An Overview of the ROADSTER Trial

Evaluation of transcarotid CAS with dynamic flow reversal.

BY CHRISTOPHER J. KWOLEK, MD, AND RICHARD M. RUEDY

Enrollment in the pivotal phase of the Investigation of Transcarotid CAS With Dynamic Flow Reversal in Subjects With Significant Extracranial Carotid Stenosis (ROADSTER) trial evaluating the safety and efficacy of the Silk Road Neuroprotection System (NPS; Silk Road Medical, Sunnyvale, CA) began in the first quarter of 2013. Chris Kwolek, MD, National Coprincipal Investigator of the ROADSTER trial and Director of the Vascular and Endovascular Training Program at the Massachusetts General Hospital, successfully performed the first procedure. The ROADSTER trial is a prospective, single-arm, multicenter clinical study conducted under an investigational device exemption and is intended to support FDA clearance of the Silk Road NPS.

Symptomatic and asymptomatic patients requiring carotid revascularization who are at high risk for complications from carotid endarterectomy (CEA) will be followed for 30 days postprocedure, with the primary endpoint being a composite of any stroke, myocardial infarction (MI), or death. In order to make direct comparisons to the CEA arm of the CREST study, patients with suspected stroke will be followed to 3 months, and those with suspected cranial nerve injury will be followed to 6 months.[1]

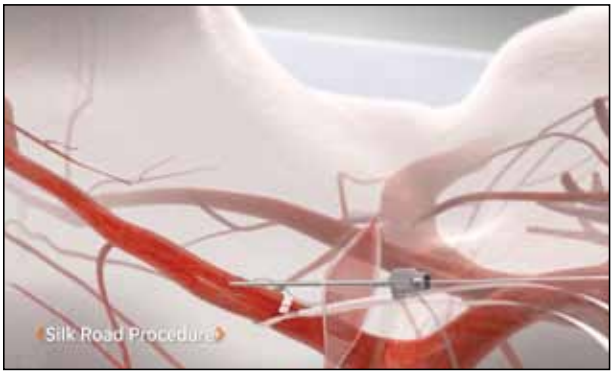

Figure 1. Direct common carotid access with micropuncture through a small transverse incision just above the clavicle.

The ROADSTER trial is being conducted at 20 centers in the United States and three centers in the European Union. Silk Road Medical plans to complete enrollment of the pivotal cohort in 2014. Data from the ROADSTER trial will support premarket approval of the Silk Road Medical Carotid Stent System, a proprietary stent delivery system designed for transcarotid access, and FDA clearance of the Silk Road NPS.

THE SILK ROAD PROCEDURE

The Silk Road procedure was designed to combine the advantages of both CEA and carotid artery stenting (CAS) by pairing a direct carotid approach with proximal reverse flow embolic protection and stenting, offering physicians an entirely new path for carotid revascularization. In contrast to traditional CAS, the Silk Road procedure starts at the neck instead of the groin. Direct carotid access is intended to minimize the risk of microemboli and stroke associated with arch navigation. Control of the common carotid artery is accomplished through a small cutdown above the clavicle (Figure 1), where an arterial access sheath is placed. Because the incision is made just above the clavicle, the risk of cranial nerve injury is minimized.

A second access sheath is placed in the femoral vein. The two sheaths are connected by a flow controller to create an arteriovenous shunt to divert embolic debris away from the brain by reversing flow in the internal and external carotid arteries. Flow reversal is established at the start of the procedure, providing embolic protection before any manipulation of the carotid lesion. Additionally, direct common carotid

placement of a large-diameter sheath and large-bore extracorporeal tubing generates high reverse flow rates. The high rate of flow reversal is controllable with the push of a button, allowing the operator to increase, decrease, or arrest flow at any given step, which is especially important during key procedural maneuvers at high risk for embolization. Debris is trapped in an inline filter, preventing it from entering the venous circulation.

