Carotid stenting-in stent restenosis and treatment modalities

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Disclosure

Speaker name: PIOTR PIENIAZEK.

I have the following potential conflicts of interest to report:

- [x] Consulting
- □ Employment in industry
- □ Stockholder of a healthcare company
- □ Owner of a healthcare company
- □ Other(s)
- □ I do not have any potential conflict of interest
The Krakow Program of Stroke Prevention by Carotid Artery Stenting (from Jan 2001)

- comprehensive patient evaluation including non-invasive imaging:
  - extra- and intracranial Doppler
  - extra- and intracranial CT angio
  - brain perfusion (MRI)

- independent neurological consultation (NIHSS, MMSE, Rankin Scale)
- patient- and lesion-tailored neuroprotection before meshstent era (Roadsaver & CGuard)

- independent histologic evaluation of captured material

- coronary angiography prior to CAS (except pts. after CABG or recent PCI)

- rigorous follow-up is mandatory !!!!
The largest meta-analysis comparing outcome in different stent design before meshstents era.

RESULTS: From 2654 unique identified articles, two randomized, controlled trials and 66 cohort studies were eligible for analysis (including 46,728 procedures). Short-term clinical MAE rates were similar for patients treated with open cell vs closed cell or hybrid stents. Use of an Acculink stent was associated with a higher risk of short-term MAE compared with a Wallstent (risk ratio [RR], 1.51; P = .03), as was true for use of Precise stent vs Xact stent (RR, 1.55; P < .001). Intermediate-term clinical MAE rates were similar for open vs closed cell stents. Use of open cell stents predisposed to a 25% higher chance (RR, 1.25; P = .03) of developing postprocedural new ischemic lesions on MR-DWI. No differences were observed in the incidence of restenosis, stent fracture, or intra procedural hemodynamic depression with respect to different stent design.
**Fig 2.** Overview of pooled risk ratios (RRs) of 11 meta-analyses performed on stent design in relation to adverse outcome after carotid artery stenting (CAS). CI, confidence interval.
Severe, recurrent in-stent carotid restenosis: endovascular approach, risk factors. Results from a prospective academic registry of 2637 consecutive carotid artery stenting procedures (TARGET-CAS)

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Table II. Numbers and percentages of stents used for initial angioplasty and restenosis rate in each stent group

<table>
<thead>
<tr>
<th>Stent brand</th>
<th>Initial CAS, $N = 2637$ $n$, % of the group</th>
<th>First &gt; 50% restenosis, $N = 95$ $n$, % of the initial brand group</th>
<th>Second &gt; 70% restenosis, $N = 13$ $n$, % of the initial brand group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid Wallstent</td>
<td>968, 36.7</td>
<td>57, 5.89</td>
<td>8, 0.83</td>
</tr>
<tr>
<td>Cristallo Ideale</td>
<td>546, 20.7</td>
<td>11, 2.01</td>
<td>1, 0.18</td>
</tr>
<tr>
<td>Xact</td>
<td>381, 14.4</td>
<td>8, 2.10</td>
<td>1, 0.26</td>
</tr>
<tr>
<td>Precise</td>
<td>322, 12.2</td>
<td>10, 3.10</td>
<td>1, 0.31</td>
</tr>
<tr>
<td>Cguard</td>
<td>145, 5.5</td>
<td>3, 2.1</td>
<td>0</td>
</tr>
<tr>
<td>Acculink</td>
<td>97, 3.7</td>
<td>3, 3.09</td>
<td>2, 1.38</td>
</tr>
<tr>
<td>Roadsaver</td>
<td>58, 2.2</td>
<td>2, 3.45</td>
<td>0</td>
</tr>
<tr>
<td>Vascuflex</td>
<td>50, 1.9</td>
<td>1, 2.00</td>
<td>0</td>
</tr>
<tr>
<td>NexStent</td>
<td>21, 0.8</td>
<td></td>
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<tr>
<td>Omni Link</td>
<td>13, 0.5</td>
<td></td>
<td></td>
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<tr>
<td>Exponent RX</td>
<td>8, 0.3</td>
<td></td>
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<tr>
<td>Palmaz</td>
<td>7, 0.3</td>
<td></td>
<td></td>
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<tr>
<td>Mer</td>
<td>5, 0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smart</td>
<td>3, 0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herculink</td>
<td>2, 0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>10, 0.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results

Demographic and clinical data

Out of 2637 stented arteries, in 95 cases (95/2637; 3.6%) >50% ISR restenosis was detected in DUS. Of those, 53 (53/2637; 2.0%) patients had ≥70% restenosis confirmed in angiography, including one case of asymptomatic total occlusion. No stent fracture was detected.
Comparison with CEA recommendation

Ad Hoc Committee, American Heart Association

Maximally allowed 30-day stroke/death-rate (after CEA)

- 6 - 7% for symptomatic
- 3% for asymptomatic

- Restenosis Surgery

14.2%
4.9%
5 - 11%

In-stent restenosis after carotid stenting is not a trivial problem as it still exists.

