QUANTITATIVE ANALYSIS OF EMBOLIC DEBRIS CAUGHT IN DIFFERENT FILTERS DURING CAS: What is Their Nature And What Are The Implications

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INTRODUCTION

Cerebral embolization during carotid artery stenting (CAS) may occur during several steps of the procedure:
- Aortic arch manipulation
- Stenotic lesion crossing
- Stent deployment
- Ballooning

This results in a non-negligible rate of embolization, that is confirmed by clinical and instrumental data:
- 2-4% clinically relevant neurological complications
- 40-60% of new brain ischemic lesions detected with DWI MRI within 48 hours
- 75% of analysed filters have embolic debris

INTRODUCTION

This high rate of embolization may undermine the benefit of CAS, especially in patients with asymptomatic carotid stenosis.

Stent design may have a role, and new generation micromesh (MM) stents have been specifically designed to reduce distal embolization and plaque prolapse.

However, no previous studies compared the embologenic potential of MM stents with open cell and closed cell stents, using a quantitative analysis of embolic filter debris load, that can be considered as a direct objective measure of the embolization during the procedure.

OBJECTIVE

To compare the quantity of embolized material captured by filters during carotid artery stenting (CAS) in asymptomatic patients, using different types of stent design:
- Open Cell (OC)
- Closed Cell (CC)
- Micromesh (MM)

METHODS

STUDY DESIGN
- Single-center retrospective study
- Consecutive patients treated from January 2012 to May 2019

INCLUSION CRITERIA
- Asymptomatic carotid stenosis >70%
- Criteria for CAS

EXCLUSION CRITERIA
- Symptomatic carotid stenosis
- Use of proximal occlusion EPD

202 carotid artery stentings: 82 OC (40.5%), 64 CC (31.6%), 59 MM (29.2%)

1. High risk for CEA
2. Hostile neck

Only in presence of a suitable anatomy for CAS

Preoperative demographics and clinical data

Perioperative data and Early outcomes

• Preoperative clinical data
• Perioperative data and Early outcomes (relevant ischemic neurologic events: TIA, minor stroke and major stroke)

Early (30-days) outcomes

1 Timaran CH, McKinsey JF, Schneider PA, Littooy F. Reporting standards for carotid interventions from the Society for Vascular Surgery. JVS 2011

METHODS: filter analysis

EFD load measurement using a stereo-microscope and computed morphometric analysis with the Image Pro/Plus software (Media Cybernetics)

RESUL TS

Plaque anatomical characteristics

Filter quantitative analysis in the overall cohort

RESULTS

Preoperative cerebral CT

Severe (> 90°)
Moderate (> 60°)
Mild (< 60°)
Absent

Type V (calcified) 4 (4.8) 3 (4.7) 1 (1.7)
Type IV (uniformly echogenic) 15 (18.3) 17 (26.6) 11 (20.0)
Type III (mainly echogenic) 54 (65.8) 30 (46.8) 29 (52.7)
Type II (predominantly hypoechogenic) 7 (8.5) 9 (14.0) 10 (18.2)
Type I (hypoechogenic) 2 (2.4) 5 (7.8) 4 (7.2)

Severe circumferential 3 (3.7) 3 (4.7) 1 (1.8)
Absent 35 (42.7) 21 (32.8) 23 (41.8)

> 15 mm + more than one lesion 6 (7.3) 7 (10.9) 6 (10.9)
> 15 mm 27 (32.9) 9 (14.1) 16 (29.1)
< 15 mm + more than one lesion 40 (48.8) 38 (59.4) 28 (50.9)
< 15 mm 9 (10.9) 10 (15.6) 5 (9.1)

Contralateral ischemic lesion 2 (2.4) 3 (4.7) 6 (10.9) .125
Ipsilateral ischemic lesion 10 (12.1) 7 (10.9) 8 (14.5) .829
RESULTS

Quantitative analysis stratified by anatomical characteristics

- Hypoechoic plaque
- Plaque height ≥15 mm
- Plaque length ≥5 mm
- Preoperative silent ischemic cerebral lesion

**P<.001**

- MM OC/CC
- MM OC
- MM CC

OC/CC

The use of MM stents seems to be associated to an overall significantly lower embolization rate and EFD load compared to OC and CC stents.

- The reduction of EFD load is more evident in a specific subset of carotid stenotic lesions:
  - Hypoechoic plaque
  - Plaque length ≥15 mm
  - Preoperative silent ischemic cerebral lesion

- The use of micromesh stents may be considered to decrease the incidence of perioperative embolization, in particular in presence of these plaque characteristics.

CONCLUSIONS

- In this cohort of patients with asymptomatic carotid stenosis, the rate of neurological complications was similar between OC, CC and MM stents.
- The use of MM stents seems to be associated to an overall significantly lower embolization rate and EFD load compared to OC and CC stents.
- The use of micromesh stents may be considered to decrease the incidence of perioperative embolization, in particular in presence of these plaque characteristics.