Quantity, particle size, and histologic composition of embolic debris collected in a distal protection filter after carotid angioplasty and stenting: Correlation with patient characteristics, timing of carotid artery stenting, and procedural details

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The occurrence of distal embolization during carotid artery stenting (CAS) is a major complication. Determining the preoperative risk of embolization may lead to improved patient selection and outcome of CAS. This study examined the quantity, particle size, and histologic composition of embolic debris collected in a distal protection filter and its possible correlation with patient characteristics, timing of CAS, and procedural details.

CLINICAL SUMMARY

Subjects

Patients who underwent a CAS procedure during a 17-month period in which a SPIDER Embolic Protection Device (EPD) (ev3 Endovascular Inc, Plymouth, Minn) was used were included. Patient demographics, cardiovascular risk factors, neurologic symptoms, and time interval between symptoms and CAS were retrospectively recorded.

Procedure

CAS was performed according to the standardized protocol in our center as described previously.1 This protocol also dictates the antiplatelet regimen.

TABLE 1. Patient (n = 55) and lesion (n = 59) characteristics

<table>
<thead>
<tr>
<th>Patients, n (%)</th>
<th>Lesions, n (%)</th>
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<tbody>
<tr>
<td>Age, y Mean, 67.2 (range, 47-89)</td>
<td>Asymptomatic 5 (8.5)</td>
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<tr>
<td>Male sex 36 (66)</td>
<td>Symptomatic 54 (91.5)</td>
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<tr>
<td>Hypertension 43 (78)</td>
<td>Amaurosis fugax 8 (14)</td>
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<td>Hypercholesterolemia 41 (75)</td>
<td>Retinal infarction 1 (2)</td>
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<tr>
<td>Diabetes 9 (16)</td>
<td>Transient ischemic attack 28 (48)</td>
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<tr>
<td>Cardiac disease 13 (24)</td>
<td>Stroke 17 (29)</td>
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<tr>
<td>Chronic renal insufficiency 9 (16)</td>
<td>Onset of symptoms before CAS 0-28 d 35 (59)</td>
</tr>
<tr>
<td>Smoking history 39 (71)</td>
<td>&gt;28 d 24 (41)</td>
</tr>
</tbody>
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Histopathology and Filter Analysis

Debris was photographed before (Figure 1, A) and after (Figure 1, B) removal from the EPD. Clemex image analysis software (Clemex Technologies Inc, Longueuil, Canada) was used to analyze the number and size of the particles.

Consecutive series of paraffin sections were stained with hematoxylin–eosin as a routine stain, resorcin-fuchsin for
collagen and elastin, and von Kossa for collagen and calcified tissue to study the particles at different depths. Debris was classified as thrombus (containing platelets, erythrocytes, and fibrin), atheroma (fibrous matrix, cholesterol clefts, and foam cells), and calcified tissue on the basis of morphologic criteria.

### Statistical Analysis

Data were analyzed using SPSS software (SPSS Statistics 17.0; SPSS Inc, Chicago, Ill). Continuous variables were expressed as median (minimum-maximum) in case normality could not be assumed and compared with nonparametric tests.
RESULTS

Patients and Procedures
Demographics of the 55 included patients and details of the 59 treated stenotic lesions in these patients are presented in Table 1.

Histopathology
Macroscopic evaluation detected particles in 44 of the 59 collected filters (75%) (Figure 1). Table 2 represents patient and procedural details of these cases and the number and size of the detected particles. The EPD in patients who smoked showed a significantly lower number of particles compared with nonsmokers (7 vs 14, \( P = .029 \)). The number of particles was significantly higher when CAS was performed in the first 4 weeks after the qualifying neurologic event (10 vs 4, \( P = .048 \)).

Qualitative assessment of histologic sections showed determinable embolic debris in 36 (82%) of the processed filters. Embolic particles consisted of atheromatous debris in 13 cases (36%), thrombus in 16 cases (44%), and calcified tissue in 7 cases (19%) (Figure 2). Atheromatous plaques generated a significantly higher number of particles (median 14, \( P = .01 \)).

DISCUSSION
Despite the use of protection devices, cerebral embolization has been shown by transcranial Doppler and diffusion-weighted magnetic resonance imaging.\(^2\)\(^3\) Although most of the clinical implications of detected microemboli remain
Is there any benefit in using awake anesthesia with thoracic epidural in thoracoscopic talc pleurodesis?

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Supplemental material is available online.

General anesthesia is commonly used for video-assisted thoracic surgery (VATS) with talc pleurodesis, although use of regional anesthesia in the awake patient might improve outcomes. The purpose of this randomized study is to compare the hospital discharge of patients undergoing VATS with talc pleurodesis using thoracic epidural or general anesthesia.

CLINICAL SUMMARY

Forty patients with malignant pleural effusion were randomized to undergo VATS with talc pleurodesis by awake anesthesia with thoracic epidural (awake group, N = 20) or general anesthesia and 1-lung ventilation (control group, N = 20) (ClinicalTrials.gov registration No. NCT01469728). The study was approved by the Policlinico Tor Vergata University ethical committee, and written informed consent was obtained by the patients. Eligibility criteria are summarized in Table E1.

In the awake group, the thoracic epidural catheter was inserted at the T4 level for continuous infusion of ropivacaine and fentanyl. In the control group, no spinal or epidural anesthesia was used. VATS was performed under general anesthesia and 1-lung ventilation. The awake group was randomly assigned to receive epidural anesthesia with ropivacaine, 0.2% diluted in saline solution, at a rate of 4 mL/h, or 0% saline solution (control group). Intraoperative analgesia was provided by medications administered intravenously, with morphine used as an alternative to fentanyl.

The awake group had a significantly shorter hospital stay compared with the control group (3.2 vs 6.8 days, respectively; p = 0.001). There were no significant differences between the groups in terms of pain scores or length of hospital stay. However, the awake group had a lower incidence of postoperative complications, including pneumonia and pleural effusion, compared with the control group (p = 0.039 and p = 0.001, respectively).

The awake group had a significantly lower incidence of postoperative complications compared with the control group. The awake group also had a shorter hospital stay, which is associated with lower health care costs and improved patient satisfaction. These results suggest that awake anesthesia with epidural analgesia may be a viable alternative to general anesthesia for thoracic surgery, with potential benefits for patient outcomes and health care costs.