Does CREST Trial Change the Practice of Symptomatic Carotid Stenosis

Andrej Schmidt, MD

Park-Hospital Leipzig
Medical Clinic I, Angiology, Cardiology

Heartcenter Leipzig
Clinical and Interventional Angiology

Germany

Randomized Studies CEA vs. CAS

	N	Stent	Surgery	P
CAVATAS, *Lancet 2001*	505	10 %	10 %	ns
SAPPHIRE, *NEJM 2004*	307	4,4 %	9,9 %	ns
EVA 3S, *NEJM 2006*	527	9,6 %	3,9 %	< 0,05
SPACE, *Lancet 2006*	1183	6,8 %	6,3 %	-
ICSS, *Lancet 2010*	1649	7,4 %	4,0 %	< 0,05

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CREST, *NEJM 2010*	**2502**	**5,2 %**	**4,5 %**	**ns**

CAVATAS

Carotid and Vertebral Artery Transluminal Angioplasty Study

- Multicentric, randomized, 251 PTA, 253 CEA
- 30 days MAE (stroke > 7 days or death):
  - PTA **9,9%**
  - CEA **10,0%**
- Stent-implantation only in **26 %**

Lancet 2001

Embolization During CAS

SPACE: CEA vs. CAS in Symptomatic Patients

	CEA (584)	CAS (599)	*P*
Primary endpoint (ipsilateral stroke or death within 30 days)	**6.34 %**	**6.84 %**	0,09

Protection-system	Yes	No
	172	413

The Space Collaborative Group, *Lancet* 2006

Prerequisites for a RCT Comparing CEA and CAS

- Stent-implantation is mandatory
- Cerebrale protection is mandatory
- Surgical / interventional experience

EVA-3S: CEA vs. CAS in Symptomatic Patients

	CEA	CAS
30-days stroke / death	3.9 %	9.6 %

- Interventionalist with **no** experience in CAS could include patients, if CAS was performed under supervision.

Mas et al., *NEJM* 2006

ICSS (International Carotid Stenting Study)

CAS vs. CEA of symptomatic patients: **Interim-analysis**

Primary endpoint: any stroke up to 3 y after revascularization

	CEA (821)	CAS (828)	P
Any stroke	3.3 %	7.0 %	0.001

Qualification of the surgeon: 50 procedures
Qualification of the interventionalist: 10 procedures

Lancet 2010; 375:985-97

CREST: Stent vs. CEA

- Symptomatic and asymptomatic patients

- Primary endpoint:
  - Periprocedural stroke / MI / death
  - Ipsilateraler stroke up to 4 years

- Surgeons and interventionalists were individualy credentialized during a lead-in phase.

- Cerebral protection in 96.1 %

Brott et al., *N Eng J Med* 2010

CREST: Periprocedural Complications

	CEA	CAS	P
N	1240	1262	
Stroke	2.3 %	4.1 %	0.01
MI	2.3 %	1.1 %	0.03
Death	0.3 %	0.7 %	0.18
Primary endpoint (Stroke, MI, death)	**4.5 %**	**5.2 %**	**0.38**

Brott et al., *N Eng J Med* 2010

CREST Asymptomatic vs. Symptomatic Patients

To improve comparability to other trials

- Asymptomatic n = 1181

(≥ 60% stenosis by aniography)

- Symptomatic n = 1321

(≥ 50% stenosis by aniography)

Silver et al., *Stroke* 2011;42:675-680

CREST: Periprocedural Complications

	CEA	CAS	P
Entire group Primary endpoint (Stroke, MI, death)	**4.5 %**	**5.2 %**	**0.38**
Symptomatic pts. Primary endpoint	**5.4 %**	**6.7 %**	**0.30**
Asymptomatic pts. Primary endpoint	**3.6 %**	**3.5 %**	**0.96**

Silver et al., *Stroke* 2011;42:675-680

CREST: Periprocedural Complications: Stroke and Death for Pts. < 80 years

NASCET, ECST, ACS, ACST included only patients < 80 years

	CEA	CAS	P
Symptomatic pts. (n=1170)	**2.6 %**	**5.6 %**	**0.006**
Asymptomatic pts. (n=1091)	**1.5 %**	**2.4 %**	**0.27**

Rates are within the AHA/ASA-guidelines:
< 6% for symptomatic,
< 3% for asymptomatic stenoses

