed in 26 patients in the target group (45,6%) as compared with 19 patients in the controlgroup (37,3%). A favorable outcome occurred in 25 patients in the target group (43.9%) as compared with 15 patients in control group (29.4%).
Discussion: In spite of results without significant statatistical difference (p=0,136), a trend to bether recovery was observed in the target group. TCD may have a role in the improvement of outcomes of patients submitted to thrombolytic approach.

Key words: *acute ischemic stroke, patients prognoses, thrombolysis, ultrasound-enhanced.*

P44

DEVELOPMENT OF THROMBUS-TARGETING BUBBLE LIPOSOME FOR DIAGNOSTIC AND TPA THROMBOLYSIS ACCELERATION

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Objective: The combination thrombolysis therapy with recombinant tissue plasminogen activator (rt-PA), microbubbles and ultrasound, was reported higher recanalization ratio in ischemic cerebrovascular disease. Ultrasound and microbubbles vibrate the fibrin net and accelerate thrombolysis. Recently, we developed novel liposomal submicron bubbles (Bubble Liposome (BLs)) containing ultrasound imaging gas, perfluoropropane. In this study, we developed BLs with Arg-Gly-Asp (RGD) sequence-containing peptides, which bind to the activated platelet glycoprotein IIb/IIIa complexes. The aim of this study was to examine the enhancing effects in ultrasonic thrombus imaging using these targeted BLs in vitro and in vivo.
Material and Methods: Liposomes composed of 1,2-distearoylphosphatidylcholine (DSPC) and N-[(3-Maleimide-1-oxopropyl)aminopropyl polyethyleneglycol-carbamyl] distearoylphosphatidyl-ethanolamine (DSPE-PEG-Maleimide) were manufactured, and RGD sequence contained peptide (CGGcyclic(RGDfK)) was attached liposomes by a covalent coupling reaction between cysteine and DSPE-PEG-Maleimide. RGD conjugated liposomes were sonicated with perfluorocarbon gas to form RGD-BLs. In vitro, rat activated platelets binding ability of RGD conjugated liposomes or RGD-BLs was evaluated with flowcytometry, or confocal laser scanning microscope. In vivo, thrombus accumulation ability of RGD-BLs was detected by ultrasonic diagnostic equipment (VEVO2100) on the ferric chloride induction thrombus in rat left CCA.
Results: In vitro, RGD conjugated liposomes or RGD-BLs were observed more effective binding to platelets by flowcytometry or confocal laser scanning microscope. In vivo, RGD-BLs treated group was detected higher echo signal on CCA thrombus compared with non-targeted BLs treated group.
Discussion: RGD-BLs represents a novel echo contrast agent, which can markedly enhance ultrasounic thrombus imaging in vitro and in vivo, and may be useful for noninvasively diagnosing acute thrombotic vessel occlusion and thrombolysis acceleration.

Key words: *bubble liposome, RGD-peptide, thrombus imaging, ultrasound.*

P45

INTRAOPERATORY ULTRASOND IN PATIENTS WITH ARNOLD CHIARI TYPE 1

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Objective: Arnold Chiari type I malformation is narrowly defined when the tonsils of the cerebellum extend below the foramen magnum, leading to a variety of neurological symptoms. Optimal treatment for patients with Arnold Chiari type 1 is not yet well established, especially when associated with syringomyelia. Isu et al (1993) described surgical decompression technique without performing the dural opening. Mushim and Frimm (2000) concluded more reliable reduction in the syringomyelia when duraplasty technique was applied, however some of these patients developed cerebrospinal (CSF) leaks and meningitis. Currently there are no data to determine which patients with Arnold-Chiari I malformation would benefit from the removal of the bone structure alone without the need for duraplasty.
Material and Methods: 49 symptomatic patients with Arnold Chiari tipe 1 were underwent to surgical treatment. Patients underwent craniotomy with removal suboccipital arch of C1. Intraoperatory ultrasound was performed to measure retrocerebellar space and pulsatility Doppler technique to

measure CSF flow after suboccipital craniotmy. Patients with CSF flow above 3 cm/s were not subjected to dural opening. Patients with CSF flow below 3 cm/s were submitted to duroplasty technique. All patients were evaluated for the development of neurological symptoms and with MRI flow study 6 months after surgery.
Results: 69% of patients CSF flow presented above 3 cm/s and were not submitted to duraplasty. 6% of patients submitted to duroplasty developed CSF leaks. The outcome of patients was considered favorable as the clinical improvement or stabilization of symptoms (87% and 88% of the patients with or without duroplasty respectively).
Discussion: Intraoperatory Doppler CSF flow measure may be effective in the selection of patients who benefit from bone decompression isolated.

Key words: *Arnold Chiari type 1, duroplasty, intraoperatory ultrasound.*

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ULTRASOUND NAVIGATION IN NEUROSURGERY – FIELDS OF APPLICATION AND SURGICAL RESULTS

