



Drug-Eluting Stent Thrombosis: From Incidence to Preventive Strategies

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INTRODUCTION

In the search for Percutaneous Coronary Intervention (PCI), the use of Drug-Eluting Stents (DES) has developed treatment outcomes. However, stent thrombosis remains a determined concern, necessitating a detailed balance between ischemic protections and bleeding risks associated with Dual Antiplatelet Therapy (DAPT) [1]. This short communication aims to explore the complexities of stent thrombosis linked to DES, explore methods for improving the optimal duration of DAPT, and understand the incidence and temporal pattern of stent thrombosis [2].

DESCRIPTION

Exploring stent thrombosis

Stent thrombosis, characterized by the formation of blood clots within coronary stents, presents a significant risk to patients undergoing PCI. Despite advancements in DES technology, stent thrombosis continues to be a rare yet potentially fatal complication, particularly in the first year post-implantation. Variables such as stent type, patient demographics, procedural complications, and observation of antiplatelet therapy all control the risk of stent thrombosis [3].

Insights into stent thrombosis incidence

Stent thrombosis, though rare, presents a significant clinical challenge in patients undergoing Percutaneous Coronary Intervention (PCI) with Drug-Eluting Stents (DES) [4]. Understanding the incidence and temporal pattern of stent thrombosis is essential for risk assessment and therapeutic decision-making.

Incidence rates: The incidence of stent thrombosis varies depending on multiple factors, including stent type, patient characteristics, procedural technique, and the observation of antiplatelet therapy. Early studies reported higher rates of stent thrombosis with first-generation DES compared to Bare-Metal

Stents (BMS), assigned to delayed endothelialization and polymer-related inflammation [5]. However, the introduction of newer-generation DES with improved stent design and biocompatible polymers has led to a significant reduction in thrombotic events.

Temporal pattern: Stent thrombosis typically follows as early, late, or very late thrombosis, based on the time interval from stent implantation. Early stent thrombosis, occurring within the first 30 days post-PCI, is often related to procedural factors such as incomplete stent apposition, residual dissections, or acute stent malapposition. Late stent thrombosis, occurring between 1 month and 1 year post-PCI, is generally associated with delayed healing and neoatherosclerosis. Very late stent thrombosis, occurring beyond 1 year post-PCI, is thought to result from a combination of factors, including chronic vessel remodeling, endothelial dysfunction, and incomplete strut coverage [6].

Clinical implications: Despite advancements in stent technology and antiplatelet therapy, stent thrombosis remains a rare but potentially serious complication of PCI. Stent thrombosis is associated with significantly higher rates of myocardial infarction, target vessel revascularization, and mortality, highlighting the importance of attentive surveillance and prompt management [7]. Patients presenting with acute coronary syndrome or sudden cardiac death following PCI should undergo urgent evaluation for stent thrombosis, with coronary angiography and related imaging modalities such as intravascular ultrasound or optical coherence tomography playing an essential role in diagnosis and management.

Preventive strategies: Preventing stent thrombosis requires an adaptable approach including optimal stent selection, detailed procedural technique, and following to dual antiplatelet therapy [8]. Patient education regarding the importance of medication adherence and recognition of symptoms suggestive of stent thrombosis is important in reducing the risk of negative outcomes. Additionally, risk assessment tools such as the Academic Research Consortium (ARC) criteria aid in identifying individuals at higher risk of stent thrombosis, allowing for personalized therapy plans and close surveillance post-PCI [9,10].

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Future directions

With advancements in interventional cardiology and pharmacotherapy, ongoing study activities aim to rectify strategies for curing stent thrombosis risk and optimizing DAPT duration. Several potential methods require exploration in the activity of improved outcomes for patients undergoing Percutaneous Coronary Intervention (PCI) with Drug-Eluting Stents (DES).

Enhanced stent technologies: Future innovations in stent design and composition holds potential for minimizing the risk of stent thrombosis. Bioresorbable structure offers the potential for temporary vessel support followed by complete absorption, reducing the long-term risk of thrombotic events.

Personalized antiplatelet therapy: Moving towards personalized medicine approaches, future study will mainly focus on personalized antiplatelet therapy procedure based on individual patient characteristics and thrombotic risk profiles.

Novel antithrombotic agents: The exploration of novel antithrombotic agents offers potential methods for reducing stent thrombosis risk while minimizing bleeding complications.

CONCLUSION

Stent thrombosis remains a formidable challenge in the landscape of PCI, necessitating a nuanced approach to DAPT duration selection. By integrating risk stratification tools and personalized therapy regimens, clinicians can optimize outcomes while minimizing the risk of adverse events. Continued research and collaborative efforts are imperative in navigating the complexities of stent thrombosis and advancing DAPT strategies in clinical practice.

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