

National Experience with Extracranial Carotid Artery Aneurysms: Epidemiology, Surgical Treatment Strategy, and Treatment Outcome

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Objective: Extracranial carotid artery aneurysms (CAAs) are rare but confer risk of stroke, rupture, and local symptoms. Few cases have been reported, even from large centers, and therefore knowledge of the disease is limited. The purpose of this study was to review epidemiology, surgical treatment, and outcomes of CAAs in a nationwide setting using the Swedish National Registry for Vascular Surgery (Swedvasc).

Methods: Data on all surgical interventions for CAAs from January 1997 to December 2011 were retrieved from the Swedvasc registry. Additional clinical information was collected from hospital records.

Results: A total of 48 cases of CAAs were identified. The cause was atherosclerosis in 34 cases, infection in 2, and pseudoaneurysm in 12. The most common presentation was a pulsatile mass with or without local symptoms. Aneurysms isolated to the internal carotid artery predominated. Resection with end-to-end anastomosis was the most common technique used for treatment. Among true aneurysms, 24% had a known synchronous aneurysm elsewhere. Stroke-free survival ($n = 48$) was 90% after 30 days and 85% after 1 year. A total of 12.5% patients experienced permanent cranial nerve injury and 33% experienced any complication.

Conclusions: CAAs are rare entities in vascular surgery. In terms of stroke-free survival, the Swedish national results approach reports from large volume centers. The relatively high risk for permanent cranial nerve injury advocates caution when performing surgery on CAAs.

INTRODUCTION

Extracranial carotid artery aneurysms (CAAs) constitute only approximately 0.4% of all peripheral aneurysms,¹ and are therefore rarely

encountered by most vascular surgeons. Whenever present, CAAs confer a risk for stroke, severe bleeding, and local symptoms, ranging from neck pain to cranial nerve palsy. Vascular surgical intervention is often considered mandatory to relieve local symptoms and to decrease the risk of stroke and rupture. To the authors' knowledge, among modern surgical series evaluating CAAs, only 5 papers^{2–6} have reported more than 50 cases, illustrating the rarity of the disease. Because of this rarity, limited knowledge exists about the epidemiology of the disease and optimal surgical treatment strategies and treatment outcomes after vascular surgical repair. In this context, this report presents the results from one of the world's largest surgical series for CAAs, assessing the current nationwide experience in a population-based setting, using prospectively collected data from

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the Swedish National Registry for Vascular Surgery (Swedvasc).⁷

METHODS

Study Design

This study retrospectively analyzed the prospectively collected data on CAAs in Swedvasc. Additional clinical information was retrospectively collected from the original hospital records. Ethical approval was obtained from the Regional Ethical Review Board at the University of Gothenburg. The dataset from the Swedvasc registry was received after a formal consent from the National Steering Committee of the Swedvasc registry, according to the requirements from the registry.

The Swedvasc Registry

The Swedvasc registry has been collecting prospective data from all vascular surgical centers in Sweden since 1994. The registry has been validated several times regarding data accuracy^{8–10} and aggregate data regarding risk factors, performed procedures, complications, and outcomes of all vascular interventions in the country. Follow-up visits according to the registry protocol are scheduled 1 month and 1 year after the procedure. Mortality data in the Swedvasc registry are retrieved through automatic cross-matching with the Swedish National Population Registry, which contains accurate data regarding time and cause of death for all deceased individuals in Sweden.

Study Population

In a dataset ranging from January 1997 to December 2011, a total of 155,975 vascular procedures were registered. This time frame was selected because the registry search strategy used codes from the *International Classification of Diseases-10th Revision* (ICD-10) and the NOMESCO Classification of Surgical Procedures, which was introduced in the registry 1997. Results showed 14,091 interventions for abdominal aortic aneurysms (AAAs), 1217 for popliteal artery aneurysms (PAAs), and 48 for CAAs. The medical records for all CAA cases were thereafter collected from all of the 13 involved vascular centers, including information from the first admission for surgery to the follow-up visits during the first year after the procedure. Detailed information for each case regarding demography, risk factors, comorbidity, and surgical procedures, together with outcomes at 30 days and 1 year, was assembled in a prespecified database.

Statistical Analysis

Statistical analysis was performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). For continuous variables, means and standard deviations or medians and ranges were calculated, and for categorical variables, absolute numbers and/or percentages were calculated.

RESULTS

Study Population

Demographics and risk factors are listed in [Table 1](#). The incidence of surgical intervention was approximately 3 operations per year per 9 million individuals (Swedish mean population during 1997–2011). Sex distribution was similar to what was reported by other authors.^{3,5} The median CAA diameter was 25 mm (15–60 mm) and the side distribution was similar (22 right-sided and 26 left-sided). The cause was atherosclerosis in 34 cases, infection in 2 cases, and pseudoaneurysms (predominantly after previous endarterectomy with synthetic patch closure; $n = 8$) in 12 cases. Median time to development of pseudoaneurysm after endarterectomy was 38 months (25–71 months). The most common clinical presentation was a pulsatile mass in the neck ($n = 30$), with or without local symptoms (neck pain, $n = 6$; dysphagia, $n = 4$; cranial nerve palsy, $n = 2$; asymptomatic, $n = 18$). Ten individuals had their CAA diagnosed secondary to a cerebrovascular event (amaurosis fugax, $n = 1$; transient ischemic attack [TIA], $n = 1$; crescendo TIA, $n = 1$; minor stroke, $n = 5$; major stroke, $n = 2$). Of the patients with a cerebrovascular event as the presenting symptom, 9 were true aneurysms. Surgery for these cases occurred after a median period of 40 days (0–300 days).

Two subjects presented with rupture; both had developed pseudoaneurysms (mean diameter 30 mm at presentation) after dental procedures under local anesthesia. The cause of these pseudoaneurysms were, as judged by the responsible vascular surgeon, related to accidental puncture of the carotid artery during local anesthesia (mandibular blockade) administered before the dental procedure.

Diagnosis was established by computed tomography angiography in 22 cases (46%), duplex ultrasound in 15 cases (31%), and magnetic resonance imaging or digital subtraction angiography in 4 cases (8% each). Based on the present review of the hospital records, 19% of all cases had a synchronous or metachronous aneurysm in another vascular territory (abdominal aorta, $n = 7$; thoracic aorta, $n = 1$;

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