Silver et al., *Stroke* 2011;42:675-680

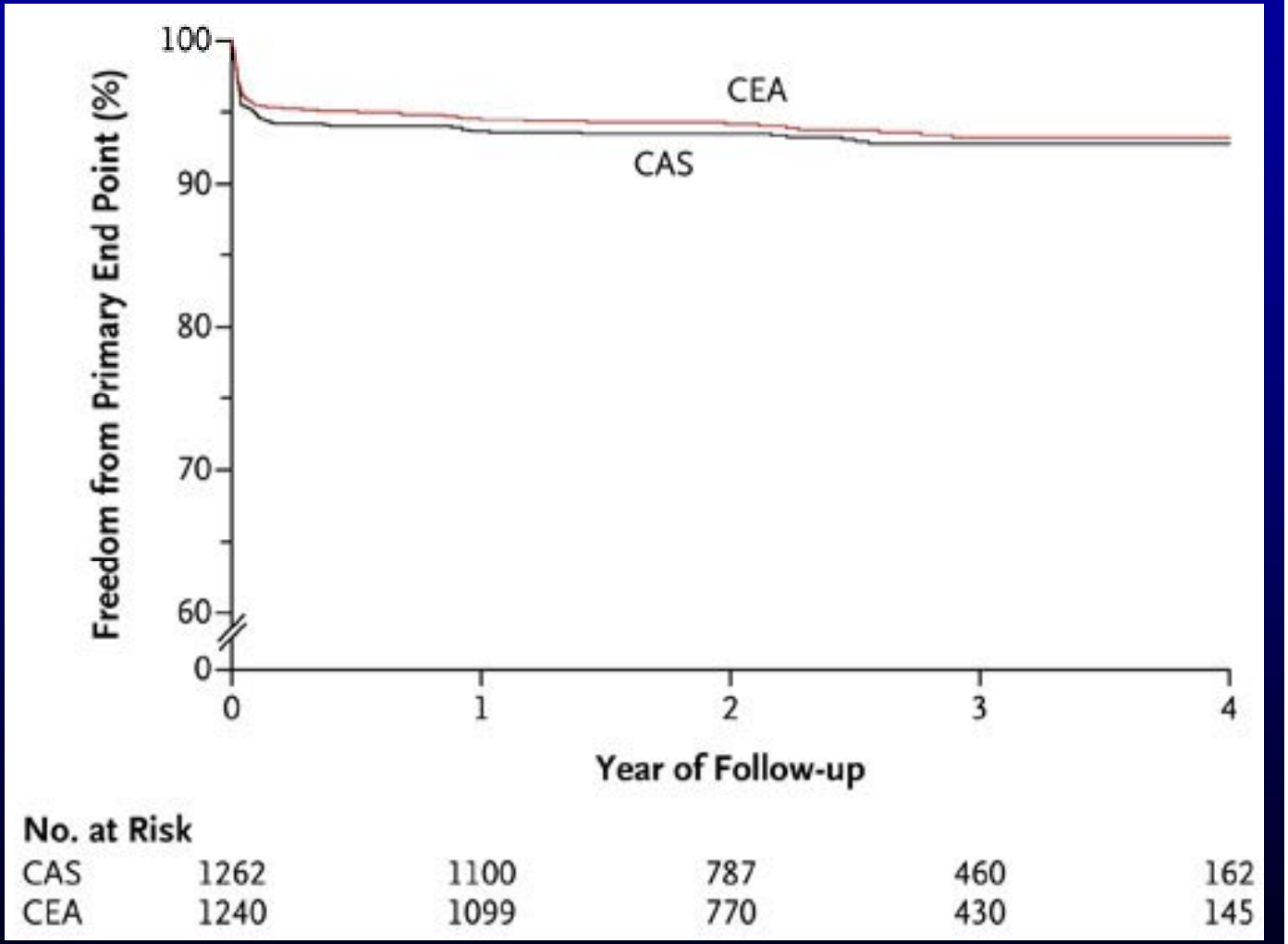
CREST: Periprocedural Stroke

		CEA	CAS	P
All stroke	Symptomatic	**3.2 %**	**5.5 %**	**0.043**
	Asymptomatic	**1.4 %**	**2.5 %**	**0.15**
Major stroke	Symptomatic	**0.9 %**	**1.2 %**	**0.61**
	Asymptomatic	**0.3 %**	**0.5 %**	**0.66**
Minor stroke	Symptomatic	**2.3 %**	**4.3 %**	**0.042**
	Asymptomatic	**1.0 %**	**2.0 %**	**0.15**

Silver et al., *Stroke* 2011;42:675-680

CREST: 2. Primary Endpoint: Ipsilateral Stroke up to 4 Y after Revascularizariton

	Ipsilateral Stroke
Stent	2.0 %
Surgery	2.4 %



Brott et al., *N Eng J Med* 2010

CREST Conclusion

- Similar results for CAS and CEA
- independent from symptomatic status

- Rate of minor strokes in favour for CEA

- Do we need further RCTs ?

