

# Impact of Duplex Ultrasound Frequency on Clinical Outcome Following Carotid Endarterectomy

## INTRODUCTION

- ❖ Stenosis of the internal carotid artery is a common cause of stroke, transient ischemic attack, and amaurosis fugax<sup>1</sup>
- ❖ Carotid endarterectomy (CEA) is the recommended treatment for many patients with symptomatic and asymptomatic carotid stenosis<sup>1,2</sup>
- ❖ Some patients experience early restenosis of the ipsilateral carotid artery after CEA as a result of intimal hyperplasia, and therefore are less likely to embolize than regular atherosclerotic plaque<sup>2,3</sup>
- ❖ The Society for Vascular Surgery (SVS) clinical practice guidelines recommend five carotid duplex scans in the first two years after CEA<sup>1</sup>
  - ❖ This surveillance protocol is intended to detect ipsilateral recurrent stenosis and progression of contralateral carotid disease before development of neurologic events<sup>2,4</sup>
- ❖ There is some evidence suggesting that early duplex surveillance does not significantly reduce the incidence of stroke or mortality<sup>4,5</sup>
- ❖ The purpose of this study is to examine the clinical outcome of patients following CEA and to assess the effectiveness of carotid duplex surveillance at preventing neurologic events

## METHODS

This is an IRB-approved retrospective chart review of every patient who underwent a CEA at a single community-based private practice in the years 2016 and 2017. Demographic information, medical history, procedure notes, and duplex scan results were accessed through the electronic medical record and patients were then de-identified.

Patients were excluded from the study if they had a previous CEA or stent placement in the ipsilateral carotid artery prior to the study CEA. A prior history of contralateral CEA was not considered for exclusion.

Clinical outcome and duplex results were assessed for two years following each CEA. Patients were evaluated for neurologic events, ipsilateral carotid restenosis, and presence or progression of contralateral disease. Neurologic events included stroke, transient ischemic attack, and amaurosis fugax.

Standardized duplex velocity criteria were used to categorize carotid stenosis as none (0%), mild (<50%), moderate (50-69%), severe (70-99%), or total occlusion (100%).

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## RESULTS

- ❖ 246 patients underwent 254 CEAs
- ❖ On average, each patient received 2.84 carotid duplex scans

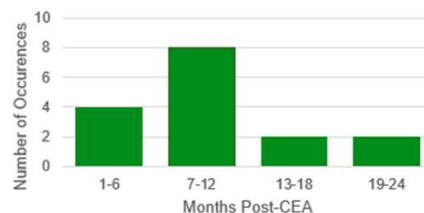
Ipsilateral restenosis (Figure 1):

- ❖ Moderate (50-69%) restenosis developed in **8.1%** of carotids
- ❖ Severe (70-99%) restenosis developed in **1.4%** of carotids
- ❖ Total occlusion (100%) developed in **0** of the carotids

Contralateral stenosis (Figure 2):

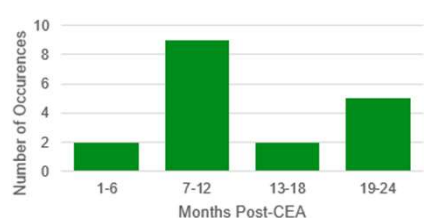
- ❖ **35.8%** of patients had >50% contralateral stenosis at time of CEA
- ❖ **12.4%** of contralateral carotids developed progression of stenosis
  - ❖ **7.7%** progressed to moderate (50-69%) stenosis
  - ❖ **4.7%** progressed to severe (70-99%) stenosis

Figure 1: Incidence of Ipsilateral Restenosis



The incidence of ipsilateral carotid artery restenosis was most likely to be identified in the first 12 months following CEA. The period from months 7-12 had the highest number of restenoses. Duplex scans after month 13 were unlikely to discover restenosis.

Figure 2: Incidence of Contralateral Disease Progression



The disease pattern of contralateral carotid stenosis closely resembled that of ipsilateral restenosis. Most of the contralateral disease progression was identified in the 7-12 months following CEA.

Neurologic events:

- ❖ 2 patients developed ipsilateral strokes within 3 months
- ❖ 1 patient developed ipsilateral TIA at 20-month follow-up
- ❖ 0 patients developed neurologic events from the contralateral carotid artery
- ❖ All 3 patients who developed neurologic events had <50% ipsilateral restenosis
- ❖ **Presence of ipsilateral or contralateral stenosis on surveillance duplex ultrasound was not associated with any neurologic sequelae**

## CONCLUSIONS

- ❖ Early ipsilateral restenosis and progression of contralateral carotid disease occurs infrequently and is clinically benign
- ❖ Adherence to SVS clinical practice guidelines for duplex surveillance during the 1<sup>st</sup> 2 years after CEA would not have predicted or prevented the 2 strokes and 1 TIA that occurred in our study
- ❖ Five duplex scans in 2 years is resource intensive, and is difficult for patients and practices to accomplish
- ❖ We recommend revision of the guidelines to match the clinical outcomes and disease patterns occurring in the early postoperative period after CEA
- ❖ We recommend a baseline duplex scan at 6 weeks, 12 months and annually thereafter
- ❖ We believe following this practical approach would reduce the surveillance cost and resource utilization without increasing the risk for stroke during early postoperative period

## REFERENCES

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