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Objective: For more than two decades the neuronavigation was successfully used in the neurosurgery. Some shortcomings of the method have evoked the need of an appropriate intraoperative imaging to compensate for the registration and shifting bias and the intraoperative ultrasound is found to be a good option. To analyze the results of the usage of intraoperative ultrasound combined with neuronavigation in different fields of neurosurgery.
Material and Methods: Between the years 2008 and 2013, 240 surgeries under ultrasound/navigation guidance were performed in the Department of Neurosurgery of the MMA – Sofia. Patients were at an average age of 54±14.26 years, harboring oncologic (91.3%), vascular (6.7%), inflammatory (1.3%) and congenital (0.8%) diseases. Integrated ultrasound navigation system (Sonowand Invite) was used intraoperatively in different modes: ultrasound only – in 46cases; 3D ultrasound registration – in 72 cases; "classic" neuronavigation (based on preoperative images) – in 15cases; and ultrasound-based navigation – in the rest 107 (45%) cases. The Power Doppler and Color Doppler capabilities of the ultrasound scanner were used in 64 of the exams, mostly for vascular disorders and highly vascularised tumors.
Results: Metastases (90 pts) and glial tumors (90 pts) prevailed among the oncologic cases, followed by meningiomas (24 pts). In 152 surgeries (69.4%) a total resection was achieved and in 6 cases (2.7%) with low-grade astrocytoma – a supratotal resection with perfect functional outcome. Among the vascular diseases, 6 out of 8 aneurysms were successfully clipped and one was "trapped". All of the AVMs (2 pts) were totally excised. The complication rates were comparatively low with mostly transient neurologic worsening (26%) and only 9% surgical complications. The overall mortality for the series was 5%.
Discussion: The intraoperative ultrasound, combined with neuronavigation, appears to be a useful tool in the hands of the experienced surgeon in different neurosurgical fields when properly used and with caution on indications.

Key words: *complications, neurosurgery, surgical results, ultrasound navigation.*

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ULTRASONIC EVALUATION OF ACETAZOLAMIDE VASOREACTIVITY IN BRAIN TISSUE AND MAJOR CEREBRAL ARTERIES

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Objective: In order to evaluate cerebrovascular reserve capacity in the brain tissue, acetazolamide (ACZ) cerebrovascular reactivity (CVR) has been measured in major cerebral arteries by transcranial Doppler sonography. This has shown some correlation with CVR in the brain tissue, as measured by neuroradiological modalities.
We have evaluated ACZ CVR in the brain tissue by transcranial power modulation imaging (PMI) and correlated with transcranial color duplex sonography (TCDS) observed CVR in the major arteries.
Material and Methods: Time-averaged maximum velocity (Vmax) in the middle/posterior cerebral arteries (MCA/PCA) was measured by TCDS before/after ACZ. After a bolus intravenous Levovist®, transcranial PMI was evaluated via temporal windows in 11 patients without and 10 patients with a transducer holder (Sonopod). Peak intensity (PI) and time to PI (TPI) before/ after ACZ were measured and CVR calculated on the basis of time-intensity curves in five regions of interest; bilateral basal ganglia (BG) and thalamus (Th), and contra-lateral temporal lobe (TL). Correlations between Vmax and PI/TPI in the corresponding vascular territories were evaluated before/after ACZ and in CVR.
Results: 1) Both before/after ACZ, Vmax in the ipsilateral MCA and PCA correlated closely with PI/TPI in the ipsilateral BG/TL and Th, respectively. 2) Easily disrupted PI/TPI CVR resulted in poor correlations with Vmax CVR. 3) Much closer CVR correlations were not always identifiable, despite utilization of the Sonopod.
Discussion: 1) Regardless of the use of time- or intensity-dependant parameters or a transducer holder, the tendency of close ACZ relationships between brain tissue perfusion and velocity changes in the major arteries remains unchanged. 2) Easily disrupted CVR in the brain tissue due to intraparenchymal lesions resulted in poor correlation with CVR in the major arteries.

Key words: *acetazolamide vasoreactivity, color duplex sonography, power modulation imaging.*

Poster Session II–2. Non-vascular Ultrasound Neuroimaging and Laser Doppler

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SUBSTANTIA NIGRA ECHOGENICITY IS CORRELATED WITH NIGROSTRIATAL IMPAIRMENT IN MACHADO-JOSEPH DISEASE

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Objective: Several studies have demonstrated increased substantia nigra (SN) in Parkinson's disease (PD), and Machado Joseph disease (MJD). Pathological substrate of PD is characterized by dopaminergic nigrostriatal cell loss, also found in MJD. Also, SN hiperechogenicity might be associated with nigrostriatal disfunction in PD, when comparing dopamine transport binding with SN echogenicity. The present study aimed to correlate the SN echogenicity size and striatal dopamine transporter density in MJD patients.
Material and Methods: We performed TCS in 30 subjects and spect with (99mm TC) - TRODAT-1 in 18 subjects with MJD. Fifteen healthy subjects matched for age and gender formed control group. TCS and (99mm TC) -TRODAT-1 SPECT findings both MJD patients and control group subjects were compared.
Results: There were no differences regarding age (p=0.358) or gender (p=0,566) between groups (MJD versus control group). Mean DAT binding potentials and SN echogenicity were significantly different between groups. There was significant negative correlation with regard to the SN echogenic size and the ipsilateral striatal TRODAT 1 uptake: the higher SN echogenicity, the lower DAT uptake in the isilateral cerebral hemisphere.
Discussion: Increase in SN echogenic size likely correlates with presynaptic dopaminergic nigrostriatal in MJD, suggesting a concurrent in vivo pathophysiological mechanism.

Key words: *brain ultrasound Dupplex, Machado Joseph disease, substantia nigra echogenicity, TRODAT.*

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A SEMI-QUANTIFIED EVALUATION OF SUBSTANTIA NIGRA HYPERECHOGENICITY IN PARKINSON'S DISEASE AND PARKINSONIAN SYNDROME

