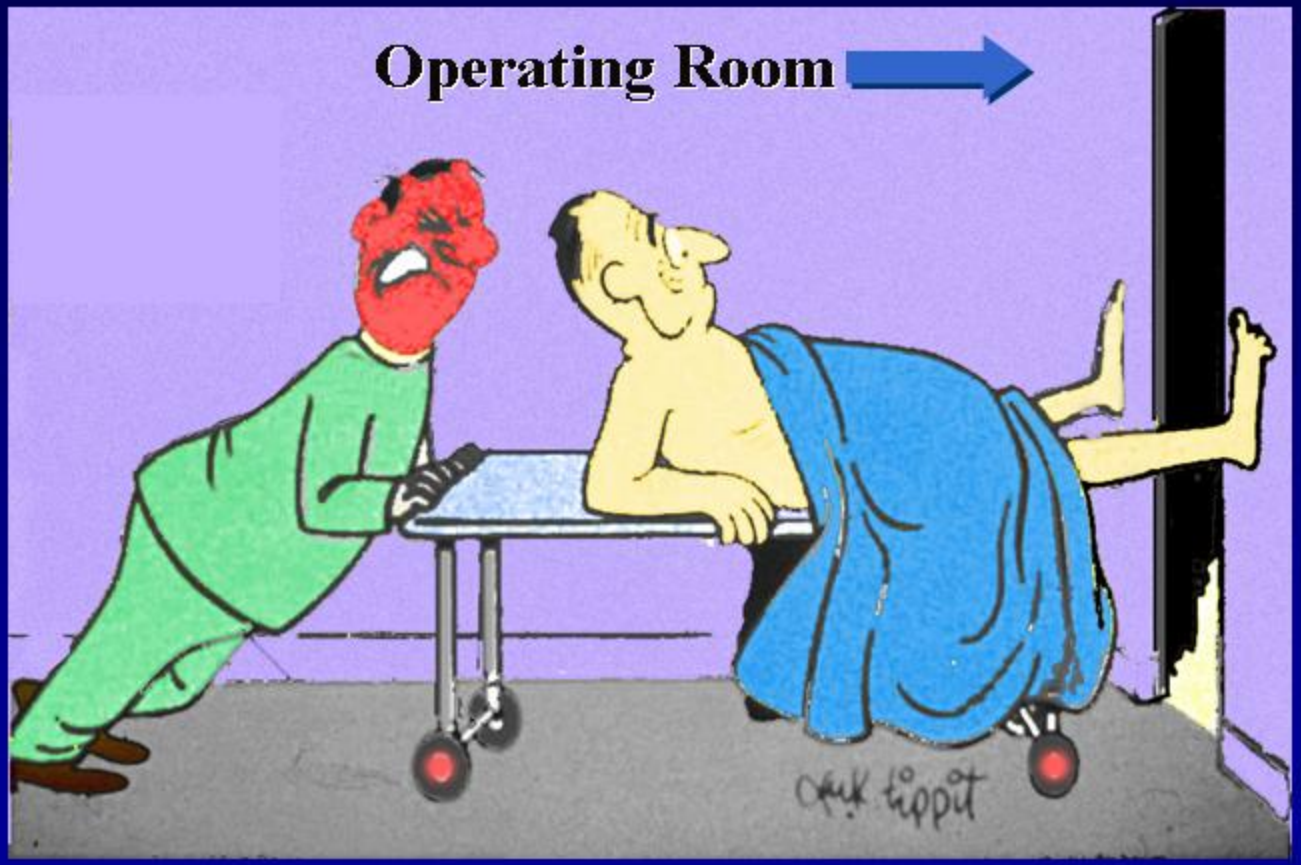
EMBOLIC PROTECTION DEVICES DURING CAROTID ARTERY STENTING

DR. MUKUNDAN.C

Carotid Surgery



CAS guidelines

- Class I
- **2. Carotid artery stenting (CAS) is indicated as an** alternative to CEA for symptomatic patients at average or low risk of complications associated with endovascular intervention when the diameter of the lumen of the internal carotid artery is reduced by more than 70% as documented by noninvasive imaging or more than 50% as documented by catheter angiography and the anticipated rate of periprocedural stroke or mortality is less than 6%. (Level of Evidence: B)

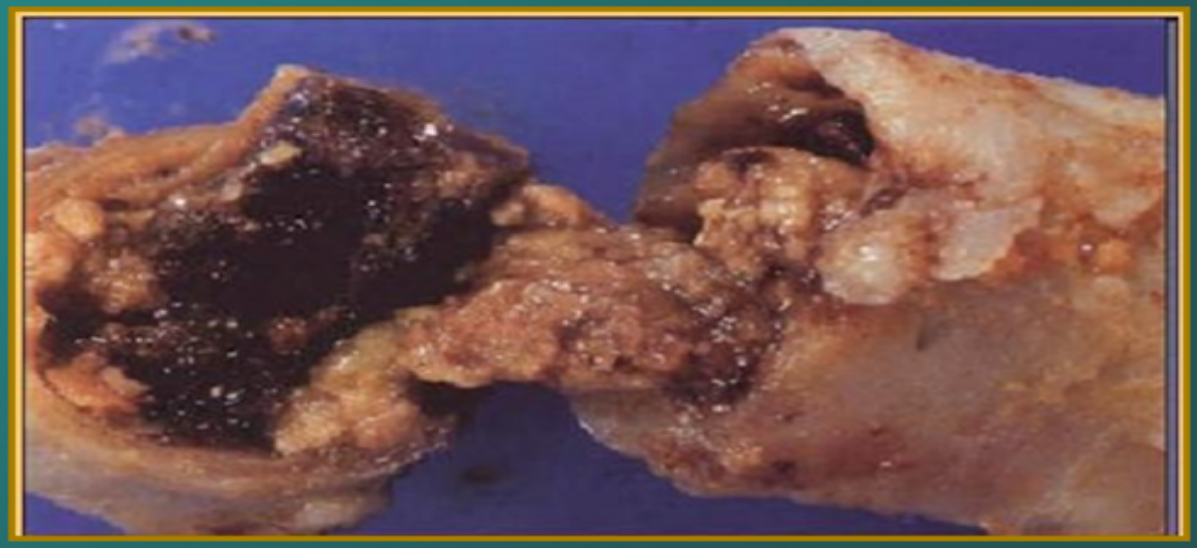
Management of Patients Undergoing CAS

- Class IIa
  - **1. Embolic protection device deployment during CAS** can be beneficial to reduce the risk of stroke when the risk of vascular injury is low. (Level of Evidence: C)

Technology Improvements

- Reduction in device profiles
- Nitinol self-expanding stents as additional therapeutic options to Wallstent
- Development of other dedicated carotid equipment:
  - Sheaths/guide catheter access
- Embolic protection devices:
  - Distal balloon occlusion
  - Proximal balloon occlusion with flow reversal
  - Distal filtration

