
DSAN

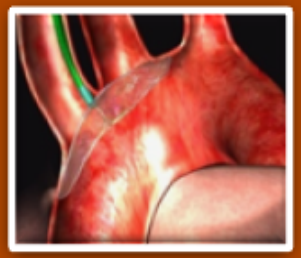
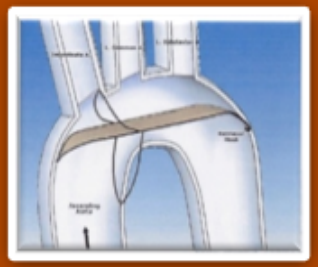
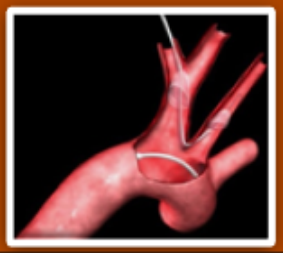
Perspectives on Cerebral Protection

Jeffrey W. Moses, MD

Professor of Medicine
Director, Interventional Cardiac Therapeutics
Columbia University Medical Center
Director Complex Coronary Interventions
St. Francis Hospital, Roslyn, LI

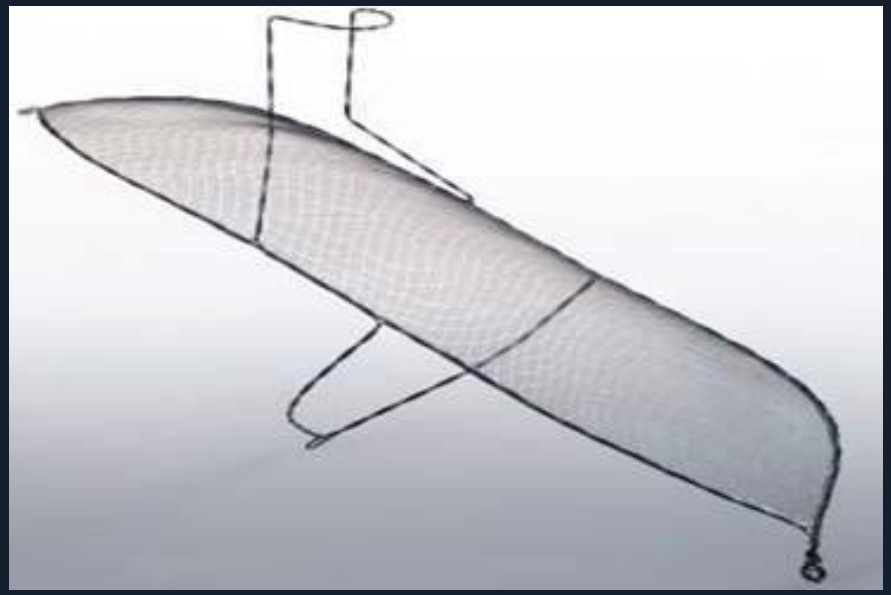
Capture or Deflection?

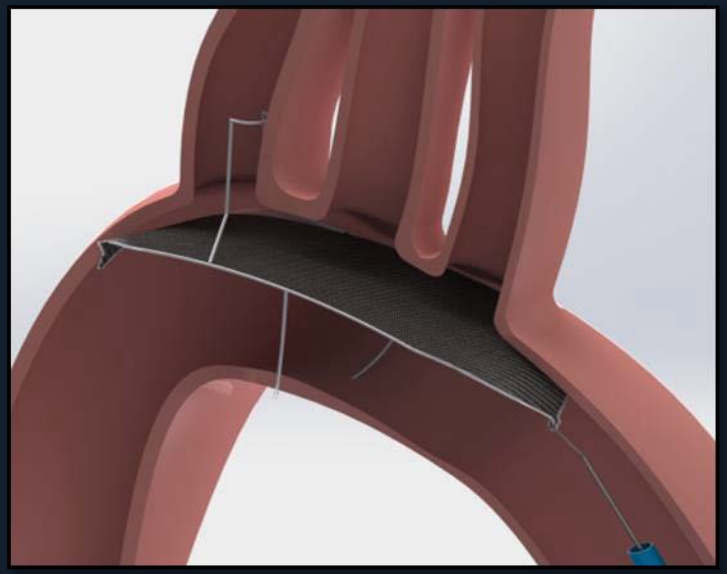
Embolic Protection Devices

Feature	Embrella	SMT	Claret Medical
			
Access	Radial	Femoral	Radial
Position	Aorta	Aorta	Brachiocephalic Left Common Carotid
Coverage Area	Brachiocephalic & LCC	Brachiocephalic & LCC & LSC	Brachiocephalic & LCC
Mechanism	Deflection	Deflection	Capture
Size	6F	9F	6F
Pore Size	100 microns	~200 microns	140 microns