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Objective: In Parkinson's disease (PD), transcranial sonography (TCS) has been used to evaluate substantia nigra (SN) hyperechogenicity as a diagnostic tool. To quantify SN hyperechogenicity in patients with PD and Parkinsonian syndrome (PS), we applied semi-quantified evaluation method.
Material and Methods: Hospitalized patients with PD (n=28) and patients with PS (n=17) and in-hospital controls (n=10) were included. The PS group consisted of patients with progressive supranuclear palsy (n=7) and multiple system atrophy (n=10). TCS was performed using a conventional transcranial Doppler sonography equipped with 2.5 MHz transducer. The SN was identified within midbrain, and then the area of echogenic signals was encircled and measured according to Berg et al. Next, echogenic signal of SN and dorsal midbrain were converted into grayscale using Adobe Photoshop and a median value of SN and dorsal midbrain on histogram was obtained. The SN to dorsal midbrain ratio was calculated.
Results: The PD group (4.1±3.7) showed increased SN to dorsal midbrain ratio compared with that in PS group (1.7±0.9) and controls (1.8±1.1). The area of SN hyperechogenicity was larger in PD group (0.19±0.11 cm^2) than in PS group (0.07±0.07 cm^2) and controls (0.05±0.07 cm^2). Both measurement of the SN hyperechogenic area and semi-quantified evaluation of SN echogenicity using SN to dorsal midbrain ratio showed good discrimination of PD from PS.
Discussion: Semi-quantified evaluation of SN echogenicity using SN to dorsal midbrain ratio is comparative to the previously reported method by Berg et al, measurement of the SN hyperechogenic area, and it may be useful in differential diagnosis of PD from PS.

Key words: *Parkinson's disease, Parkinsonian syndrome, substantia nigra, transcranial sonography.*

P50

ULTRASONOGRAPHY IN DIAGNOSING THE CAUSE OF PAPILLOEDEMA

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Objective: Papilloedema is a difficult dillema to solve due to the different possible causes. The objective of our study is to present a difficult case of unilateral papilloedema.
Material and Methods: We used complete ophtalmologic examination including Visual acuity, perimetry, fluorecein angiography, OCT, ultrasonography and MR in trying to solve a difficult case.
Results: We present a rare case of a young mother who has

a unilateral papilloedema one month after birth and a rapid drop of the visual acuity. She was diagnosed with FA and OCT which could not give concrete information about the cause of the edema. We speculated of inflammatory reason as well as thrombotic cause. The ultrasonography and MR confirmed the inflammatory genesis.
Discussion: Although complex examinations are a must in difficult cases ultrasonography can provide essential information for the cause of the disease.

Key words: *papilloedema, ultrasonography.*

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ULTRASOUND IMAGING OF CHRONIC BLAST EYE TRAUMA: A CASE REPORT OF CHARLES BONNET SYNDROME

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Objective: To demonstrate the diagnostic abilities of multimodal 2D/3D/4D ultrasound imaging of chronic blast eye trauma associated with full blindness.
Material and Methods: A 31-year-old man with amaurosis after eye blast trauma at the age of 17, underwent multiple operations and different eye-procedures (including a silicon vitreous filling) was studied by parallel application of multimodal 2D/3D/4D ultrasound eye-imaging, electroencephalography, visual and auditory evoked potentials, CT and MRI.
Results: Neuro-ophthalmological status showed chronic traumatic damage of both eyes with complete blindness. The right eye was with pars plana vitrectomy and corneal leucoma and the left bulb was with phthisis. Ocular fundus was not visible on both sides. The 2D/3D/4D eye images showed severe deformation of the left eye with chronic retinal detachment and optic nerve atrophy. The right bulb was fully anechoic, with a normal shape but no images of the lens, optic disc and optic nerve were obtained due to silicon filling of the vitreous. Both ophthalmic arteries and veins had normal ultrasound pattern. The EEG repetitive visual stimulation and visual evoked potentials were associated with color hallucinations during and after the investigation (Charles Bonnet syndrome). These findings correlated with neuroimaging studies where normal occipital cortex, optic nerve atrophy and severe eye deformation were found.
Discussion: The multimodal ultrasound eye imaging can be used as a reliable non-invasive method for screening and topic diagnosis of chronic eye injury.

Key words: *blast eye trauma, Charles Bonnet syndrome, ultrasound.*

P52

CORRELATIVE ELECTROMYOGRAPHIC AND MULTIMODAL ULTRASOUND IMAGING STUDIES OF CALF MUSCLE LESIONS

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Objective: To summarize our experience in parallel electromyographic (EMG) and multimodal ultrasound imaging studies of calf muscle structure and function in patients with different neurological and non-neurological disorders.
Material and Methods: Different types of triceps surae (TS) muscle disturbances due to traumatic injury, genetic disorders, peripheral neuropathy, chronic spastic hemiparesis, venous pathology and combined hemiparesis after cervical and lumbar spinal surgery were evaluated by EMG and electroneurography. The findings were juxtaposed to corresponding images obtained by simultaneous multimodal 2D/3D/4D myosonography in rest, during maximal plantar flexion and electrical stimulation. The results were compared to EMG findings and myosonograms of healthy persons.
Results: Typical EMG findings and calf muscle architectonics were found in relation to the location, type and severity of TS lesions, muscle fibers contractility, degree of muscle atrophy, fat tissue infiltration, fibrosis and vascularisation. Both methods give the opportunity to evaluate possible discrepancy between peripheral nerve damage and associated functional muscle changes.
Discussion: The combined use of EMG and myosonology is superior to the single application of each of both methods providing additional information about the structural and functional changes of calf muscles in normal and pathological conditions.