- Yes, therapies are improving over time

CREST: Stent vs. Surgery

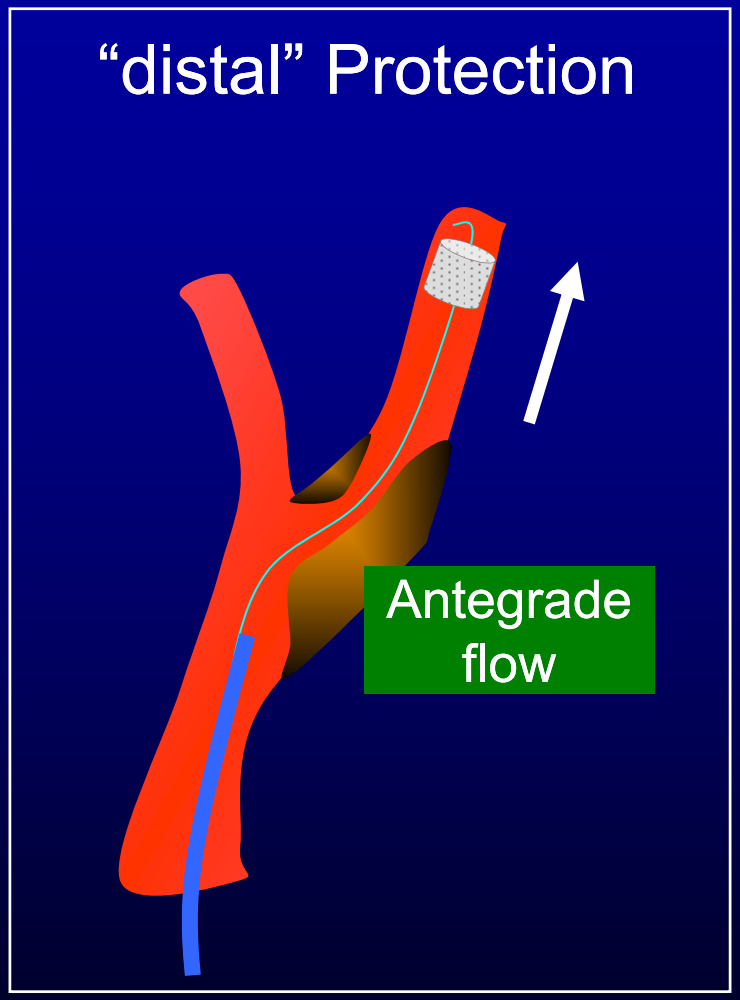
- Patient-inclusion 2000 - 2008

- Interventional technique:
  - Only 1 filter-system (Accunet, Abbott)
  - Only 1 stent-system (Acculink, Abbott)