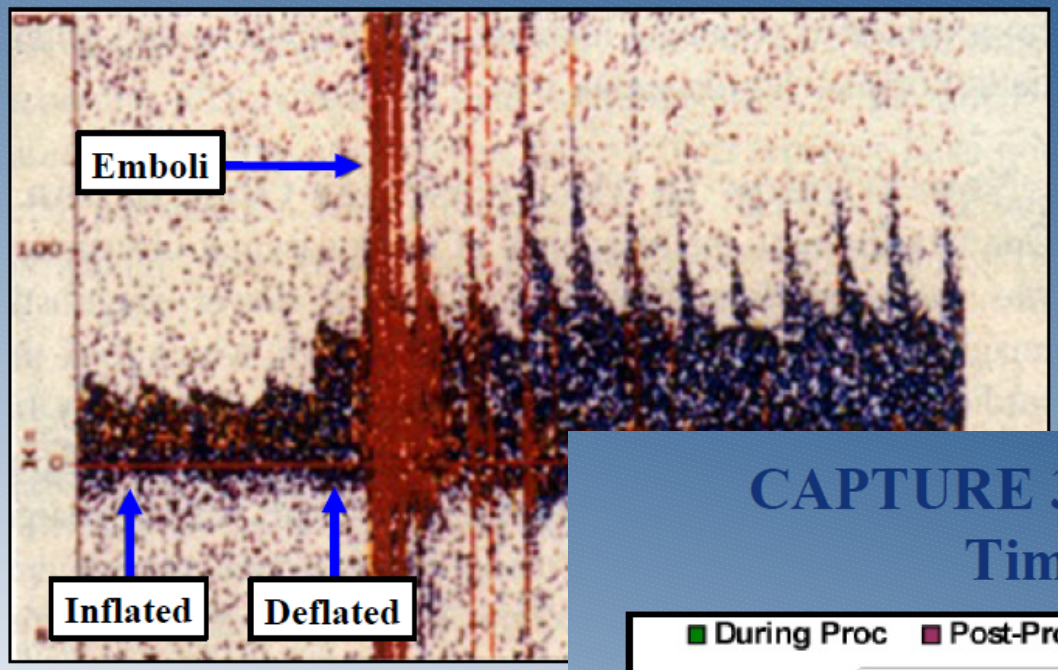
Why Embolic Protection?



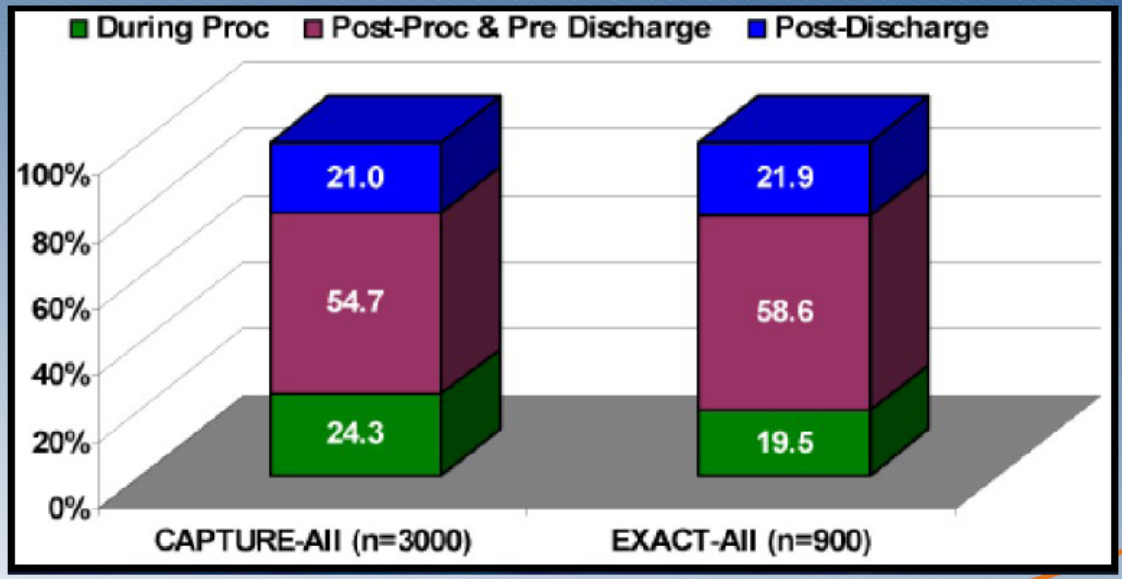
The main cause of complications is . . .

Cerebral Embolization

Transcranial Doppler During CAS



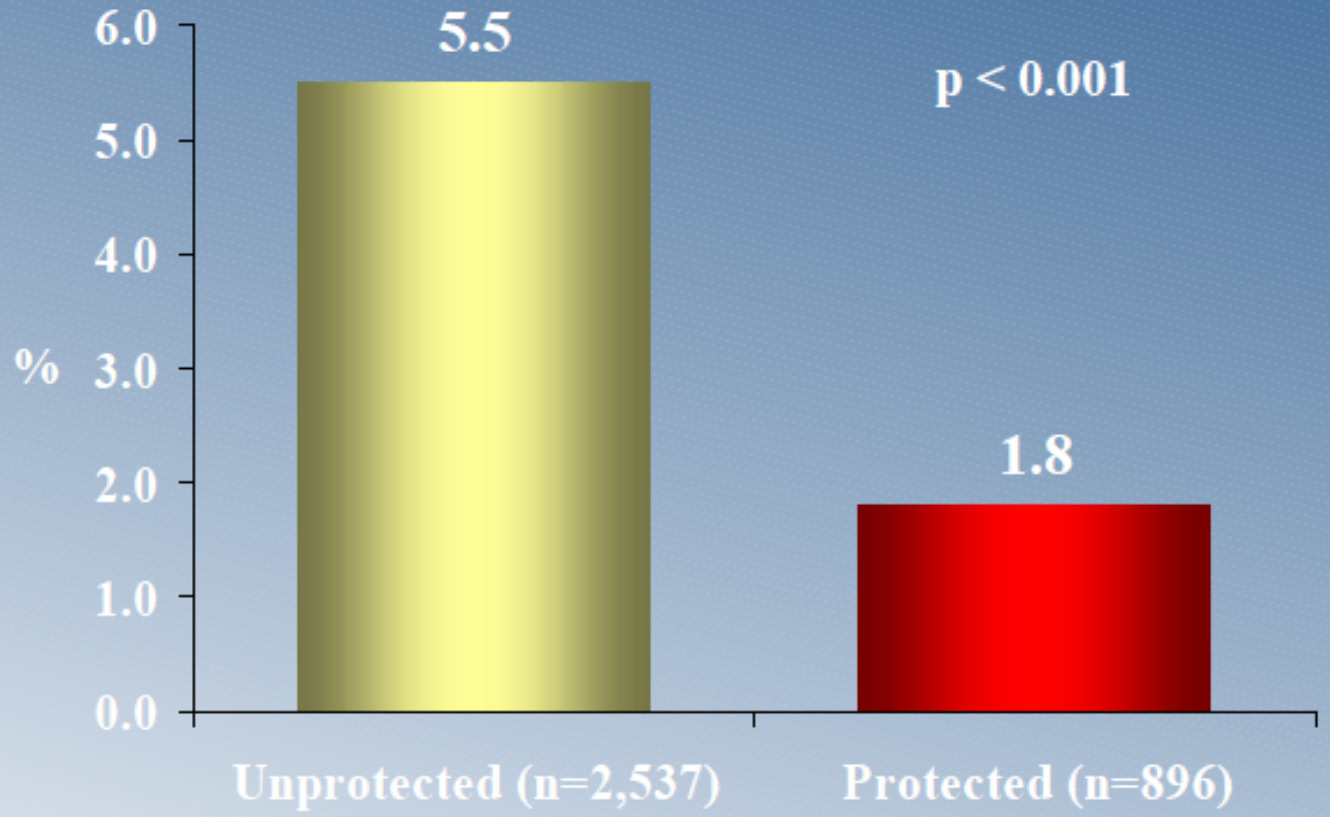
CAPTURE 3000 Vs. EXACT 900: Timing of Stroke



The Majority of Strokes Occur Post-Procedure and Before Discharge

Death and Stroke With and Without CPD

"A Systematic Review of the Literature"



Kastrup, A., et al, *Stroke* 2003;34:813–819.