TriGuard™ Embolic Deflection Device

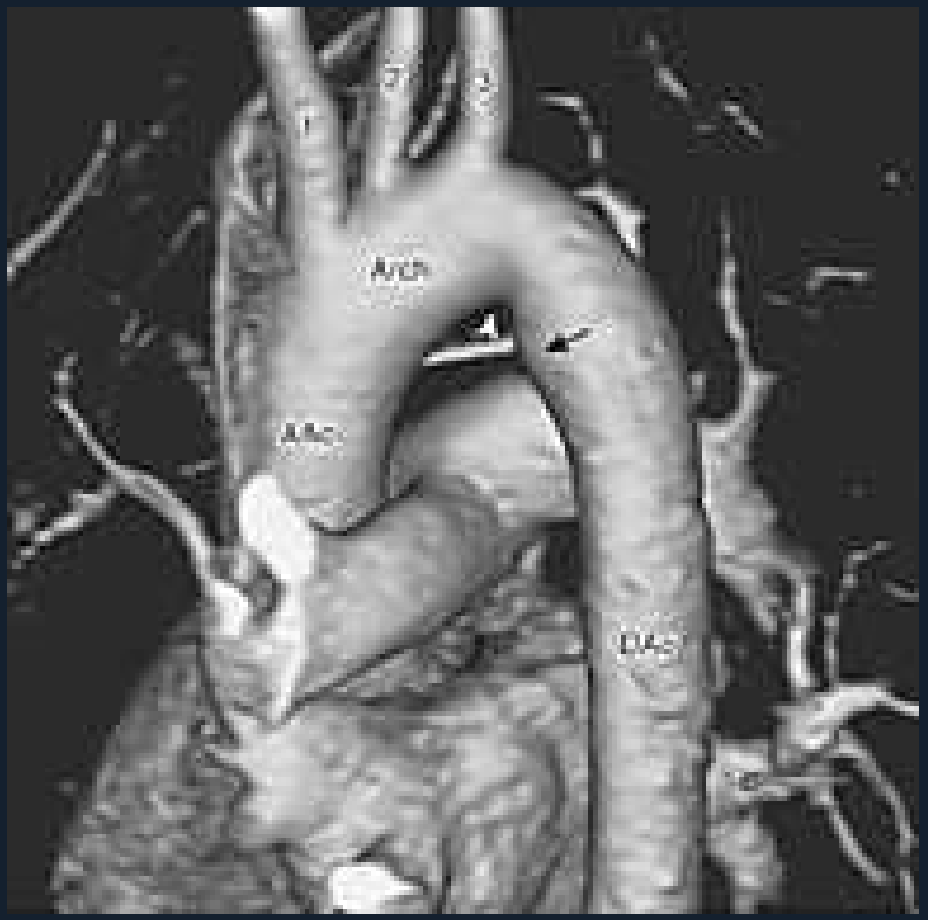
- Nitinol mesh filter with pore size of 250µm designed to deflect cerebral emboli while allowing maximal blood flow
- Device is positioned across all 3 cerebral vessels and maintained by stabilizers
- Delivered via 9 Fr sheath from femoral artery





Ideal Protection Device

- Safe
- Effective
- Easy to use
- Accommodates various anatomies
- Minimal interference with procedure

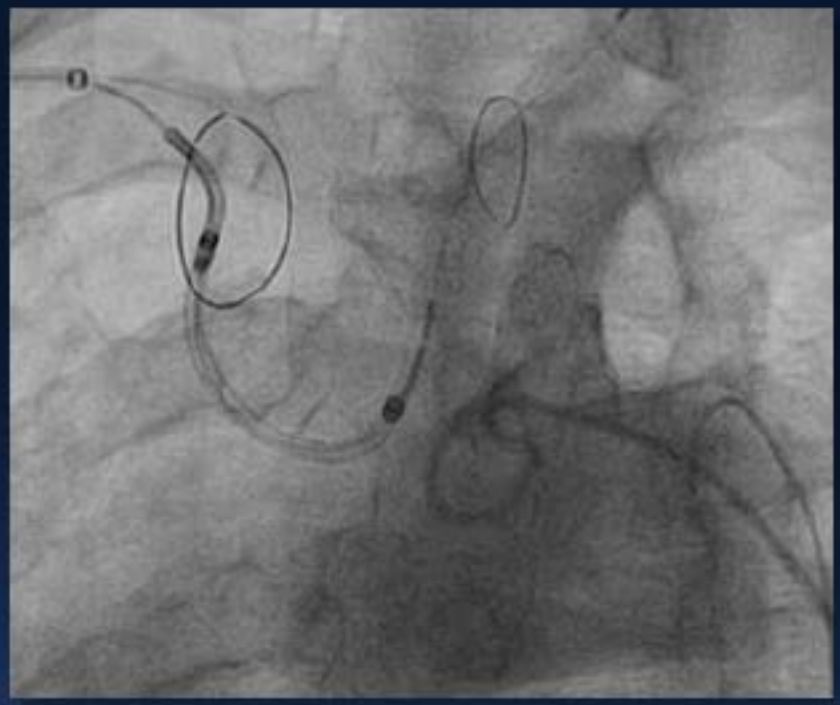


CLEAN-TAVI: A Prospective, Randomized Trial of Cerebral Embolic Protection in High-risk Patients with Aortic Stenosis Undergoing Transcatheter Aortic Valve Replacement

Axel Linke[1], Stephan Haussig[1], Michael G Dwyer[2], Norman Mangner[1], Lukas Lehmkuhl[1], Christian Lücke[1], Felix Woitek[1], David M Holzhey[1], Friedrich W Mohr[1], Matthias Gutberlet[1], Robert Zivadinov[2], Gerhard Schuler[1]

[1]University of Leipzig, Heart Center, Leipzig, Germany,
[2]University of Buffalo, Buffalo, NY, US

Background



- The Claret Montage™ dual-filter Cerebral Protection System was developed to protect the brain from injury caused by embolic debris
- Randomized controlled trial data showing the efficacy of any embolic protection device in TAVR are missing