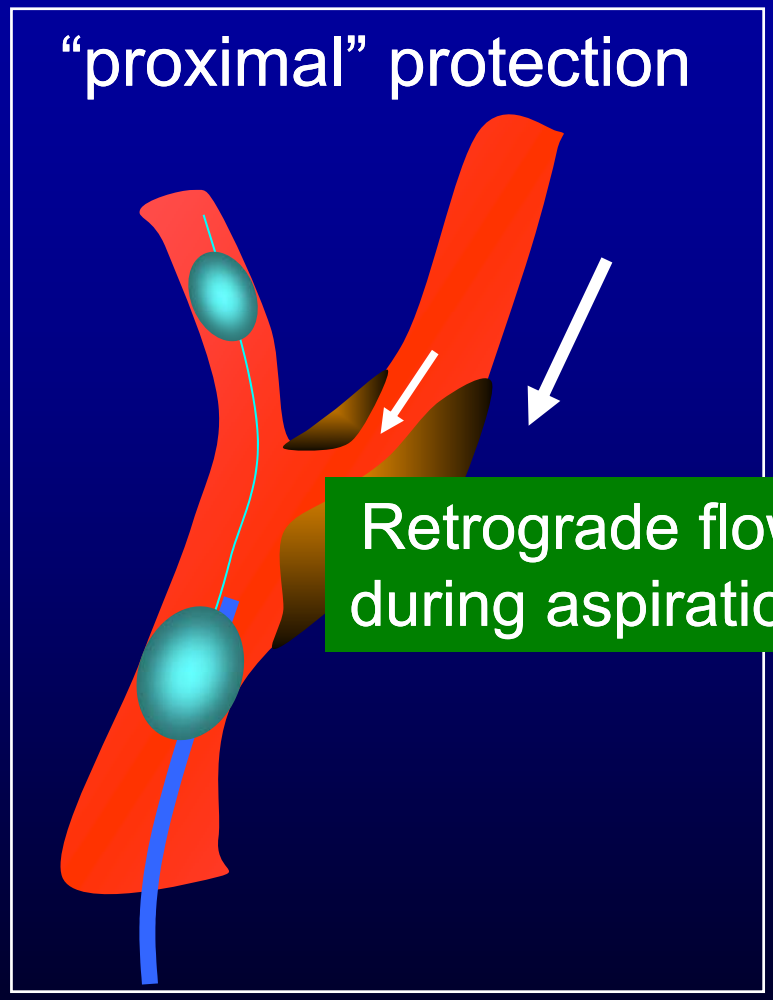
Brott et al., *N Eng J Med* 2010

Would you treat this lesions using a filter ?