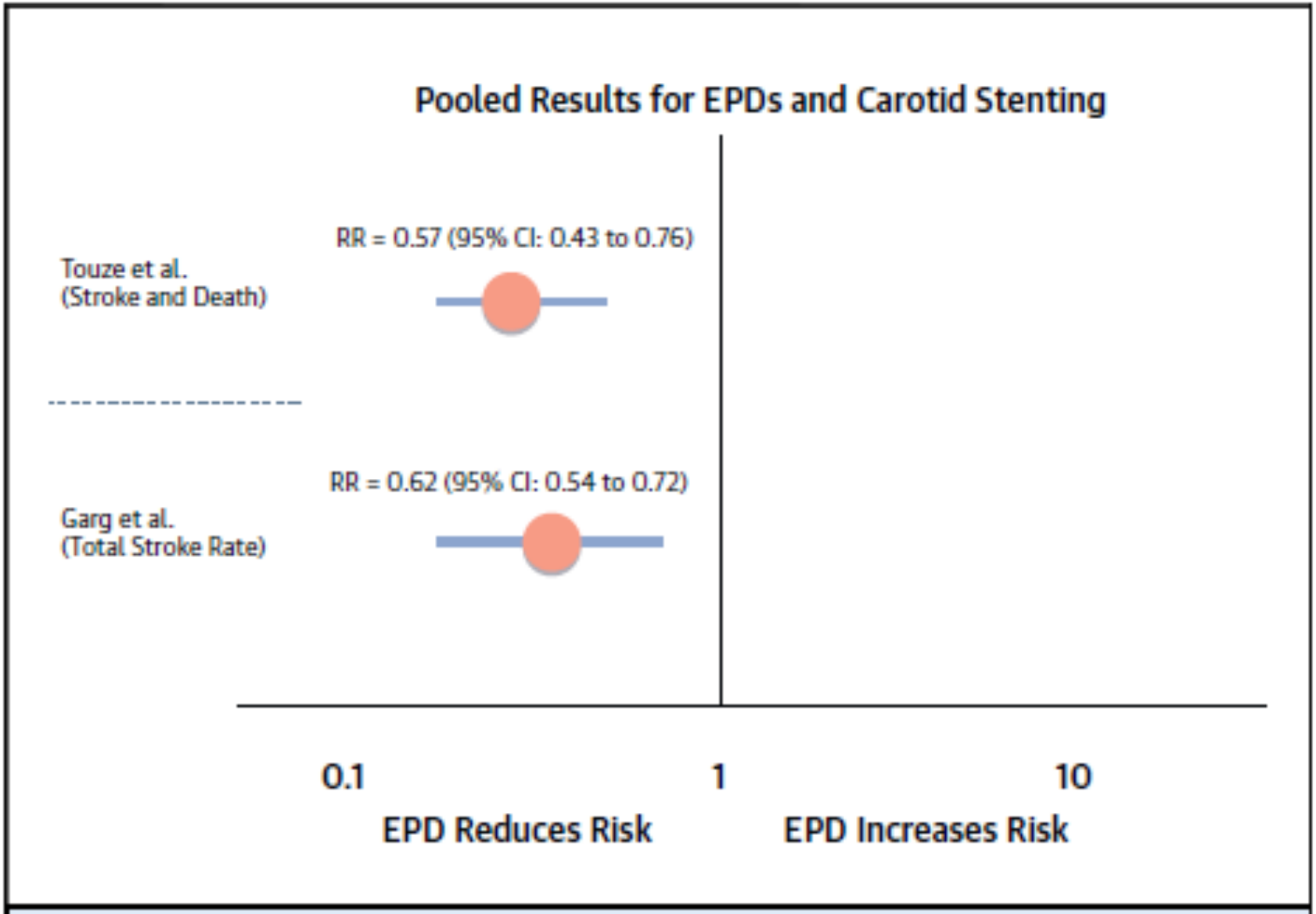


FIGURE 4 Utility of Embolic Protection Devices in Carotid Artery Stent

High Risk Patients

- ACT I
- ARCHER I-III
- CASES
- CABERNET
- CREATE
- CHRS
- EXACT
- MAVERIC
- PASCAL
- SECURITY

registries

- SAPPHIRE

randomized trial

Prospective Randomized Trials

- CAVATAS
- SPACE
- EVA-3S
- ICSS
- CREST
- SAPPHIRE

symptomatic patients

sympt. + asympt. patients

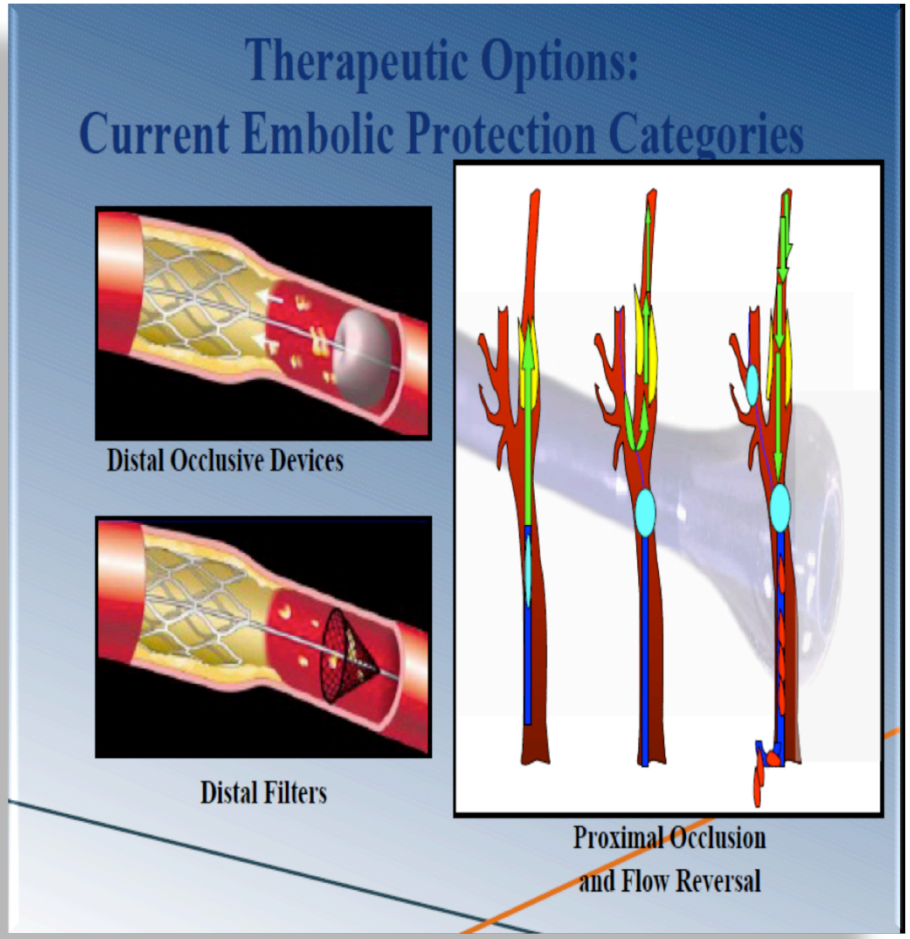
sympt. + asympt. high risk patients

- Percutaneous carotid revascularization with balloon angioplasty was pioneered in the early 1980s
- The advent of stent technology in the mid 1990s allowed protection against dissections and a restenosis rate in the single-digit range.

