Eur J Vasc Endovasc Surg (2015) 49, 420–425

The Benefit of Revascularization in Nonagenarians with Lower Limb Ischemia is Limited by High Mortality

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WHAT THIS PAPER ADDS

The increased life expectancy of the population has led to new challenges, as very old patients with vascular problems are referred to vascular specialists. This series assesses the outcome of patients aged 90 years and older with lower limb ischemia. It was found that good limb salvage can be achieved by both surgical and endovascular revascularization, and independent living can be maintained in the majority of patients. However, the benefit of revascularization is limited by high mortality. Dementia seems to be an independent risk factor for poor survival, and in these patients conservative treatment should be considered if possible.

Objective/Background: Owing to the increased life expectancy of the population the number of very old patients referred to vascular surgical units has increased. Advanced age is a well known risk factor in patients undergoing surgical interventions for lower limb ischemia. However, amputation performed on an elderly person living independently will lead to permanent institutional care. The aim of this study was to evaluate the outcome of patients aged 90 years and older with lower limb ischemia undergoing surgical or endovascular revascularization.

Methods: Two hundred and thirty-three nonagenarians with either chronic critical limb ischemia (CLI) or acute limb ischemia (ALI) who underwent revascularization at the authors' institution between 2002 and 2013 were included in this retrospective study. Risk factors were evaluated and survival, limb salvage, and amputation free survival (AFS) assessed.

Results: The median age of the study population was 92 years (range 90–100 years). The majority (81.1%) of the patients were female. One in four (24.5%) patients had diabetes, and the incidence of coronary artery disease was 79.8%. Seventy-three percent of the patients had CLI and 27% of had ALI. Seventy percent of the patients underwent surgical revascularization and 30% were treated endovascularly. The majority (72.5%) of the patients maintained their independent living status; 27.5% ended up in institutional care post-operatively. Similarly, the majority (82.0%) of the patients maintained their walking ability, while 18% were not able to ambulate independently after revascularization. One year survival, limb salvage, and AFS rates were 50.9% versus 48.6% ($p = .505$), 85.1% versus 87.0% ($p = .259$), and 45.7% versus 44.4% ($p = .309$) in the surgical versus endovascular group, respectively. Dementia was an independent risk factor of poor AFS (odds ratio: 1.56; 95% confidence interval: 1.077–2.272; $p = .019$).

Conclusion: Good limb salvage can be achieved by both surgical and endovascular revascularization, and independent living can be maintained in the majority of the patients. However, the benefit of revascularization is limited owing to high mortality, especially in patients with dementia.

Article history: Received 2 September 2014, Accepted 23 December 2014, Available online 16 February 2015

Keywords: Lower limb ischemia, Nonagenarians, Outcome, Revascularization

INTRODUCTION

As a result of increasing life expectancy, older patients with lower limb ischemia are being referred to vascular surgery units.[1] Revascularization of a critically ischemic leg can be justified for very elderly patients because limb preservation is likely to maintain ambulatory status and independent living.[2–4] Good patency and limb salvage rates after infrainguinal bypass can be achieved in older patients.[5,6] However, the overall benefit from infrainguinal bypass may be limited in the very elderly because advanced age is associated with increased peri- and post-operative mortality after vascular operations.[7] Earlier data from the authors' institution demonstrated that in octogenarians with critical limb ischemia (CLI), endovascular revascularization was associated with better amputation free survival (AFS) than bypass.[8] Not only octogenarians, but also patients over 90 years of age are referred to vascular surgical units because

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http://dx.doi.org/10.1016/j.ejvs.2014.12.027

of chronic or acute lower limb ischemia. Yet the outcome for nonagenarians with lower limb ischemia is not well known. Therefore, the main aim of this study was to assess the outcome of nonagenarians with lower limb ischemia in terms of limb salvage, survival, and AFS. Secondary objectives were to assess the independence and functional outcome after the revascularization.

