Eur J Vasc Endovasc Surg (2018) ■, 1–10

The Dutch Audit of Carotid Interventions: Transparency in Quality of Carotid Endarterectomy in Symptomatic Patients in the Netherlands☆

Eleonora G. Karthaus [a,b], Anco Vahl [c,d], Laurien S. Kuhrij [b,e], Bernard H.P. Elsman [f], Robert H. Geelkerken [g,h], Michel W.J.M. Wouters [b,i], Jaap F. Hamming [a], Gert J. de Borst [j,*], In collaboration with the Dutch Society of Vascular Surgery, the Steering Committee of the Dutch Audit for Carotid Interventions [†], the Dutch Institute for Clinical Auditing

[a] Department of Surgery, Leiden University Medical Centre, Leiden, The Netherlands
[b] Dutch Institute for Clinical Auditing, Leiden, The Netherlands
[c] Department of Surgery, OLVG, Amsterdam, The Netherlands
[d] Department of Clinical Epidemiology, OLVG, Amsterdam, The Netherlands
[e] Department of Neurology, Academic Medical Centre, Amsterdam, The Netherlands
[f] Department of Surgery, Deventer Hospital, Deventer, The Netherlands
[g] Department of Surgery, Medisch Spectrum Twente, Enschede, The Netherlands
[h] Faculty of Technical Sciences, University of Twente, Enschede, The Netherlands
[i] Department of Surgery, Antoni van Leeuwenhoek Hospital, Amsterdam, The Netherlands
[j] Department of Vascular Surgery, University Medical Centre Utrecht, Utrecht, The Netherlands

WHAT THIS PAPER ADDS

This paper provides transparency on the quality of carotid endarterectomy in patients with a symptomatic carotid stenosis in the Netherlands. Additionally, it could be used for international comparisons of quality of care and may be an incentive for other countries to establish a similar audit or could encourage harmonisation of existing national audits.

Background: The Dutch Audit for Carotid Interventions (DACI) registers all patients undergoing interventions for carotid artery stenosis in the Netherlands. This study describes the design of the DACI and results of patients with a symptomatic stenosis undergoing carotid endarterectomy (CEA). It aimed to evaluate variation between hospitals in process of care and (adjusted) outcomes, as well as predictors of major stroke/death after CEA.
Methods: All patients with a symptomatic stenosis, who underwent CEA and were registered in the DACI between 2014 and 2016 were included in this cohort. Descriptive analyses of patient characteristics, process of care, and outcomes were performed. Casemix adjusted hospital procedural outcomes as (30 day/in hospital) mortality, stroke/death, and major stroke/death, were compared with the national mean. A multivariable logistic regression model (backward elimination at $p > 0.10$) was used to identify predictors of major stroke/death.
Results: A total of 6459 patients, registered by 52 hospitals, were included. The majority (4,832, 75%) were treated <2 weeks after their first hospital consultation, varying from 40% to 93% between hospitals. Mortality, stroke/death, and major stroke/death were, respectively, 1.1%, 3.6%, and 1.8%. Adjusted major stroke/death rates for hospital comparison varied between 0 and 6.5%. Nine hospitals performed significantly better, none performed significantly worse. Predictors of major stroke/death were sex, age, pulmonary disease, presenting neurological symptoms, and peri-operative shunt.
Conclusion: CEA in The Netherlands is associated with an overall low mortality and (major) stroke/death rate. Whereas the indicator time to intervention varied between hospitals, mortality and (major) stroke/death were not significantly distinctive enough to identify worse practices and therefore were unsuitable for hospital comparison in the Dutch setting. Additionally, predictors of major stroke/death at population level could be identified.

Article history: Received 4 January 2018, Accepted 31 May 2018, Available online XXX
Keywords: National clinical audit, Carotid endarterectomy, CEA, Symptomatic carotid artery stenosis, Quality of care

☆ Presented at annual meeting of the European Society for Vascular Surgery 2017.

† Members of the Dutch Society of Vascular Surgery and the Steering Committee of the Dutch audit for Carotid interventions are listed in the Collaborators section.

* Corresponding author. Department of Vascular Surgery, University Medical Centre Utrecht, PO Box 85500, G04.129, 3508 GA Utrecht, The Netherlands.
E-mail address: g.j.deborst-2@umcutrecht.nl (Gert J. de Borst).

1078-5884/
https://doi.org/10.1016/j.ejvs.2018.05.030

INTRODUCTION

In patients with a recent transient ischaemic attack (TIA) or ischaemic stroke in the presence of a high grade ipsilateral carotid artery stenosis, recurrent stroke can be best prevented by carotid endarterectomy (CEA).[1] Optimal care for patients undergoing carotid artery surgery is summarised in guidelines, based on large randomised controlled trials.[1–4] However, actual daily practice is not always consistent with these guidelines, allowing practice and patient outcomes to vary between healthcare providers.[5] This variation could indicate a difference in the quality of care at a national level.