- Theron et al performed the first carotid artery angioplasty with an EPD in 1990
- Distal balloon occlusion system that allowed most of the trapped debris to be removed with an aspiration catheter.
- In their initial report, the stroke rate was reduced by 50%
- The introduction of embolic protection devices (EPDs) in the year 2000 made CAS a safer procedure

CATEGORIES OF EPDs

- 1. Flow preservation devices: distal filters (DFs)
- 2. Distal occlusion devices (DODs): DBOs
- 3. Proximal protection devices:
  - Mo.Ma Ultra Proximal Protection System (Medtronic Invatec, Frauenfeld, Switzerland)
  - Gore Flow Reversal System (W. L. Gore and Associates, Flagstaff, Ariz)



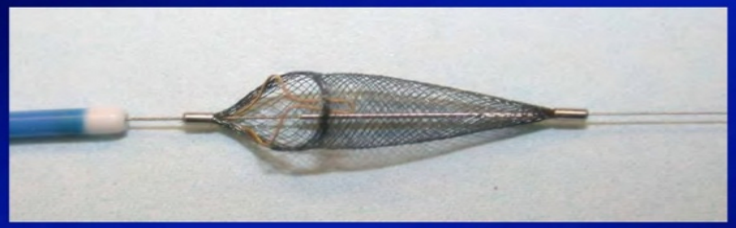
Flow preservation devices (DFs)

- The most commonly used
- Allows antegrade cerebral flow during the entire procedure
- Filter designs vary: some can be advanced over a 0.014-inch wire, and others are attached to a steerable wire tip

Flow preservation devices (DFs)- limitations

- The need to cross the lesion before
- Escape of particles below the size of 60 micron
- Filter occlusion and flow stagnation
- Filter entanglement in the stent
- In tortuous and large distal carotids incomplete wall apposition and escape of particles

Spider (ev3)



3.2 F
Retrieval-Catheter 3.2 F
Filter ∅ 3-7 mm
Micropores: 48-167µ
Wire of your choice

Accunet RX (Guidant)

3.5 – 3.7 F

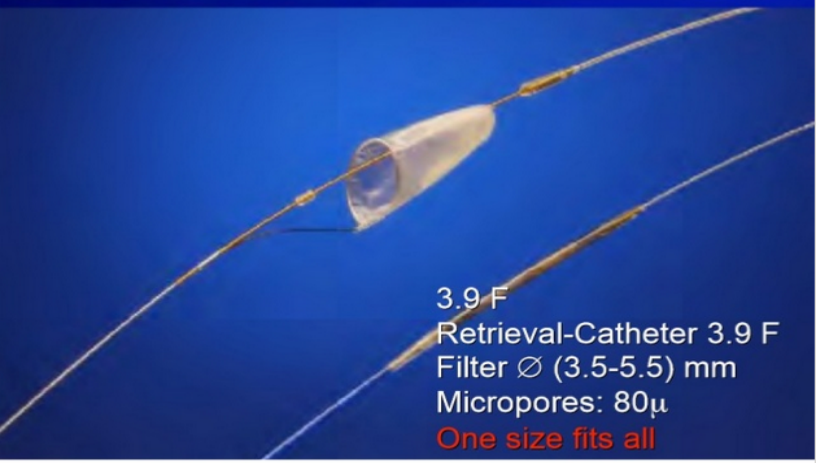
Angioguard XP (Cordis)

3.2-4.0 F
Retrieval-Catheter 5.1 F
Filter ∅ 4-8 mm

Emboshield (Mednova-Abbott)

2.9 – 3.3 F
Retrieval-Catheter 6 F
Filter ∅ 3-6 mm

EPI-Filter EZ (Boston Scientific)



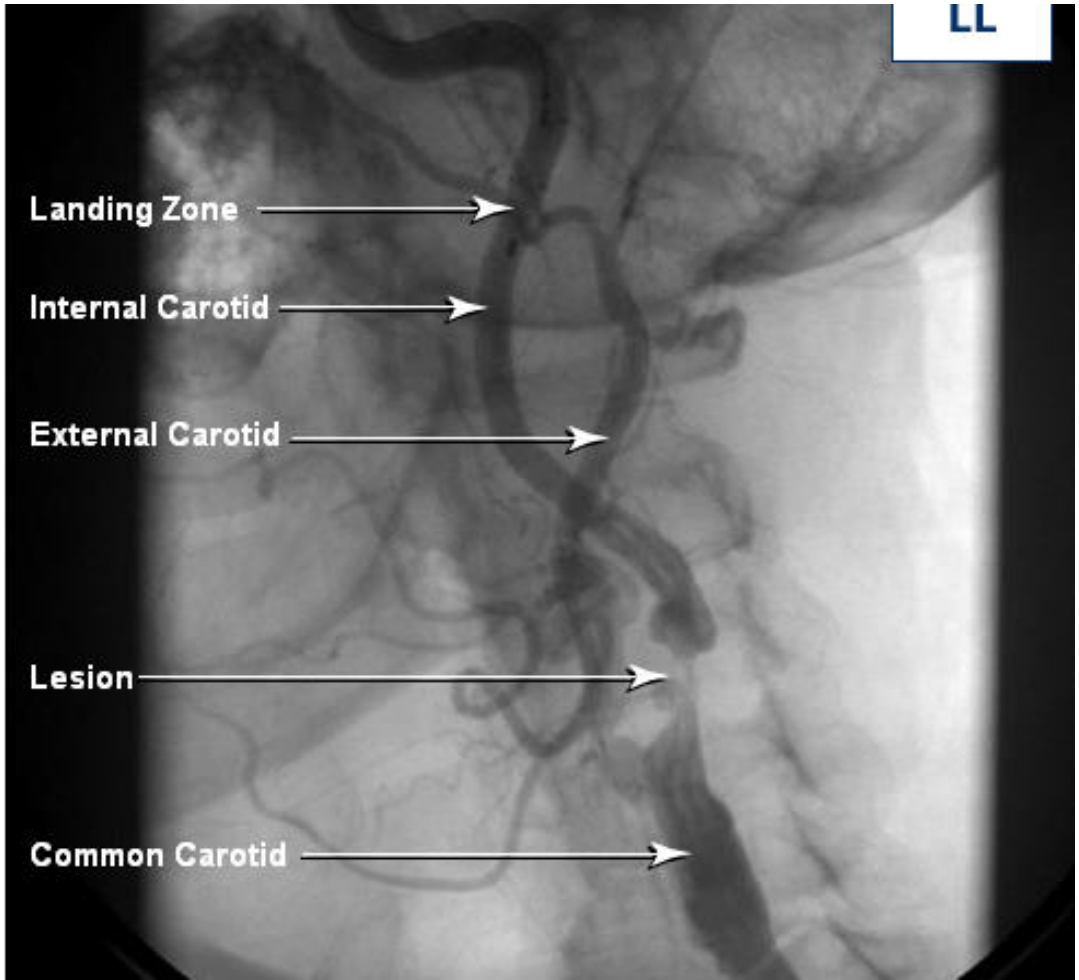
3.9 F
Retrieval-Catheter 3.9 F
Filter ∅ (3.5-5.5) mm
Micropores: 80µ
One size fits all

