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ORIGINAL ARTICLE

# Peri-procedural outcome of series of 104 carotid artery stenting procedures

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**Abstract** *Background:* Management of carotid artery stenosis is considered an important strategy for stroke prevention. Carotid artery stenting (CAS) has been introduced as an acceptable alternative to surgical carotid endarterectomy (CEA) in the treatment of internal carotid artery (ICA) stenosis.

*Objective:* Assessment of peri-procedural outcome of CAS in 104 consecutive procedures.

*Methods:* The study included 104 consecutive CAS procedures. Included patients had ⩾50% ICA stenosis in the symptomatic group and ⩾70% stenosis in the asymptomatic group. Procedures were performed in cath. labs of Catania and Ragusa hospitals-Italy.

*Results:* Included procedures were done in 100 consecutive eligible patients with ICA stenosis. Four patients had undergone CAS procedures in both sides in 2 separate sessions. Patients were 71 males and 29 females, mean age was 71.9 ± 7.85 years, and 21 patients were ⩾80 years old (octogenarians). The majority of patients had asymptomatic ICA stenosis (76%) and was diagnosed

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accidentally during medical checkup. Twenty-four patients had symptomatic ICA stenosis (ipsilateral TIA or stroke). Technical success was obtained in 103 procedures (99%). Embolic protection devices were used in all succeeded cases. Combined cerebrovascular events had occurred in 5 patients with estimated rate = 4.8%. No cases of amaurosis fugax, MI or death had occurred. Adverse events was 4.1% in the symptomatic group and 1.3% in the asymptomatic group with no significant statistical difference ($P = 0.064$).

*Conclusion:* CAS with EPDs seems a feasible and safe procedure and could be performed with an acceptable rate of periprocedural adverse events.



## 1. Introduction

Cerebrovascular stroke is the leading cause of long-term disability and the third leading cause of death after cardiac and cancer-related deaths in the developed countries.[1] There are two main types of stroke: ischemic and hemorrhagic strokes. The major cause of ischemic stroke is related to large vessel atherosclerosis (accounting for one-third of all strokes), with the highest risk associated with stenosis of the internal carotid arteries (ICA) that may account for up to 20% of ischemic cerebrovascular events, and it is considered one of the treatable causes of initial and recurrent strokes.[2] Management of carotid bifurcation stenosis represents an important strategy in stroke prevention and has been subjected to extensive clinical investigations, including multiple controlled randomized trials.[3] Carotid endarterectomy (CEA) has been shown to be superior to medical treatment in reducing the overall risk of stroke especially in symptomatic patients with significant carotid artery stenosis.[4] However, surgery is not free from complications especially in high surgical risk patients. CAS has been proposed as a valid alternative to surgery, and two randomized studies comparing CAS and CEA had shown comparable results even without embolic protection devices (EPDs).[5,6] Recent randomized controlled trial; Carotid Revascularization Endarterectomy versus Stenting Trial (CREST)[7] showed non inferiority of CAS in relation to CEA. Adverse anatomical features of the aortic arch and culprit carotid lesions as well as elderly patients were associated with an increased rate of neurological adverse events during the CAS procedures.[8]

## 2. Objective

The aim of the study was to determine the peri-procedural outcome of CAS in 104 consecutive procedures in order to evaluate the safety of the procedure.

## 3. Patients and methods

The study included 104 consecutive CAS procedures. Patients were classified as symptomatic or asymptomatic based on the presence or absence of ipsilateral symptoms (Transient Ischemic Attack (TIA), Stroke, or amaurosis fugax) related to the culprit carotid artery stenosis within the last 6 months before the procedure. Carotid angioplasty was performed in catheterization labs in Catania and Ragusa hospitals-Italy during the period from October 2009 to May 2011. Procedures were carried out by 2 main operators who have a good experience in carotid angioplasty and each performs about 50 procedures per year.

### 3.1. Inclusion criteria

- Symptomatic patients with $\geqslant 50\%$ stenosis of ICA.
- Asymptomatic patients with $\geqslant 70\%$ stenosis of ICA.

Assessment of the degree of ICA stenosis was done in the angiographic views that showed the minimal luminal diameter. Measurement was done according to NASCET method (the distal ICA is the reference diameter).[9]

### 3.2. Exclusion criteria

- Total occlusion and pre-occlusive ICA lesions with trickle antegrade flow (String sign).
- Lesions that showed evidence of thrombi by carotid duplex or angiography.
- Lesions due to in-stent restenosis.
- Lesions that showed heavy circumferential calcifications.
- Peripheral vascular disease precluding femoral artery access.
- Major neurological deficit.

### 3.3. Pre-procedure

Patients underwent thorough clinical examination including full neurological assessment. Carotid Duplex was performed in all patients within 1 week before the CAS procedures for the evaluation of plaque characteristics and degree of stenosis. Laboratory tests including blood urea, serum creatinine, prothrombin time and concentration were performed before the procedures. Patients were asked to stop oral intake about 6 h before the procedures. All patients were on aspirin and Clopidogrel.

### 3.4. Intra-procedure

All procedures were performed through femoral access using local anesthesia. No sedation was given before or throughout the procedure in order to keep the conscious level as an early indicator for any complications. A bolus of unfractionated heparin (70 IU/kg) was given inside the femoral sheath; further boluses were given as needed to maintain the activated clotting time between 200 and 250 s. ECG was monitored continuously during the procedures. Atropine (1 mg IV) was given routinely just before the post-stenting dilation phase in order to reduce the bra-