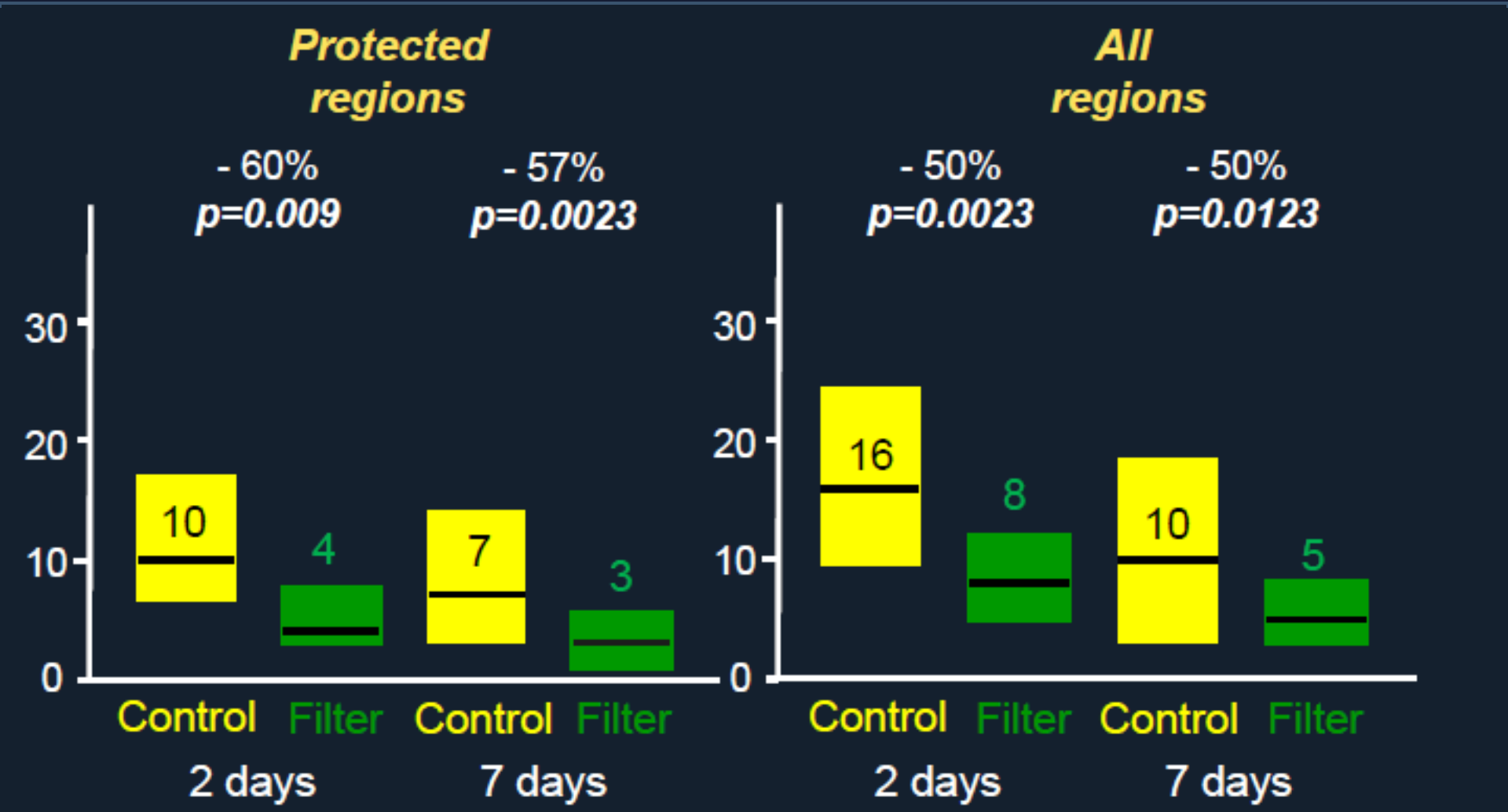
Neurological Outcome

intention-to-treat		cumulative	2 days (No, %)	7 days (No, %)	30 days (No, %)
Control	Any symptom	17 (34 %)	14 (28 %)	5 (10 %)	6 (12 %)
	- Ataxia	16 (32 %)	12 (24 %)	4 (8 %)	5 (10 %)
Filter	Any symptom	14 (28 %)	8 (16 %)	8 (16 %)	6 (12 %)
	- Ataxia	12 (24 %)	6 (12 %)	7 (14 %)	6 (12 %)

