

through depiction of both curves and parametric numbers. TIC parameters calculated for each investigation were: max video intensity value (SI peak), Time-To-Peak (TTP), bolus sharpness, and Area Under the Curve (AUC).

The mathematical model implemented in QontraXt, in order to mimic the time propagation of the video signal intensity due to the passage of the UCA, is a Gamma-Variate Function:

$$SI(t) = SI_{peak} \cdot \left[\left(\frac{t}{TTP} \right)^b \times TTP^b \cdot e^{-b \times \left(\frac{t}{TTP} \right)^b} \right]$$

The perfusion images can be visualized in full screen also in a 3D representation.

In our experience the 3D visualization is the best way to represent the perfusion deficit in acute stroke patients with a complete MCA infarct.

077

The Importance of Middle Cerebral Artery Stenosis Morphology in Patients with Recurrent Ischemic Stroke

Malferrari G¹, Casoni F², Bertolino C³, Zini A², Colombo A², Marcello N¹, Nichelli P²

¹Stroke Unit, Neurological Department Santa Maria Nuova Hospital, Reggio Emilia (ITALY); ²Department of Neuroscience Nuovo Ospedale Civile Sant'Agostino-Estente, Modena and Reggio Emilia University (ITALY); ³Division of Neurology, Ospedale privato "San Giacomo", Ponte dell'Olio, Piacenza (ITALY)

Background: Intracranial stenosis are a manifestation of atherosclerosis and a cause of cerebral ischemia. They are associated with high rate of recurrent cerebrovascular ischemic events and death. The morphology of intracranial stenosed intracranial vessels might be important in predicting cerebral ischemic events. Middle cerebral artery (MCA) stenosis has been demonstrated to be the most frequent among intracranial stenosis. We investigated the relationship between the middle cerebral artery stenosis morphology and clinical recurrence by Transcranial Color Doppler ultrasonography (TCCD) and angiopower-TCD.

Patients and Methods: 98 patients (58 male, 40 female; mean age 68.53±12.8) with first ischemic stroke admitted to our Neurological Department between January 2002 and December 2004 presented intracranial stenosis. The MCA stenosis was detected in 45 patients. The MCA stenosis was classified into severe (>50%) and mild (<50%) following the Baumgartner criteria (1999). MCA stenosis morphology was studied by TCCD and Angiopower transcranial doppler using contrast agent (SonoVue, Bracco SA) and 3 types of stenosis were identified: monofocal with and without post-stenotic dilatation, plurifocal stenosis and tubular. Clinical and TCCD recordings were performed at 3th, 6th, 12th and 24th month from discharge.

Results: A new ischemic event during the follow up in the territory supplied by the stenosed MCA occurred in 20 (44,4%) out of 45 patients. All 20 patients presented a severe MCA stenosis 9 with a tubular stenosis and 6 with monofocal stenosis without post-stenotic dilatation and 5 plurifocal stenosis. Out of the other 25 patients 10

presented a severe monofocal stenosis with post-stenotic dilatation and the other 15 patients had a mild stenosis with tubular or monofocal morphology.

Conclusion: These preliminary data suggest a possible correlation between severe MCA stenosis with tubular or monofocal without post-stenotic dilatation or plurifocal morphology and ischemic stroke recurrence. MCA stenosis morphology might be considered a predictive factor of cerebral ischemic recurrence. Further studies are needed to confirm our preliminary findings.

078

Ultrasound Perfusion Imaging within three hours in acute MCA stroke

Malferrari G¹, Zini A², Bertolino C³, Casoni F², Nichelli P², Marcello N¹

¹Stroke Unit, Department of Neurology, Arcispedale S. Maria Nuova, Reggio Emilia, ²Department of Neuroscience, University of Modena and Reggio Emilia, Nuovo Ospedale Civile S. Agostino-Estense, Modena, ³Division of Neurology, Ospedale privato "San Giacomo", Ponte dell'Olio, Piacenza

Background: Several studies have demonstrated the value of Ultrasound Perfusion Imaging (UPI) to detect perfusion deficits in patients with acute stroke, predicting size and localization of the ischemic lesion. Recently, some Authors showed different patterns of brain perfusion and differentiated "tissue at risk" and "core of infarction" in acute stroke, trying to individualize the "ultrasonic mismatch" corresponding to the ischemic penumbra. Nevertheless none of these studies were conducted within a therapeutic window.

Methods and Patients: We conducted an open, observational study using Transcranial Color-Coded Duplex Sonography (TCCD) within three hours from the stroke onset. TCCD was performed using a SONOS 5500 ultrasound system (Philips Medical Systems) and a 2.5 MHz sector transducer (S3 probe, Philips). Inclusion criteria were: age >18 years, stroke onset within three hours, good visualization of standard landmarks (third ventricle, thalamus, pineal gland, anterior horn of the ipsilateral ventricle), a baseline brain CT scan achieved no more than 1 hour before UPI. Standard TCCD was performed bilaterally after UPI. The investigation was conducted in the axial midthalamic plane and only a contralateral examination was achieved. The maximum depth was fixed in 14 cm, whereas the gain was optimized for each patient at the beginning of the investigation. UPI consisted in a bolus track technique, with i.v. injection of 2.5 mL of a second generation UCA, SonoVue® (Bracco International BV) plus 2.5 mL of saline solution (NaCl 0.9%), followed immediately by 3.0 mL of a saline bolus to flush the injection line. The technical modality for UPI was a Power Modulation contrast imaging, using a low mechanical index (MI 1.0). The gray scale images were recorded on an optical disk; then an off-line analysis of time-intensity curves (TIC) was done with a new UPI software (QontraXt®, AMID, Rome & Bracco, Milan). A

follow-up brain CT scan was done within 72 hours after stroke.