Key words: *electromyography, myosonology, triceps surae muscle.*

P53

CLINICAL, INTRAOPERATIVE AND MULTIMODAL ULTRASOUND IMAGING STUDY OF FACIAL MELANOMA

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[6]Faculty of Medicine, Sofia University St. Kliment Ohridski – Sofia, Bulgaria

Objective: To demonstrate the diagnostic abilities of multimodal ultrasound imaging and its correlation to clinical, intraoperative, histological and CT imaging in a rare case of facial malignant melanoma.
Materials and Methods: A 39-year-old man with a tumor formation in the left facial half was evaluated preoperatively with clinical, CT and multimodal (2D/3D/4D) ultrasound imaging with B-flow. The data were compared with the intraoperative and histological findings.
Results: The tumor infiltrated the soft tissue of the whole left facial half and was with sandglass-shape. It did not involve the facial bones. CT showed tumor formation with dense structure and weak vascularization. The multimodal ultrasound imaging presented heterogenic structure, part of which was less vascularized, with a distinct capsule and pseudocysts areas. The hiistological diagnosis was advanced malignant melanoma. A high correlation between ultrasound pattern and tumor histology was established before and after surgery.
Discussion: The multimodal ultrasound imaging is a reliable non-invasive method for facial tumor diagnosis providing additional information for tumor morphology and vascularisation. It could be used for intraoperative navigation to reduce possible perioperative complications.

Key words: *facial melanoma, ultrasound imaging.*

P54

ASSESSMENT OF MICROVASCULAR CHANGES IN HAND-ARM VIBRATION SYNDROME

Z. Stoyneva

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Objective: To assess microvascular morphological and functional changes in patients with hand-arm vibration syndrome (HAVS).
Material and Methods: Thirty HAVS patients and 30 healthy controls were included. After acclimatization, all subjects underwent nailfold capillaroscopy (NFC) and infrared thermography followed by laser Doppler flowmetry measurement. NFC was performed with a microscope under 10× to 20× magnification in the eponychium of the fingers. Skin blood flow of the volar part of the fingertips was measured using laser Doppler flowmeter Periflux4001 at baseline and by lowering the arm from heart level hanging to test skin venoarteriolar microcirculatory responces.
Results: Spastic narrowed capillaries or capillary dilatation and tortuosity with pericapillary oedema prevailed in the HAVS patients ($p<0.001$). The initial mean fingertip skin perfusion and skin temperatures in HAVS patients were significantly lower compared to the healthy controls. The veno-arteriolar indices were significantly abnormal. Loss of veno-arteriolar reflex responses was established in 36.7% of vibration induced secondary Raynaud's phenomenon patients proving local vasomotor dysfunction reflecting either postganglionar sympathetic insufficiency with vascular tone failure or altered microvascular smooth muscle cells' responses. A negative correlation was found between increasing capillary abnormalities and decreasing flow rates at rest and skin blood flow responses in venoarteriolar reflex test.
Discussion: Morphological and functional assessment of the cutaneous microvasculature has a crucial significance for diagnosis, prognosis and therapy of patients with hand-arm vibration syndrome.

Key words: *capillaroscopy, hand-arm vibration syndrome, laser Doppler flowmetry, microcirculation.*

P 55

REDUCED CUTANEOUS MICROVASCULAR REACTIVITY IN DIABETES MELLITUS TYPE 2

Z. Stoyneva

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Objective: to investigate skin vasomotor reflex responses in type 2 diabetic patients using laser Doppler flowmeter (LDF).
Material and Methods: Skin blood flow was measured at the first tiptoe of each foot of 89 patients with type 2 diabetes mellitus and of 44 healthy controls during: local heating to 440C; venoarteriolar test by measuring sympathetic axon-reflex microcirculatory responses to foot lowering; reactive hyperemia test using laser Doppler flowmeter Periflux4001.
Results: The initial mean skin perfusion of the tiptoes in supine position were higher in the diabetic patients compared to the healthy controls ($p<0.0001$). Significantly reduced skin blood flow responses to local heating were measured. A tendency to increasing instead of decreasing of perfusion values during leg lowering was established and venoarteriolar indices proved significantly decreased sympathetic axon-reflex vasoconstrictor responses. The postischemic endothelial-dependent dilator flux responses and hyperemic peak of the tiptoe skin perfusion were significantly decreased in the diabetic patients.
Discussion: Abnormally reduced cutaneous microvascular reactivity was established in type 2 diabetes mellitus. Laser-Doppler flowmetry is an easy contemporary non-invasive method for investigation of skin microcirculation and vasomotor reactivity.

Key words: *diabetes mellitus, laser Doppler flowmetry, microcirculation.*

Satellite Poster Session. General Neurology

P56

EPIDEMIOLOGICAL AND GENETICS ASPECTS OF MULTIPLE SCLEROSIS IN LATIN AMERICA

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National Institute of Neurology and Neurosurgery – Mexico City, Mexico

Epidemiological and genetic studies suggest that the prevalence, median age of onset, and specific phenotypes of MS are different in Caucasians and Latino Americans.
Recent epidemiological studies indicate an increase in MS prevalence in LA, where the south–north gradient of latitude described for Nordic countries does not exist.
Analysis of MS epidemiological and specific aspects in LA suggests that susceptibility and clinical behavior of the disease are related to mixtures of genes in the population.
LA is a vast geographical territory of the Americas (approximately 21,069,500 km^2), where languages derived from Latin are primarily spoken. It extends from the southern limit of the USA (latitude 328 north) to the Antarctic (latitude 568 south).
Its population is around 580 million people and its geographical subregions include North America, Central America, the Caribbean, and South America.
Studies in LA report high frequency of visual and spinal abnormalities at onset and during the course of MS and a higher frequency than expected for neuromyelitis optica.
Other clinical studies suggest that MS manifestations in LA are generally similar to the classic (or Western) forms of the disease.
In LA, MS appears to develop in racial groups of mixed European-Amerindian and European-African ancestry (Mestizo) as well as in Caucasian patients, rather than in unmixed Amerindians, perhaps in relation to the mongoloid genes in the latter group.