Concepts of Cerebral Protection

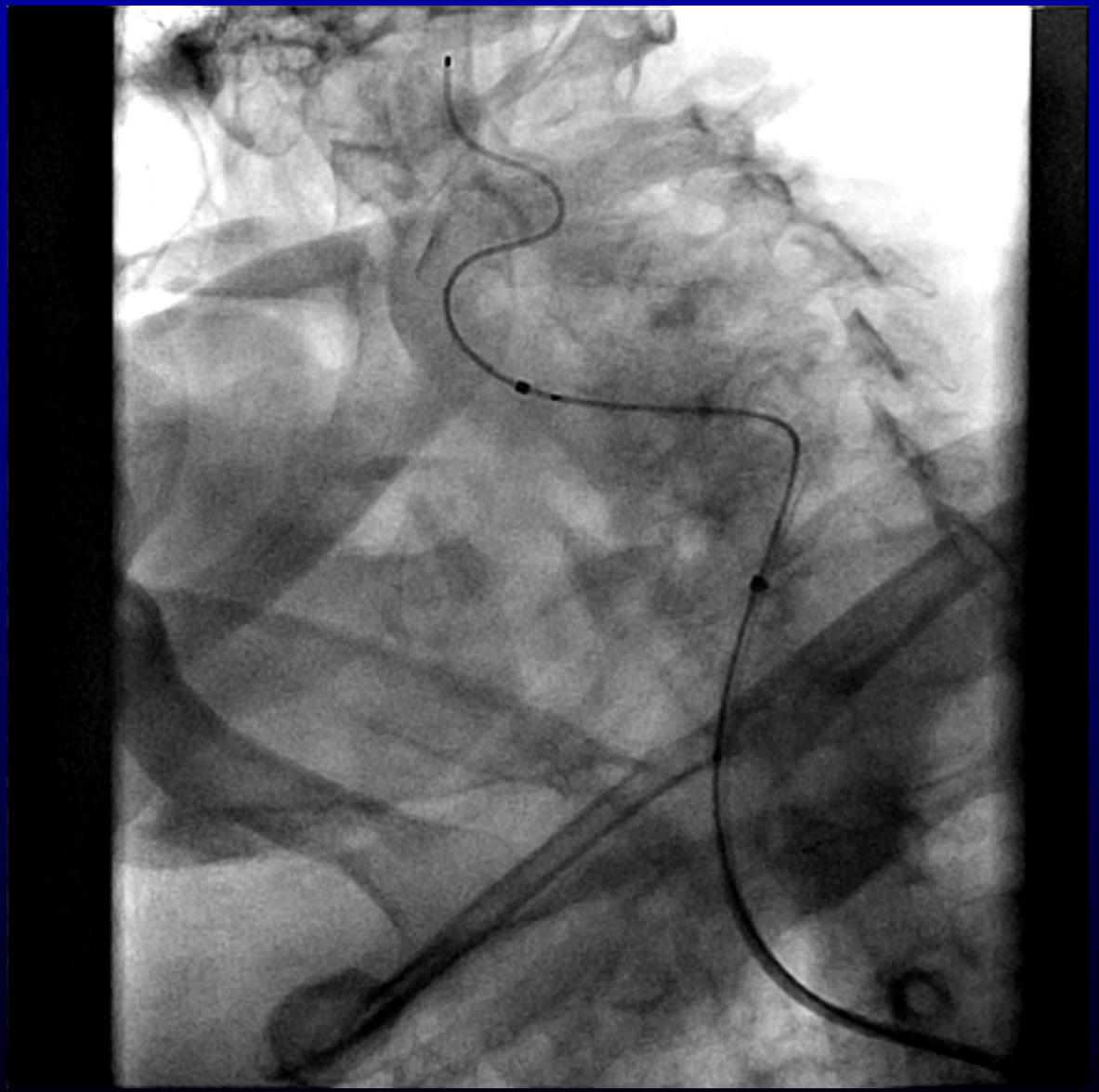


Filter-systems



MO.MA (Medtronic Invatec)
Flow Reversal (Gore)

Proximal oder distal Protection ?



