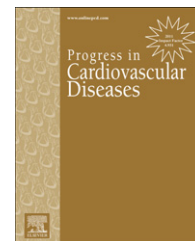


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# Advances in Percutaneous Coronary Interventions for Elderly Patients



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## ARTICLE INFO

### Keywords:

Coronary artery disease  
Cardiovascular disease  
Percutaneous coronary intervention  
Elderly patient

## ABSTRACT

Coronary heart disease (CHD) is one of the leading causes of morbidity and the most common cause of death in older adults. Paradoxically, elderly patients tend to be systematically excluded from randomized-controlled cardiovascular trials, which complicates decision-making in this population. Management of CHD in the elderly is frequently more difficult in virtue of chronic comorbid conditions and aging-intrinsic dynamics. Despite these challenges, the number of elderly and very elderly patients undergoing percutaneous coronary interventions (PCI) is increasing. Elderly patients in many registries and large clinical series exhibit even a greater benefit from interventional procedures than younger patients, but they have a higher rate of overall complications. We present an overview of the current available evidence of PCI in older adults with stable and unstable CHD, including comparisons between drug-eluting and bare-metal stents, transfemoral and transradial access, and methods of revascularization. Adjuvant antiplatelet and antithrombotic therapies are also discussed.

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The population of older adults is growing rapidly in the United States (US) and much of the world; currently, there are more than 40 million Americans aged 65 and older, a higher proportion than at any other time in US history. This has major public health implications, particularly in terms of incidence and prevalence of cardiovascular (CV) disease (CVD). Age-related physiology fundamentally predisposes older adults to CVD,<sup>1</sup> especially in association with the progressing harm of CVD risk factors as they accumulate over lifetime.<sup>2</sup> Senior adults account for more than 85% of CVD hospitalizations and 80% of CVD deaths, including the highest proportions of hospitalizations and mortality for myocardial infarction (MI) and coronary heart disease (CHD).<sup>3</sup> Aging also increases complexity of CHD: 1) intrinsic

pathophysiology tends to be more advanced; 2) comorbid conditions escalate and commonly complicate management and outcomes (e.g., renal insufficiency, chronic obstructive lung disease, diabetes, strokes, depression, cognitive impairment, and/or functional limitations), 3) and aging dynamics often undermine standard processes of care (e.g., treatment delays, iatrogenesis, and poor compliance).

Paradoxically, despite the predictable burden of CHD in older patients, this group tends to be systematically excluded from randomized-controlled trials in CHD therapies, leading to significant gaps in knowledge and the likelihood of unmet clinical needs.<sup>4</sup> Consistently, evidence-based pharmacologic therapies are often omitted for eligible elderly patients, often due to apprehensions by providers in respect to comorbid-

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### Abbreviations and Acronyms

ACS = acute coronary syndromes

BMS = bare-metal stent

CABG = coronary artery bypass graft

CHD = coronary heart disease

CTO = chronic total occlusion

CV = cardiovascular

CVD = cardiovascular disease

DAPT = dual anti-platelet therapy

DES = drug-eluting stent

GFR = glomerular filtration rate

ISR = in-stent re-stenosis

MACE = major adverse cardiovascular events

MI = myocardial infarction

NSTEMI = non-ST segment elevation myocardial infarction

PCI = percutaneous coronary intervention

STEMI = ST-segment elevation myocardial infarction

QoL = quality of life

UA = unstable angina

US = United States

CRUSADE = Can Rapid risk stratification of Unstable angina patients Suppress ADverse outcomes with Early implementation of the ACC/AHA guidelines

KAMIR = Korean Acute Myocardial Infarction Registry

NIS = National Inpatient Sample

SCAAR = Swedish Coronary Angiography and Angioplasty Registry

SYNTAX = SYnergy between percutaneous coronary intervention with TAXus and cardiac surgery

TIME = Trial of Invasive versus Medical therapy in Elderly patients with chronic angina

TIMI = Thrombolysis In Myocardial Infarction

ties, polypharmacy, and/or potential complications<sup>5</sup> that may overwhelm intended therapeutic benefits. Nonetheless, it can also be argued that the absolute risk reduction achieved by CHD treatments outweighs risks, particularly in older adults presenting with acute coronary syndromes (ACS).<sup>4,6,7</sup>

Older adults constitute a substantial proportion of patients referred for emergent and elective percutaneous coronary interventions (PCI). Even in patients who are older and more infirmed, there has been a progressive decrease in PCI adverse CVD events over time.<sup>8</sup> Catheter-based revascularization procedures may improve mortality and morbidity, as well as symptoms and quality of life (QoL),<sup>9</sup> which may be even an even more important end-point from the perspective of many eligible patients. This review focuses on modern advances, limitations and controversies of different aspects of PCI in patients over 65 years of age. Both improvements in PCI technology and technique as well as refinements in identifying which older CVD patients are

### PCI for stable CHD

The 2012 guidelines for diagnosis and management of patients with stable CHD acknowledge many of the inherent challenges when treating older patients with CHD<sup>10</sup> but still endorse PCI's utility. After an extensive account of PCI utility for younger adults, the guidelines state that individuals over 75 years of age tend to have more diffuse and severe coronary atherosclerosis, higher burden of calcification, and higher prevalence of multi-vessel disease, often including left main involvement. These guidelines stress the importance of establishing an individualized education plan to optimize cardiovascular care and wellness, including discussions about medication adherence, risk reduction strategies and a comprehensive review of all therapeutic options. (See Tables 1 and 2.)

The use of PCI for the treatment of stable CHD in the elderly has increased over the past two decades, corresponding at least in part to improvements in device technologies and medical therapies. Based on a large administrative database of Medicare beneficiaries,<sup>8</sup> temporal trends and outcomes in elderly patients after PCI were compared between the balloon angioplasty era (1991–1995, mean patient age 72), the bare-metal stents (BMS) era (1998–2003, mean patient age 74) and the drug-eluting stents (DES) era (2004–2006, mean patient age 74). Despite a growing number of patients with significant comorbidity and management complexity, the number of post-PCI major adverse CVD events (MACE) significantly decreased over time, including reduced death and MI at 3-year follow-up. The reduced MACE were mostly due to substantial reductions in the need for repeat target vessel/lesion revascularizations and coronary artery bypass grafting (CABG), highlighting the increased efficacy of evolving PCI technologies and techniques, as well as improving adjunctive therapy. Nonetheless, it remains notable that amidst these overall positive trends, risks still increase with aging, and women aged  $\geq 75$  years were at highest risk of adverse PCI outcomes across all subgroups.

The German ALLK registry,<sup>11</sup> in which 21.5% of all consecutive patients (over 35,000) undergoing elective PCI were 75 years or older provides corroborating data and perspective. In this cohort, there was no difference in adverse intraprocedural complications in those over the age of 75 as compared to younger individuals (1.2% vs 1.1% respectively); overall rate of MACE was significantly increased in older vs. younger groups (0.9% vs 0.6% respectively, no gender differences noted) but still within a clinically acceptable range. These results support the authors' assertion that symptomatic elderly patients with stable CHD should not be deprived from PCI therapies based on age alone.

The impact of PCI on QoL in elderly patients with stable CHD has become a subject of related interest. Compared to longevity, maintenance of independence with comfort and preserved function is often regarded as a more valued clinical objective. A systematic review<sup>9</sup> including 700 octogenarians (mean age 82.9 years) recently concluded that successful PCI consistently improves QoL in this group. Notably, post-

most likely to benefit from PCI are features that have helped advance utility and application of PCI for older adults.

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