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Review article – *Special issue: Panvascular medicine*

# Endovascular management of patients with peripheral vascular disease with cardiovascular multi-morbidity

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ARTICLE INFO

Article history:  
 Received 31 August 2017  
 Received in revised form  
 1 October 2017  
 Accepted 3 October 2017  
 Available online xxx

Keywords:  
 Peripheral vascular disease  
 Endovascular therapy  
 Intervention  
 Cardiovascular morbidity

ABSTRACT

Polyvascular presentation among patients with peripheral artery disease is common. The cardiovascular burden among those patients highlights the need of minimally invasive therapeutic techniques. Advances in endovascular technology and skills over the last decades offer an alternative to open surgery. This review discusses the cardiovascular morbidity in patients with peripheral artery disease and currently utilized endovascular management.

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<https://doi.org/10.1016/j.crvasa.2017.10.001>

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**Introduction**

The global prevalence of peripheral artery disease (PAD) increased significantly over the past decades; it affected approximately 202 million people worldwide in 2010 [1]. PAD is found to be associated with poor quality of life, cardiovascular morbidity and mortality especially for patients with PAD and pan-vascular disease [2]. The cardiovascular burden in patients with PAD highlights the need of minimally invasive therapeutic techniques. Previous studies demonstrated that patients with PAD had approximately a 5-7 fold increased risk of mortality from cardiovascular disease compared with patient without PAD [3-6].

Advances in endovascular technology and interventional therapy over the last decades offer an alternative to open surgery in many patients with cardiovascular co-morbidities with reported equivalent efficacy, lower peri-procedural risk and satisfactory late outcomes [7,8].

**Mortality and cardiovascular morbidity in patients with PAD**

The annual rate of cardiovascular events increases significantly in patients suffering from PAD [3-6]. Consequently, cardiovascular events are the major cause of death among those patients. A long-term follow-up of 16,440 index patients showed that the annual mortality among patients diagnosed with PAD is higher than among patients with previous myocardial infarction (8.2% and 6.3%, respectively) [9]. Epidemiological data confirm that PAD is undertreated, thus contributing to the increased incidence of cardiovascular events [10].

*Coexistence of PAD and coronary artery disease*

There is considerable overlap between coronary, and peripheral atherosclerotic disease. Previous studies demonstrated that 22-42% of patients with coronary artery disease (CAD) have coexisting PAD [11-13]. The coexistence of PAD in patients with CAD is associated with worse prognosis [14].

Similarly coronary artery disease CAD is common in patients with PAD. CAD was present in 58-68% of PAD patients [15,16]. According to the REACH-Register, patients with CAD and PAD are at increased risk for one-year fatal and non-fatal cardiac events compared to patients with CAD [17]. The correlation between PAD and cardiovascular disease emphasizes the fact that PAD is a marker for pan-vascular disease.

*Coexistence of PAD and heart failure*

Heart failure is accompanied with low cardiac output and consequently reduced peripheral perfusion. Furthermore, coexistence of heart failure (EF <35%) impeded an expected improvement by supervised exercise program due to restricted physical activity [18]. A multivariate analysis of CORONA-trial showed an increased risk of mortality and myocardial infarction among patients with systolic heart failure and PAD [19]. Patient with heart failure should be therefore routinely screened for PAD.

*Coexistence of PAD and cerebrovascular disease*

A meta-analysis which enrolled 19 prospective studies including 45,738 patients showed a prevalence of 25% and 14% for >50% carotid stenosis and >70% carotid stenosis in patients with PAD, respectively [20]. Moreover, patients with PAD are at increased risk of cerebrovascular events. In a meta-analysis of 10 studies including 22,355 patients, PAD identified by ABI <0.9 was associated with increasing risk of subsequent stroke and ischemic stroke (+43% and +83%, respectively) [21].

Likewise, PAD is common in patients with cerebrovascular disease (CVD) and has been reported in 44.9-52% in patients with stroke or transient ischemic attack (TIA), especially when ankle brachial index (ABI) is used to assess the subclinical form of PAD [22,23].

*PanVascular presentation of PAD*

Polyvascular presentation among patients with PAD is common. In a previous study enrolled 1802 patients with mean age 80 years, patients with PAD showed the highest rate of polyvascular disease (PVD) in compare with those with

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