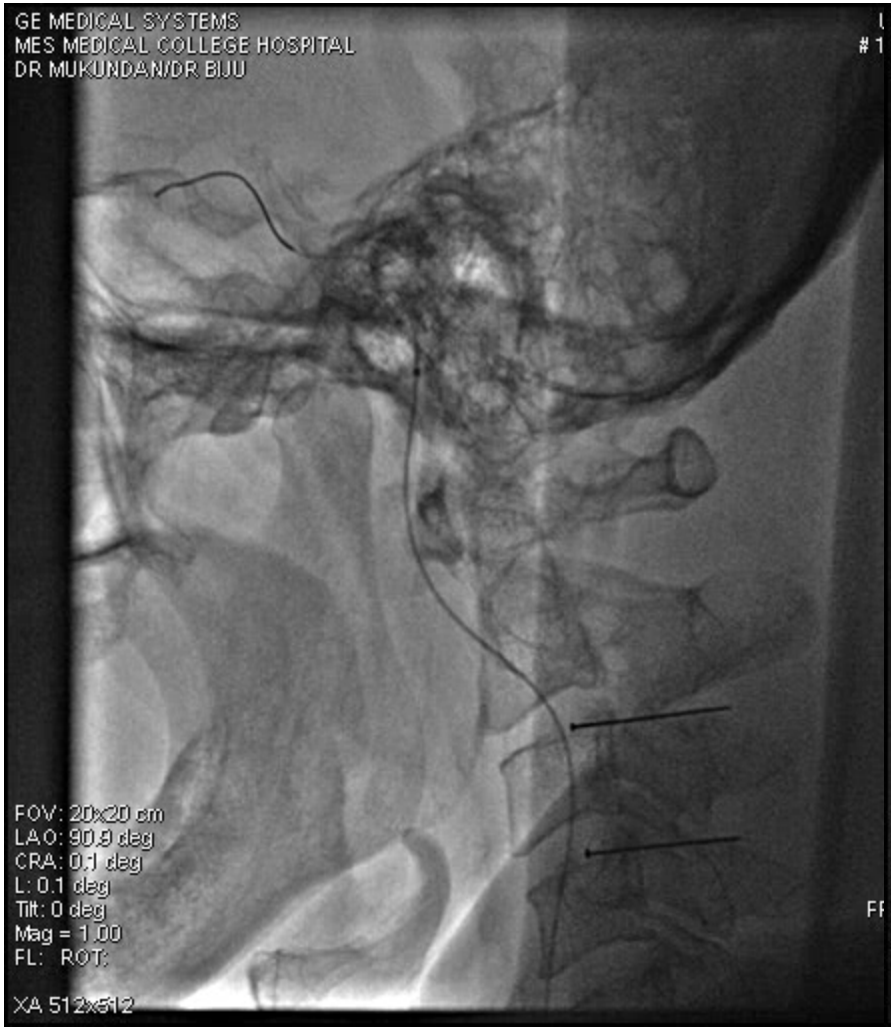
Rubicon Filter (Rubicon/Boston)

Distal Embolic Filters

Landing Zones

- Filters are positioned in a straight portion of the ICA(“landing-zone”) in order to optimise adaptation of the frame to thevessel wal

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Tilt: 0 deg
Mag = 1.00
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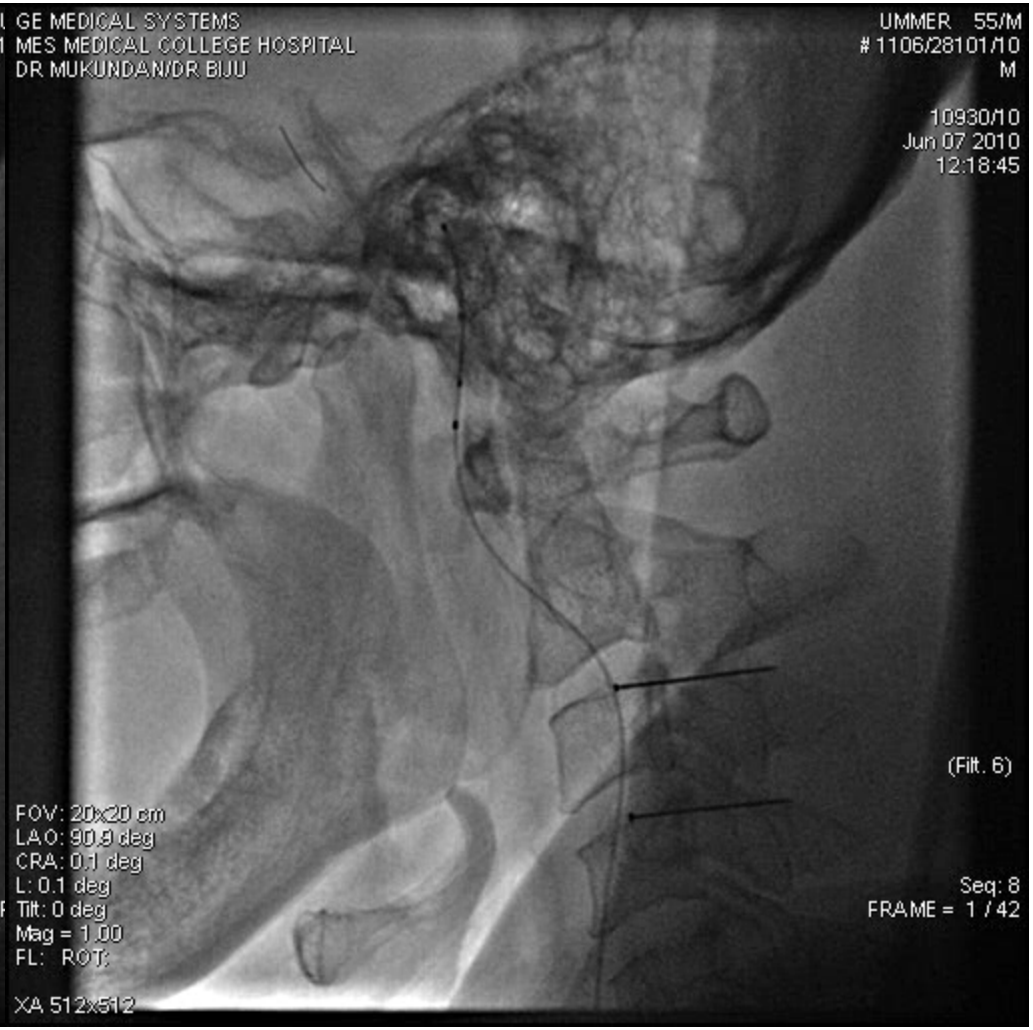
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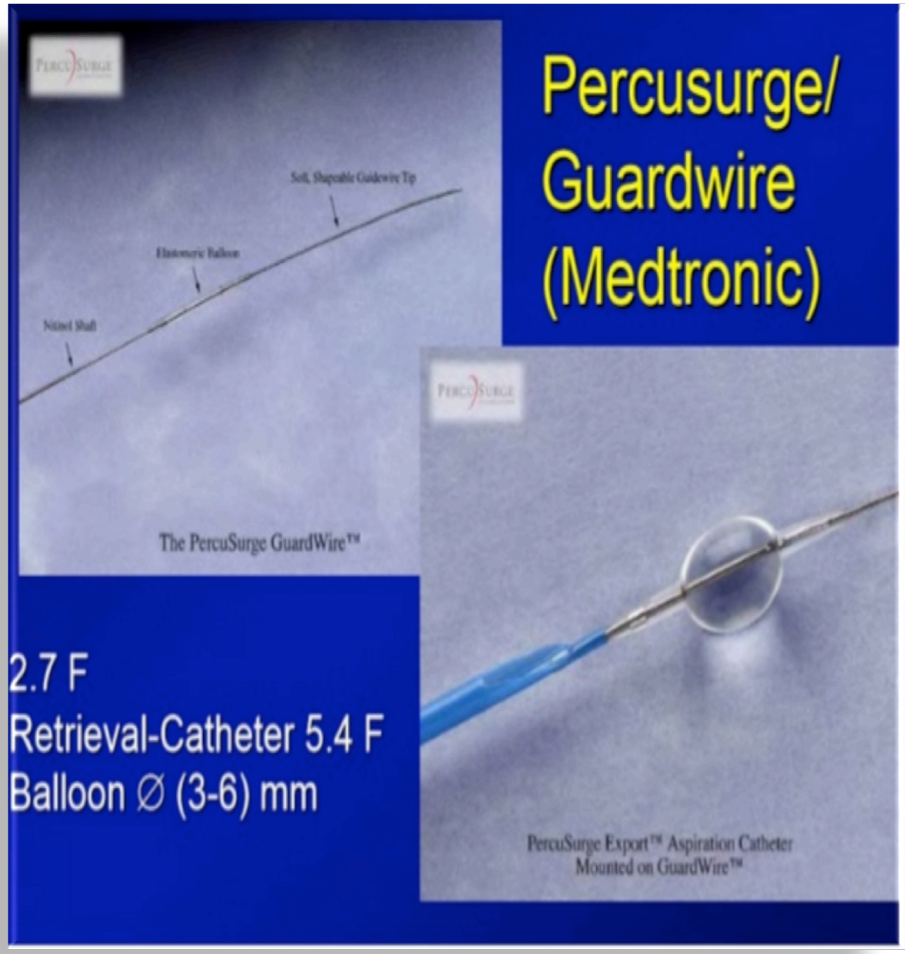
Table 3. Filter devices.

