

# Carotid Stenting

## Minimally invasive treatment for arteriosclerotic narrowing of the carotid arteries

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### Introduction

Arteriosclerosis is well known as a vascular disease and cardiovascular risk factor. In its generalised form it affects not only the peripheral vessels (pelvis, legs) but also the coronary vessels and the carotid arteries. Arteriosclerosis is primarily a manifestation of advancing age, hence it is often accompanied by other diseases of the lungs and the heart as well as by metabolic diseases (diabetes) (multimorbidity).

### Diagnosis

Whereas in the past digital subtraction (DS) angiography, tailored to the specific artery, was an indispensable prerequisite for visualization of the carotid arteries, today it is generally possible to diagnose carotid diseases non-invasively using magnetic resonance imaging (MRI) or multislice computed tomographic angiography (MS CTA).

Using MS-CT the entire supraaortic flow region can be depicted with a single spiral – thus providing for imaging of the following: 1. the origins of the supraaortic branches (subclavian artery origin stenosis), 2. bifurcation of the carotid arteries, 3. the carotid arteries at the level of the base of the skull (tandem stenosis) and also 4. the intracranial vascular loop (anastomoses of the circle of Willis).

The contrast medium is administered intravenously through an antecubital vein using a volume of 80 millilitres and a 4 ml/s flow rate. A proximal-to-distal scanning direction or vice versa can be employed. The former method generally results in less venous superimposition of the carotid bifurcation, while the second method minimises the superior vena cava arte-

facts mediated by the contrast medium. This, however, mainly calls for a more experienced interventionalist. The start delay after administration of the contrast medium can be set either manually by the interventionist or be standardised via the SureStart mechanism.

First of all, thin slices with a thickness of between 0.5 and 1 mm are computed. These are then converted into multiplanar reconstructions (MPRs) at the workstation, with the paracoronal and parasagittal diagonally oriented 3D-MIPs proving especially beneficial for visualization and quantification of stenoses of the carotid bifurcation. With a judicious choice of window, it is also possible to differentiate clearly between calcified plaques and emboligenic soft plaques and associated vascular ulcers. For the reconstructions the use of an up to 50% overlapping reconstruction of 1-2 mm thick slices is recommended, since this provides for a good signal-to-noise ratio with a low radiation dose and low partial volume effect.

Supplementary 3D-VR reconstructions can generate a plastic impression of the vascular anatomy, but have no diagnostic merit. It is absolutely necessary to inspect the original single axial slices to check the plausibility of the degrees of stenoses. Recently implemented reprocessing tools assist the physician in determining the degrees of stenosis and planning the length and diameter of the stent required for treatment.

### Treatment

In particular, patients of this risk group, for whom anaesthetic and surgery pose a higher risk, are suitable candidates for carotid stenting since

#### Materials:

- 7" F introducer device
- 5 mm PTA balloon
- 8 mm/4 cm wall stent
- 3.2" F protection system

#### Scanparameters

- Neck region
- Scan length 25 cm
- Scan direction cr-cd/cd-cr
- 120 kV
- 180 mA
- Rotation time 0.5 s
- Collimation 16 x 1 mm
- FoV 5

#### Reconstruction parameters

- RecoFilter 12
- RI 5 + 1 mm
- Images approx. 300

#### Contrast media

- Ultravist 370
- Volume 100 ml
- Flow 3.5 ml/s
- Delay Manual
- Delay 21 s

Fig. 2: Plaque and calcified deposit with 80% ACI stenosis and small vascular ulcer in MS-CTA visualization (a.p./lateral)