Key words: *genetics, Latin America, multiple sclerosis, neuroepidemiology.*

P57

DYSREGULATION AND ITS CLINICAL SIGNIFICANCE

D. Pankov, T. Pankova

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Objective: To study central nervous system changes in patients with vascular and autonomic nervous system disorders.
Material and Methods: Electroencephalography, ultrasound Dopplerography and rheoencephalography were used.
Results: Revealed disorders of blood circulation as a result of cerebral dysregulation.
Discussion: Different approaches for treatment of vascular disorders caused by cerebral dysregulation are discussed.

Key words: *adolescents, cerebral dysfunction.*

P58

THROMBOLYTIC THERAPY – RESULTS AND PROBLEMS

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Objective: The aim of the present study is to describe the results and the problems in evaluation of the thrombolytic therapy for management of acute ischemic stroke in the Second clinic of Neurology with Intensive Neurology Care Unit .
Material and Methods: One hundred twenty two patients (mean age 68.3±7.2 years) with acute stroke, hospitalized in the period between 01.08.2009 and 31.05.2013 were studied. The following factors: time between onset of symptoms, NIH-stroke scale, Rankin score were recorded on the admission and three months after dehospitalisation. The relationship between the time of diagnosis of ischaemic stroke and the time of treatment was studied.
Results: The first thrombolysis in Varna was done in Second Clinic of Neurology on April 2007. Until December 2009 were implemented 20 thrombolyses. The problems of organisation and management are described. The main technical difficulties and findings in preparation were pointed out. From December 2009 to May 2013 significantly was decreased “door to niddle time” through the good management of stroke patients.
Discussion: Stroke is an emergency. The effective treatment of stroke already exists - thrombolytic therapy. For optimal treatment exists a therapeutic window. Thrombolysis lead to decrease of disability and mortality.

Key words: *management of ischemic stroke, thrombolysis.*

P59

OUR EXPERIENCE WITH ENDOVASCULAR TREATMENT OF BRAIN ANEURYSMS AND AVMS

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Endovascular treatment of brain aneurysm and AVM’s is

minimally invasive method performed to block or stop blood flow into the pathological vessels and to prevent main complications. In these procedures are used different technical devices like platinum coils, stents, occlusion ballons , liquid embolizants and etc.
The last 15 years endovascular technics shown significant progress and development in treatment of brain vascular malformations.
Endovascular treatment in Bulgaria has been performed since 2007 under supervision of foreign specialists. We present our experience and will show our cases from the last year – methods, strategy and the follow up.

Key words: *brains aneurysm, brains AVM, embolization, endovascular procedure.*

P60

ORTHOSTATIC REACTIVITY IN PATIENTS WITH DIABETIC NEUROPATHY

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Objective: To assess the effect of a structured physical therapy (PT) programme on the orthostatic reactivity in patients with diabetic neuropathy (DNP).
Material and Methods: The study was performed in 90 patients with DNP (38 male and 52 female, mean age 60.8±7.8 years) of lower extremities. The orthostatic autoregulation was evaluated using an active orthostatic test. The arterial blood pressure and the heart rate were determined after 10 minutes of rest in lying position before and after 1, 5 and 10 minutes of active standing. All patients had therapy with alpha-lipoic acid and a structured intensive 10 days PT program, later continued as a home exercise programme. The orthostatic autoregulation was evaluated three times – at the start of the study, at day 10 and at week 6 after the beginning of PT. The classification of Thulesius was used to divide the patients into 3 groups according to the type of their orthostatic reactivity.
Results: At the start of the study a normotonic orthostatic reactivity (NOR) was observed in 32 patients. Abnormal sympathicotonic type of orthostatic reactivity (SOR) was found in 18 patients and asympaticotonic type of orthostatic reactivity (AOR) was established in the remaining 40 patients.
Discussion: After the PT treatment a significant improvement of the orthostatic autoregulation in the groups with SOR and AOR was found – NOR was observed in 66 patients with DNP (80.3%) at 6 weeks after the start of PT.

Key words: *exercise therapy, orthostatic tolerance, physical therapy, type II diabetes.*

P61

EARLY PHYSIOTHERAPY INTERVENTION FOR PRETERM NEONATES WITH HYPOXIC IMPAIRMENT OF THE CENTRAL NERVOUS SYSTEM

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Objective: The goal of this paper is to evaluate whether early physiotherapy intervention (EPI) that started immediately after birth has a positive outcome for premature neonates with hypoxic impairments of the central nervous system (CNS) who are at risk of developing motor disorders.
Material and Methods: The study is prospective and includes preterm neonates born at the Neonatal Department of the Regional hospital in Ruse, Bulgaria. The newborns are with hypoxic impairments of the CNS and are split into two groups. The first group includes those neonates whose parents signed a written consent form and had an EPI that started immediately after birth and lasted until the infant was 3 months old and released from the Neonatology department. The mothers are trained and perform the physiotherapy techniques at home. This paper presents the precise EPI techniques that are being used. The second group includes the neonates without EPI. Neurodevelopment tests are performed at the age of 1, 2 and 3 months after birth to the neonates from both groups in order to access the efficiency of the EPI.
Results: The neurodevelopment and motor development tests performed to both groups of preterm neonates show considerable improvement in the motor development of those neonates with EPI that started immediately after birth.
Discussion: Neonate's brain has high plasticity after birth and great opportunities for recovery. Thanks to this fact premature neonates with hypoxic impairments of the CNS and at risk of developing motor disorders have better motor outcomes if they have EPI that started within the first days after birth.

