

# Carotid endarterectomy: the Maltese experience

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## Abstract

**Introduction:** Carotid endarterectomy significantly reduces the risk of cerebrovascular events in both symptomatic and asymptomatic patients with significant carotid stenosis. The recent American Heart Association/American College of Cardiology guidelines advise that carotid endarterectomy is only beneficial when the perioperative stroke or mortality rate is below 6%. The aim of this study was to review the results of carotid endarterectomy performed in Malta by one vascular surgeon.

**Methods:** All patients undergoing carotid endarterectomy between July 2007 and June 2011 were included in the study. Data was entered prospectively into a vascular database. Retrospective review of the case notes of all patients undergoing carotid endarterectomy was also performed. Demographics of the patient cohort as well as information about perioperative mortality, cerebrovascular events, cardiac events as well as any other complications were recorded. Information was also

## Keywords

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collected about any deaths and cerebrovascular events during the follow up period.

**Results:** 51 patients underwent carotid endarterectomy during the study period. 94% were symptomatic (65% CVA; 15% TIA; 10% amaurosis fugax; 4% TIA and amaurosis) and 6% asymptomatic. 46% had an internal carotid artery stenosis of 90% or more while the rest had a stenosis of 70% or more. 31% of patients also had significant contralateral carotid stenosis or occlusion. There was one postoperative mortality (1.9%) and one patient sustained a postoperative lacunar stroke (1.9%). There were no cranial nerve injuries and no bleeding requiring return to theatre. The combined perioperative mortality and stroke rate in this cohort was 3.9%.

**Conclusions:** The combined perioperative mortality and stroke rate in this study is better than that reported in the major randomised controlled trials. The perioperative death and stroke rate is well below the threshold level advised by the AHA/ACC.

## Introduction

Carotid endarterectomy was developed in the 1950s but has now become a well established surgical procedure which has been shown in several randomized controlled trials to be highly beneficial in symptomatic patients with a significant carotid stenosis (>70%) at preventing strokes (1-3). Carotid endarterectomy is less beneficial in symptomatic patients with a 50-60% stenosis and not beneficial in patients with less than 50% carotid stenosis (1,2). More recently carotid endarterectomy has also been shown to be effective at reducing the risk of ipsilateral and any stroke by approximately 30% over 3 years in asymptomatic patients with a significant stenosis although the absolute risk reduction is low and consequently the number needed to treat higher (4-6). Carotid stenting has been compared to carotid endarterectomy in a number of trials in the last few years (7-10). Most of the trials showed that the risks of perioperative stroke were higher after carotid stenting compared to endarterectomy. Despite this the American Heart Association and the American College of Cardiology issued guidelines on the

management of patients with extracranial carotid disease wherein they stated that carotid stenting is an alternative to carotid endarterectomy if the periprocedural risks are less than 6% (11). This has been vehemently opposed by some claiming that the current evidence indicates that carotid endarterectomy is still the gold standard in the treatment of extracranial carotid disease.

Currently carotid endarterectomy is offered to patients with significant carotid stenoses at Mater Dei Hospital. The recently published AHA recommendations clearly state that the procedure should only be offered if the anticipated rate of perioperative stroke or mortality is less than 6% (11). This article reports the results of patients undergoing carotid endarterectomy under the care of one vascular surgeon (KC) at Mater Dei Hospital and compares these with the reported literature. The aim of this study is to ascertain whether the results of carotid endarterectomy in this context are acceptable and to ensure that the recommendations of the AHA are being met.

## Methods

All patients who underwent carotid endarterectomy under the care of one vascular surgeon (KC) at Mater Dei Hospital between July 2007 and June 2011 were included. Data on these patients were collected prospectively and entered into a vascular database. Data collected included details on demographics (gender, age), major risk factors for arterial disease (smoking, hypertension, hyperlipidaemia, diabetes, renal function, ischaemic heart disease), indications for surgery, operative details (side, use of patch closure, use of intra-operative shunt), post-operative complications (including mortality, TIA, stroke, cranial nerve injury, wound complications, haemorrhage, paraesthesia and others) and follow up.

Other data collected included previous carotid intervention and pre-operative treatment. Details were also collected on HDU/ITU admission, days spent in HDU/ITU, total duration of hospital stay and discharge destination.

