ELSEVIER

Transradial and Transbrachial Arterial Approach for Simultaneous Carotid Angiographic Examination and Stenting Using Catheter Looping and Retrograde Engagement Technique

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Background: The purpose of this study was to introduce a novel and safe technique with high procedural success for carotid artery stenting (CAS).

Methods: From April 2004 to May 2009, 161 patients underwent CAS using either a high transradial arterial approach (TRA, defined as 10 cm above styloid process) or a transbrachial arterial approach (TBA) with a 7F arterial sheath. Selective carotid angiography was performed using a 6F Kimny guiding catheter and Teflon wire (260 cm in length) by Catheter Looping And Retrograde Engagement Technique (CLARET) with the guiding catheter seated on the right coronary cusp and its tip engaged into the common carotid artery (CCA). Teflon wire was introduced into the CCA again after the diagnostic procedure, followed by replacement of the 6F Kimny guiding catheter by a 7F Kimny catheter for CAS using one of the following techniques: (1) direct-engagement method, i.e., from right innominate artery into the right CCA; (2) looping method plus double-wire technique (utilized two Teflon wires to provide an adequate support) for both the right and left CCA; and (3) looping method plus a PercuSurge balloon anchoring at the external carotid artery.

Results: This distinctive technique offered 100% diagnostic success and 99.4% CAS success. Two patients (1.2%) experienced major ischemic stroke after CAS and two (1.2%) died during hospitalization.

Conclusion: The results of the present study showed that high TRA/TBA using CLARET for CAS in patients with severe carotid artery stenosis is safe and technically feasible with an extremely high success rate.

INTRODUCTION

Growing data have suggested the feasibility of catheter-based carotid artery stenting (CAS) as an alternative to carotid endarterectomy in patients with high-grade symptomatic or asymptomatic carotid artery stenosis, especially for high-risk patient subgroups such as those with serious medical problems[1-5] and the elderly.[6,7] Although the transfemoral arterial approach (TFA) is the most common method worldwide for both coronary and carotid angiographic studies and interventions,[1-9] this conventional approach for either coronary or carotid interventions has its anatomical limitations, including difficulty in engaging the common carotid artery (CCA) due to the presence of a bovine arch (i.e., left and right CCA stems

S.-Y.C. equal contribution in this study compared with first author; C.-J.W. equal contribution in this study compared with corresponding author.

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Ann Vasc Surg 2010; 24: 670-679
DOI: 10.1016/j.avsg.2009.12.001

Published online: April 5, 2010

from a main trunk), aortic arch anomaly (Kommerell's diverticulum), distal abdominal aortic disease, morbid obesity, as well as very tortuous or occluded iliofemoral or abdominal aorta.[10-14] Additionally, patients with symptomatic degenerative spine or hip problems and those with benign prostate hyperplasia would be unable to tolerate a long period of bed rest after TFA for coronary or carotid intervention. Furthermore, TFA is also associated with hemostatic and groin complications[15,16] that may prolong hospitalization. Therefore, an alternative method with safety and efficacy for those patients who are not suitable for CAS from TFA becomes a necessity in our clinical practice.

Kaohsiung Chang Gung Memorial Hospital is one of the earliest centers in Asia to perform both coronary angiographic studies and interventional procedures via the transradial arterial approach (TRA).[17] Based on our experience with TRA for coronary intervention,[17-19] we have previously adopted a brand new method, i.e., looping technique, for cerebral angiographic study via TRA[20] and for CAS via the transbrachial arterial approach (TBA).[21] Recently, we have extended the applicability of the looping technique[20] via high (H)-TRA/TBA for patients with severe carotid artery stenosis undergoing carotid intervention. To the best of our knowledge, this could be the most consistently reproducible method among all the reported H-TRA/TBA series in the literature with excellent safety and a nearly 100% success rate. Therefore, we would like to share our experience with H-TRA/TBA for carotid intervention with interventionists.

METHODS

This study evaluated the feasibility and safety of H-TRA and TBA for CAS in patients with severe and symptomatic carotid stenosis treated at Chang Gung Memorial Hospital, Kaohsiung, Taiwan, R.O.C. Each subject provided written informed consent.

Patient Enrollment and Exclusion Criteria

Enrollment criteria included the following: (1) severe extracranial carotid artery (ECCA) stenosis ($\geq$70%) determined by magnetic resonance imaging (MRI)/MR angiography (MRA) and duplex ultrasound of the carotid arteries prior to extracranial and intracranial angiographic studies; (2) history of stroke (>2 months), transient ischemic attack (TIA), or dizziness related to a significant ECCA stenosis. Exclusion criteria were as follows: (1) history of acute or recent stroke (<2 months), myocardial infarction, and surgery or trauma within the preceding 2 months; (2) unconsciousness or unwillingness to undergo the procedure; and (3) subclavian or brachiocephalic artery stenosis. Accordingly, from April 2004 to May 2009, 161 patients were consecutively and prospectively enrolled into this study.

Procedure and Protocol

Selection of puncture site. Either right or left H-TRA (defined as a puncture site 10 cm above the styloid process) was considered the first choice in the procedure. However, if obstruction was at the right ECCA, then right H-TRA was preferred. TBA was utilized for patients taller than 175 cm or with the following conditions: (1) diameters of both radial arteries at high-radial arterial level were too small; (2) pulsations at high-radial arterial level were weak or lost on both sides; or (3) Allen's test in both hands was positive. Additionally, if left subclavian artery stenosis was diagnosed, right H-TRA was utilized. Conversely, if innominate artery stenosis was diagnosed, left H-TRA was utilized.

A 7F arterial sheath was inserted into the artery following successful puncture. A cocktail consisting of a mixture of 5,000 U heparin and 200 μg nitroglycerin was routinely given intra-arterially from the arterial sheath.

Selection of guiding catheter. A 6F Kimny Miniradial guiding catheter (Boston Scientific, Scimed, Maple Grove, MN) was utilized for the ECCA angiographic study. To avoid repeated engagement for diagnostic and interventional procedures on the same side, angiographic examination of the non-culprit side was first performed, followed by that of the culprit side using a 6F catheter. After examination of the culprit ECCA, the 6F catheter was replaced by a 7F Kimny guiding catheter for intervention.

Using the catheter looping and retrograde engagement technique for CAS of the ECCA. A 6F Kimny guiding catheter along with a 0.035-inch (length 260 cm) J-tip Teflon guidewire (Argon Medical Devices, Athens, TX) was passed carefully through the radial artery and brachial artery into the subclavian artery or brachiocephalic artery. The guiding catheter was then advanced with the Teflon guidewire and curved at the aortic cusp level (Fig. 1A). The tip of the guiding catheter was manipulated toward the left side for engagement of the left CCA and vice versa to engage the right CCA. The Teflon guidewire was then carefully advanced into the CCA (Fig. 1B, C), and the guiding catheter was