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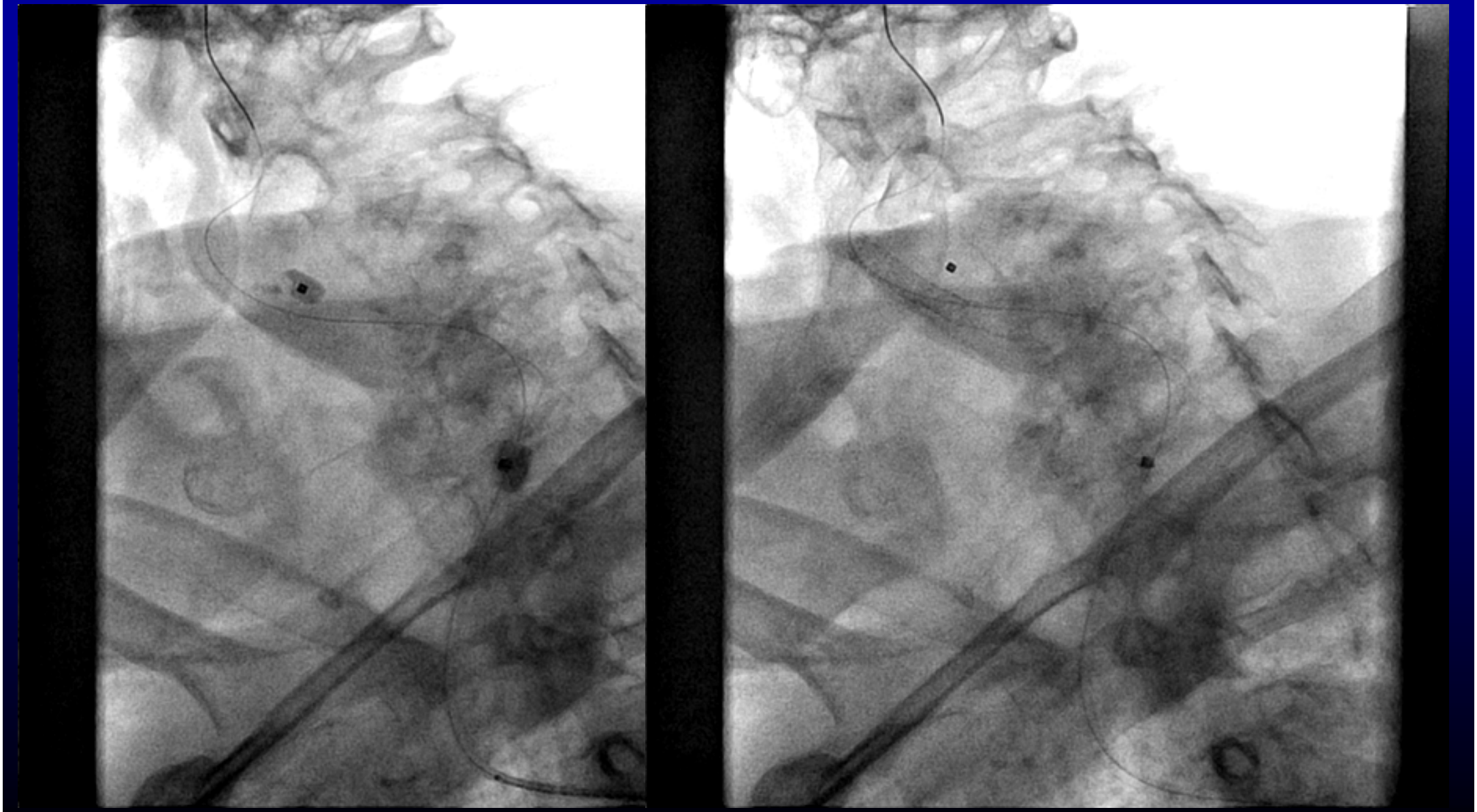
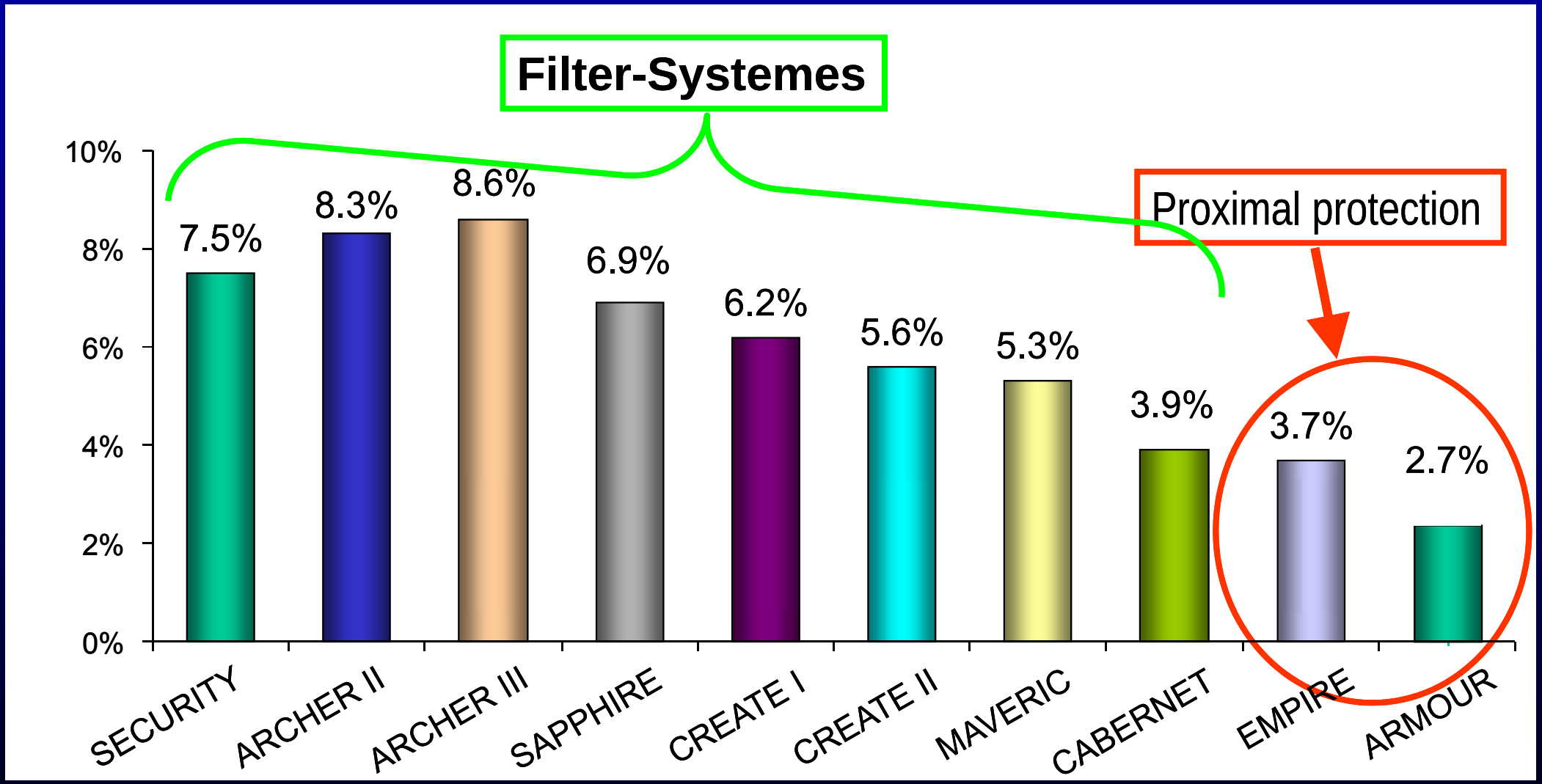