The case files of all patients were reviewed between July and August 2011 to identify major cardiovascular events and other complications beyond the perioperative period. A proforma was constructed to ensure that data collection was as comprehensive as possible. All data was coded to allow easier analysis of the information. A database was constructed using data from the prospectively collected vascular database and information collected from retrospective review of the patient case files.

SPSS version 16.1 was used to analyse the data.

## Results

Between July 2007 and June 2011 fifty one patients underwent carotid endarterectomy. 42 patients (82%) were male. The median age was 65 years with a range from 40

to 80 years. The median follow up period was 41 weeks 4 days with a range of 6 days to 199 weeks 3 days.

64% of the cohort were current or previous smokers. 38% were diabetics. 22% were also known to suffer from ischaemic heart disease having undergone previous surgery or percutaneous coronary intervention. 32% of patients were hypertensive on treatment and 36% were hyperlipidaemic.

The vast majority of patients (81%) were being treated preoperatively with both aspirin and statins. 6% of this cohort (3 patients) did not take either antiplatelet or lipid lowering agents. 6 patients (12%) were not on a statin. One patient had previously undergone a contralateral carotid endarterectomy and another had undergone an attempt at ipsilateral carotid endarterectomy by another team but the procedure was abandoned because of technical issues.

65% of patients were referred to the vascular surgeon after sustaining a stroke, 15% for transient ischemic attack, 10% for amaurosis fugax while 6% were asymptomatic (3 patients) while the remaining 4% had sustained both amaurosis fugax and transient ischaemic attacks.

46% of the patients had a greater than 90% stenosis of the internal carotid artery on preoperative assessment, while the remaining 54% had a greater than 70% stenosis. 31% of patients also had significant contralateral internal carotid artery stenosis (>70%) or occlusion.

All procedures were performed under general anaesthetic. 55% of procedures were carried out on the left side. 55% of patients were shunted intraoperatively. A Brenner shunt was used in all cases requiring shunting. Shunting was on a selective practice based on stump pressure and contralateral carotid disease. Patients were shunted if the stump pressure was less than 40mmHg or if the contralateral carotid system was occluded or significantly stenosed (>70%). All carotid endarterectomies were closed with a patch (venous or polyurethane).

87% of the patients were admitted to intensive care/high dependency unit postoperatively. In 13% of cases no ITU/HDU bed was available and these patients were either transferred directly to the ward after a period of monitoring in the theatre recovery area (3 patients) or transferred to the coronary care unit (4 patients) for overnight monitoring.

The vast majority (91%) of patients transferred to ITU/HDU postoperatively were only kept overnight for monitoring. 4 patients required a longer stay in ITU/HDU with the longest stay being 3 days (2 patients).

61% of patients were discharged on the 2nd day post op, 4% were discharged on 1st day post op. The median postoperative stay was 2 days with a mean of 4 days and a range of 2-9 days.

### ***Perioperative complications***

There was one death (1.96%) in this cohort. This was a sudden death on the 2nd day post op. The patient had recovered well from his surgery and was due to be discharged on the following morning. He was found to be in asystole by nursing staff at 3 am in the morning. The resuscitation team was called and cardiopulmonary resuscitation was attempted without success. A post mortem examination was refused by the family and his death was attributed to a cardiovascular event.

One patient sustained a lacunar stroke in the postoperative period (1.96%). This was confirmed on MRI. No other strokes or TIAs were recorded in this group of patients. The one death and one stroke give a combined perioperative stroke and death rate of 3.9%.

Two patients had minor bleeding episodes from the operative site which did not require intervention and which settled spontaneously. Other complications included urinary retention, hematuria and dysuria, ST segment depression recorded on the electrocardiogram, chest pain but with a normal electrocardiogram and cardiac enzymes, right neck swelling at the site of incision and a right basal pneumonia. One patient also had a severe headache which lasted for 2 days which resolved spontaneously. Four patients reported minimal paraesthesia either at the angle of the jaw, over the mandible or over the face. No cranial nerve injuries were recorded.

### ***Longterm complications***

Complaints recorded within 6 months of surgery included numbness at incision site, insertion of a permanent pacemaker due to the development of new Wenckebach on the background of a left bundle branch block and left axis deviation, grade 1 spondylolisthesis and lung cancer. One patient reported severe dizziness and vomiting between 6 months and 1 year after surgery. One patient sustained an ischemic stroke which was confirmed on magnetic resonance imaging more than 1 year after surgery. This affected the ipsilateral left temporo-parietal region. Carotid scanning revealed no evidence of restenosis at the site treated. Considerable atherosclerotic plaque in the contralateral side was identified but there was no significant stenosis.