Filter	Manufacturer	Relationship to guidewire	Basket position	Effective pore size (μm)	Vessel size (mm)	Crossing profile (Fr)
Accunet	Abbott Vascular	Wire-mounted torque independent	Concentric	125	3.25-7.0	3.5-3.7
Angioguard	Cordis	Wire-mounted	Concentric	100	3-7.5	3.2-3.9
Emboshield NAV6	Abbott Vascular	Wire-mounted & bare-wire	Concentric	120	2.5-7.0	2.8-3.2
Fibernet	Invatec	Wire-mounted	Concentric	40	3.5-7.0	2.4-2.9
FilterWire	Boston Scientific	Wire-mounted	Eccentric	110	3.5-5.5	3.2
Spider	ev3	Bare-wire	Eccentric	167-209	3.0-7.0	3.2

Distal occlusion devices (DODs): DBOs

- 3-6mm diameter, 014 system
- Low profile, short landing zone
- Can be used in tortuous vessels
- Ability of aspiration of particles below100 micron

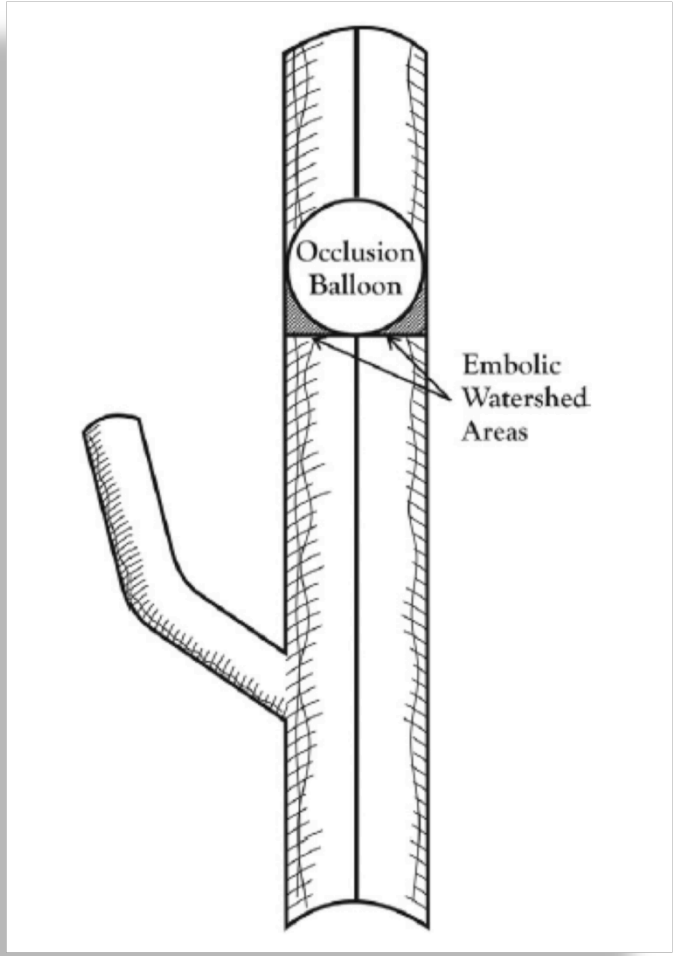


Distal occlusion devices (DODs): DBOs-limitations

- DOD intolerance- circulation arrest in the internal carotid artery
  - preoperative evaluation of the circle of Willis and the status of the contralateral carotid artery
- Inability to visualize the lesion
- Potential for spasm or dissection.

Distal occlusion devices (DODs): DBOs- limitations

The inability to remove all of the embolic material from the watershed area on either side of the balloon.



