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Symptomatic Atherosclerotic Plaque Progression as a Face of ”Restenosis” in Single-layer Stent CAS: Management, Long-term Outcome - and Prevention

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Introduction Restenosis in a first-generation (single-layer) carotid stents (FGS) is believed to represent an exaggerated healing response of (neo)intimal hyperplasia (NIH) formation. Rather than NIH, we describe a symptomatic in-FGS unstable plaque (neo)atherosclerosis mandating re-revascularization. To halt continued plaque evolution, we propose a novel treatment strategy involving a microNet-covered stent (MCS, second-generation carotid stent) to sequestrate the plaque from the vessel lumen.

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History and Physical With a seemingly optimal result of FGS (Precise) symptomatic carotid lesion revascularization followed by optimal medical therapy, a late (>3 years) progressive in-stent restenosis (ISR) arose. At year 11, crescendo ipsilateral transient ischaemic attacks occurred (Indication for Intervention).

Imaging Angiography showed an ulcerated tight lesion throughout stent length (Fig 1 A). Intravascular ultrasound (IVUS) virtual histology imaging revealed thin-cap fibroatheroma (Fig 1 B).

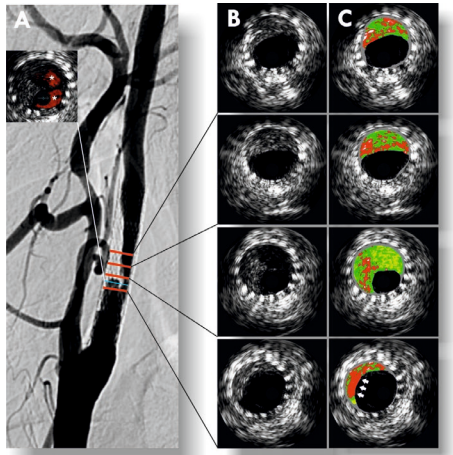

Fig 1. Angiography (A) – an ulcerated, tight lesion throughout the stent length; IVUS (A and B) – in-stent plaque burden 84.1%, MLA 1.5x2.8mm; VH (C) – large irregular areas of necrotic core in contact with the lumen – thin-cap fibroatheroma (TCFA)

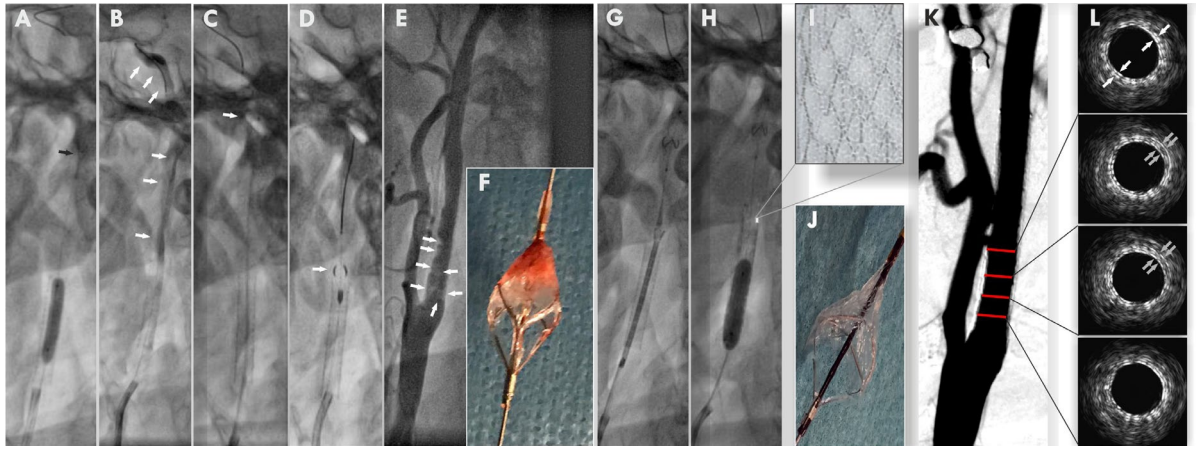

Fig 2. Undersized balloon predilatation (A); Flow cessation with acute symptoms of ipsilateral cerebral ischaemia (B); 7F aspiration catheter use to reduce the filter embolic load (C); Filter removal in a 'half-open' position (D); protruding plaque elements (arrows, E); filter basket filled with embolic particles (F); a novel generation, micronet-covered stent implantation for plaque sequestration (I) into the original single-layer carotid stent (G); stent postdilatation optimization for a „full" new lumen gain (H, MLA 5.1x4.9mm, 19.7mm2); filter basket empty – no embolism (J); optimal angiographic result (K); optimal stent expantion and apposition, plaque protrusion absence on IVUS (L) - micronet-covered stent plaque effective insulation of the in-single-layered stent lesion, optimal lumen reconstruction

Intervention Reintervention was performed under distal protection (Fig 2). Undersized balloon predilatation to insert a stent caused symptomatic no-flow (Fig 2B), and aspiration catheter was used to reduce the filter load (Fig 2C). A MCS (CGuard) was implanted and post-dilated to ensure full lumen gain; IVUS confirmed complete plaque sequestration (Fig 2L). The optimal anatomic result remained unchanged throughout 5 years (ultrasound and computed tomography verification (Fig 3); this was accompanied by clinical cure.

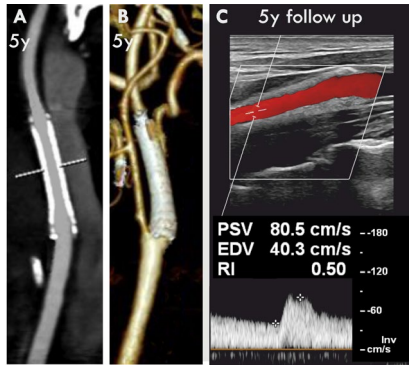

Fig 3. At 60 months – a fully maintained optimal treatment result, normal in-stent velocities, absence of any in-stent re-restenosis on CT angiography (A,B).

Key Messages

· Incomplete atherosclerotic plaque coverage with first generation (FGS, single-layer) stent use in carotid artery stenting may be associated with in-stent atherosclerosis progression (thus addressing carotid stenosis with FGS is a "treatment", not cure)

· Endovascular management of 'in-stent restenosis' ('ISR') resulting from (neo) atherosclerosis progression may be associated with cerebral embolism

· Cerebral protection device use is mandatory in case of in-stent lesion

· Predilation of in-stent material should be performed only if necessary for stent delivery

· The in-FGS plaque growth may be non-linear and sudden onset cerebral ischaemia may occur

· MicroNet-covered stent (MCS) enables plaque insulation with optimal long-term outcome (MCS cure)

· A priori Micronet-covered stent use in CAS may eliminate - by effective plaque sequestration - the phenomenon of in-stent atherosclerotic plaque progression

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