CAROTID ANGIOPLASTY AND STENTING THE EXPERIENCE OF THE EMERGENCY UNIVERSITY HOSPITAL BUCHAREST *CLINICAL STUDY 2005-2007*

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ABSTRACT

The carotid stenosis treatment implies medical approaches or surgery treatment such as endarterectomy (CEA) or angioplasty/ stenting (CAS). In our paper we report the experience of the Neurology Clinics of the Emergency University Hospital in carotidian stenting. The study includes over 60 patients stented during a three years period of time (2005 – 2007) with good clinical outcome. As complications we registered only one case of contralateral ICA dissection and one case of restenosis. The results of our study are confirming the efficiency of CAS for patients with symptomatic over 70% ICA stenosis in the absence of CEA criteria.
Key words: stenosis, stenting, carotids, dissection, restenosis

VASCULAR RISK FACTORS

Carotid stenosis represents the narrowing of the arterial lumen with its consequence the diminishing of the blood flow.

The vascular risk factors for the formation and progression of carotid stenosis are:

1. *Atherosclerosis* is the most frequent cause of carotid stenosis appearing after 25 years of age [1]. The carotid arteries are affected by atherosclerosis usually in a focal or multifocal manner, but never diffuse. Most of intramural lesions are placed in the first 2 cm from the origin of the internal carotid artery (ICA) [2]. The significant hemodynamic variables for a stenosis are:
- a reduced section area (a diminished diameter with 50% corresponding to a transversal section of 70-80%) [3]
- the stenosis length
- the velocity of the blood flow
- the viscosity of the blood

2. *Genetic factors*. There is evidence from several studies that atherosclerosis is partially genetically determined. There are some markers of atherosclerosis highly heritable: common carotid artery wall thickness and abdominal calcification [4] as well as genes mutations: phospsodiesterase 4D (PDE 40), interleukin 6, 5-lipoxtgenase (5-LO), arachidonate 5 lipoxygenase activing protein (FLAP) are usually associated to carotid intima-media wall thickness and carotid atheroma [5].

3. *Constitutional factors*
- age: although stroke is often considered as a disease of elderly persons, 25% of strokes occur in persons younger than 65 years of age [6]
- sex: men are at higher risk for stroke than women [6]
- race: stroke is occurring mostly in blacks and hispanics since the cardiovascular risk factors are increased [7]

4. *Associated conditions*: arterial hypertension, dyslipidemia (elevated triglyceride levels and low HDL cholesterol [8, 9]), diabetes, being overweight, cardiovascular disease, policitemia vera, elevated serum levels of uric acid (also responsible for gout), recent stroke or transient ischemic attack [10], hyperthyroidism [11].

5. *Environmental factors* such as unhealthy diet, smoking, alcohol abuse, sedentary lifestyle, stress, psychosocial and behavioural factors.

6. *Novel risk factors* such as elevated serum levels of homocysteine, fibrinogen, C-reactive protein, apolipoprotein (apo) A-1, apoB-100 [12].

7. Mitchel and Schwartz observed some particularities of the carotid stenosis in men such as a strong correlation between the carotid and iliac degree of the stenosis and the severity of coronary stenosis or the severity of the complicated aortic atherosclerosis [13].

Clinical expression of carotid stenosis changes depending on the stenosis degree, the circle of Willis anastomosis and the presence of collateral circulation [14].

THE TREATMENT OF CAROTID STENOSIS

The carotid stenosis treatment depends on both the stenosis degree and the clinical manifestations associated to the cardiovascular pathology. The treatment implies medical approaches (antiagregant therapy combined with statins), surgical treatment – endarterectomy (CEA) or carotid angioplasty (CAS).

Over the last decade angioplasty/stenting has been investigated for the treatment of carotid occlusive disease, with encouraging low stroke/death rate in rats [15, 16].

CAS represents the new endovascular treatment for patients with carotid disease.

There are some advantages of the CAS such as a less invasive method, less traumatic, faster and painless. It is avoiding dissection of the neck as well as nerve damage and anesthetic risks.

The published recommendations for carotid stenting:

The European Stroke Initiative Recommendations for Stroke Management-Update 2003 [17] suggested that CAS, with or without stenting, is not routinely recommended for patients with asymptomatic carotid stenosis.

Acceptable Indications: [18]

Symptomatic

1. Symptomatic high-grade stenosis in a patient suitable for surgery in an experienced unit that can demonstrate good outcomes (a high-grade stenosis is a = 70% stenosis by the North American Symptomatic Carotid Endarterectomy Trial – NASCET criteria; equivalent to a = 85% stenosis by the European Carotid Surgery Trial ECST criteria).

2. Symptomatic high-grade stenosis that is relatively inaccessible surgically i.e. high bifurcation that may require mandibular disarticulation and would expose the patient to increased risk of postoperative cranial neuropathy.