RR 1.379 (0.927 to 2.050), OR 2.042, p=0.175

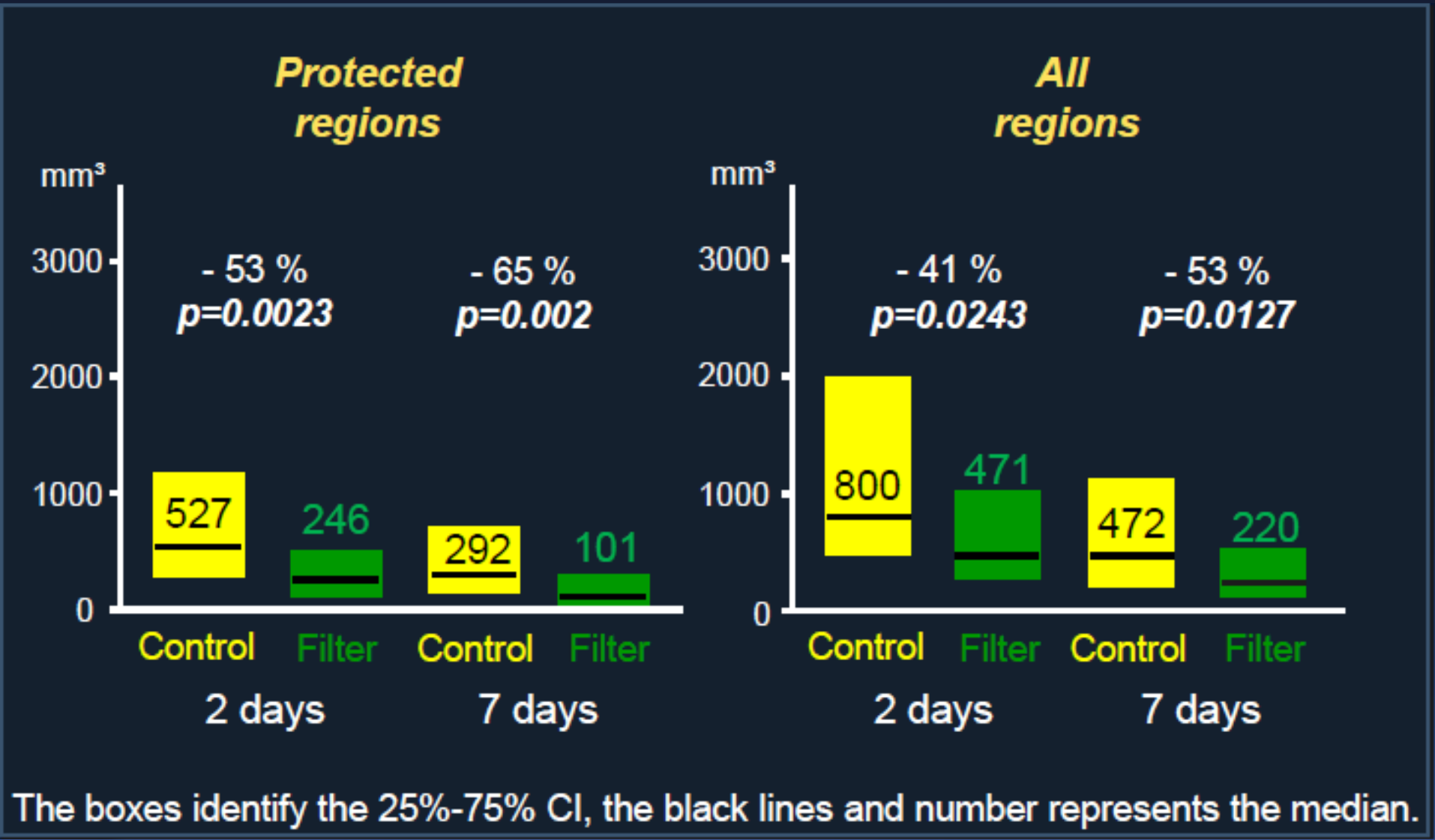
RR 1.439 (0.963 to 2.149), OR 2.316, p=0.118

Total Lesion Number at 2 & 7 Days



The boxes identify the 25%-75% CI, the black lines and number represents the median.

Total Lesion Number at 2 & 7 Days



The boxes identify the 25%-75% CI, the black lines and number represents the median.

Poststroke dementia

Didier Leys, Hilde Hénon, Marie-Anne Mackowiak-Cordoliani, Florence Pasquier

Dementia is one of the major causes of dependency after stroke. The prevalence of poststroke dementia (PSD)—defined as any dementia occurring after stroke—is likely to increase in the future. In community-based studies, the prevalence of PSD in stroke survivors is about 30% and the incidence of new onset dementia after stroke increases from 7% after 1 year 48% after 25 years. Having a stroke doubles the risk of dementia. Patient-related variables associated with an increased risk of PSD are increasing age, low education level, dependency before stroke, prestroke cognitive decline without dementia, diabetes mellitus, atrial fibrillation, myocardial infarction, epileptic seizures, sepsis, cardiac arrhythmias, congestive heart failure, silent cerebral infarcts, global and medial-temporal-lobe atrophy, and white-matter changes. Stroke-related variables associated with an increased risk of PSD are stroke severity, cause, location, and recurrence. PSD might be the result of vascular lesions, Alzheimer pathology, white-matter changes, or combinations of these. The cause of PSD differs among studies in relation to the mean age of patients, ethnicity, criteria used, and time after stroke. In developed countries, the proportion of patients with presumed Alzheimer's disease among those with PSD is between 19% and 61%. Patients with PSD have high mortality rates and are likely to be functionally impaired. These patients should be treated according to the current guidelines for stroke prevention.