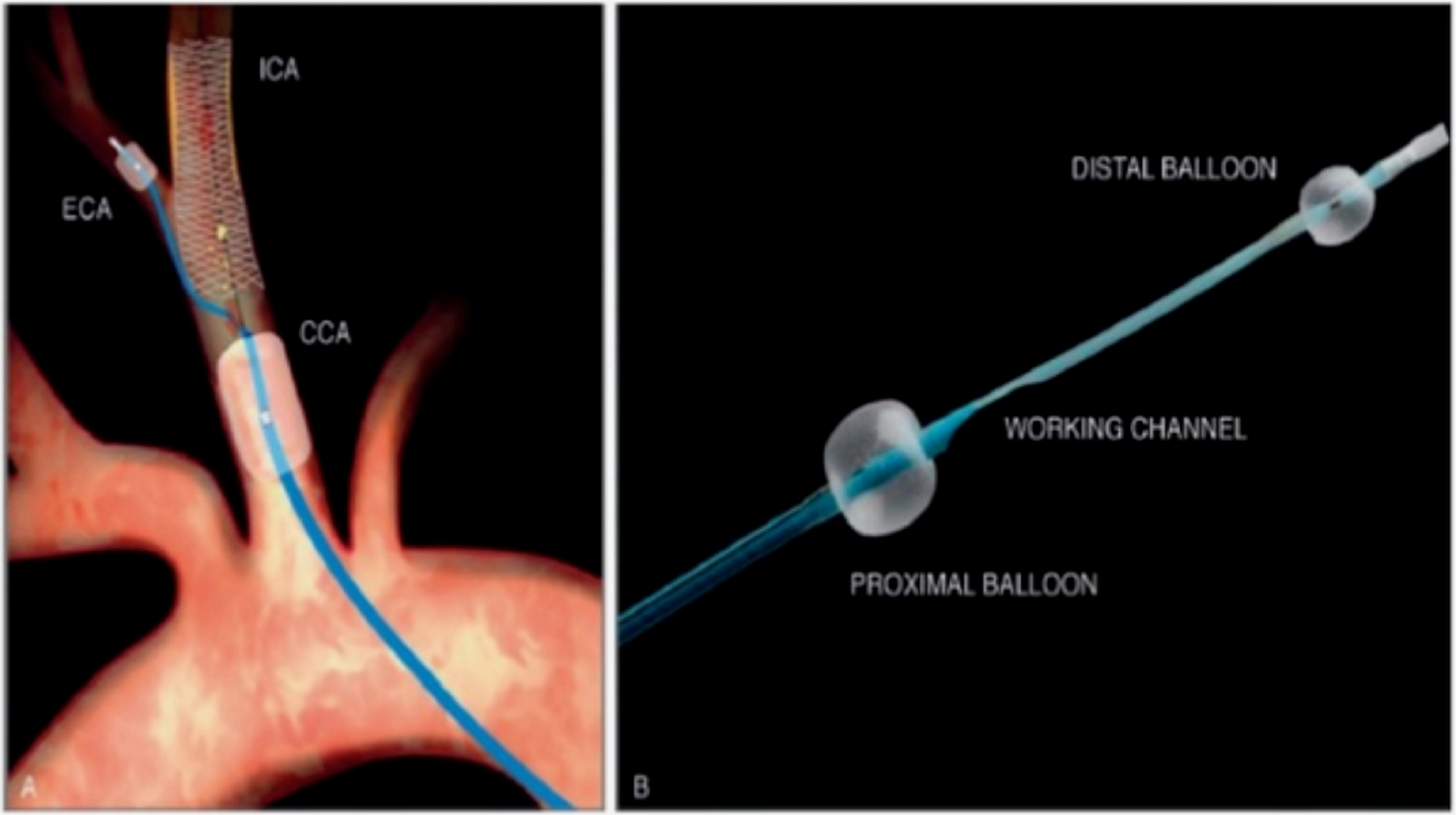
Proximal protection devices

- Reports shows 15% of cerebral emboli occur during the initial crossing of the lesion
- Allows embolic protection before the lesion is crossed using flow stasis and flow reversal.
- Advantage – no interaction with the plaque occurs until the reversal/stagnation of flow is initiated.

Proximal embolic protection

- Flow reversal (WL Gore NPS)
- Flow arrest (Invatec/Medtronic Mo.Ma)
- F.A.S.T. (Silk Road)

MO.MA™ (INVATEC S.P.A., RONCADELLE, ITALY



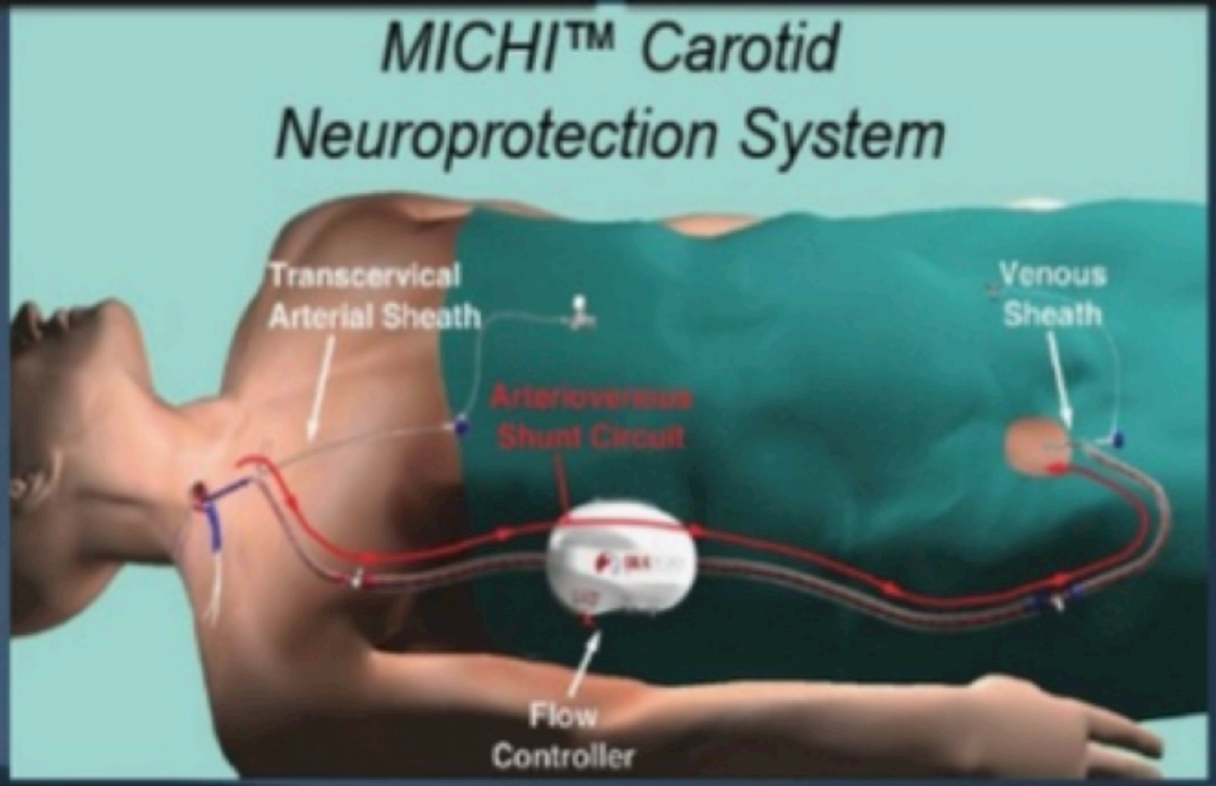
9FR sheath with integrated baloon in CCA
EXTENDED INTEGRATED BALOON IN ECA.

FAST-CAS

Flow Altered Short Transcervical Carotid Artery Stenting

- Direct carotid access
- Arteriovenous shunt
- Hi – Lo – Stop reverse flow control
- Dedicated transcervical sheath design

- Avoids arch manipulation
- Neuroprotection before crossing lesion
- Simplified stent delivery
- No distal filters or ECA balloon required



Proximal protection recommended for

1. Symptomatic carotid ulcerative plaque/filling defect in patients who are not candidates for open surgery
2. Symptomatic patients with abnormal transcranial echoes with reduced cognitive function

Journal of
Vascular Surgery®

The type of embolic protection does not influence the outcome in carotid artery stenting

Vikram Iyer, MD,[a] Gianmarco de Donato, MD,[b] Koen Deloose, MD,[a] Patrick Peeters, MD,[c] Fausto Castriota, MD,[d] Alberto Cremonesi, MD,[d] Carlo Setacci, MD,[b] and Marc Bosiers, MD,[a]
Dendermonde and Bonheiden, Belgium; and Siena and Cotignola, Italy

Conclusion: The use of EPDs is associated with a low risk of procedural adverse events. We were unable to detect significant differences in risks of procedural adverse events between different devices or types of devices. We speculate that the observed differences seen at 30 days are largely attributable to differences in stent-type used. (J Vasc Surg 2007;46: 251-6.)

