Value of Transcranial Doppler in Cerebro-vascular Stroke

Essay

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Radiodiagnosis

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ولذلك يجب أن يسلط المزيد من الضوء حول دور الدوبلر بالموجات فوق الصوتية على شرايين الدماغ في حالات السكتة الدماغيه.

List of abbreviations

TCD	: Transcranial Doppler
TCCS	: Transcranial Color-coded duplex ultrasonography
CVS	: Cerebrovascular stroke
CCA	: Common carotid artery
ICA	: Internal carotid artery
ECA	: External carotid artery
ACA	: Anterior cerebral artery
MCA	: Middle cerebral artery
PCA	: Posterior cerebral artery
VA	: Vertebral artery
BA	: Basilar Artery
AICA	: Anterior inferior cerebral artery
PICA	: Posterior inferior cerebral artery
2D	: Two dimensional
SAH	: Subarachinoid hemorrhage
MHz	: Mega hertz
KHz	: Kilo hertz
CS	: Carotid Siphon
OA	: Ophthalmic artery
PCoA	: Posterior communicating artery

AcoA : Anterior communicating artery
MFV : Mean flow velocity
MRI : Magnetic resonance imaging
MRA : Magnetic resonance angiography
CT : Computed tomography
CE : Contrast Enhanced

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Introduction and aim of the work

Stroke is a leading cause of death and disability in the world, and the worldwide burden from stroke is expected to increase further during the 21st century **(Adams et al., 2003)**. Efficient, effective, and rapid diagnosis of stroke and transient ischaemic attack is crucial. The diagnosis of the exact type and cause of stroke, which requires brain imaging as well as traditional clinical skills, is also important when it will influence management **(Warlow et al., 2003**).

The use of Doppler ultrasound to estimate blood flow velocity was described in 1960, but it was only in the 1980s appreciated that sufficient ultrasound would pass through the skull to allow the detection of blood flow within the intracranial circulation. To achieve sufficient bone penetration low frequency ultrasound is used; 2 MHz is conventional. This increases tissue penetration at the cost of poor spatial resolution.

Therefore, even with more recent transcranial duplex scanners two-dimensional B mode images are of low spatial resolution and in adults the technique primarily provides useful information about blood flow velocity . **(Aaslid et al.,1982)**

Transcranial Doppler **(TCD)** has a number of advantages as a method of evaluating cerebral haemodynamics; it is relatively cheap, bedside and non-invasive. It allows repeated measurements and continuous monitoring and provides rapid and reliable data regarding stroke subtype and mechanism immediately after onset . **(Seidal et al., 1995)**

Much of the initial application of transcranial Doppler was in the detection of stenoses of the basal intracerebral arteries. Stenoses of greater than 50% or 60% can be identified by the accompanying increase in velocity through the narrowed artery. TCD findings play an important role in the early prognosis of anterior circulation stroke, providing possible guidance for

therapeutic interventions . **(Baracchini et al., 2000)**
TCD enables grading of the severity of MCA stenosis according to the flow velocity. This method provides a noninvasive and reliable method for grading MCA stenosis and allows longitudinal monitoring of the relationship between clinical outcome and hemodynamic change **(Gao et al., 2002**) Also Serial TCD examination may reveal dynamic changes in cerebral circulation that may be missed on a single MRA study .
(Akopov et al., 2002)

There are many promising applications of TCD in the stroke management helping in diagnosis of risk factors and prevention e.g. It has been demonstrated that it can be used to detect circulating cerebral emboli **(Markus,** 2000). Saline contrast TCD is a relatively non-invasive bedside procedure useful in the detection of venous to arterial shunting . **(Yeung et al., 1996)**

Anatomy

Since the mode of distribution of the vessels of the brain has an important bearing upon a considerable number of the pathological lesions which may occur in this part of the nervous system, A detailed understanding of the standard anatomy and common variants of the cerebral vasculature is a prerequisite to the performance and interpretation of TCCS studies**. (Bogdahn 1999)**

The cerebral arteries are derived from the internal carotid and vertebral, which at the base of the brain form a remarkable anastomosis known as the **arterial circle of Willis.** It is formed in front by the anterior cerebral arteries, branches of the internal carotid, which are connected together by the anterior communicating; behind by the two posterior cerebral arteries, branches of the basilar, which are connected on either side with the internal carotid by the posterior communicating.(**Figure1**) **(Dyson and Bannister1989)**