One patient passed away during the follow up period. Death occurred almost two years after carotid surgery. He presented with a two day history of epigastric pain, nausea and coffee ground vomit and subsequently suffered a cardiac arrest. Cardiopulmonary resuscitation was started immediately and was transferred to intensive care unit. He

sustained a second cardiac arrest at ITU but cardiopulmonary resuscitation was unsuccessful.

### **Discussion**

This study shows that the perioperative risk of stroke and death after carotid endarterectomy performed by a vascular team at Mater Dei Hospital is 3.9%. Only one perioperative death and one perioperative stroke was reported in this series. This figure is well below the 6% quoted in the recent AHA/ACC recommendations (11). This figure also compares very well with the results reported in the major randomized controlled trials. The European Carotid Surgery Trial (ECST) reported a perioperative stroke and death rate of 7.5% (1) while the NASCET Trial reported a 5.8% rate (2). The Veterans Affairs trial reported a 6.5% combined perioperative death and stroke rate (12). The perioperative death and stroke rate after carotid endarterectomy in symptomatic patients in more recent trials has been 6.5% in the SPACE trial (7), 3.9% in the EVA-3S (8), 3.4% in the ICSS (9) and 3.2% in CREST (10). ICSS reported the rate of stroke, death or periprocedural MI at 120 days at 5.2% (9). ICSS also reported a cranial nerve palsy rate of 5.5% and a haematoma rate of 6.1%.

Furthermore the vast majority of the patients operated on in this cohort were symptomatic patients with only 6% being asymptomatic. This is in contrast with some of the major trials which included a significant proportion of asymptomatic subjects. It is known that the risks of intervention are significantly higher in symptomatic patients. Despite the high proportion of symptomatic patients in our study the complication rate is as low or lower than any of the major trials some of which only allowed surgeons with a proven track record of low complication rates to participate.

Although the proportion of patients on effective secondary risk factor management in our cohort is much higher than most of the trials, there was still a small proportion of patients who were not on a statin. The main reason for this was that statins are not provided free of charge to patients with cerebrovascular disease on the Maltese national health service as the condition is not one of the Schedule V list of conditions. This is unfortunate as the benefits and cost effectiveness of this group of drugs in the context of carotid disease are well recognized. There is also clear evidence that use of statins significantly reduces the perioperative risks in patients undergoing carotid endarterectomy. One could speculate that if all patients were on statins the preoperative complication rate could be reduced further. Indeed the patient who

passed away in the postoperative period was not on statins.

A small proportion of patients (3 patients) were not on antiplatelet treatment. The reasons for this included the fact that they were on anticoagulation for other reasons (e.g. atrial fibrillation, prosthetic heart valves) or had contraindications.

It is also encouraging to see that there were no patients who required return to theatre for bleeding despite the fact that all patients who were on antiplatelet treatment continued to take their treatment even during the perioperative period. No major wound infections or patch infection were recorded. No cranial nerve injuries were seen and apart from minor paraesthesia in a small number of patients around the incision site no other complications related to the surgery were identified.

The recent recommendations published by the AHA/ACC suggest that noninvasive imaging of the extracranial carotid arteries is reasonable at 1 month, 6 months and yearly after carotid endarterectomy to assess patency and to exclude the development of new and contralateral lesions as long as the patient remains a candidate for intervention. This is not our current practice but the resources required for implementation of this recommendation will need to be addressed. The experience from our study however suggests that this is not necessary or is unlikely to be cost effective. Indeed the AHA/ACC recommendation is only a class IIa recommendation based only on level C evidence. In our cohort, out of the 51 patients throughout the follow up period only one patient sustained a stroke and when scanned this was not related to any restenosis at the site of endarterectomy. In contrast there were 6.8% of patients in the ECST trial with a symptomatic stenosis over 70% who sustained stroke or surgical death in the follow up period after endarterectomy and 9% of symptomatic patients with a more than 70% stenosis in the NASCET trial who sustained an ipsilateral stroke after endarterectomy.

The good results obtained in our cohort of patients are reassuring but are only possible through the effective and committed teamwork involving surgical, neurological, medical, anaesthetic and nursing personnel both in the peri- and postoperative periods. This is the first reported series of carotid endarterectomy in Malta and will hopefully serve to encourage neurologists, physicians and

ophthalmologists to continue to refer deserving patients for this intervention.

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