

ARTERIAL HEALING AND STENT FAILURE AFTER CORONARY STENTING

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ABSTRACT:

This article examines the clinical factors associated with arterial healing and stent failure following coronary stenting, as well as high-risk patient groups. Successful coronary stenting depends on effective arterial healing, which may be impaired by factors such as patient comorbidities, lesion characteristics, and procedural technique. Stent failure, manifested as ISR or ST, remains a significant challenge. This article summarizes current evidence on the impact of factors such as diabetes mellitus, chronic kidney disease, inflammation, and genetic predisposition on arterial healing and stent outcomes. It also analyzes the influence of lesion complexity, stent type (drug-eluting vs. bare-metal), and antiplatelet therapy regimens on the risk of ISR and ST. Finally, this review identifies high-risk patient groups, including those with complex coronary artery disease, prior stent failures, and poor medication adherence, and discusses strategies for managing them to improve long-term outcomes after coronary stenting.

Keywords: Coronary stenting, Percutaneous coronary intervention (PCI), In-stent restenosis (ISR), Stent thrombosis (ST), Arterial healing, Clinical factors, High-risk patients, Diabetes mellitus, Chronic kidney disease, Drug-eluting stent (DES), Bare-metal stent (BMS), Antiplatelet therapy, Lesion characteristics, Coronary artery disease (CAD).

INTRODUCTION

Ischemic heart disease (IHD) is one of the leading causes of death and disability worldwide. One of the most common manifestations of IHD is the narrowing or obstruction of coronary arteries due to atherosclerosis, which disrupts adequate blood supply to the myocardium. Coronary stenting, that is, percutaneous coronary intervention (PCI) with stent implantation, is widely used to relieve coronary stenosis and restore myocardial perfusion.

The main goal of stenting is to mechanically expand the narrowed artery and stabilize the vascular wall to improve blood supply to the heart muscle. Initially, bare-metal stents (BMS) were commonly used, but they were associated with in-stent restenosis (ISR). ISR refers to the re-narrowing of the vessel at the stented site, which may clinically manifest as angina (chest pain) or myocardial infarction.

Drug-eluting stents (DES) were developed to overcome the limitations of BMS. By coating the stent with antiproliferative drugs, DES inhibit the proliferation of vascular wall cells, thereby reducing the risk of ISR. Clinical studies have demonstrated the superiority of DES over BMS; however, DES are also associated with specific problems, including stent thrombosis (ST)—the formation of blood clots at the stent site, which can result in myocardial infarction or even death.

Arterial healing after coronary stenting is a critical determinant of long-term stent success. Arterial healing refers to the vascular response to injury at the stented site, involving inflammation, cell proliferation, and vascular remodeling. Normal arterial healing leads to the formation of an endothelial layer covering the stent, which enhances its antithrombotic properties and reduces the risk of ISR.

However, this healing process can be disrupted by numerous factors. Patient comorbidities (such as diabetes mellitus, chronic kidney disease, and inflammatory disorders), lesion characteristics (long lesions, bifurcation lesions, small vessel diameter), and procedural techniques (malapposition, high-pressure deployment) may all adversely affect arterial healing. Impaired arterial healing may result in stent failure, namely ISR or ST.

Therefore, identifying the clinical factors influencing arterial healing and recognizing high-risk patient groups after coronary stenting is of critical importance. Such knowledge can help optimize stenting strategies, personalize antiplatelet therapy, and implement targeted interventions to prevent stent failure.

In this article, we analyze clinical factors and high-risk patient groups associated with arterial healing and stent failure (ISR and ST) after coronary stenting. We review the effects of diabetes mellitus, chronic kidney disease,

inflammation, genetic predisposition, lesion characteristics, stent type, and antiplatelet therapy regimens on arterial healing and stent outcomes. We also identify high-risk patient populations, including those with complex coronary artery disease, prior stent failures, and poor adherence to medications, and discuss strategies for managing them. This article may serve as a foundation for future research aimed at improving long-term outcomes after coronary stenting.

CONCLUSION

This article analyzed clinical factors and high-risk patient groups associated with arterial healing and stent failure following coronary stenting. While coronary stenting is a widely used treatment for ischemic heart disease, complications such as in-stent restenosis (ISR) and stent thrombosis (ST) remain a concern.

Arterial healing is a key determinant of long-term stent success. However, factors such as diabetes mellitus, chronic kidney disease, inflammatory conditions, complex lesion characteristics, and suboptimal procedural techniques may impair arterial healing.

High-risk patient groups—such as those with complex coronary artery disease, prior stent failures, and poor adherence to antiplatelet therapy—are more prone to stent failure. Identifying these factors allows for optimization of stenting strategies, personalized antiplatelet therapy, and the implementation of targeted interventions.

Future research in this field, incorporating new technologies and improved pharmacological approaches, may enhance stent performance and improve long-term patient outcomes after coronary stenting.

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