The increasing demand for quality control methods and the introduction of a minimum threshold on hospital volume of 20 CEA per year in The Netherlands has led to the initiation of the Dutch Audit for Carotid Interventions (DACI).[6] This nationwide audit was initiated in 2012 and since June 2013 has been mandatory for all vascular surgeons performing carotid artery interventions. The main objective of this audit was to measure and improve quality of care in carotid artery interventions in The Netherlands. By registering important parameters on process of care and patient outcomes, a comparison of hospitals can be made and surgeons can be provided with benchmarked information on their quality of care. Providing insight into possible variation between hospitals can subsequently incite quality improvement. Additionally, information from the DACI can be used to monitor national guideline adherence and outcomes in patients undergoing carotid interventions.

This report describes the design of the DACI and provides an overview of the results of patients with a symptomatic carotid artery stenosis undergoing CEA in The Netherlands in the first years of the audit. The aim of this study was to report variation between hospitals in processes of care and (adjusted) patient outcome, as well as to identify independent predictors of major stroke and/or death related to CEA.

METHODS

DICA

The DACI is facilitated by the Dutch Institute for Clinical Auditing (DICA).[6] The DICA facilitates and organises the initiation of nationwide audits for various medical professions and offers a uniform format. In collaboration with DICA, the Dutch Society for Vascular Surgery initiated the Dutch Audit for Carotid Interventions (DACI). The DACI is overseen by a scientific committee, which is responsible for interpretation and accountability of the data.

DACI data source

Since June 2013, the DACI has been mandatory for all vascular surgeons and registers all patients undergoing a carotid intervention for a high grade carotid artery stenosis in the Netherlands. This includes CEA with or without patch angioplasty, eversion CEA, or carotid artery stenting (CAS). Each registered patient is scored on 77 items, grouped into three categories (Appendix 1). The first category includes patient characteristics and clinical presentation required to enable an adjusted comparison of data between hospitals. The second category includes items regarding the process of care and surgical treatment. The post-operative period and patient outcomes (30 day/in hospital) are registered in the third category. The data are prospectively collected via a web based survey or provided by the hospitals via a batch data file. Hospitals may decide who registers the data (e.g. data managers, nurse practitioners, or physicians). However, in all participating hospitals the final responsibility for registration of patients lies with the physician. The content of the dataset is evaluated on an annual basis and, if necessary, alterations are made. Verification of the DACI data was carried out in 2015 by a trusted third party. The process of verification was coordinated by an independent data verification committee, which consisted of medical experts, a biostatistician, a deputy of the Dutch Health Care Inspectorate, and a deputy from the Dutch patient federation. Data were verified through a random sample of 15 hospitals, and this will be continuously repeated in the future.

Patient selection

All patients undergoing CEA for a symptomatic stenosis and registered in the DACI between January 2014 and December 2016 were included. Date of birth, date of surgery, type of surgical procedure performed, and patient survival status (30 day/in hospital) had to be known to consider a patient eligible for further analysis. In The Netherlands, asymptomatic patients usually do not receive surgical intervention outside the confines of randomised clinical trials and CAS is not performed as standard primary treatment for a symptomatic carotid stenosis, therefore asymptomatic patients and patients treated by CAS were excluded. Additionally, patients treated in a hospital that stopped performing CEAs during the first year of the study were also excluded.

Definitions

Within the DACI, time to intervention was defined as the time from first consultation at the hospital to CEA, instead of the time from first neurological symptoms to intervention, because this is the timeframe that hospitals can influence themselves and can improve. Post-operative mortality was defined as mortality within 30 days after CEA and/or during the primary admission (30 day/in hospital). A post-operative stroke was described as a new neurological deficit 30 day/in hospital, which lasted longer than 24 h. A stroke resulting in a decline of more than 2 points in post-operative modified Rankin Scale (mRS) was considered as a major stroke, all others as minor strokes.[7,8] The combined outcome parameters stroke and/or death (stroke/death) and major stroke and/or death (major stroke/death) consisted of the patients who had a (major) stroke and/or death 30 day/in hospital. Cranial nerve injury (CNI) was defined as the loss of function of a cranial nerve, measured as 30 day/in hospital. Only a post-operative wound

Please cite this article in press as: Karthaus EG, et al., The Dutch Audit of Carotid Interventions: Transparency in Quality of Carotid Endarterectomy in Symptomatic Patients in the Netherlands, European Journal of Vascular and Endovascular Surgery (2018), https://doi.org/10.1016/j.ejvs.2018.05.030