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REVIEW

Management of Extracranial Carotid Artery Aneurysm

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WHAT THIS PAPER ADDS

This review provides an overview of the current scarce literature on treatment of extracranial carotid artery aneurysms (ECAAs). This review for the first time identifies a shortcoming of guidance for treatment of patients presenting with ECAA. There is a clear lack of knowledge on the natural course of these aneurysms. Specific essential details on etiology and aneurysm configuration, size, and volume are currently insufficiently available. Furthermore, defining treatment indications for both surgical and endovascular intervention is not possible due to the low quality of studies and confounding by indication. This review supports the need for an international multicenter registry to reveal the optimal treatment for ECAA.

Introduction: Aneurysms of the extracranial carotid artery (ECAA) are rare. Several treatments have been developed over the last 20 years, yet the preferred method to treat ECAA remains unknown. This paper is a review of all available literature on the risk of complications and long-term outcome after conservative or invasive treatment of patients with ECAA.

Methods: Reports on ECAA treatment until July 2014 were searched in PubMed and Embase using the key words aneurysm, carotid, extracranial, and therapy.

Results: A total of 281 articles were identified. Selected articles were case reports ($n = 179$) or case series ($n = 102$). Papers with fewer than 10 patients were excluded, resulting in the final selection of 39 articles covering a total of 1,239 patients. Treatment consisted of either conservative treatment in 11% of the cases or invasive treatment in 89% of the cases. Invasive treatment comprised surgery in 94%, endovascular approach in 5%, and a hybrid approach in 1% of the patients. The most common complication described after invasive therapy was cranial nerve damage, which occurred in 11.8% of patients after surgery. The 30 day mortality rate and stroke rate in conservatively treated patients was 4.67% and 6.67%, after surgery 1.91% and 5.16%. Information on confounders in the present study was incomplete. Therefore, adjustments to correct for confounding by indication could not be done.

Conclusions: This review summarizes the largest available series in the literature on ECAA management. The number of ECAAs reported in current literature is scarce. The early and long-term outcome of invasive treatment in ECAA is favorable; however, cranial nerve damage after surgery occurs frequently. Unfortunately, due to limitations in reporting of results and confounding by indication in the available literature, it was not possible to determine the optimal treatment strategy. There is a need for a multicenter international registry to reveal the optimal treatment for ECAA.

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INTRODUCTION

Invasive treatment for extracranial carotid artery aneurysms (ECAAs) pertains to only 0.6—3.8% of all extracranial carotid interventions,[1—13] 0.6—2% of all carotid endarterectomies,[3,5,7,10] and 0.4—2% of all extracranial arterial

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aneurysm repairs.[14–16] A substantial portion of the ECAAs will probably remain clinically silent. However, ECAAs may lead to neurologic symptoms including transient ischemic attacks (TIAs) or ischemic stroke.[17–19] Other symptoms include pulsating mass and related cranial nerve dysfunction (CND). Information regarding the natural history, indications, and the best treatment in patients with ECAAs is scarce and guidelines are lacking. Both medical, surgical, and endovascular treatment of the aneurysm have been recommended.[14,15,18,20] The best medical treatment comprises antithrombotic treatment and regular follow up and may have a place in the treatment of asymptomatic patients. Traditional surgical treatment, which is the current treatment of choice of symptomatic or growing ECAAs, consists of open resection of the entire aneurysm with or without arterial replacement with an interposition graft.[14,20–22] However, this approach has been associated with the risk of stroke and cranial nerve damage.[23] Endovascular ECAA repair has only been described in small case series.[23]

For a proper assessment about which treatment should be preferred, a better insight into natural history and risk of complications of the different treatments is needed. This paper is a review of all available literature on the risk of complications and long-term outcome after conservative or invasive treatment of patients with ECAA.

METHODS

Search strategy

In July 2014 a search was performed of all literature since 1900 in Medline (with Pubmed as interface) and Embase combining the following search terms: aneurysm, carotid, extracranial, therapy (and all synonyms for all treatment options). The search was performed according to the search strategy and data collection guidelines of the Meta-analysis of Observational Studies in Epidemiology (MOOSE) Group.[24]

Definition of ECAA

Because no generally accepted definition of ECAA exists, all aneurysms defined as such by the authors of the parent paper, regardless of the definitions used, located in the internal carotid artery (ICA) or in the common carotid artery (CCA) were included. Only aneurysms located between the CCA origin at the aortic arch and base of the skull were included.

Selection of studies

Retrieved records were independently screened by two authors (J.W., G.B.) on title, abstract, and full text. All discrepancies (3%) were discussed until final agreement was reached. If necessary, a third opinion could be obtained, but agreement between authors was reached in all papers. Inclusion criteria were (a) adult patients with an ECAA; (b) description of the type of intervention (conservative treatment, surgery, endovascular treatment, or any combination); (c) report of data on outcome during follow up (case fatality, fatal or non-fatal stroke, or local cervical symptoms); and (d) series describing 10 patients or more.

Language of publications was restricted to Dutch and English. Studies regarding aneurysms located at the level of the skull base or above, aneurysms located in the external carotid artery (ECA), non-human data, and unavailable full text papers were excluded. Studies presenting data at a group level containing the ECA were included because of the low number of ECAs in these series and the relevance to present these large series.[12,19,25–27] The reference list of all selected articles was hand searched to retrieve additional studies. Selected studies were critically appraised based on study design, study quality, consistency, and directness using the GRADE system.[28] Subsequently, the level of evidence of the studies was graded by one author (J.W.). The level was graded high, moderate, low, or very low.

Data extraction

Three authors (J.W., B.N., G.B.) independently extracted data by means of predefined parameters. Individual patient data were obtained when available. The following data were retrieved: publication year, country of origin, number of patients, study design, patient characteristics (age, gender, history of smoking, diabetes, hypertension, and hyperlipidemia), aneurysm characteristics (affected vessel, exact location, aneurysm shape, affected side, and aneurysm size), etiology, and detailed method of treatment.

Outcome measurements included case fatality, stroke, and local cervical symptoms. Local cervical symptoms are defined as any symptom, most likely related to the aneurysm, in the cervical region on the ipsilateral side of the aneurysm. Local cervical symptoms were scored as reported by authors. Furthermore, any neurological deficit with an acute onset persisting for at least 24 hours for which no other cause could be found was considered a stroke. Early complications included all events that occurred within 30 days after intervention, or after detection of the ECAA in patients who received conservative treatment. Late outcome consisted of death from any cause and any stroke that occurred after at least 30 days.

Statistical analyses

A pooled or summary estimate of the risk of all cause mortality and of all and non-fatal strokes across all studies was calculated together with a 95% confidence interval using a random effects model. The heterogeneity in results among studies was evaluated by I^2 statistics and by prediction intervals. A 95% prediction interval shows the likely range of values for the risks than can be expected if a new and large study would be performed similar to those included in this review. The prediction interval provides insight into the variability or consistency between the results of individual studies whereas a 95% confidence interval around the pooled estimates provides insight into how certain we are about the significance of the pooled estimate. The amount of between study variation (tau-squared value of a random effects model) is a key factor