Incidence of Poststroke Dementia

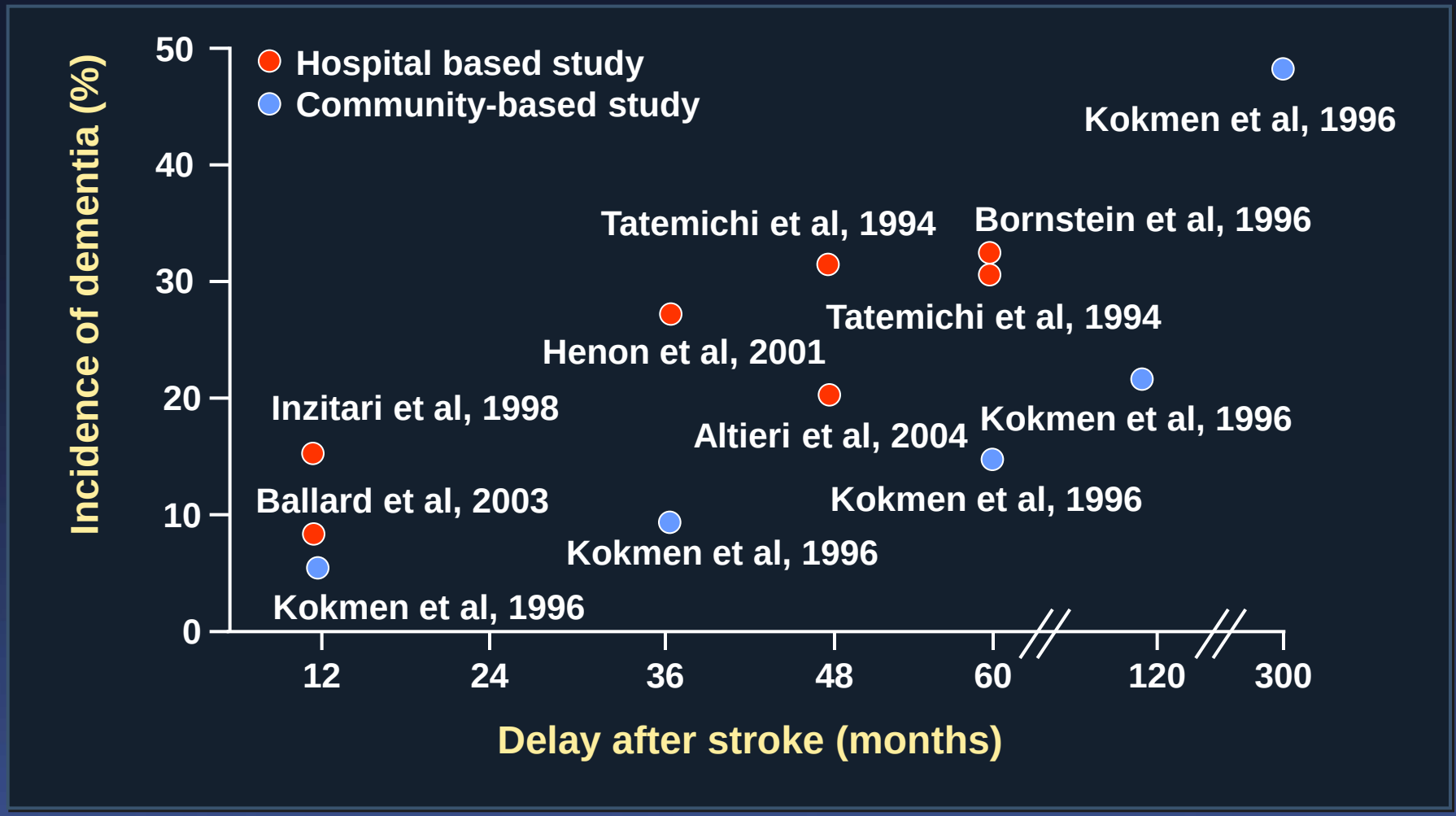


Figure: Incidence of poststroke dementia at different time intervals after stroke onset, in hospital-based studies (red) and community-based studies (blue)

Leys et al, *Lancet Neurol* 2005;4:752-59

Prevalence of Silent Cerebral Ischemia in Paroxysmal and Persistent Atrial Fibrillation and Correlation With Cognitive Function

Objectives The aim of this study was to compare the prevalence of silent cerebral ischemia (SCI) and cognitive performance in patients with paroxysmal and persistent atrial fibrillation (AF) and controls in sinus rhythm.

Background Large registries have reported a similar risk for symptomatic stroke in both paroxysmal and persistent AF. The relationship among paroxysmal and persistent AF, SCI, and cognitive impairment has remained uncharted.

Methods Two hundred seventy subjects were enrolled: 180 patients with AF (50% paroxysmal and 50% persistent) and 90 controls. All subjects underwent clinical assessment, neurological examination, cerebral magnetic resonance, and the Repeatable Battery for the Assessment of Neuropsychological Status.

