CHOICE OF STENT IN CAROTID INTERVENTION

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CAROTID STENTING

- Balloon angioplasty of ECA to prevent stroke is a relatively simple procedure established 30 yrs ago
- Less invasive compared CEA
- Emerged as an alternative procedure to CEA in high surgical risk patients due to medical co - morbidities and anatomical complexities
- Over the years the technique got modified from BES,SES,EPD & increasing operator experience

UTILITY OF CAROTID STENTING

- Predictable angiographic result for operator
- Deals with procedural complications
- Dissections & Abrupt vessel closure
- Improve long-term patency by preventing recoil
- Initial non flexible stainless steel balloon expandable stent (palmaz)
- Acute technical success rate high but prone for stent crushing- superficial & by neck movement
- No longer used

CAROTID STENTING

- Flexible self expandable stents
- Conform to the tortuous anatomy of carotid bifurcation and change in vessel shape associated with neck movements
- Nitinol ,a nickel titanium alloy is the most widely used material for self expanding stent
- Because it has large elastic range it can withstand significant deformation

CAROTID STENT - DESIGN

- Closed cell or open cell design
- Closed cell- Superior scaffolding but
  Reduced flexibility
  Open cell – More flexible
- Cobalt based alloy closed cell (wall stent)
  More rigid stent
  Excellent scaffolding

Tapered and non tapered designs available

CAROTID STENTING

- Comes in variety of sizes that match the diameter of ICA & CCA(5 to 10 mm)
- Length generally 20 to 40 mm
- The nominal diameter should be 1 to 2 mm larger than the largest treated vessel(CCA)
- Stent should cover the lesion completely
- **Tapered stents**-Reduces the size mismatch between the ICA & CCA & facilitate Rx across the carotid bifurcation- commonly used now

CAROTID STENTING

- Tapered stents- commonly used are 6-8 mm or 7-9 mm diameter with length 30 to 40 mm
- Technical success rate & clinical outcome similar with most of the available stent
- Closed cell technology with a smaller cell area results in excellent lesion coverage, plaque containment
- Easy removal of EPD
- Less atherosclerotic plaque prolapse
- Reduce life threatening cerebral embolism

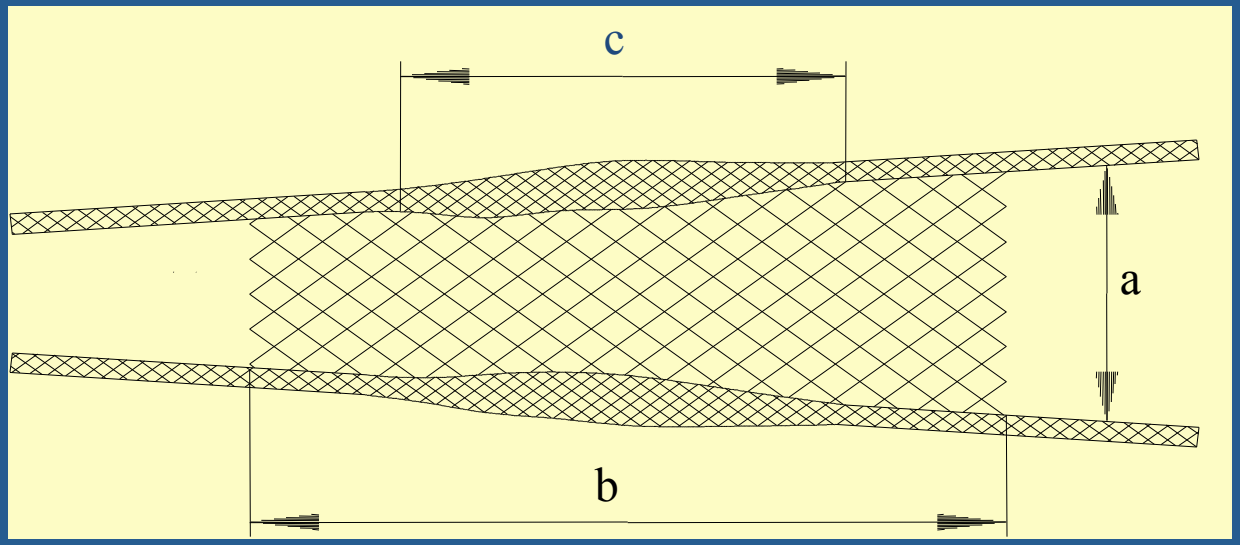
TABLE 39-3 Self-Expanding Carotid Artery Stents