- Occurs less frequently than in subclavian, vertebral, renal or peripheral arteries.
- Is less frequent than restenosis after carotid endarterectomy.
- 10% according guidelines is not acceptable.
- Treatment modality in-stent restenosis has still growing progress.
- Re-PTA for in-stent restenosis needs always temporary NPD.
- In recurrent in-stent restenosis of label devices need to be use.
- Rigorous US investigation in such patients is mandatory.
Carotid Revascularization Using Endarterectomy or Stenting Systems (CaRESS): 4-Year Outcomes

Christopher K. Zarins, MD, Rodney A. White, MD, Edward B. Diethrich, MD, Rebecca J. Shackelton, MSc, and Flora S. Siami, MPH

Conclusion:

The risk of death or nonfatal stroke 4 years following CAS with distal protection is equivalent to CEA in a broad category of patients with carotid stenosis. There were no significant differences in stroke or mortality rates between high-risk and non-high-risk patients and no differences in outcomes between symptomatic and asymptomatic patients. After 4 years, CAS had a 2-fold higher restenosis rate compared to CEA. The

Baseline Characteristics of the 184-Patient CMS-Defined High-Risk Subset by Treatment Arm

<table>
<thead>
<tr>
<th></th>
<th>Caucasian</th>
<th>Non-Caucasian</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Clinical status</td>
<td></td>
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<tr>
<td>Symptomatic</td>
<td>33 (30.8%)</td>
<td>18 (23.4%)</td>
<td>0.264</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>74 (69.2%)</td>
<td>59 (76.6%)</td>
<td></td>
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<tr>
<td>Percent stenosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%–75%</td>
<td>11 (10.3%)</td>
<td>1 (1.3%)</td>
<td>0.015</td>
</tr>
<tr>
<td>&gt;75%</td>
<td>96 (89.7%)</td>
<td>76 (98.7%)</td>
<td></td>
</tr>
<tr>
<td>Etiology of carotid disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td>93 (86.9%)</td>
<td>58 (75.3%)</td>
<td>0.043</td>
</tr>
<tr>
<td>Restenosis</td>
<td>1 (0.9%)</td>
<td>24 (31.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Radiation</td>
<td>1 (0.9%)</td>
<td>1 (1.3%)</td>
<td>0.814</td>
</tr>
</tbody>
</table>
Never compare incomparable groups. Then it's easy to get compromising conclusions!!!
Zotarolimus-Eluting Stent for the Treatment of Recurrent, Severe Carotid Artery In-Stent Stenosis in the TARGET-CAS Population

Lukasz Tekieli, MD, PhD\textsuperscript{1,3}; Piotr Pieniazek, MD, PhD\textsuperscript{1,3}; Piotr Musialek, MD, DPhil\textsuperscript{1,3}; Anna Kablak-Ziembicka, MD, PhD\textsuperscript{1,3}; Tadeusz Przewlocki, MD, PhD\textsuperscript{1,3}; Mariusz Trystula, MD, PhD\textsuperscript{2,3}; Zbigniew Moczulski, MD\textsuperscript{3}; Karolina Dzierwa, MD\textsuperscript{1,3}; Piotr Paluszek, MD\textsuperscript{3}; and Piotr Podolec, MD, PhD\textsuperscript{1,3}

Results: ZES implantation under distal embolic protection was technically successful and uncomplicated. Angiographic stenosis was reduced from 84.6\%\pm 7.5\% to 10.7\%\pm 3.6\% (p<0.01). In 5 patients with ZES implanted fully within the self-expanding carotid stent, duplex ultrasound follow-up (mean 17 months, range 6–36) revealed no evidence of restenosis or stent fracture/deformation. In the 2 other patients, the ZES had been implanted for distal edge ISS such that the ZES protruded beyond the original carotid stent. This protruding segment of the ZES demonstrated deformation/kinking in both; in one, this led to symptomatic stent occlusion.