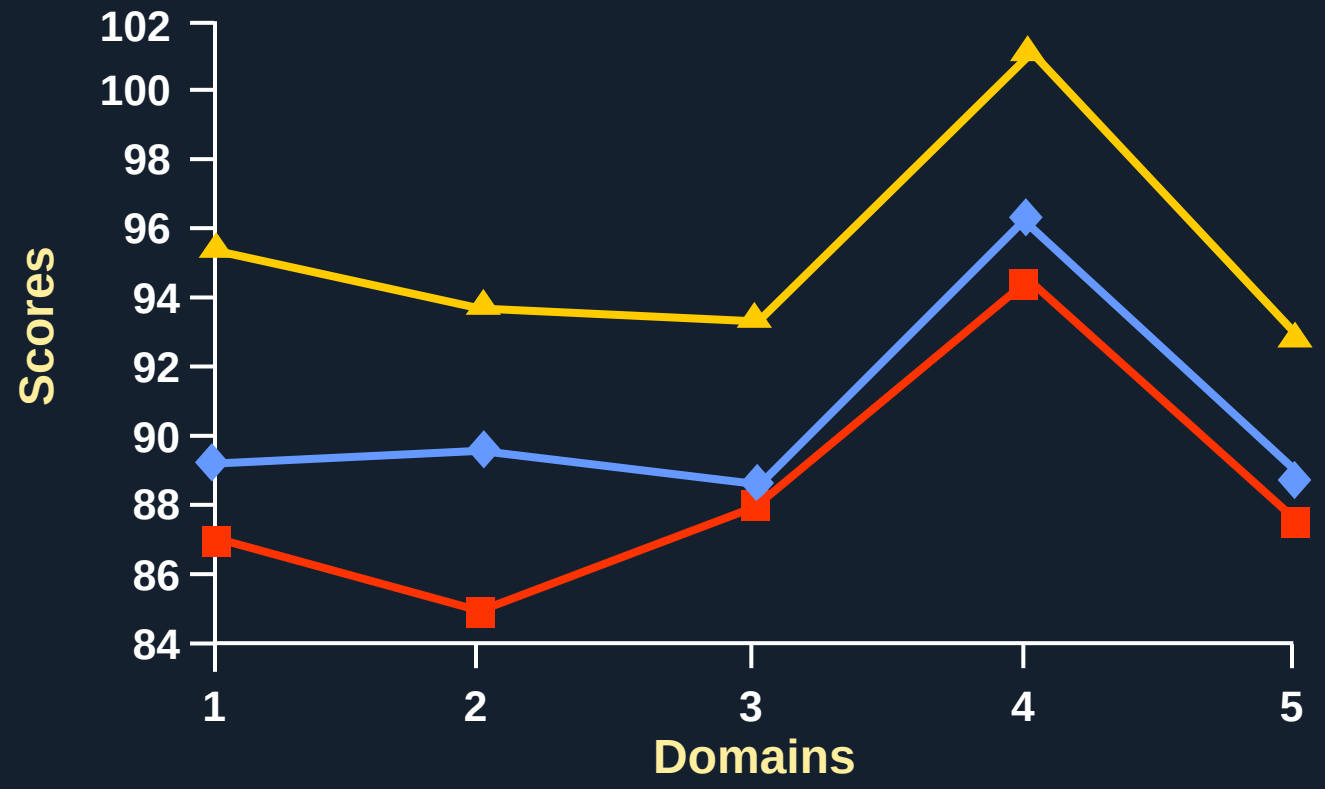
Results At least 1 area of SCI was present in 80 patients (89%) with paroxysmal AF, 83 (92%) with persistent AF (paroxysmal vs. persistent, $p = 0.59$), and 41 (46%) controls (paroxysmal vs. controls and persistent vs. controls, $p < 0.01$). The number of areas of SCI per subject was higher in patients with persistent AF than in those with paroxysmal AF (41.1 ± 28.0 vs. 33.2 ± 22.8, $p = 0.04$), with controls reporting lower figures (12.0 ± 26.7, $p < 0.01$ for both). Cognitive performance was significantly worse in patients with persistent and paroxysmal AF than in controls (Repeatable Battery for the Assessment of Neuropsychological Status scores 82.9 ± 11.5, 86.2 ± 13.8, and 92.4 ± 15.4 points, respectively, $p < 0.01$).

Conclusions Patients with paroxysmal and persistent AF had a higher prevalence and number of areas of SCI per patient than controls and worse cognitive performance than subjects in sinus rhythm. (J Am Coll Cardiol 2013;62:1990–7)

Afib and Cognitive Dysfunction

90 PerAF 90 PAF 50 controls

SCI: Afib 91% Controls 46%



Graph and results of cognitive function evaluation assessed by Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) score in controls (triangles), patients with paroxysmal (PRX) atrial fibrillation (AF) (diamonds), and patients with persistent (PER) AF (squares).

Gaita et al, *JACC* 2013;62:1990-7

A Prospective Randomized Single-Center Study on the Risk of Asymptomatic Cerebral Lesions Comparing Irrigated Radiofrequency Current Ablation with the Cryoballoon and the Laser Balloon

Asymptomatic Cerebral Lesions in AF Ablation. *Background:* Asymptomatic cerebral lesions (ACL) may occur during atrial fibrillation (AF) ablation. We sought to compare the ACL incidence between 3 contemporary technologies: (1) irrigated radiofrequency current (RFC), (2) the single big cryoballoon (CB), and (3) the endoscopic laser-balloon (LB) in a prospective randomized pilot study.

Methods and Results: Ninety-nine patients were treated in 3 groups. Diffusion weighted MRI was acquired pre- (n = 20) and 24–48 h postablation (n = 99). After ablation, new ACL were detected in 22% of patients without significant differences between groups (RFC 8/33; CB 6/33; LB 8/33; P = 0.8). The presence of hypertension was identified as the only independent predictor of ACL by univariate regression analysis. During LB ablation, more ablation lesions (140 ± 19 vs 119 ± 18; P = 0.007) were applied during longer procedures (166 ± 36 vs 143 ± 32 min; P = 0.05) in patients with ACL. Univariate analysis revealed that a higher number of ablation lesions predicted ACL (P = 0.02).

Conclusion: In this prospective, randomized, single-center pilot study, ablation technology did not influence the occurrence of ACL during AF ablation. *(J Cardiovasc Electrophysiol, Vol. 24, pp. 869-874, August 2013)*

Afib Ablation and Cognitive Dysfunction

Table 2. Number and Size of ACL per Patient. No Neurological Deficits Were Found in Any Patient after Ablation

Energy Source	# of ACL per Patient 0	1	2	3	Size Range (mm)
RFC	25	5	2	1	1–10
CB	27	6	0	0	2–5
LB	25	7	1	0	3–9

Schmidt et al, *J Cardiovasc Electrophysiol* 2013;24:869-74

Subtle Post-Procedural Cognitive Dysfunction After Atrial Fibrillation Ablation

Objectives This study sought to determine whether post-operative neurocognitive dysfunction (POCD) occurs after ablation for atrial fibrillation (AF).

Background Ablation for AF is a highly effective strategy; however, the risk of transient ischemic attack and stroke is approximately 0.5% to 1%. In addition, magnetic resonance imaging studies report a 7% to 14% prevalence of silent cerebral infarction. Whether cerebral ischemia results in POCD after ablation for AF is not well established.