Complication-Rates
CAS-Registries 2000-2010



Archer II + III: Accunet + Acculink

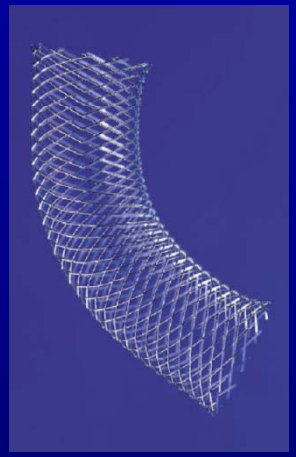
Results of Experienced Centers

	n	Protections-system	Death / Stroke (30 days)
Cremonesi et al. Stroke 2003	442	Filter / proximal protection	**1,1 %**
Stabile et al. JACC 2010	1300	Proximal protection	**1,3 %**

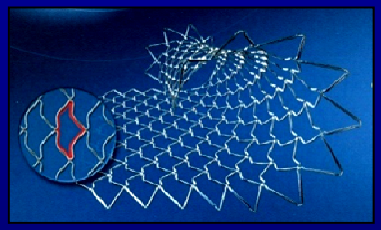
Development of Stent-Technology

Precise (Cordis)

Vivexx (Bard)



Adapt (BS)

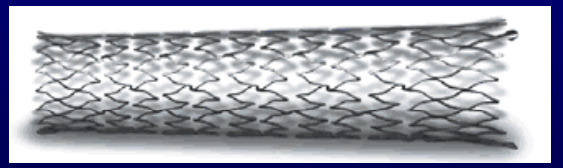


Xact (Abbott)

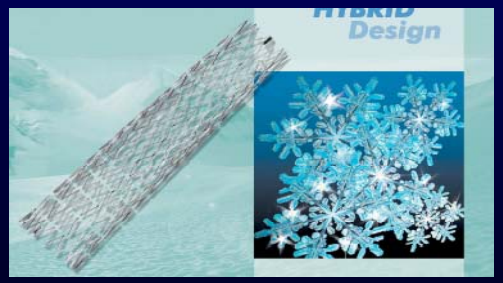
Zilver (Cook)

Carotid Wallstent (BS)

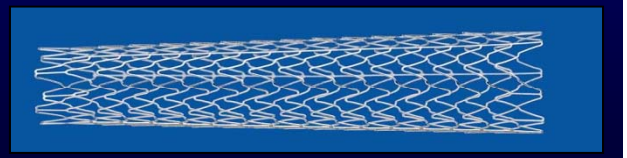
Sinus (Optimed)



Cristallo Ideale (Invatec)



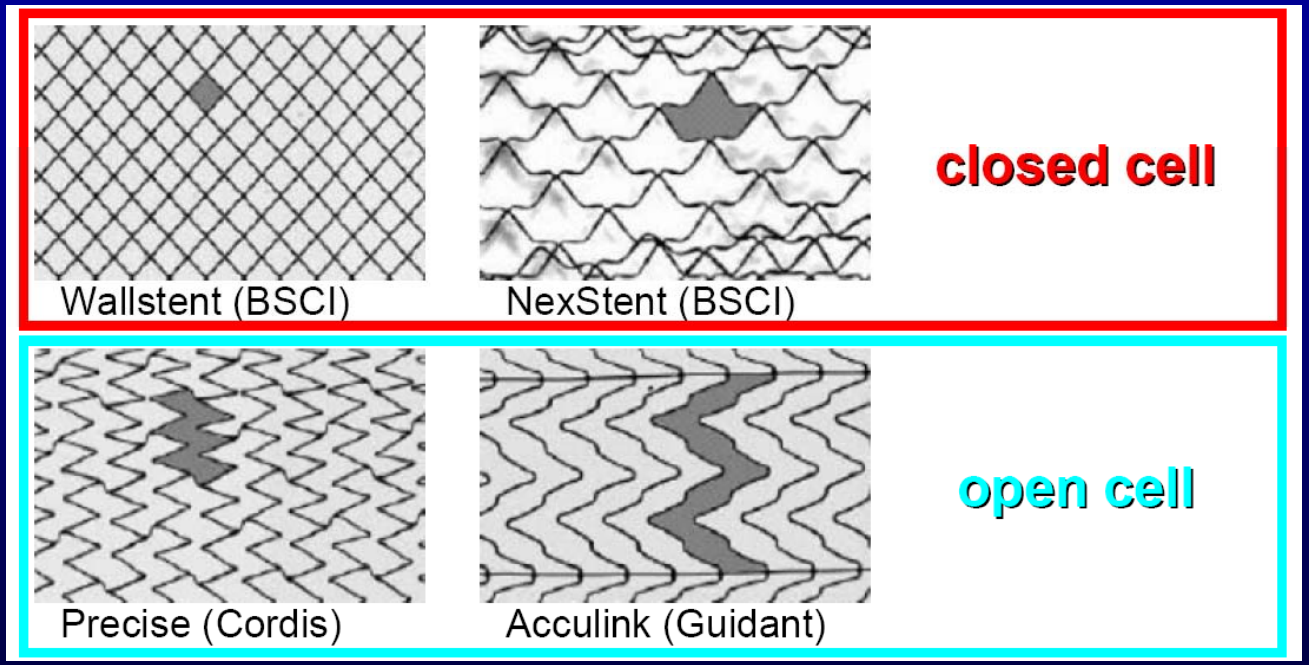
Acculink (Guidant)

