

Case Report

Carotid Revascularization in a Nonagenarian Patient: Should Chronological Age Alone Contraindicate Carotid Angioplasty? A Case ReportFacundo Figueroa F, MD¹; Guillermo Garelli G, MD¹; Laura Alonso L, MD; Díaz-Gerevini G, Geriatrician, PhD²¹Vascular Surgery Service, Sanatorio de la Cañada, Córdoba, Argentina²San Ricardo Pampuri Medical Center, Western Association of Clinics and Sanatoriums (Acysa), Villa Carlos Paz, Learning to Live Program, Faculty of Medical Sciences, National University of Córdoba, Argentina***Corresponding author**

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Abstract

Background: Carotid revascularization in nonagenarians is controversial because procedural risk, frailty, and limited life expectancy may reduce the net benefit, particularly in asymptomatic disease. Nevertheless, chronological age alone may not capture the heterogeneity of this population. We report protected carotid artery stenting in a functionally independent 95-year-old woman with severe asymptomatic internal carotid artery stenosis and ulcerated plaque morphology.

Case presentation: A 95-year-old woman with hypertension, previous tobacco exposure, and recurrent syncope was referred after duplex ultrasonography suggested severe bilateral carotid disease. She had no history of transient ischemic attack, amaurosis fugax, stroke, or focal neurological deficit. She lived alone, walked independently, and remained autonomous in activities of daily living. Catheter angiography clarified the findings: it demonstrated an irregular ulcerated plaque causing approximately 85% stenosis of the right internal carotid artery, whereas the left internal carotid artery had no hemodynamically significant stenosis. An individualized endovascular strategy was selected to avoid open cervical surgery. Under local anesthesia, transfemoral carotid artery stenting was performed with distal embolic protection and implantation of a 6 × 30-mm CGuard MicroNet-covered self-expanding stent, followed by 1:1 post-dilatation. Completion angiography showed restored patency without flow-limiting residual stenosis, dissection, recoil, or thrombosis. The patient remained neurologically intact and was discharged within 24 hours on aspirin and clopidogrel. At 20-day clinical follow-up she remained asymptomatic, independent, and free of access-site complications.

Conclusion: This case illustrates the technical feasibility of protected carotid artery stenting in a carefully selected, functionally independent nonagenarian. It does not establish benefit for asymptomatic nonagenarians; rather, it emphasizes that extreme age should prompt rigorous individualized assessment of functional status, plaque morphology, procedural risk, life expectancy, and patient goals instead of acting as an isolated exclusion criterion.

Keywords: Carotid stenosis; carotid artery stenting; nonagenarian; embolic protection; CGuard; case report

INTRODUCTION

Extracranial carotid atherosclerosis is a major preventable cause of ischemic stroke. In asymptomatic carotid stenosis, contemporary medical treatment has reduced the baseline risk of ipsilateral stroke, so the absolute benefit of revascularization is smaller and depends largely on rigorous patient selection, where it is essential to consider whether the person is functionally independent. Consequently, current recommendations limit the consideration of carotid intervention to selected patients with severe stenosis, clinical or imaging characteristics associated with a higher risk of stroke, low expected periprocedural morbidity and mortality, and a life expectancy sufficient to achieve a delayed preventive benefit [1,2].

Decision-making is particularly complex in nonagenarian patients. Very elderly people are underrepresented in randomized trials, and chronological age is associated with frailty, competing mortality, tortuosity of the aortic arch and carotid vessels, calcification, and increased procedural risk. In the Carotid Revascularization Endarterectomy versus Stenting Trial (CREST), increasing age altered the relative outcomes of carotid an-

gioplasty with stenting (CAS) and carotid endarterectomy (CEA), with increased risk following CAS at older ages [3]. Published experience specifically in patients aged 90 years or older remains limited and has raised questions about both periprocedural events and the survival required to achieve clinical benefit [4]. We present the case of a 95-year-old functionally independent patient with asymptomatic severe stenosis of the right internal carotid artery and an irregular ulcerated plaque, treated with transfemoral CAS using an embolic protection filter and a double-layer micromesh stent. This report follows the CARE guidelines for transparent case reporting [5].

Case Presentation**Patient Information and Clinical Findings**

A 95-year-old female patient with a history of hypertension, dyslipidemia, functional independence, and mild carotid stenosis presented with recurrent syncopal episodes and a history of smoking. She was referred to the Vascular Surgery Service after a Doppler ultrasound of the neck vessels revealed severe bilateral carotid atherosclerotic disease. The last syncopal

episode had occurred 30 days prior to evaluation. She had no documented history of transient ischemic attack, amaurosis fugax, ischemic stroke, aphasia, hemiparesis, or any other focal neurological deficit. Because syncope without focal neurological manifestations is not considered an ischemic symptom attributable to the carotid territory, the lesion was classified as asymptomatic.