Stent	*Manufacturer*	*Metal Composition*	*Design*	*Tapered Version Available*	*FDA-Approved*
Carotid WALLSTENT	Boston Scientific	Cobalt chromium	Closed-cell	No	Yes
Exponent	Medtronic	Nitinol	Open-cell	No	Yes
Precise	Cordis	Nitinol	Open-cell	No	Yes
Protégé	ev3	Nitinol	Open-cell	No	Yes
AccuLink	Abbott	Nitinol	Open-cell	Yes	Yes
X-Act	Abbott	Nitinol	Closed-cell	Yes	Yes
Zilver	Cook	Nitinol	Open-cell	No	No
Cristallo Ideale	Invatec	Nitinol	Hybrid	Yes	No

Size Selection of Carotid stent

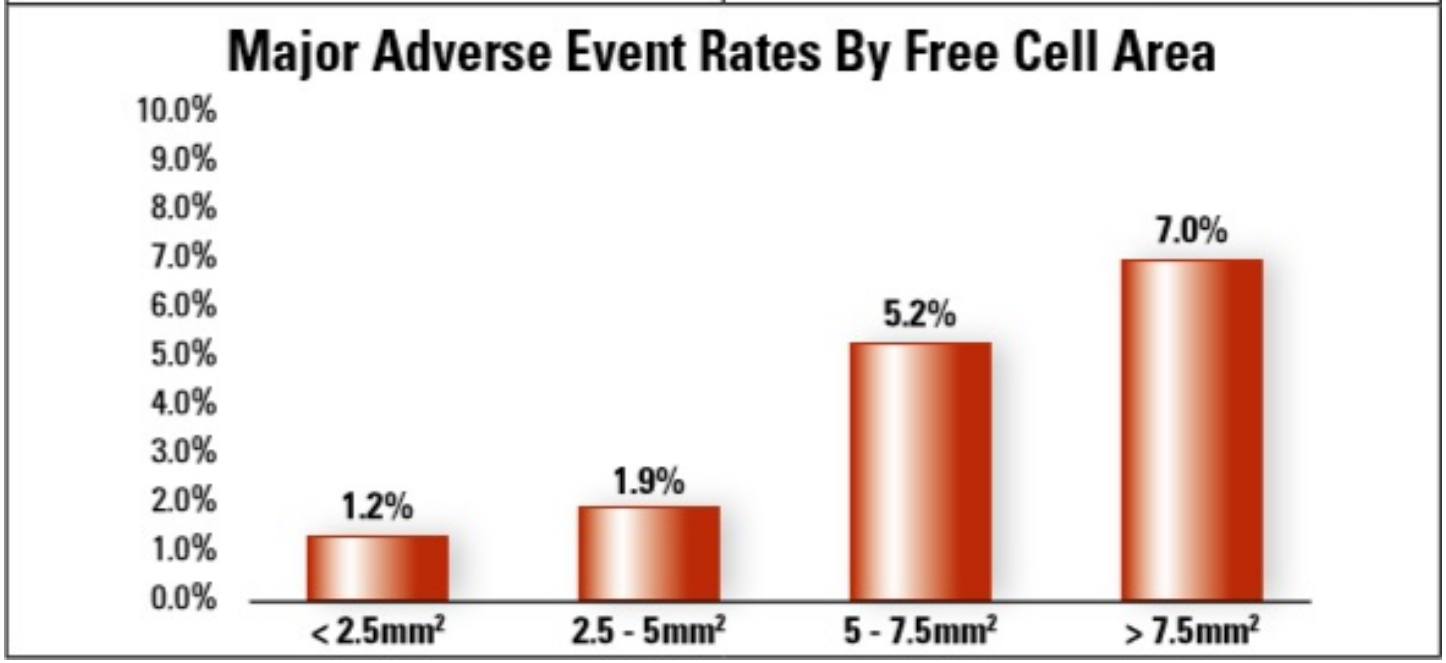
Stent diameter = Vessel diameter (a) + 1 or 2 mm