Results and Discussion: Forty-four acute stroke patients were investigated within three hours between January and December 2005. Thirty-two patients (M/F: 1.9) had an adequate insonation condition for UPI analysis (72.7%). No adverse events related to the US investigation were observed. The pixel-by-pixel analysis converted the gray-scale loop in a colour map, and a 3D-visualization was possible. In the group of patients with a complete MCA infarct it was possible to identify the perfusion deficit on the parameter images. The area of hypoperfusion corresponded to the area of infarction in follow-up brain CT scan. TIC parameters calculated for each investigation were: Peak Intensity (PI), Time-To-Peak (TTP), and Area Under the Curve (AUC). In conclusion Ultrasound Perfusion Imaging might be of help in the early identification of ischemic areas in acute stroke patients within the therapeutic window, allowing to a more selective and safe identification of stroke patients eligible for thrombolysis.

079

Improvement of Cerebrovascular Reserve (CVR) on middle cerebral artery (MCA) after carotid revascularization, evaluated by Transcranial Color-Coded Duplex sonography (TCCD)

Manca A, Zedde M, Baule G, Bianco P, Gentilini A
Medicina Terza Divisione e Malattie del Metabolismo, Ospedale SSma Annunziata Sassari

It is known that cerebral haemodynamic impairment is a risk factor for ipsilateral ischemic stroke and TIA in patients with carotid stenosis and occlusion. In these patients haemodynamic and embolic factor contribute to stroke risk, but it is not quite studied how cerebral hemodynamics changes after carotid surgery or stenting in both symptomatic and asymptomatic subgroup. The aim of this study is to identify the direction and the time of short term changes in CVR on MCA after carotid revascularization, either surgical or endovascular. For this purpose we have used TCCD with Diamox test (administration of acetazolamide 1 g i.v.). Twenty-one patients (2 female, 19 male, 14 symptomatic and 7 asymptomatic, mean age 69,48 years, standard deviation 7,93 years) with unilateral or bilateral carotid artery stenosis (>60% on NASCET criteria) underwent TCCD using a commercially available ultrasound machine (Toshiba Aplio). All the patients had at least 3 cerebrovascular risk factors. Vasomotor reactivity of the main cerebral vessels was determined using the Diamox test before surgery and at 10, 30, 60-80, 160-180 days and one year after. The data were compared using the Wilcoxon rank test for paired data and t test. In the subgroup with unilateral symptomatic carotid stenosis CVR on ipsilateral MCA shows a statistical significant improvement in the early days after revascularization (Wilcoxon rank test, p 0,0234) and at 6 months (t di Student, p 0,02). CVR on ipsilateral MCA shows a statistical significant improvement in the early days after revascularization (Wilcoxon rank test, p 0,0336) in the subgroup with

bilateral symptomatic carotid stenosis too. In asymptomatic patients with unilateral and bilateral carotid disease CVR on ipsilateral MCA does not significantly improve during follow-up. Instead in the subgroup with asymptomatic bilateral carotid disease there is a statistical significant improvement in CVR on contralateral MCA (Wilcoxon rank test, p 0,0339) in the early days after surgery. In patients with unilateral stenosis and subclavian-vertebral disease there is a statistical significant improvement in CVR on ipsilateral MCA both early (Wilcoxon rank test, p 0,0391) and late (Wilcoxon rank test, p 0,0232). Evaluation of cerebral haemodynamics using TCCD and Diamox test may help to select the asymptomatic patients for carotid surgical or endovascular procedure. In this higher risk subgroup there are at the moment patients with bilateral significant carotid disease and patients with unilateral carotid stenosis plus subclavian-vertebral disease, although we need larger sample of patients in order to confirm this view.

080

A subclavian steal syndrome with bulbar TIAs on hemodynamic ground, investigated by Transcranial Color-Coded Duplex sonography (TCCD) and Diamox test

Manca A, Zedde M, Bianco P, Gentilini A, Baule G
Medicina Terza Divisione e Malattie del Metabolismo, Ospedale SSma Annunziata Sassari

C.S., female, 51 years old, came to our out-patients' department in November 2005 because of repeated occurrence of a sensory disturbance with sudden onset and spontaneous relief. Since at least 5 months she was having at a daily rate a right hemifacial loss of sensation and formicolar paresthesias with a spatial course from ear to mouth like an onion's bulb. These symptoms were triggered by standing up and sitting and relieved by lying down. Neurological exam was normal unless right hemifacial hypoesthesia on sitting position. Physical exam shown a clear asymmetry in humeral and radial pulses with right side hypospagyria. The past history was only notable for mild hypercholesterolemia, mild obesity and past smoking. Clinical suspect of bulbar TIAs on hemodynamic ground was made and then the patient underwent to MRI of brain with gadolinium, that was normal, and ultrasound examination of supraaortic trunks, that shown a tight right subclavian artery (SA) stenosis in the prevertebral segment with fully inverted flow direction in ipsilateral vertebral artery (VA). A TCCD was performed in order to investigate cerebral hemodynamics. The main results were the identification of a large anastomotic loop between left and right VA, the inverted flow direction on right VA proximal to this loop with normal flow direction in the segment distal to it in lying down position and the inverted flow direction in the precommunicant right posterior cerebral artery (PCA P1). Instead in sitting position flow direction was inverted in the full course of right VA and there was a partial steal on basilar artery too. Then Diamox test (administration of acetazolamide 1 g i.v.) was performed and it shown