Despite her advanced age, the patient maintained functional independence and excellent functional status: she lived alone, walked without assistance, and performed her activities of daily living autonomously. This baseline functional profile was a relevant element for individualized treatment planning.

Diagnostic Evaluation

The Doppler ultrasound of the neck vessels, performed on June 11, 2026, revealed an approximate 85% stenosis in the right carotid bulb and 80% in the left. The peak systolic/end-diastolic velocities were 86/17 cm/s on the right and 70/11 cm/s on the left, with preserved flow. Due to the discrepancy between the morphological assessment and the hemodynamic parameters, catheter angiography was performed to define the anatomy. The study was conducted under local anesthesia via a 6 Fr right radial artery, with administration of 5,000 IU of unfractionated heparin and selective carotid catheterization using a Simmons catheter.

The right common carotid artery showed severe atherosclerosis with intraluminal involvement at the bulb. The right internal carotid artery showed an irregular, ulcerated plaque causing approximately 85% luminal stenosis. The right external carotid artery remained patent, with moderate proximal atherosclerosis. On the left side, the common carotid artery showed mild atherosclerosis, and the internal carotid artery showed moderate disease without hemodynamically significant flow impairment. A severe fibrocalcified plaque was identified causing approximately 95% stenosis of the left external carotid artery. Thus, the angiography clarified the initial Doppler impression of bilateral internal carotid artery disease and identified the right internal carotid artery lesion as the relevant therapeutic target.

Therapeutic Decision

The indication was analyzed considering the severe stenosis of the right internal carotid artery, the morphology

Intervention

The procedure was performed in the cardiac catheterization laboratory under local anesthesia. After antisepsis and placement of sterile drapes, retrograde puncture of the right common femoral artery was performed using the Seldinger technique, and a 7 Fr introducer sheath was inserted. 5,000 IU of unfractionated heparin were administered. A catheter and hydrophilic guidewire were advanced to the brachiocephalic trunk, and the right common carotid artery was selectively catheterized. Angiography confirmed severe, ulcerated stenosis of the right internal carotid artery.

An Amplatz support guidewire was advanced and exchanged for a 7 Fr sheath. The stenosis was traversed with a distal embolic protection filter, which was deployed beyond the lesion. A 6 × 30 mm CGuard self-expanding, double-layer carotid stent covered with MicroNet was positioned over the right internal carotid artery lesion and deployed without complications. Post-dilation was performed using a balloon sized 1:1 to the stent diameter. Follow-up angiography showed satisfactory stent expansion and restoration of patency of the internal carotid artery, without residual flow-limiting stenosis, dissection, recoil, or thrombosis. The distal filter was removed without complications. No new neurological deficits were recorded. At the end of the procedure, heparin was reversed, and hemostasis was achieved by manual femoral compression followed by a compression bandage.

Current Events and Follow-up

During the postoperative period, the patient remained hemodynamically stable, afebrile, alert, and without neurological deficits. She was able to move all four limbs, responded to commands, tolerated oral feeding with preserved swallowing, and maintained spontaneous urination. The femoral puncture site showed no bleeding or hematoma. She was discharged within the first 24 hours with dual antiplatelet therapy: acetylsalicylic acid 100 mg once daily and clopidogrel 75 mg once daily.

At the 20-day follow-up, the patient continued to have no focal neurological signs, was able to move all four limbs normally, and had no complications at the puncture site. At 30 days, she returned to her usual activities, participating in the "Learning to Live" program, which included cognitive stimulation and adapted physical activity (Taekwondo).

Chronology
Time Clinical Event

Time Clinical Event	Clinical Events
30 days prior to referral	Last syncopal episode, without focal neurological manifestations.
June 11, 2026	Doppler ultrasound reported approximately 85% stenosis in the right medulla oblongata and 80% in the left.
Diagnostic Angiography	Right radial access angiography identified an irregular, ulcerated plaque with 85% stenosis of the right internal carotid artery and no significant stenosis of the left internal carotid artery.
Intervention	Filter-protected transfemoral carotid artery stent, 6 × 30 mm CGuard stent, and 1:1 post-dilation.
Less than 24 hours	Discharged neurologically unharmed on aspirin 100 mg/day and clopidogrel 75 mg/day.
Follow-up at 20 days	No focal neurological deficits or complications at the access site.
Follow-up at 30 days	No deficit, returned to her usual routines included, "Learning to live Program"

Discussion

This case highlights a complex preventive decision: whether to revascularize, and if so, which strategy, a severe but clinically asymptomatic carotid lesion in a 95-year-old patient. Its relevance lies less in the technical novelty than in the tension between extreme age, preserved function, high-risk plaque morphology, procedural risk, and the time required to achieve a benefit in stroke prevention.