Key words: *early physiotherapy, hypoxic impairment, premature neonates.*

P62

FUNCTIONAL INDEPENDENCE IN PATIENTS WITH ISCHEMIC STROKE IN THE CHRONIC PERIOD

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Objective: To investigate the influence of the specialized physical therapy on functional independence and to compare the impact of usual physical therapy in patients with ischemic stroke in the chronic period.
Material and Methods: The study included 10 patients / 6

in the experimental and 4 in the control group, 6 men and 4 women with chronic right-sided and left-sided hemiparesis after ischemic stroke within 3 months. Subjects were evaluated on performance test of functional independence / FIM / at the beginning, of the 10th day, 1st month and 3 months.
We used two exercise methods: specialized physical therapy methodology (SPTM) applied in the experimental group (EG) and usual physical therapy methodology applied in the control group (CG). SPTM was developed by us based on principles of motor control, motor learning and contemporary guidance to neurodevelopmental treatment (NDT). Patients from EG after 10-day daily physical therapy continued with adapted program for home rehabilitation and requirements for it.
Results: The difference in FIM-assessments at the beginning between CG (3.79) and EG (4.31) groups was not significant (p>0,05). On the 10th day, FIM-assessment in the EG (5.81) was significantly greater (p<0,01) compared to CG (4,38). On 1 months, FIM-evaluation in EG (6.46) was significantly greater (p<0,001) in comparison to that of the CG (4.29). At 3 months, the FIM-evaluation in EG (6.81) was significantly greater (p<0,001) in comparison to that of the CG (4.13).
Discussion: The physical therapy applied by us, continued later as an exercise program at home, that significantly improves functional independence in patients with ischemic stroke in the chronic period.

Key words: *exercise therapy, functional independence, ischemic stroke, physiotherapy.*

P63

INFLUENCE OF EARLY PHYSICAL THERAPY PROGRAM IN PATIENTS WITH ACUTE ISCHEMIC STROKE

K. Grigorova-Petrova, D. Lubenova, A. Dimitrova

National Sports Academy Vassil Levski – Sofia, Bulgaria

Objective: To study the effect of application of the feedback breathing device and therapeutic exercises on motor deficits and respiratory disorders in patients with ischemic stroke.
Material and Methods: Ten patients (NIHHS – up to 14 points, Glasgow-Liege scale – 20 points) with acute ischemic stroke were studied. Changes of trunk control (Trunk Kontrol Test), pulmonary function (spirometry), inspiratory capacity (feedback breathing device for inspiratory training) were measured before and after physical therapy program.
Results: Respiratory training of breathing disorders improves pulmonary function – forced vital capacity, forced expiratory volume 1 sec (%), peak expiratory flow and inspiratory capacity. The methodology of physical therapy improves trunk control and body transfer of stroke patients in the clinical setting.
Discussion: Using a feedback breathing device is possible in patients with ischemic stroke in the clinical setting. The study revealed that physical therapy program is beneficial for recovery in-hospital patients with acute ischemic stroke.

Key words: *breathing device, exercise, stroke.*

P64

CORRECTION AND EVALUATION OF MOTOR IMPAIRMENT IN MULTIPLE SCLEROSIS PATIENTS USING BIOFEEDBACK

A. Ryazantseva, V. Alifirova, N. Brazovskaya, A. Pribilskaya

SibGMU – Tomsk, Russia

Objective: Correction of motor disorders in patients with multiple sclerosis using biofeedback training.
Materials and Methods: The study involved 9 patients with a documented diagnosis of MS with pyramidal and cerebellar symptoms. In 5 (55.5%) patients diagnosed with remitting type of the disease (RRMS) in 4 (44.5%) – secondary progressive (SPMS). Disease duration 14,5 ±5,2 years, in 4 patients (44.5%) are dominated by the pyramidal disorders, 2 patients (22.2%) – cerebellar disorders, equal severity - in 3 patients (33.3%). During biofeedback training used an individual approach and the optimal set of exercises based on their patient's complaints and clinical manifestations of the disease. exercises were aimed at forces operating time in the paretic muscle (quadriceps) and the development of coordination in the hand. For biofeedback training uses a hardware-software complex Reakor.Until and after the course sessions of biofeedback therapy was assessed quality of life (SF-36), the evaluation of disease impact profile (SIP) and the fatigue scale (FSS). For the processing of the results of the program were used for statistical analysis SPSS 11.5 and Statistica 6.0.
Results: In the treatment group showed a statistically significant dynamics of (non-parametric Wilcoxon test for paired comparisons) decreased fatigue rating scale FSS (p<0,05), increased motor control SIP2 (p<0,05), physical (p<0,05) and psychological (p <0,05) component health.
Discussion: The positive results of the application of biofeedback therapy in patients with MS to support the use of this method in the complex rehabilitation measures for the correction of motor and psycho-emotional disorders.

Key words: *biofeedback, MS.*

P65

COMPARISON OF CLOSED AND OPEN KINETIC CHAIN EXERCISE IN PATIENTS WITH PARKINSON'S DISEASE

A. Dimitrova, D. Lubenova, Kr. Grigorova-Petrova

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Objective: The purpose of the survey is to study the effect of two physical therapy (PT) programs in patients with Parkinson's disease (PD).
Material and Methods: Two groups of patients suffering from PD were studied. Each group consists of 8 subjects. In the first group A exercises in open kinetic chain were applied. In the second group B exercises in closed kinetic chain were applied. Both groups participated in 25 PT exercise sessions.
Results: Stage of PD, motor ability, activities of daily living, number of steps for 10 meters, fine movements, postural

stability, TUG and hemodynamic changes have been studied before and after therapeutic exercise course of treatment.
Discussion: In the patients of both groups a significant improvement was observed. In group A better results were shown in daily activities, motor ability and TUG, while group B improved more significantly the following parameters: fine movements, static balance and gait.

