MINERVA CARDIOANGIOL 2005;53(Suppl. 1 al N. 6):58-9

Carotid ultrasound and transcranial Doppler sonography in the acute stroke patients. Retrospective analysis of the first 15 month collaboration of the angiology unit and the stroke team at Florence Careggi University Hospital

S. CASTELLANI[1], E. TESI[1], P. NAZERIAN[1], F. MORONI[1], M. BACCI[1], L. PANTONI[2], C. LAZZERI[1], M. FOSCHI[1], P. NENCINI[2], G.F. GENSINI[1], D. INZITARI[2]

[1]Angiologia Clinica e Sperimentale, Dipartimento Area Critico Medico Chirurgica, AOU Careggi, Università degli Studi di Firenze, Firenze; [2]Clinica Neurologica III, Dipartimento Scienze Neurologiche e Psichiatriche, AOU Careggi, Firenze

Neurovascular ultrasound can play an important role in the diagnostic work-up of acute cerebral ischemia [1]; indeed urgent bedside evaluation of patients with stroke with ultrasound techniques can accurately determine the presence and site of cerebrovascular obstruction [2,3]. The feasibility, sensitivity and specificity of ultrasound techniques in this clinical setting have already been reported and were subsequently confirmed by several investigators [4-7]. Few data have been collected to determine the possible advantages of combining intra and extracranial examination with transcranial Doppler (TCD) and carotid Duplex (DUS) in the acute stroke patients [8] and, to the best of our knowledge, carotid DUS and TCCS have never been simultaneously used for this purpose. To test the applicability, feasibility and reliability of TCCS and DUS in acute cerebral ischemia we have retrospectively analysed all acute ischemic stroke patients admitted to our hospital since the institution, in February 2004 of a multidisciplinary stroke team. We compared the ultrasound results with those of radiological neuroimaging techniques and we evaluated the consequences of ultrasound examination on therapeutical decisions and patient outcome before and after thrombolytic treatment.

Materials and methods

DUS and TCCS were performed by an experienced vascular sonographer soon after the hospitalisation in the Emergency Department (ED) and/or within 2 days after the admission in the Stroke Unit, with a 512 Acuson Sequoia or a Sonos Philips 5500 machine with a 2-4 MHz phased array transducer for TCCS and with a linear 4-7 MHz transducer for carotid DUS. In the presence of poor acoustic temporal windows 5 ml intravenous contrast agent (Sonovue - Bracco) were injected. to visualize the intracranial vessels. We have developed a fast track neurovascular ultrasound examination protocol according to the methods described in previous studies and to the standard technique of our laboratory, to urgently evaluate acute stroke patients at bedside (examination time < 15 preted by the same sonographer blinded to other radiological neuroimaging exams using standardized diagnostic criteria for DUS [6] and for TCCS (Table I, II).

The combined TCCS and DUS results were compared with angio computed tomography (angioCT), angio magnetic resonance (angioMR) and/or digital substraction

Table I. – TCCS criteria.

Proximal obstruction	= no detectable flow signal	
MCA branch obstruction Interhemispheric asymmetry index, E. M. Zanette [1]	AI >21% AI= MV1-MV2/(MV1 +MV2)/2x100	
		>50% stenosis
Intracranial stenosis:	ACA	>155 cm/s
PSV criteria according	MCA	>220 cm/s
to Bagmgartner [6]	PCA	>145 cm/s
	Basilar	>140 cm/s

Table II.- DUS criteria for carotid disease.

% Stenosis	PSV ICA	EDV ICA	ICA/CCA PSV
30-49		≥ 100	< 1001,5-1,8
50-69	125-180	< 100	> 1,8
70-79	180-250	£ 100	≥ 3
80-95	≥ 250	≥ 100	≥ 3,5
Occlusion	No flow or inverted flow proximal to obstruction		

Results

From February 2004 to May 2005 we studied 99 consecutive acute ischemic stroke patients (men 59, women 40, mean age 66 ±15 years) with a mean NIHSS at ED admission of 9±6. Among them 9 received systemic, 8 intra-arterial fibrinolysis, 3 underwent carotid endarterectomy and 3 urgent percutaneous transluminal angioplasty. All patients underwent DUS and TCCS. In 19 there wasn't an adequate acoustic window but in 3 of them the matter was overcome with the use of contrast agent therefore TCCS examination was possible in 83/99 pts (84%). In 49 pts (50%) US examination was performed in the emergency department (ED) within 40 minutes from the admission; the other 50 were examined only later in the stroke unit. DUS was abnormal in 31 (31%); TCCS was abnormal in 38 (46%). In 51/53 pts (96%) DUS and TCCS findings were consistent with those of neuroimaging techniques. A simultaneous ultrasound and clinical follow up evaluation was performed in 19 patients: arterial viability and NIHSS changes were consistent in all cases. Ultrasound provided the earliest evidence of arterial dissection in 4 pts. 9 pts were treated with systemic fibrinolysis: 5 were examined by US before treatment, 4 pts only after; the door to needle time was similar.

Conclusions

In 96% of patients ultrasound and neuroradiologic findings were similar. DUS and TCCS were reliable and effective in detecting vascular obstructions; in the ED US examinations were performed sooner and more frequently than other neurovascular imaging techniques
Their use has been crucial for early detection and treatment of arterial dissections and has allowed subsequent bedside follow-up evaluation in the stroke unit.

References

1. Zanette EM, Fieschi C, Bozzao L, Roberti C, Toni D, Argentino C, *et al.* Comparison of cerebral angiography and transcranial Doppler sonography in acute stroke. Stroke 1989;20:899-903.
2. Postert T, Braunh B, Meves S. Contrast-enhanced transcranial color-coded sonography in acute hemispheric brain infarction. Stroke 1999;30:1819-26.
3. Alexandrov AV, Demchuk AM, Wein T, Grotta JC. Yield of transcranial Doppler in acute stroke. Stroke 1999;30:1604-9.
4. Gerriets T, Goertler M, Stoltz E, Postsert T, Sliwka U, Schlachetzki F et al. for the Duplexsonography in Acute Stroke (DIAS) Study group. Feasibility and validity of transcranial duplex sonography in patients with acute stroke. J Neurol Neurosurg Psychiatr 2002;73:17-20.
5. Seidel G, Fiss I, Modrau B, Kaps N. Contrast-enhanced transcranial color-coded duplex sonography: efficiency and validity. Neurology 2002;52:1133-7.
6. Baumgartner RW, Transcranial color duplex sonography in patients with acute stroke. J Neurol Neurosurg Psychiatr 73, 17-20, 2002.
7. Castellani S. Ultrasound examination Techniques in patients with stroke. Cerebrovasc Dis 2002;14(suppl 1):19-20.
8. Cheryshey OY, Garami Z, Calleja S, Song J, Campbell MS, Noser EA, *et al.* Yield and accuracy of urgent combined carotid/transcranial ultrasound testing in acute cerebral. Stroke 2005;36:32-7.