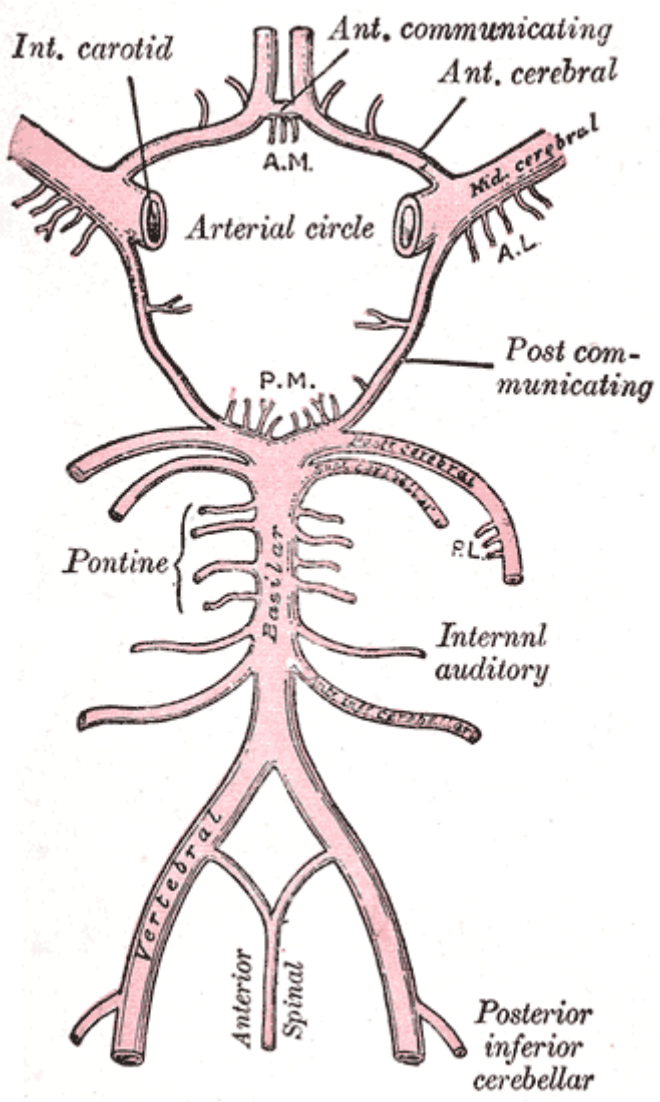


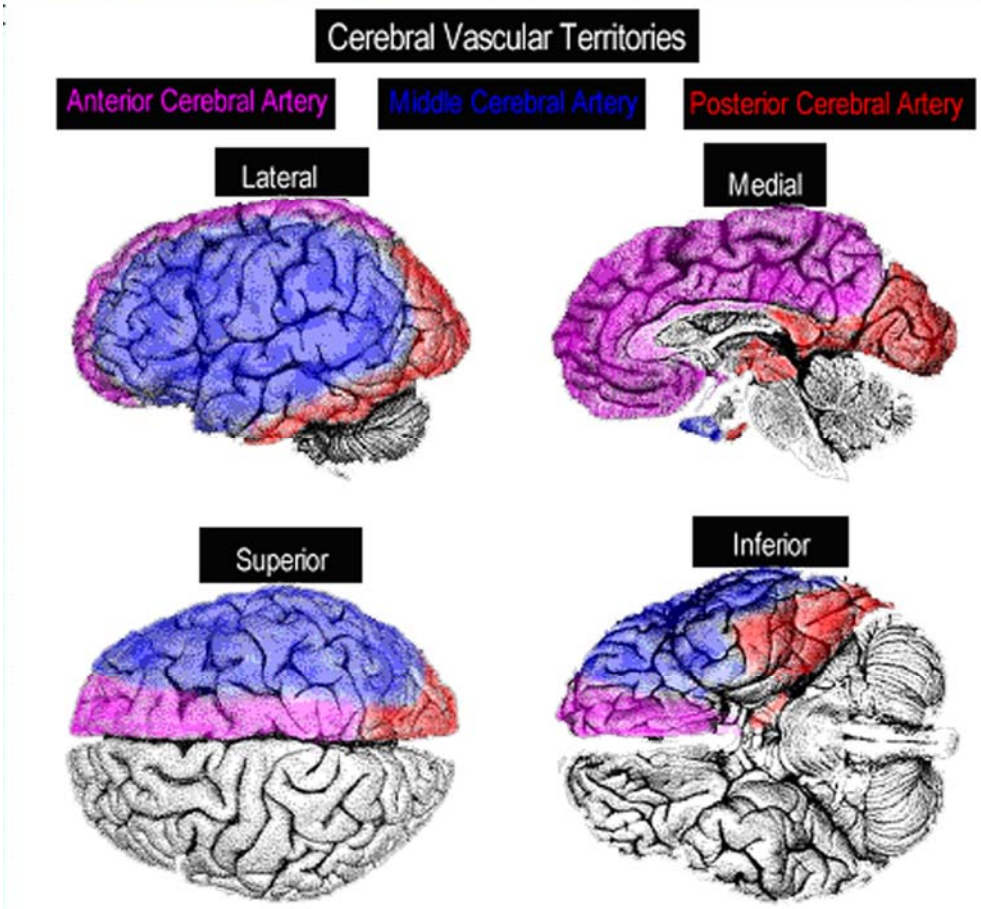
FIGURE 1– Diagram of the arterial circulation at the base of the brain. *A.L.* Antero-lateral. *A.M.* Antero-medial. *P.L.* Postero-lateral. *P.M.* Posteromedial ganglionic branches**.**

(Quoted from Dyson and Bannister 1989)

The three trunks which together supply each cerebral hemisphere arise from the arterial circle of Willis. From its anterior part proceed the two anterior cerebrals, from its antero-lateral parts the middle cerebrals, and from its posterior part the posterior cerebrals **(Figure 2) (Osborn 1996)**

(Quoted from Osporn 1996)

FIGURE 2 Cerebral vascular territories



Each of these principal arteries gives origin to two different systems of secondary vessels.

One of these is named the **ganglionic system,** and the vessels belonging to it supply the thalami and corpora striata; the other is the **cortical system,** and its vessels ramify in the pia mater and supply the cortex and subjacent brain substance. These two systems do not communicate at any point of their peripheral distribution, but are entirely independent of each other, and there is between the parts supplied by the two systems a borderland of diminished nutritive activity, where, it is said, softening is especially liable to occur in the brains of old people. **(Quoted from Dyson and Bannister 1989)**