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Embolic Protection Devices for Carotid Artery Stenting

Is There a Difference Between Filter and Distal Occlusive Devices?

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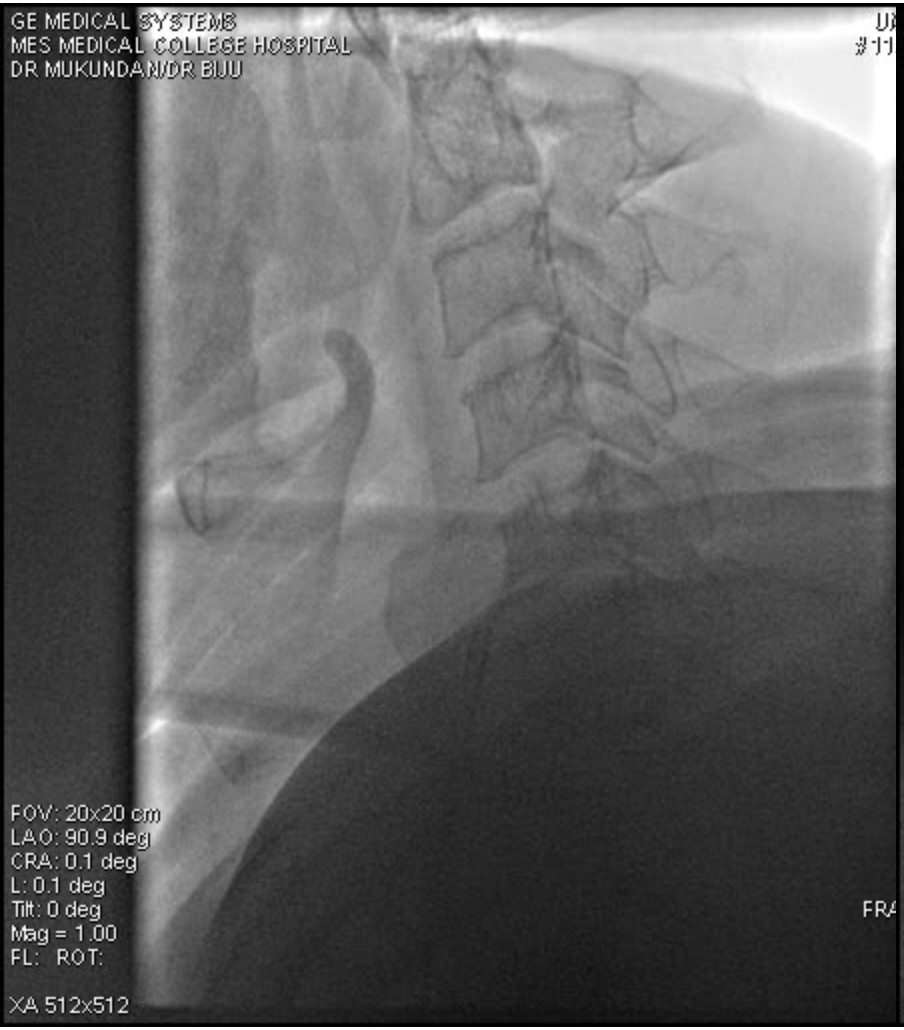
Ludwigshafen, München-Bogenhausen, Worms, Wesel, Trier, Hannover, Wiesbaden, and Detmold, Germany

CONCLUSIONS Filter EPD is the currently preferred method of EPD in clinical practice. Both F-EPD and DO-EPD seem to be equally effective during CAS. (J Am Coll Cardiol 2005;45:1769–74)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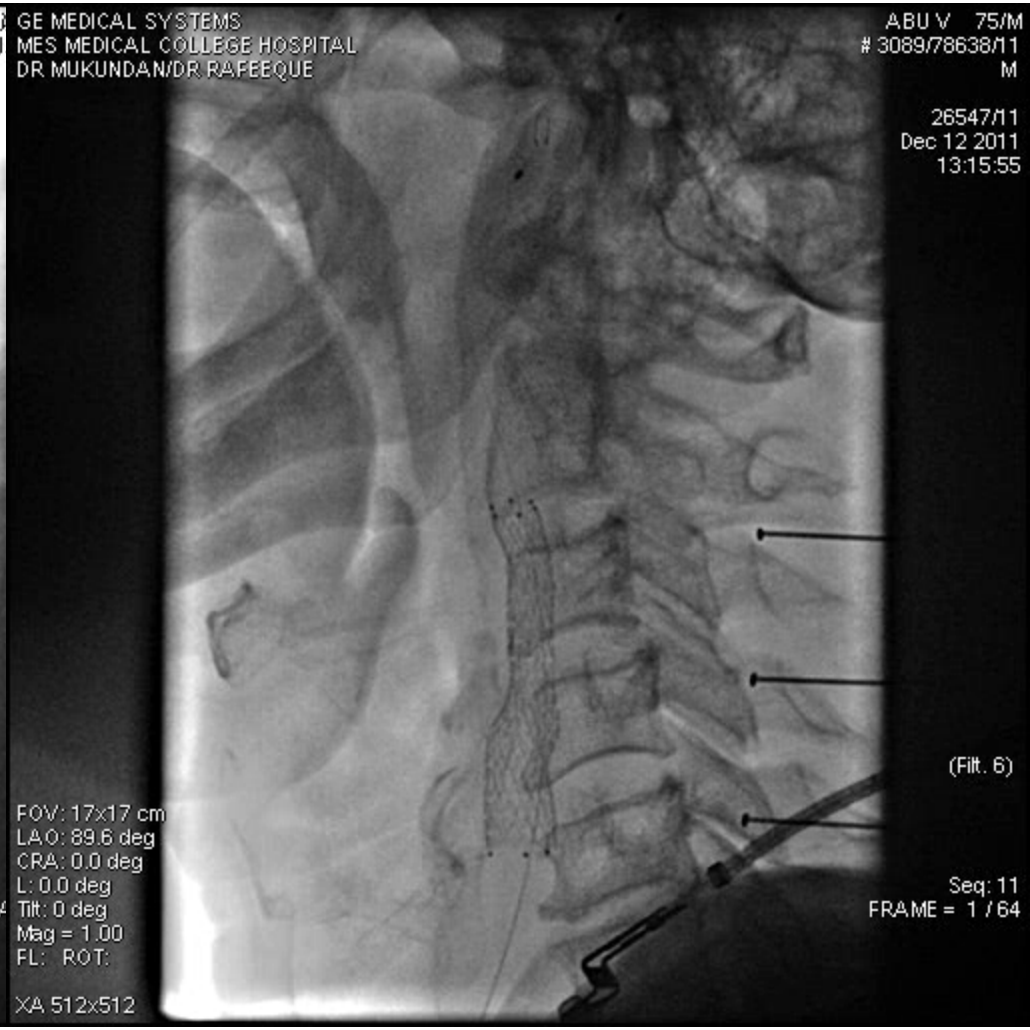
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Thank You