

Complications of Carotid Endarterectomy: Systematic Literature Review

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Abstract

This review is aiming to discuss the carotid endarterectomy complications, the presented review was conducted by searching in Medline, Embase, Web of Science, Science Direct, BMJ journal and Google Scholar for, researches, review articles and reports, published over the past years. were searched up to May 2020 for published and unpublished studies and without language restrictions, if several studies had similar findings, we randomly selected one or two to avoid repetitive results. On the basis of findings and results this review found medical complications such as myocardial infarctions, other cardiovascular disorders, respiratory complications, transient confusions, surgical related errors inappropriate or an obvious contraindication and also stroke and death.

Keywords: Carotid; Endarterectomy; Complications; Stroke; Myocardial Infarctions

Introduction

An obvious benefit of carotid endarterectomy (CE) in symptomatic cases with high grade internal carotid artery (ICA) stenosis (70% - 99%) showed by the North American Symptomatic Carotid Endarterectomy Trial (NASCET) and the European Carotid Endarterectomy Trial [1,2].

In other hand a study showed that patients with moderate grade stenosis (30% - 69%) will only get the benefits of CE if they carefully be selected [3].

Currently, CE is considering the most common elective procedure, in the United States about 130 000 patients had CE during the year 1997 [4].

Although there is a huge benefit in the long life time of the patient but CE may result in complications. These complications may be due to the operation itself or due to other medical conditions. Reducing the perioperative risk in the CE patients remain as a challenge facing the future studies. Many reports represented the type and incidence of complications that are related to the surgical procedure, while less of them paid attention to the medical complications that are not directly caused by the procedure [5-10].

In the year 1991 there is two large randomized studies have developed the carotid endarterectomy standards [1,2].

When followed a proper indications and surgery done with a minimum incidence of complications they showed that surgery is preferred to best medical treatment in patients with symptomatic carotid artery stenosis. According to these studies informal agreement based on about 5% incidence of combination of stroke and/or death within thirty days is an acceptable level of complications followed the procedure.

Approximately more than 50 CE operations done in Sweden yearly by few centers, in this study we have inspected the cases with complications to recognize the probable causes/risk factors and discover the related evidences to improve future practice.

A positive result has been published by many great randomized controlled clinical trials such as (NASCET), (ECST) and (ACAS), the rates of carotid endarterectomy have increased intensely as a way to avoid stroke in high-grade carotid artery stenosis patients [8,11-15].

Perioperative complications such as stroke or death are still considering a major problem and it may refute the benefits of the operation.

Surgeons must identify the risk factors that may affect the outcomes of the operations, knowing these risk factors may help in patient selection and counselling.

Many studies have done in CE risk factors but it showed a degree of limitations such as using univariate statistical method and small group of sample [16-18].

In this study we used a large sample size (large group) in order to recognize the preoperative risk factors for the development of perioperative complications.

Materials and Methods

The present review was conducted May2020 in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) declaration standards for systematic reviews. We reviewed all the topics on the complications related to carotid endarterectomy such as cardiovascular disorders, respiratory complications, transient confusions, errors of surgical technique or postoperative management such as inappropriate or an obvious contraindication, stroke and death.

To achieve this goal, we searched Medline, Embase, Web of Science, Science Direct and Google Scholar for, researches, review articles and reports, published over the past years.

Our search was completed without language restrictions. Then we extracted data on study year, study design, and key outcome on diabetes. The selected studies were summarized and unreproducible studies were excluded. Selected data is shown in the table 1.

Author and year	Sample	Complications	Key point
Maurizio Paciaroni 1999 [19]	A 1436 patients included in surgical arm and 1449 patients in medical arm.	Myocardial infarctions, other cardiovascular disorders, respiratory complications, transient confusions, and other complications.	Endarterectomy patients with MI, angina, and hypertension were found to developed medical complications 1.5 times more than others.
T. Troeng 1999 [20]	During 1995 - 1996, 1518 patients were reported to the Swedish Vascular Registry	Surgical or management error and contraindications	Confirming the correct criteria for surgery will help to reduce stroke and death.
Jack V 2003 [21]	6038 reports for patients who underwent CE.	Stroke and death	A simple risk score consisted of five risk factors may help in patient counselling and in the prediction of postoperative complications.