In asymptomatic carotid stenosis, optimal medical therapy remains the cornerstone of treatment. Contemporary European and North American guidelines propose a selective, rather than systematic, approach to intervention. The ESVS suggests considering carotid artery stenosis endovascular ablation (CEA) in selected patients with asymptomatic stenosis of 60% to 99% and characteristics associated with a higher risk of stroke despite medical treatment, provided that the institutional rate of stroke or death within 30 days is equal to or less than 3% and life expectancy exceeds 5 years. Coronary artery bypass grafting (CABG) may be considered in selected patients when anatomy, comorbidities, or surgical risk support an endovascular strategy [1]. The Society for Vascular Surgery also emphasizes best medical therapy, quality of procedure, and adequate life expectancy [2]. At 95 years of age, competing mortality and uncertainty about five-year survival considerably reduce the expected preventive benefit, even

when functional status is excellent.

This patient's lesion was angiographically irregular and ulcerated. High-risk plaque characteristics can improve stratification beyond the degree of luminal stenosis. A meta-analysis of 64 studies including 20,751 participants found that patients with asymptomatic stenosis and high-risk plaque characteristics had a higher incidence of ipsilateral ischemic events than those without such characteristics [6]. However, plaque ulceration alone does not demonstrate that an intervention offers a net benefit in a nonagenarian patient. In this case, it contributed to the individualized risk assessment but did not replace it.

The choice of transfemoral CAS also requires caution. CREST demonstrated an interaction between age and treatment: in patients treated with CAS, the risk of the primary endpoint increased approximately 1.77-fold for every 10-year increase in age, whereas no similar age-related increase was observed in patients treated with CEA [3]. More recent pooled data from trials in asymptomatic patients aged 75 to 79 years also showed a higher risk of stroke or death with CAS than with CEA in the oldest age stratum studied; patients aged 80 years or older had generally been excluded [7]. Evidence in nonagenarians is particularly scarce. Wach et al. reported 21 CAS procedures in 20 patients aged 90 years or older, with two periprocedural strokes and one periprocedural death; Furthermore, survival was frequently shorter than the interval considered necessary to obtain preventive benefit. Consequently, the favorable outcome in this case should not be generalized to routine coronary artery bypass grafting (CABG) in nonagenarians nor interpreted as evidence of superiority over coronary artery bypass grafting (CABG) or medical treatment.

Cerebral embolization during the procedure is a central concern in CABG, especially in the presence of an ulcerated plaque. In this patient, distal embolic protection was used. Additionally, the CGuard stent combines a self-expanding nitinol scaffold with a MicroNet outer layer of polyethylene terephthalate, designed to limit plaque protrusion through the stent cells. In the prospective CARENET study, CGuard-protected coronary artery stents achieved 100% technical success in 30 patients, with no major cardiac or cerebrovascular adverse events at 30 days [8]. In a randomized trial of 100 patients undergoing filter-protected coronary artery stents, the MicroNet-covered stent reduced the total volume of new ipsilateral lesions on diffusion-weighted magnetic resonance imaging compared to a conventional stent. The prospective C-GUARDIANS study included 316 patients considered high risk for coronary artery stents and reported a pooled rate of death, any stroke, or myocardial infarction of 0.95% at 30 days; its interpretation should acknowledge the single-arm design and industry sponsorship. These data support the feasibility of the device and a plausible basis for embolic protection, but do not establish that the stent design caused the absence of events in this individual patient. The patient's functional independence is central to this case. Chronological age does not fully represent biological reserve, frailty, cognition, autonomy, or individual goals. Living alone, walking without assistance, and maintaining daily activities suggested a robust functional phenotype despite her advanced age. However, preserved function does not eliminate the age-related risks of transfemoral coronary artery bypass grafting (CABG) nor does it guarantee sufficient longevity to achieve the delayed benefit of prophylactic revascularization. Shared decision-making should

address the alternatives of intensive medical treatment, coronary artery bypass grafting (CABG), and CABG; the anticipated periprocedural risk; life expectancy; and the patient's values.

Limitations

This is a single case with brief clinical follow-up, therefore it is not possible to establish comparative safety, effectiveness, or long-term benefit. The report lacks formal frailty and cognition scales, cross-sectional images of the plaque, and periprocedural diffusion-weighted brain MRI. Baseline Doppler ultrasound showed discrepancies between the morphological estimation of the stenosis and the spectral velocities, and their percentages should not be interpreted as equivalent NASCET measurements. The angiographic estimation of the stenosis was based on the operative report and not on independent evaluation by a central laboratory. These limitations are especially relevant because the lesion was asymptomatic, and the long-term net benefit of revascularization at age 95 remains uncertain.