3. Symptomatic high-grade stenosis in a patient with significant medical co-morbidity that may render the patient a high risk for surgery (cardiac insufficiency, high cardio-pulmonary risk etc.).

4. Symptomatic severe stenosis and one of the following conditions:

- significant tandem lesion that may require endovascular therapy
- radiation-induced stenosis
- restenosis after CEA
- stenosis secondary to arterial dissection
- stenosis secondary to fibromuscular dysplasia
- stenosis secondary to Takayasu arteritis

5. Pseudoaneurysm.

6. Refusal to undergo CEA after appropriate informed consent.

7. Patient with symptoms attributable to global hypoperfusion. Guidance from a neurologist with an interest in stroke prevention or stroke physician is helpful.

Asymptomatic [18]

1. Combined bilateral stenosis of the ICA = 160% in a patient who is awaiting cardiac surgery (coronary artery bypass grafting or valve replacement). The evidence-base to support this intervention is limited.

2. Units that can demonstrate independently reviewed good outcomes compared to CEA may offer CAS to younger male patients with a rapidly progressing high-grade asymptomatic lesion plus/minus cerebral infarction on computerised

tomography (CT) of brain in light of the Asymptomatic Carotid Surgery Trial (ACST) results [19].

3. Asymptomatic stenosis with hemodynamically increased risk.

Contraindications: [18]

Relative

1. High-grade stenosis in a patient whose symptoms may be attributable to an alternative embolic source i.e. atrial fibrillation, patent foramen ovale, mechanical heart valves etc.

2. Symptomatic high-grade stenosis in a patient with a significant contraindication to angiography.

Absolute [18]

1. A high-grade stenosis that cannot be safely reached or crossed by an endovascular approach.

2. Floating thrombus complicating ICA stenosis (according to the Swedish intensive care registry guidelines – SVIR).

3. Carotidian occlusion.

4. Stenosis of the brachiocephalic trunk or at the origin of common carotid artery.

Under debate:

There are no data to guide practice for the symptomatic high-grade stenosis associated with an intracranial vascular malformation. The treatment of symptomatic high-grade stenosis in patients with recent cerebral infarction remains as well controversial. There are studies suggesting that surgery should be delayed over 6 weeks but recent work may challenge these preconceptions. Whilst the optimal period of benefit for intervention for a patient presenting with TIA is considered to be within two weeks, timing of intervention following cerebral infarction documented on cross-sectional imaging of brain is unclear for both CEA and CAS [20, 21, 22].

In Romania, the carotid stenting, still a therapeutic alternative is included in the National Program for Cerebrovascular Disease Prevention.

CLINICAL STUDY

The study was performed during the period of time March 2005- December 2007, in both the Neurology Clinics and the Department of Radiology of the Emergency University Hospital, Bucharest and included 78 patients, 71.6% men and 18.4% women with age ranged 70-80 years.

In Romania, the carotid stenting, still a therapeutic alternative is included in the National Program for Cerebrovascular Disease Prevention.

The **inclusion criteria** are:

1. Over 70% symptomatic carotid stenosis at patients age ranged 18-80 year.
2. Carotid stenosis (over 70%) with contralateral occlusion.
3. Surgical high risk or patient's refuse for CEA
4. Postendarterectomy stenosis.
5. Cervical postiradiation stenosis.
6. Recurrent stenosis (with surgical risk of 20%)
7. ICA stenosis with high risk of general anesthesia.
8. Stenosis with endarterectomy in antecedents resulting in vocal chords paralysis.

The exclusion criteria **for the program are**:

1. Carotid occlusion.
2. Carotid stenosis due to intralumenal thrombosis.
3. Stenosis of the brachiocephalic trunk or of the origin of commun carotid artery.
4. Pathological associated conditions such as:
   - arteriopathy obstructing the lower limbs.
   - renal insufficiency (creatinine over 2 mg%).
   - severe liver failure or haematological disease.
   - unbalanced diabetes.
   - arterial hypertension.
   - allergy to contrast agents.
5. Life expectancy under one year.

Selection of patients

1. bilateral carotid affection:

	Stenosis <50%	Stenosis 70-89%	Stenosis 90-98%
Contralateral Stenosis 70-89%	8.33%	0	0
Contralateral preocclusive stenosis	8.33%	6.66%	3.33%
Contralateral occlusion	3.33%	6.66%	10%

2. unilateral carotid affection:
Stenosis 70-89%: 21.66% patients
Preocclusive stenosis: 30% patients
Occlusion: 5% patients

Associated pathology:

- Hypertension (89.83% patients)
- Dyslipidemia (59.32% patients)
- Ischaemic cardiac disease (25.6%)
- Diabetes (22.2% patients)
- Peripheral vascular disease (13.56% patients).
- Previous stroke (45.76% patients)

- Myocardial infarction (6.77% patients)
- Severe coronarian disease: one patient with triple coronarian bypass, one patient double stented on right proximal and medium coronary arteries, one patient stented on the left circumflex coronary artery and PTCA on both iliac arteries; there was one patient with coronary angioplasty before the carotid stenting
- only 8,47% of patients had smoking habits