Key words: *parkinson's disease, physical therapy.*

P66

WEB-BASED INTERACTIVE SIMULATION OF A CLINICAL CASE WITH PARKINSON'S DISEASE

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Objective: To facilitate implementation of problem-solving oriented e-learning, the aim is to develop a Web-based interactive clinical case with a virtual patient with Parkinson's disease to be solved by the Bulgarian and English speaking preclinical medical students at the Medical University of Sofia.
Materials and Methods: The Web-based programs for simulation of virtual patients are written in PHP and JavaScript languages. Data arrays include current situations, questions, suggested decisions, comments, decision weights and data for navigation through the steps of the problem-solving process.
Results: The Web-based program for simulation of the virtual patient displays the case history, data from physical examination, laboratory tests, other investigations, diagnosis making, discussion of disease mechanism, therapy, case-specific help with reference values, links to internal or external sources and additional information. To solve the case, the students choose decisions among suggested ones or enter their independent decision via the keyboard. The feedback is after each chosen decision in the form of detailed comments.
Discussion: Initial questions accentuate on the dopamine deficiency as the major pathobiochemical symptom and on the causes for neurons degeneration in substantia nigra and other brain areas. Knowledge of the synthesis and degradation of dopamine is necessary to understand the mechanisms of neuroprotection and delaying the disease progression via treatment with anticholinergic agents or dopamine precursors in combination of inhibitors of the peripheral DOPA decarboxylase. The program allows the students to understand and learn about the action of MAO and COMT inhibitors, dopamine agonists, and drugs increasing dopamine concentration in the synapses or inhibiting back uptake of dopamine. The harmful action of reserpine and neuroleptics is also considered. Solving the case is useful for future clinical activities. The case shows the possibility for better future collaboration between preclinical and clinical disciplines.

The financial support of the Council of Medical Science at Medical University – Sofia is gratefully acknowledged (Grant 10-2012/17.07.2012).

Key words: *interactive virtual patient, parkinson disease.*

P67

CLINICAL STUDIES OF THE EFFECTS OF ARTIFICIAL TECHNOGENIC ELECTROMAGNETIC RADIATION WHEN REGISTERING BRAIN ACTIVITY WITH AN EEG

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Moscow State University of Medicine and Dentistry – Moscow, Russia

Objective: Identify, describe and make a list of artifacts that are caused by a wide range of electromagnetic radiation: from 3 to 3000 MHz.
Materials and Methods: Original method of research (has no analogues in clinical practice) has been developed.
Nihon Kohden donates equipment for research; Volynskaya Bolnica Hospital #1 of the Department for Presidential Affairs of the Russian Federation provides support in the format of advisers and equipment; Center of Speech Pathology and Neurorehabilitation provides support in the format of advisers; The Ministry of Education and Science of the Russian Federation provides administrative support.
Results: Systematized and described artifacts identified for further development of methods of the electroencephalogram in the presence of the background of technogenic electromagnetic radiation.
Discussion: At present portable EEG-devices are widely used. The influence of artificial electromagnetic radiation (EMR) is actual for the quality of recording brain activity. A lot of artifacts are considered non-physiological artifacts that are caused by a wide range of electromagnetic radiation: from 3 to 3000 MHz. Considering the above, the identification, description and making a list of these artifacts is a priority now. It will make it possible to create a software filter for EEG-systems.
Artificial electromagnetic radiations have a major impact on the EEG recording. This fact prevents an accurate diagnosis. Original method of research (has no analogues in clinical practice) has been developed. That will allow recording the EEG in any unprepared urban environments to create a method of excluding impacts to the above.

Key words: *artefact, EEG, EMR, functional diagnostics.*

P68

SPONTANEOUS SPINAL EPIDURAL AND SUBDURAL HEMATOMA ON TH_6-TH_{10}. A CASE REPORT

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(Student Presentation)

ULTRASOUND TECHNOLOGIES
Challenges Before Young Doctors

Project № BG13/A3.1.2/225/R2

October 15-20, 2013
Park Hotel Moskva – Sofia, Bulgaria

БАНМХ BSNCH
Bulgarian Society of Neurosonology and Cerebral Hemodynamics
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Youth in Action Programme

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ULTRASOUND TECHNOLOGIES – CHALLENGES BEFORE YOUNG DOCTORS

Sofia, 2013

Youth in Action Programme

Project № **BG13/A3.1.2/225/R2**

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Brief Description

ULTRASOUND TECHNOLOGIES
Challenges Before Young Doctors

Project Mission:

Young people go beyond cultural and national differences for a common humanitarian cause: all people are equal before the disease regardless of race, gender and religious differences, all they need help – that's the young doctors' mission!

The project aims to implement training in the field of Medicine in one of the most revolutionary diagnostic methods – ultrasound diagnostics. This method plays a key role in cardiovascular diseases (CVDs) prophylaxis. Target groups of the project are young doctors and medical students who are to raise their awareness on the prophylaxis of CVDs.

The significance of the problem is demonstrated by the fact that within the European Union a number of policy documents have been adopted such as the *(1)Decision of the European Parliament from 2004 on the cardiovascular morbidity* and *(2) Luxembourg Declaration on startup and vigorously strengthening the prevention and prophylaxis and the European Heart Health Charter.* The project is aimed at informing professional audience of young doctors and medical students from the countries that border with the European Union to achieve better prevention by formal and/or informal training and education at all levels of society.

The training is organized in Sofia, October 15-20, 2013 by: Bulgarian Society of Neurosonology and Cerebral Hemodynamics (BSNCH) as host and applicant (Bulgaria), Medical University of Graz (Austria), Georgian Society of Neurosonology and Cerebral Hemodynamics – GSNCH (Georgia) and Serbian National Society for Neuroangiology (Serbia), actively involved in the preparation, planning and implementation of the activities. The cooperation and commitments of each organization are based on existing traditional partnerships within the European and the World Federations of Neurology. The profile and experience of applicant organizations as well as the high qualification and professionalism of the members guarantee the successful implementation of the objectives and high quality of the training. The high academic level of the project is ensured by the support of the leading Bulgarian universities: Faculty of Medicine of Sofia University "St. Kliment Ohridski", Medical University of Varna "Prof. Dr. Paraskev Stoyanov"; Medical University of Pleven, National Sports Academy "Vassil Levski" and Military Medical Academy – Sofia.