Stent length (b) = Lesion length (c) + 10 mm (i.e. 5 mm on each side)



For symptomatic patients, the post procedural adverse events was lower for closed cell stents (1.3%), compared to open cell stents (6.3%), with a p-value of <0.0001

Post-Procedural Adverse Events: Symptomatic Population[9] (p < 0.0001)		
Free cell area comparison	**Odds Ratio**	**95% C.I.**
2.5-5 mm^2 vs. < 2.5 mm^2	1.6	[0.2 - 12.3]
5-7.5 mm^2 vs. < 2.5 mm^2	4.3	[1.8 - 10.9]
> 7.5 mm^2 vs. < 2.5 mm^2	6.0	[2.7 - 13.1]



A Subanalysis of the 30 day results from the SPACE clinical trial.[10]

The SPACE collaborative group.

- Prospective, randomized multi-center clinical trial of 1,200 patients, comparing CEA[6] to CAS.
- This subanalysis aims to determine the influence of cell design on the major adverse event rates.

Patients who had a closed cell stent implanted (namely the Carotid WALLSTENT™) had lower major adverse event rates (5.9%), compared to patients who received an open cell stent (11.0%), with a p-value of 0.075. Patients who underwent CAS with a closed cell stent had similar major adverse event rates to that of CEA (6.3%).

Procedure	Cell Design	MAE*** Rates
Carotid Endarterectomy (CEA)		**6.3%** (37/584)
Carotid Artery Stenting (CAS)	**Closed Cell** 	**5.9%** (26/437)
Carotid Artery Stenting (CAS)	**Open Cell** 	**11.0%** (14/127)

CELL DESIGN

Distal Embolic Protection Device Recovery Catheter Problems During Carotid Stenting: A Technical Analysis.

S. Myla, L. Jacobs, M. Kleinbart, C. Moore, et al.

- A retrospective analysis of 278 CAS cases.

	Closed Cell Stents	Open Cell Stents
Number of cases	120	158
Recovery catheter issues	1	27
% of catheter issues	0.8%	17.1%

RADIAL FORCE

The Relationship of Post CAS Hypotension to Stent Type.
Barry T. Katzen.

- Retrospective analysis of 256 patients who underwent CAS.
- This study aims to assess whether there is a significant difference in the incidence of peri-procedural hypotension requiring treatment related to stent type used in the carotid artery for de novo lesions.

There was a significant difference in peri-procedural hypotension between slotted tube nitinol stents (11.3%) and Carotid WALLSTENT™ (0%), p = 0.0188. Additionally, there were trends towards significant differences in hypotension at 24 hours that did not achieve statistical significance.

	Slotted Tube Nitinol Stent[8]	Carotid WALLSTENT	Statistical Significance
Radial Force	High	Moderate	
Peri-procedural Hypotension	11.3%	0%	p = 0.0188

CAROTID STENTING

- Around 25 % cases the choice of stent should be individualized
- Influenced by arterial anatomy and lesion morphology

Tortuous anatomy

Stents with greatest flexibility may be preferred

(open cell Nitinol with large open cell areas & highly flexible interconnecting bridges- Precise, Zilver)

Calcified lesions-

Stents with high radial force

Moderate outward expansive force

(Nitinol stents with closed cell design - X-Act)

Lesions with greatest risk of distal embolism

Stents that provides greatest vessel scaffolding

(Closed cell Nitinol or cobalt alloy stents – wallstent, X-Act)

CHOICE OF CAROTID STENT

- Several reports of CAS complications with open cell stents especially in symptomatic patients & those with echo lucent plaque, a large series failed to show any relationship between stent type and CAS stenting complications which was confirmed by RCTs

- Tapered stents may be preferred to avoid the mismatch between CCA &ICA

- Stent type - open cell or closed cell does not appear to affect occurrence of complications, it is the lesion morphology

THANK YOU