Conclusion: The use of coronary ZES in the treatment of recurrent carotid ISS is feasible and appears effective provided the ZES is placed entirely within the original stent. Placement of a coronary ZES outside the carotid stent scaffold should be avoided.
Figure 1  (A) A 50-year-old man treated with CAS 17 months earlier for RlCA stenosis presented with asymptomatic recurrent lSS that became critical (92%) 6 months after in-stent balloon angioplasty was performed for the initial lSS. (B) A 4.0×24-mm ZES was positioned within the self-expanding 4–9×30-mm NexStent. (C) The ZES was implanted with up to 16 atmospheres of balloon pressure. Angiographic results immediately after the procedure (D) and at 12 months (E).
Figure 2: Two cases of ZES crush. Patient 1: (A–C) orthogonal CTA projections of ZES protruding (white arrows) from a self-expanding 7×30-mm Carotid Wallstent 8 months after ZES implantation. Note the elliptical cross section of distal part of the Wallstent and protruding segment of the ZES. (D, E) One month later, angiography showed distal edge ZES deformation (white arrow) resulting in stent occlusion 3 days after an episode of left-hemispheric TIA. Patient 2: (F, G) angiography showing in-ZES stenosis (F, black arrow) and distal edge ZES deformation (white arrow) 12 months after ZES implantation. (H) In-ZES angioplasty with a 4.0×20-mm balloon, and (I) the final angiographic result.
Treatment modality of ISR

Patient 78 y. with bilateral ICA stenosis after syncope two months earlier with recurrent bilateral RESTENOSIS
LICA ReRe in-stent restenosis: 80% IVUS stenosis; MLA 4.2mm . CAS - 20 Feb. 2018
Viatrac 4.5/20mm STENTYS X position 3.0-3.5/27mm, MAVERIC 5.0/20mm & FilterWire
Diffuse in-stent & edge in-stent restenosis. Standard balloon & DCB 5.0/40mm 3 inflation 8 atm for 45 min!! Our standard of treatment for in-stent restenosis.
Our current approach with Carotid In-Stent Restenosis. DCB is used after excellent artery preparation with Standard, Cutting or NC Balloon. Temporary NPD use is mandatory.
Risk of Death Following Application of Paclitaxel-Coated Balloons and Stents in the Femoropopliteal Artery of the Leg: A Systematic Review and Meta-Analysis of Randomized Controlled Trials.

Katsanos K, Spiliopoulos S, Kitrou P, Krokidis M, Karnabatidis D.
PMID: 30561254  Free Article

Meta-analysis finds a higher risk of death in the long term when paclitaxel-coated devices are used in the leg

New data published in the Journal of the American Heart Association (JAHA), suggest that there is an increased risk of death at two and five years following the use of paclitaxel-coated balloons and stents in the femoropopliteal artery. While the authors, Konstantinos Katsanos (Patras, Greece) and colleagues, write in JAHA that this meta-analysis provides good statistical evidence to back these findings, some leading physicians state that it lacks individual patient-level data from the randomised controlled trials.

In the JAHA paper, the investigators write that several randomised controlled trials have already shown that paclitaxel-coated balloons and stents significantly reduce the rates of vessel restenosis and target lesion revascularisation after lower extremity interventions.

The investigators conducted a systematic review and meta-analysis of randomised controlled trials investigating paclitaxel-coated balloon angioplasty or paclitaxel-coated metal stents in the femoral and/or popliteal arteries. In all, 28 randomised controlled trials with 4,663 patients (89% intermittent claudication) were included. As reported in JAHA, they last screened...
COMPARE: Does **Ranger DCB** with dose density of 2μg/mm² have similar efficacy compared to and **In. Pact DCB** with dose density of 3.5μg/mm²?

<table>
<thead>
<tr>
<th>Length</th>
<th>Nominal dose (μg/device) to treat a typical lesion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranger 5mm</td>
<td>1301</td>
</tr>
<tr>
<td>In. Pact 5mm</td>
<td>2553</td>
</tr>
<tr>
<td>40mm</td>
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</tbody>
</table>
Concept Medical nabs breakthrough designation for sirolimus-coated balloon for PAD

All balloons have CE registrations

A phenomenon of coating for MagicTouch

Spray Coating on the Balloon

Low Pressure Inflation For Uniform Coating

Folding
The Coated Balloon is then Folded.

Inflation
The Coating is done to its Fullest and this leads to complete drug repartition 100% Surface Coated
Treatment modality for in-stent restenosis.

Balloon angioplasty always with bigger diameter.

Cutting Balloon (only whey the standard balloon slides away from lesion).

Second self expanding stent (stent in stent technique, do not use Carotid Wallstent).

Drug eluting balloon with Paclitaxel (problem with 45 sec. inflation).

Self expanding sirolimus coronary stent – STENTYS X position (withdrawn from the market in 2019 ) but the new DCB is coming.

Surgery should be avoided!!!!
Take home message:

- Restenosis after carotid stenting is not a frequent complication and should not exceed 5%.
- Treatment strategy for in-stent restenosis is changing.
- New technological solutions should be taken for consideration.
- We use DCB with Paclitaxel as a standard choice for in-stent restenosis treatment.
- For restenosis after CAS or CAE do not use Carotid Wallstent.
Thank you
The ACST-2 trial: Recruitment complete!

What are the characteristics of our patients, operators, and interventions?

LINC

28 January 2020

Richard Bulbulia (Co-PI ACST)