MATERIAL AND METHODS

Two hundred and thirty-three consecutive patients over 90 years of age who underwent either surgical or endovascular revascularization for lower limb ischemia between January 2002 and December 2012 at Helsinki University Central Hospital were included in this retrospective study. Demographic data, procedural details, post-operative outcome, and follow up data were collected prospectively into the authors' institutional vascular and endovascular database (Husvasc), and scrutinized retrospectively. The demographic data included age, sex, comorbid conditions (diabetes, coronary artery disease [CAD], hypertension, dyslipidemia, cerebrovascular disease, renal insufficiency), and smoking habits, as well as pre-operative ambulatory and living status. The procedural data contained indications, type of revascularization, and details of the treated arterial segment (inflow and outflow vessels, and target vessel of endovascular revascularization), as well as graft materials and balloons, stents and so on. Post-operative data included complications and outcome at discharge. The follow up data comprised post-operative ambulatory and living status, limb status, revascularization patency, and dates of major amputation or death. The date and cause of late death were retrieved from the Finnish national population register, Statistics Finland. Data on late major lower limb amputation were completed retrospectively from the amputation register.

Diabetes was considered as hyperglycemia requiring diet, oral medication, or insulin treatment. CAD was defined as a previously documented myocardial infarction and/or ongoing angina pectoris, or previous coronary bypass surgery or percutaneous coronary intervention. Cerebrovascular disease was defined as a previous stroke or transient ischemic attack. Estimated glomerular filtration rate (eGFR) was determined according to the modified Modification of Diet in Renal Disease study equation.[9,10] The presence of dementia was based on previously diagnosed dementia in patient records (Alzheimer's disease, vascular dementia, or other type of permanent cognitive impairment). The diagnosis was usually made by a neurologist or geriatrician. The functional status pre- and post-operatively was assessed as living status (home, nursing/sheltered home, healthcare center, or hospital) and as ambulatory status (walking without aid, walking stick, walking aid, wheelchair, or bedridden).

Survival, limb salvage, and AFS rates with mean ± SE were calculated by the Kaplan—Meyer method. Cox regression analysis was used to assess risk factors associated with poor AFS. All variables presented in Table 1, as well as revascularization level and type of ischemia (acute vs. chronic), were included in univariate analysis. Only variables with a p value < 0.2 in univariate analysis were included in regression model. Statistical analysis was performed using SPSS 19.0 statistical software (IBM, Armonk, NY, USA). The study protocol was approved by the institutional review board of Helsinki University Central Hospital (Department of Surgery).

Table 1. Demographic data of 233 nonagenarians undergoing revascularization for lower limb ischemia.

Demographics	*N*	%
Age (y), median (range)	92 (90—100)	
Sex		
Male	44	18.9
Female	189	81.1
Diabetes	57	24.5
CAD	186	79.8
Hypertension	176	75.5
Dyslipidemia	102	43.8
COPD	29	12.4
Current smoking	5	2.1
Cerebrovascular disease	37	15.9
Renal insufficiency	148	63.5
Mild—moderate (eGFR 30—60 mL/min/1.73 m^2)	131	56.2
Severe (eGFR $<$ 30 mL/min/1.73 m^2)	17	7.3
Dementia	43	18.5

Note. CAD = coronary artery disease; COPD = chronic obstructive pulmonary disease; eGFR = estimated glomerular filtration rate.

RESULTS

The median age of the study population was 92 years (range 90—100 years). The majority (81.1%) of the patients were female. The incidence of diabetes was 24.5%. Eighty percent of patients had CAD. There were only a few current smokers ($n = 5$; 2.1%). More than 60% (63.5%) of the patients had renal insufficiency; in most (56.2%), the renal insufficiency was mild or moderate (eGFR 30—60 mL/min/1.73 m^2), whereas 7.3% suffered from severe renal insufficiency (eGFR $<$ 30 mL/min/1.73 m^2). Almost one in five patients (18.5%) had dementia (Table 1).

Seventy-three percent ($n = 170$) of the patients had chronic CLI (rest pain $n = 56$, ulcer/gangrene $n = 114$) and 27% ($n = 63$) had ALI (thrombosis, embolism). Seventy percent of the patients underwent surgical revascularization (bypass, endarterectomy, or thrombectomy/embolectomy), and 30% were treated endovascularly. The type of revascularization is presented in detail in Fig. 1.

The overall survival, limb salvage, and AFS at 1 year were 50.2%, 85.8%, and 45.5%, respectively. The median survival time was 12.3 months (range 0—152.0 months), and 5 year survival was 13.2%. The overall peri-operative (30-day) mortality was 16.7% (19.6% vs. 10% in the surgical vs. endovascular group [$p = .505$], respectively). The respective 1 year survival, limb salvage, and AFS rates were 50.9% versus 48.6% ($p = .505$), 85.1% versus 87.0% ($p = .259$), and 45.7% versus 44.4% ($p = .309$) in the surgical versus