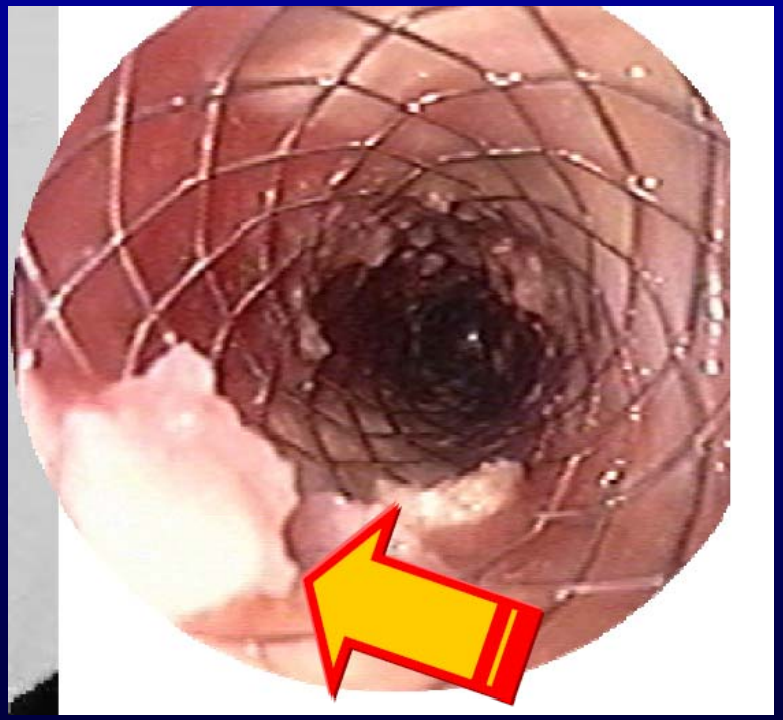


Protege (ev3)

Exponent (Medtronic)

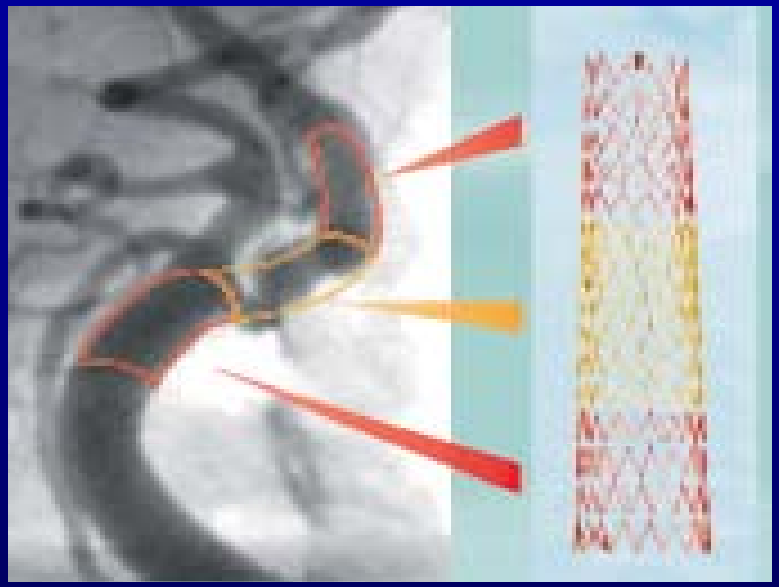
Open Cell vs. Closed Cell Design





Bosiers / Peeters CIRSE 2006

Hybrid-Stent (Open- and Closed-Cell)



With courtesy Dr. Cremonesi

Multicenter Registry 124 PTAs: 30-day complications 0 %

Cremonesi et al., J Endovasc Ther 2008; 15: 186-192

Conclusion

- Similar results for CAS and CEA were shown by CREST, the largest RCT up to date.
- Rate of minor strokes in favour for CEA.
- CAS has the potential to improve with the selection of lesion-specific technologies.