The system is designed to simplify the introduction of stents and other interventional devices due to the straight, short path from the carotid access site (Figure 2) to the lesion (typically 1 to 2 inches). The system is compatible with all commercially available guidewires, balloons, and carotid stent delivery systems, although specialized carotid stents are under development to offer shorter shaft lengths to enhance ease of delivery.

SAFETY AND PERFORMANCE

The safety and performance of the Silk Road system were initially evaluated in the PROOF study, which evaluated 75 patients at two German centers and was the basis for CE Mark approval.[2] The PROOF study evaluated the incidence of stroke, death, and MI in both symptomatic and asymptomatic patients with significant carotid stenosis. In this cohort, 38.7% of the patients were women, and 40% were older than 75 years. Local anesthesia was used in a majority of the cases, and access was accomplished via small transverse incisions.

Procedure times were typically 45 to 75 minutes from cutdown to closure. None of the patients died during the 30-day periprocedural follow-up period, nor were there any MI. One patient (1.3%) suffered a minor stroke in the contralateral posterior circulation following discharge that was deemed unrelated to the device or the procedure by an independent adjudication committee. There were no incidents of protocol-defined intolerance to reversed flow; five patients experienced transient intolerance, although none precluded the procedure from being completed. Device and procedural success were both 90.7%.

Data from a diffusion-weighted MRI substudy in the PROOF cohort were presented during the 2012 VEITH Symposium by Ralf Kolvenbach, MD, of Augusta Krankenhaus in Dusseldorf, Germany.[3] These data showed that the Silk Road procedure has a low rate of new white lesions on diffusion-weighted MRI (19.6%), which is comparable to the CEA arm of the ICSS study (17%) and much less than the rate of transfemoral CAS with the cerebral protection arm of the ICSS Study (73%).[4]

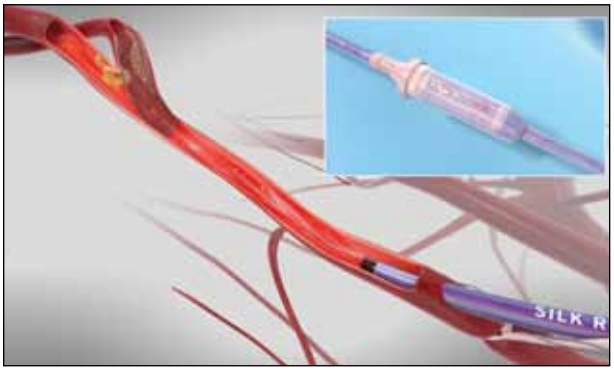

Figure 2. CAS with dynamic flow reversal. Debris is captured in the proximal inline filter.

Data from the ROADSTER trial will supplement the body of data collected in the PROOF study and the ongoing LOTUS (n = 11) and TESLA (n = 58) post-market registries that are evaluating the safety and performance in populations such as elderly symptomatic patients and in broader usage in multiple centers. Sumaira Macdonald, MBChB, of Freeman Hospital in Newcastle-upon-Tyne, United Kingdom, is the principal investigator for the LOTUS study. Frank Vermassen, MD, and Isabelle Van Herzeele, MD, of the University of Ghent Hospital in Ghent, Belgium, have submitted the initial results from the TESLA registry to the *European Journal of Vascular and Endovascular Surgery.* Both the Silk Road NPS and the Silk Road Carotid Stent System bear the CE Mark and are being used in a number of leading carotid intervention centers in Europe. ■

Christopher J. Kwolek, MD, is Director of the vascular and endovascular training program at the Massachusetts General Hospital and Chief of Vascular Surgery at Newton Wellesley Hospital in Boston, Massachusetts. He has disclosed that he is a paid advisor to Silk Road Medical. Dr. Kwolek may be reached at ckwolek@partners.org.

Richard M. Ruedy is Vice President of Regulatory Affairs, Clinical Affairs, and Quality Assurance for Silk Road Medical. He has disclosed that he is a salaried employee of Silk Road Medical and owns stock in Abbott Vascular. Mr. Ruedy may be reached at ric@silkroadmed.com.

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