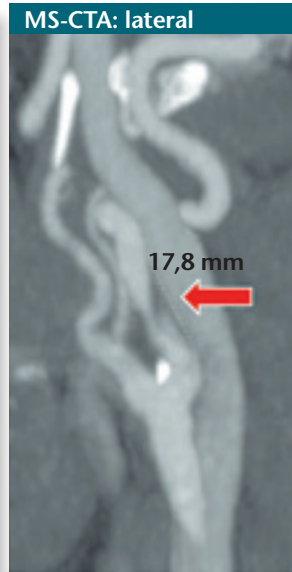
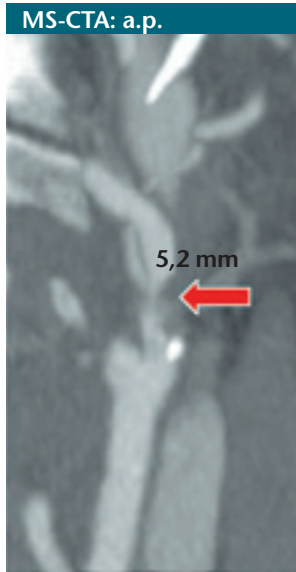


Fig. 3: Plaque and calcified deposit with 80% ACI stenosis, before and after stent placement

Fig. 1: Calcified plaque in the carotid bifurcation in 3D volume rendering visualization

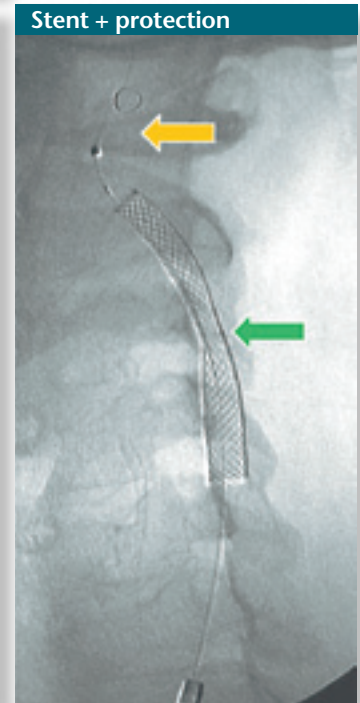
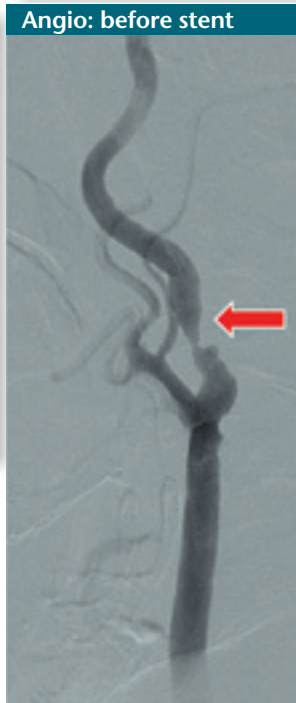
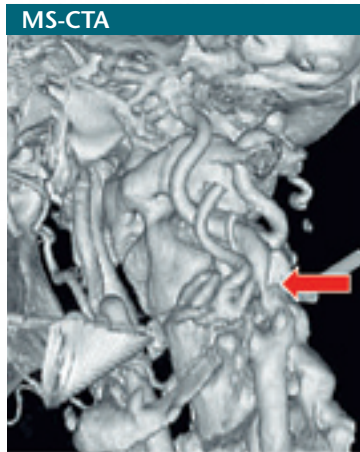


Fig. 4: Stent placement in the internal carotid artery with protection system

this novel procedure employs a minimally invasive technique that obviates the need for an anaesthetic or open surgery to treat the diseased carotid arteries. Continual blood thinning with aspirin and Clopidogrel is indispensable. This regimen must definitely be initiated already three days before the procedure and maintained for at least twelve weeks after therapy.

The monorail technique is generally used at present for this intervention, but as a rule a protection system should be employed. This latter entails, depending on the individual manufacturer, the use of a basket, sail or wire mesh that is positioned in the internal carotid artery at the level of the base of the skull and intercepts any small thrombi detached at the time of stent placement or balloon modulation before in-

tracranial vessels become blocked and can thus cause a stroke. The need for interdisciplinary cooperation must be highlighted, involving consultation with vascular surgeons when reviewing the indications for this procedure as well as with specialists in internal medicine as regards the pre- and post-procedural measures to be taken.

### Summary

Carotid artery stenting is thus a real alternative, to be taken seriously, to open carotid surgery because, in particular, patients with a high-risk profile as far as the anaesthetic and their suitability for surgery are concerned can benefit from the minimally invasive nature of this novel procedure.

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