Inclusion criteria

Inclusion criteria were the complications of carotid endarterectomy.

Exclusion criteria

Irrelevant articles [not related to the aim of this review and articles that did not meet the inclusion criteria in this review.

Data extraction and analysis

Information relating to each of the systematic review question elements was extracted from the studies and collated in qualitative tables. Direct analysis of the studies of complications of carotid Endarterectomy.

Results and Discussion

The study revealed that 150 had 142 medical complications 14 myocardial infarctions, 101 other cardiovascular disorders, respiratory complications, 6 transient confusions and 10 other complications. From the 142 complications, 69.7% were for short stay while only 26.8% had a prolonged stay. Five had passed away 3 of them from MI and the others die all of sudden. Patients who are treated medically experienced same complications with one third the frequency.

Patients with MI, angina or HTN after Endarterectomy procedure may develop medical complications by 1.5 times than others ($P < 0.05$) [19].

11 patients had complications or death in 30 days from surgical errors. 3 of them with intimal dissection, 3 had postoperative HTN or hyper perfusion which is not managed properly, 2 with no shunt used, 2 by insufficient run off flow without any attempt to correct it and the last patient developed stroke due to end the surgery without assessing the vessels. In 14 patients the reasons remain uncertain, 7 were undergoing surgery with ischaemia or asymptomatic stenosis, while the others seven had stenoses less than seventy percent. 52.5% or more than half of the patient were had the correct indication for operating on them, had a reasonable operative risk and there are no surgical/management errors were identified. 8 patients passed away within 30 days. 25 patients had Shunts. Ultrasound flow measurement, transcranial Doppler, or angiography were used at the end of the procedure in forty patients. Heparin, dextran and combination of them were given to 52 patients preoperatively. Documentation was incomplete in 11 patients [20].

Patients with some characteristics expected to develop stroke and death, these may help in counselling and also in predicting the EC procedure outcomes in the community. 6038 records of patients underwent EC procedure were reviewed in 34 hospital settings in Ontario in the period between January 1994 to December 1997, regression analysis was done to find 6.0% stroke or death in thirty days postoperatively. A simple risk score consisted of five risk factors may help in prediction of postoperative complications, these risk factors are history of transient ischemia or stroke (OR: 1.75, 95%), atrial fibrillation (OR: 1.89, 95%), contralateral carotid occlusion (OR: 1.75, 95%), congestive heart failure (OR: 1.80, 95%) and diabetes (OR: 1.28, 95%) [21].

The present study showed that a history of hypertension and cardiac diseases will increase the risk of developing medical complications. Although the prevalence of coronary lesion was high, but MI occurred only in 14 (1.0%) patients and caused 0.2% deaths and the possible explanation for that is the elimination for the patients who had a recent history of angina pectoris, MI and CHF from the trial. It may also be due to the use of aspirin in all the participants. MI was the main cause of the 2 sudden deaths and all patients died preoperatively all suffered from multiple cardiovascular risk factors. All coronary events in the future should routinely investigated noninvasively to recognize patients at risk. These routine investigations should consist of identifying heart size by ECG and chest radiography, and also by performing a complete history with stressing in MI, angina, CHF and any presence of rhythm disorder [19].

A recent report inappropriate indications were still found in 18% and the overall 30-day complication rate (stroke and/or death) was more than 5%, irrespective of indication. And that was the reason to suggest to assess complications mandatory for the hospital certification. Many reports have often focused on the low degree of appropriateness and low hospital or surgeon case-load as a risk factor. They imply that incorrect decision-making or lack of experience may cause complications. Developing an audit of surgery for carotid artery stenosis goes a step further [20].

A population-based review study to identify risk factors that increase stroke and/or death preoperatively after CEA. We found that the adverse outcomes after carotid operation were due to several risk factors such as CHF, atrial fibrillation, stroke, TIA and contralateral carotid artery occlusion. Be alert to these risks may help in decision making about the operating or not and can improve the quality of carotid surgery [21].

Conclusion

The results of this studies show the Carotid Endarterectomy complications. On the basis of findings and results this review found myocardial infarctions, other cardiovascular disorders, respiratory complications, transient confusions, errors of surgical technique or postoperative management such as inappropriate or an obvious contraindication, stroke and death.

Conflict of Interest

The authors of this article hasn't receive and support for this work and it was completely self-funded.

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