Methods The study included 150 patients; 60 patients undergoing ablation for paroxysmal atrial fibrillation (PAF), 30 patients undergoing ablation for persistent atrial fibrillation (PeAF), and 30 patients undergoing ablation for supraventricular tachycardia (SVT) were compared with a matched nonoperative control group of patients with AF awaiting radiofrequency ablation ($n = 30$). Eight neuropsychological tests were administered at baseline and at 2 days and 90 days post-operatively. The tests were administered at the same time points to the nonoperative control group. The reliable change index was used to calculate POCD.

Results The prevalences of POCD at day 2 post-procedure were 28% in patients with PAF, 27% in patients with PeAF, 13% in patients with SVT, and 0% in control patients with AF ($p = 0.007$). At day 90, the prevalences of POCD were 13% in patients with PAF, 20% in patients with PeAF, 3% in patients with SVT, and 0% in control patients with AF ($p = 0.03$). When analyzing the 3 procedural groups together, 29 of 120 patients (24%) manifested POCD at day 2 and 15 of 120 patients (13%) at day 90 post-procedure ($p = 0.029$). On univariate analysis, increasing left atrial access time was associated with POCD at day 2 ($p = 0.04$) and day 90 ($p = 0.03$).

Conclusions Ablation for AF is associated with a 13% to 20% prevalence of POCD in patients with AF at long-term follow-up. These results were seen in a patient population with predominant $CHADS_2$ (Congestive heart failure, Hypertension, Age $\geq$75 years, Diabetes mellitus, previous Stroke/transient ischemic attack) scores of 0 to 1, representing the majority of patients undergoing ablation for AF. The long-term implications of these subtle changes require further study. (J Am Coll Cardiol 2013;62:531–9) © 2013 by the American College of Cardiology Foundation

Post Ablation Cognitive Dysfunction 90 Afib 30 SVT 30 Controls

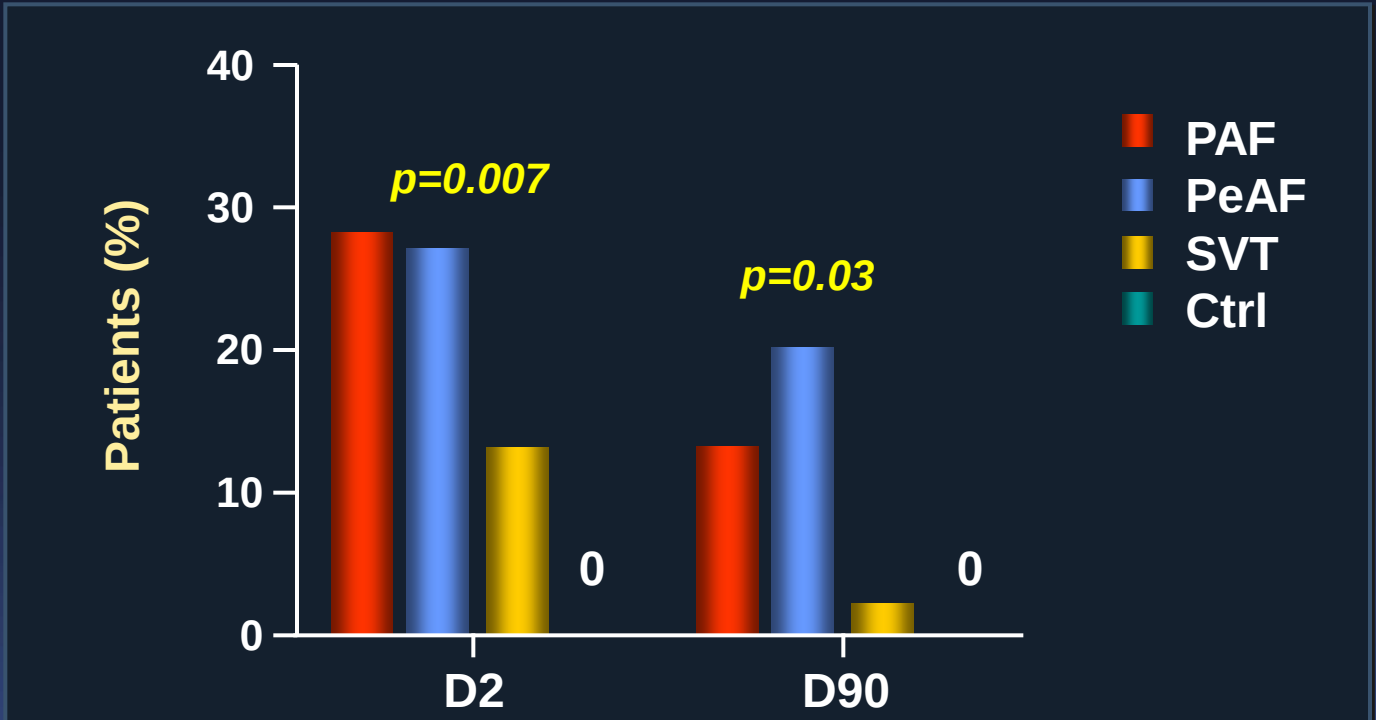


Figure 4. Prevalence of POCD Post-Ablation for AF

At day 90, the prevalence of POCD in patients with PAF was 13% and in patients with PeAF was 20%. POCD = post-operative cognitive dysfunction; PAF = paroxysmal atrial fibrillation; PeAF = persistent atrial fibrillation; SVT = supraventricular tachycardia.