Conclusion

We emphasize the importance of follow-up and support for older adults with timely referral. Carotid angioplasty protected with stent implantation was technically successful and associated with early clinical course without complications in a functionally independent 95-year-old patient with asymptomatic severe stenosis of the right internal carotid artery and ulcerated plaque. Extreme age should not be used in isolation; however, it should intensify—not relax—the analysis of the indication, procedural strategy, competing mortality, and patient preferences. This case supports individualized multidisciplinary evaluation rather than routine revascularization of asymptomatic nonagenarians.

Ethical Considerations and Declarations

Informed Consent: Written informed consent was obtained from the patient for the publication of anonymized clinical information and angiographic images.

Conflicts of Interest

The authors declare no conflicts of interest related to this work.

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Authors' Contributions

Facundo Figueroa participated in the conceptualization, data collection, literature review, and drafting of the manuscript. Guillermo Garelli participated in the patient's care, therapeutic strategy, supervision, and critical review of the manuscript. Laura Alonso participated in the patient's care, data collection, and critical review of the manuscript. Gustavo T. Díaz-Ge-revini, a geriatrician and primary care physician, identified the problem, made the timely referral, and is responsible for the Learning to Live for Older Adults program. All authors approved the final version and accept responsibility for its content.

Data Availability

All data relevant to this case are included in the article. The corresponding author may provide additional anonymized information, subject to applicable ethical and privacy restrictions.

A



B



Figure 1. (A) Selective angiography of the right carotid axis showing severe stenosis of the right internal carotid artery associated with an irregular, ulcerated plaque.

(B) Follow-up angiography after implantation of a 6 × 30 mm CGuard carotid stent, showing restoration of luminal patency without residual flow-limiting stenosis, dissection, recoil, or thrombosis.

References

1. Naylor AR, Rantner B, Ancetti S, et al. (2023) Editor's Choice—European Society for Vascular Surgery (ESVS) 2023 Clinical Practice Guidelines on the management of atherosclerotic carotid and vertebral artery disease. *Eur J Vasc Endovasc Surg*. 65: 7-111. doi:10.1016/j.ejvs.2022.04.011.
2. AbuRahma AF, Avgerinos ED, Chang RW, et al. (2022) Society for Vascular Surgery clinical practice guidelines for management of extracranial cerebrovascular disease. *J Vasc Surg*. 75: 4S-22S. doi:10.1016/j.jvs.2021.04.073.
3. Voeks JH, Howard G, Roubin GS, et al. (2011) Age and outcomes after carotid stenting and endarterectomy: the Carotid Revascularization Endarterectomy versus Stenting Trial. *Stroke*. 42: 3484-3490. doi:10.1161/STROKEAHA.111.624155.
4. Wach MM, Dumont TM, Shakir HJ, et al. (2015) Carotid artery stenting in nonagenarians: are there benefits in surgically treating this high risk population? *J Neurointerv Surg*. 7: 182-187. doi:10.1136/neurintsurg-2013-011052.
5. Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D; CARE Group. (2013) The CARE guidelines: consensus-based clinical case reporting guideline development. *BMJ Case Rep*. 2013: bcr2013201554. doi:10.1136/bcr-2013-201554.
6. Kamtchum-Tatuene J, Noubiap JJ, Wilman AH, Saqqur M, Shuaib A, Jickling GC. (2020) Prevalence of high-risk plaques and risk of stroke in patients with asymptomatic carotid stenosis: a meta-analysis. *JAMA Neurol*. 77: 1524-1535. doi:10.1001/jamaneurol.2020.2658.
7. Voeks JH, Hanlon B, Brott TG, et al. (2025) Age effect in asymptomatic carotid stenosis in the CREST and ACT-1 stenting vs endarterectomy trials. *J Vasc Surg*. 81: 938-944. doi:10.1016/j.jvs.2024.12.008.
8. Schofer J, Musialek P, Bijuklic K, et al. (2015) A prospective, multicenter study of a novel mesh-covered carotid stent: the CGuard CARENET trial. *JACC Cardiovasc Interv*. 8: 1229-1234. doi:10.1016/j.jcin.2015.04.016.
9. Karpenko A, Bugurov S, Ignatenko P, et al. (2021) Randomized controlled trial of conventional versus MicroNet-covered stent in carotid artery revascularization. *JACC Cardiovasc Interv*. 14: 2377-2387. doi:10.1016/j.jcin.2021.08.005.
10. Metzger DC, Gray WA, Lyden SP, et al. (2025) Safety and efficacy of a novel micro net carotid stent system: results of the C-GUARDIANS trial. *JACC Cardiovasc Interv*. doi:10.1016/j.jcin.2025.09.027.

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