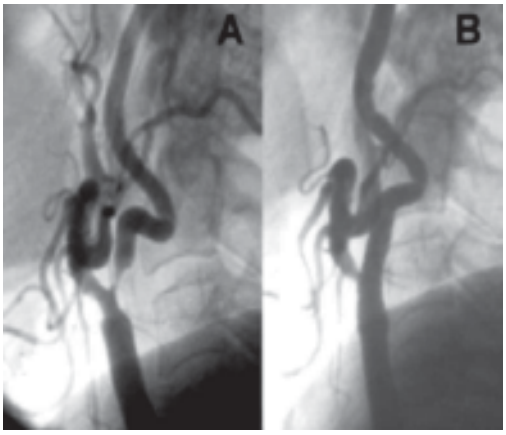

Figure 1. *Stenosis of 50% of both ICA and ECA*

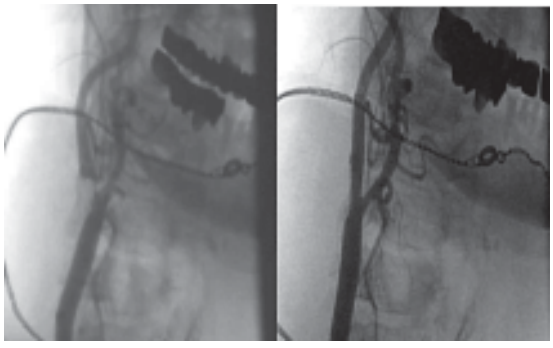

Figure 2. *Stenosis of 90% of ICA with consecutive stenting*

It has been used the self-expandable type of carotidian stents – nitinol (with MRI high compatibility) which has good wall coverage, is capturing the emboligenic material and avoids plaque protrusion as well. The risk of procedure related stroke and death is 7% according to ECST and 5.8% according to NASCET.

The patients received pre-procedural treatment with Aspirine 75-325 mg/day, Clopidogrel 75 mg/day for minimum 24-48 hours pre-procedural and statins. The antiplatelet treatment with Clopidogrel was needed for 6 months to one year post-procedural.

Complications of the procedure

1. the 24 hours post procedural complications
   - cervical hematoma – one case
   - pseudoaneurism at the puncture point – one case
   - seizure – one case
   - ocular pain – two cases
   - headache and vertigo – three cases
2. more than 24 hours post procedural complications
   - hypotension (our patients experienced post-procedural hypotension for 7-28 days)
   - external bleeding (gingivoragia)
   - significant residual stenoses – 5 cases
3. 2 years post procedural complications (4 cases)
   - contralateral internal carotid artery dissection
   - ischemic transient attack due to paroxistic atrial fibrilation
   - myocardial infarction
   - restenosis – that needed angiographic re-evaluation – one case

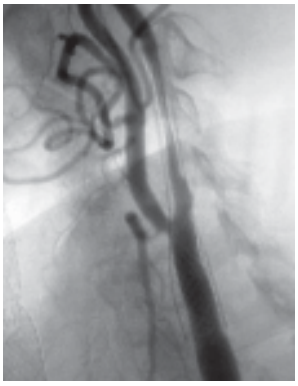

Figure 3. *The one-case of ICA restenosis*

Follow-up of the patients by using cervical Doppler ultrasonography method was necessary at 7 days post-procedural, 4 weeks, 3 months, 6 months and 12 months post-procedural.

DISCUSSION AND CONCLUSION

In the past few years CAS has increasingly been used as an alternative to CEA for the primary and secondary prevention of stroke related to carotid stenosis. Since CAS has the advantage of avoiding general anesthesia and surgical incisions, the risk to benefit ratio may be greatest in high-risk and older patients. A Cochrane Systematic Review of

CAS published slightly earlier (2004) concluded that CEA and CAS had similar early risks of death and stroke and similar long-term benefits, but that the substantial heterogeneity in the evaluated studies rendered overall estimates of effect somewhat unreliable. There are several contemporary meta-analysis (published in 2005) compared one-month composite rates of stroke or death, all stroke, disabling stroke, myocardial infarction, cranial nerve injury, and major bleeding and one-year rates of both minor and major ipsilateral stroke. The 30-day stroke and death rates associated with CAS and CEA were not significantly different. Lower rates of myocardial infarction and cranial nerve injury were observed with CAS compared with CEA [23].

The results of our study are confirming the efficiency of CAS for patients with symptomatic over 70% stenosis of ICA in the absence of CEA criteria.

Endovascular treatment appears to avoid completely the risk of cranial neuropathy, although there is some uncertainty about the potential for restenosis to develop and cause recurrent stroke. Therefore CAS can be recommended as the treatment of choice for suitable carotid artery stenosis despite the continue recruitment in the current randomized trials comparing CAS and CEA [24].

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