Medi et al, *JACC* 2013;62:531-9

Incidence, characteristics and functional implications of cerebral embolic lesions after the MitraClip procedure

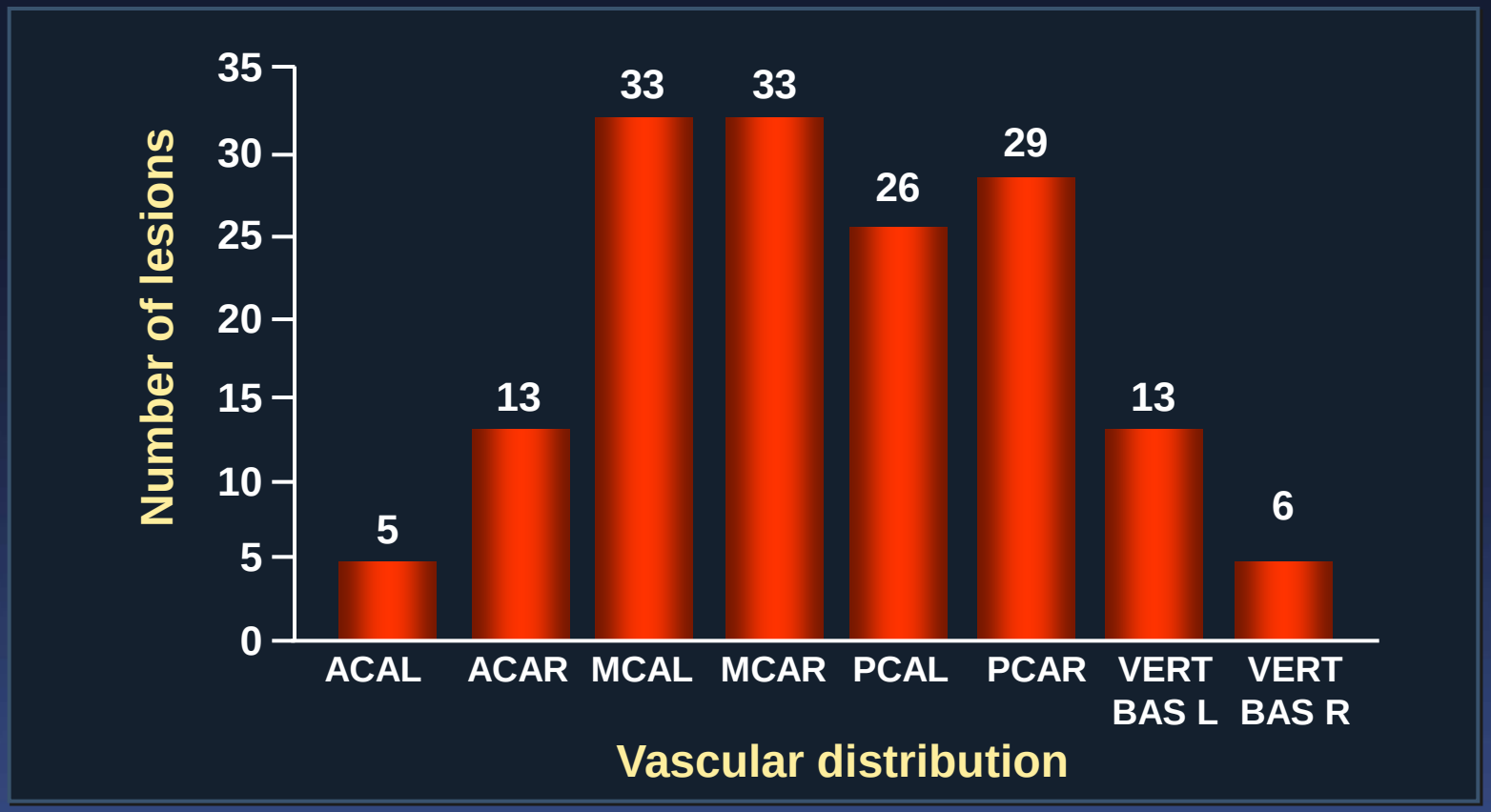
Abstract

Aims: This study aimed to assess the incidence and impact of cerebral embolic events after the MitraClip procedure.

Methods and results: Twenty-seven high-risk patients (logistic EuroSCORE I 25±15%) underwent the MitraClip procedure and cerebral diffusion-weighted magnetic resonance imaging (MRI) in median two days before and three days after the procedure. On the same day, neurocognitive function was assessed using the Montreal Cognitive Assessment (MoCA) questionnaire and thorough clinical examination. Comparison of pre- and post-interventional MRI showed that 23 of 27 patients (85.7%) had newly acquired microembolic lesions with in median three (interquartile range 1-9) new lesions per patient. Of these, three patients (11.1%) had lesions with diameter >5 mm. Patients with >3 new cerebral embolic lesions (n=13, 48%) had a lower post-interventional MoCA score in comparison to patients with ≤3 embolic lesions (23.6±3.6 vs. 20.3±4.5; p=0.046) in univariate analysis. Multivariate stepwise regression analysis identified device time as an independent predictor of the number of post-procedural new lesions (p=0.003) and, for reduced post-interventional MoCA score, a low MoCA score at baseline (p<0.001).

Conclusions: The MitraClip procedure results in new ischaemic cerebral lesions in the vast majority of patients. Preliminary data suggest that these lesions are clinically without significant impact on global cognitive function. ClinicalTrials.gov: NCT01288976

SCI with Mitraclip
n=27 100% New QWMRI Lesions



Cognitive Decline Correlated with Device Time
MoCA Decline Correlated with > 3 Lesions

Conclusions

- The most effective protection needs to cover all cerebral vessels
- We are underestimating or incidence of SCI in many procedures
- In spite of our wishful thinking these lesions are not benign