The sustainability of the project is guaranteed by the key importance of the topic for the European countries and the World, where the young generation plays a specific role in the promotion of healthy life and prevention of CVDs. The future partnership will be built on ensuring effective follow-up activities, elaboration of national and regional strategies for solving the problem and becoming of the forum a traditional yearly seminar for young doctors. The training includes formal and informal educational methods as workshops, round table discussions, classroom practice, open air activities, etc.

The final product of the training will be targeted at increased competence and adopted methods for each participant individually, which will be assessed through practical exercises and self-assessment methods. Young people will be able to make a self-assessment of the level of their knowledge.

Participants in the training will adopt a Memorandum which will be a base for further development and a message to the political stakeholders for health promotion in their countries.

Timetable

TUESDAY, 15 October 2013

14.00 – 19.00	Hotel Accomodation.
19.00 – 22.00	**Dinner**

WEDNESDAY, 16 October 2013

09.00 – 10.45	Presentation of the Participants.
10.45 – 11.00	**Coffee break**
11.00 – 12.00	Introduction to the Youth in Action Programme. *Representative of National Centre "European Youth Programmes and Initiatives"*
12.00 – 14.00	**Lunch**
14.00 – 17.00	Introduction to the Project Activities. *Project Coordinator: Mr. Yavor Profirov (Bulgaria)*

THURSDAY, 17 October 2013

09.00 – 09.40	Ultrasound Technologies in Medicine. *Project Manager: Acad. Prof. Ekaterina Titianova (Bulgaria)*
09.40 – 11.00	Ultrasound Methods in the Prevention of Socially Important Cardiovascular and Cerebrovascular Diseases. *Moderator: Assoc. Prof. Silva Andonova (Bulgaria)*
11.00 – 11.15	**Coffee break**
11.15 – 12.00	Statistics of CVDs in Partner Countries – Austria, Bulgaria, Georgia and Serbia. *Moderator: Ass. Prof. Marina Alpaidze (Georgia)*
12.00 – 13.30	**Lunch**
13.30 – 17.00	Outdoor activities.
20.00	**Dinner with BSNCH** (Park Hotel Moskva)

FRIDAY, 18 October 2013

09.00 – 19.00	Practice in Ultrasound jointly with NSRG Comprehensive Tutorial (National Palace of Culture). *Facilitators: Dr. Sonya Karakaneva (Bulgaria), Ass. Prof. Milija Mijajlovic (Serbia)*

SATURDAY, 19 October 2013

09.00 – 10.30	Telemedicine – Basic Principles. Exchange of Experience. *Moderators: Mr. Evgeni Karakanovski, M-Tel Marketing Director (Bulgaria), Assoc. Prof. Susana Horner (Austria)*
10.30 – 12.00	Evaluation of Training. *Project Coordinator: Mr. Yavor Profirov (Bulgaria)*
12.00 – 14.00	**Lunch**
14.00 – 15.30	Certification of Participants. Family photo. *Moderators: Acad. Prof. Ekaterina Titianova (Bulgaria), Prof. Kurt Niederkorn (Austria)*
15.30 – 15.45	**Coffee break**
15.45 – 19.00	Social Programme – City Tour to the Cultural and Historic Sites of Sofia.

SUNDAY, 20 October 2013

09.00 – 11.30	Open Debate for Development of a Memorandum. *Facilitators: Ass. Prof. Milija Mijajlovic (Serbia), Mr. Yavor Profirov (Bulgaria)*
11.30 – 12.00	Closing Remarks

Scientific Events 2014

8th World Congress for Neurorehabilitation – WCNR
8 – 12 April, 2014
Istanbul, Turkey
www.wcnr2014.org

19th Meeting of the ESNCH
10 – 13 May, 2014
Rome, Italy
www.esnch.org

17th Congress of the European Federation of Neurological Societies
31 May – 3 June 2014
Istanbul, Turkey
www.wcnr2014.org

8th Symposium on Neuroprotection and Neurorepair
09 – 14 April, 2014
Magdeburg, Germany
www.neurorepair-2014.de

66th Annual Meeting of the AAN
28 April – 03 May, 2014
Philadelphia, USA
www.aan.com/go/home

ESC - European Stroke Conference 2014
04 – 09 May, 2014
London, UK
www.eurostroke.org

Joint Congress of European Neurology (EFNS-ENS)
31May – 03 June, 2014
Istanbul, Turkey
www.efns2014.efns.org

9th FENS Forum of Neuroscience
July 05 2014 – July 09 2014
Milan, Italy
www.fens2014.neurosciences.asso.fr

10th Asian & Oceanian Epilepsy Congress (AOEC)
24 - 27 August, 2014, Singapoure
www.epilepsysingapore2014.org

9th Meeting of the BSNCH
3 – 5 October, 2014
Sofia, Bulgaria
www.neurosonology-bg.com

Author Index

Указания към авторите

Списанието "Невросонология и мозъчна хемодинамика" е официален орган на Българската асоциация по невросонология и мозъчна хемодинамика. То публикува оригинални статии в областта на ултразвуковата диагностика в неврологията, неонатологията и ангиологията, както и актуални проучвания върху мозъчната хемодинамика и други свързани проблематики. Списанието съдържа следните рубрики:

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- кратки научни съобщения – до 4 страници.
- обзорни статии – до 10 страници, включително книгопис.
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- рецензии на нови книги.
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4.1. Измерителни единици – обозначават се по SI системата, десетичният знак се обозначава с точка.

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