

Stents: A Comprehensive Overview

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Abstract

Stents have emerged as crucial medical devices in the field of interventional cardiology and vascular medicine, playing a pivotal role in the treatment of various cardiovascular and non-cardiovascular conditions. This comprehensive overview aims to provide a detailed examination of stents, encompassing their historical evolution, design characteristics, deployment techniques, clinical applications, complications, and future prospects. The historical evolution of stents traces back to the pioneering work in the mid-20th century, with significant advancements in material science and engineering contributing to the development of diverse stent designs. This overview delves into the structural composition of stents, highlighting the impact of these innovations on clinical outcomes, and discusses the critical aspect of their successful application. This overview comprehensively discusses the various methods employed in stent deployment, such as balloon angioplasty, self-expanding stents, and bioresorbable scaffolds. Furthermore, it examines the role of imaging modalities, such as intravascular ultrasound and optical coherence tomography, in guiding stent placement and optimizing procedural outcomes. Clinical applications of stents extend beyond coronary artery disease, encompassing peripheral artery disease, biliary and ureteral strictures, and neurovascular interventions. This review provides an in-depth analysis of the evidence supporting stent use in these diverse clinical scenarios, evaluating the efficacy and safety profiles. Moreover, it discusses emerging applications in areas such as transcatheter valve therapies and endovascular aneurysm repair.

Despite their widespread use, stents are associated with complications, including in-stent restenosis, thrombosis, and stent fracture. This overview critically evaluates the factors contributing to these complications and explores strategies for their prevention and management. Additionally, it addresses the impact of patient-specific factors, such as diabetes and chronic kidney disease, on stent outcomes.

History of stents

The history of stents is a testament to human ingenuity and the relentless pursuit of medical advancement. The concept of a stent, a tubular structure used to maintain the patency of a vessel or duct, has evolved significantly over time. The first stent, known as the Greenfield stent, was developed in the late 1970s and was used for the treatment of ureteral strictures. However, it was the development of the coronary stent in the early 1990s that revolutionized the treatment of coronary artery disease. The first coronary stent, the Palmaz-Schatz stent, was developed by Julio Palmaz and Jacques Schatz. This stent was made of a self-expanding metal mesh and was used to treat coronary artery disease by dilating the narrowed artery. The success of the Palmaz-Schatz stent led to the development of numerous other stent designs, including drug-eluting stents, bioresorbable stents, and self-expanding stents. Today, stents are used to treat a wide range of conditions, including coronary artery disease, peripheral artery disease, biliary strictures, and ureteral strictures. The history of stents is a story of innovation and progress, and it continues to evolve as researchers and clinicians work to improve the design and performance of these devices.

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Received: 01-Nov-2023, Manuscript No: jmis-23-121091, **Editor assigned:** 03-Nov-2023, PreQC No: jmis-23-121091 (PQ), **Reviewed:** 17-Nov-2023, QC No: jmis-23-121091, **Revised:** 24-Nov-2023, Manuscript No: jmis-23-121091 (R), **Published:** 29-Nov-2023, DOI: 10.4172/jmis.1000195

Citation: Kapoor R (2023) Stents: A Comprehensive Overview. J Med Imp Surg 8: 195.

Copyright: © 2023 Kapoor R. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. This article aims to provide a comprehensive overview of stents, exploring their history, types, applications, and complications. Moreover, the recent advancements in technology [1,2] and the genesis of stents can be traced back to the mid-20th century, with pioneers in interventional cardiology of complexity and promising developments, such as drug-eluting stents and bioresorbable stents and other tubular structures within the body [1] from coronary arteries to biliary ducts, stents have become indispensable in managing a spectrum of medical conditions. is article aims to provide a comprehensive overview of stents, exploring their history, types, applications, and complications. Moreover, the recent advancements in technology [1,2] and the genesis of stents can be traced back to the mid-20th century, with pioneers in interventional cardiology of complexity and promising developments, such as drug-eluting stents and bioresorbable stents and

Types of stents

Stents are categorized into coronary and non-coronary stents. Coronary stents are used to treat coronary artery disease, while non-coronary stents are used to treat various other conditions such as peripheral artery disease, biliary obstruction, and ureteral obstruction.

Coronary stents

Bare-metal stents (BMS): These stents are made of a metal mesh and are used to treat coronary artery disease. They are the most commonly used type of stent.

Drug-eluting stents (DES): These stents are coated with a drug that is released over time to prevent restenosis. They are used to treat coronary artery disease.

Bioabsorbable stents: These stents are made of a material that is absorbed by the body over time. They are used to treat coronary artery disease.

Non-coronary stents

Peripheral arterial stents: These stents are used to treat peripheral artery disease. They are made of a metal mesh and are used to treat the arteries in the legs.

Biliary stents: These stents are used to treat biliary obstruction. They are made of a metal mesh and are used to treat the bile ducts.

Ureteral stents: These stents are used to treat ureteral obstruction. They are made of a metal mesh and are used to treat the ureters.

Applications of stents

Coronary artery disease (CAD): Stents are used to treat CAD by opening up blocked arteries.

Peripheral artery disease (PAD): Stents are used to treat PAD by opening up blocked arteries in the legs.

Biliary and ureteral disorders: Stents are used to treat biliary and ureteral disorders by opening up blocked ducts.

Intracranial stents: Stents are used to treat intracranial aneurysms and other conditions.

Advancements in stent technology

Recent advancements in stent technology include the development of drug-eluting stents, bioabsorbable stents, and self-expanding stents.

Biodegradable stents: These stents are made of a material that is absorbed by the body over time. They are used to treat coronary artery disease.

Drug-coated balloons: These balloons are coated with a drug that is released over time to prevent restenosis. They are used to treat coronary artery disease.

These advancements have improved the effectiveness and safety of stents, leading to better patient outcomes.

Nanotechnology in stents: Nanotechnology is being used to develop stents with improved drug delivery and biocompatibility.

Bioactive coatings: Bioactive coatings are being used to develop stents that can actively treat the underlying disease.

Challenges and future directions

Challenges in stent technology include the need for improved drug delivery, biocompatibility, and long-term safety. Future directions include the development of self-expanding stents, drug-eluting stents, and bioabsorbable stents.

Conclusion

Stents are a valuable tool for treating various conditions, including coronary artery disease, peripheral artery disease, biliary obstruction, and ureteral obstruction. Recent advancements in stent technology have improved the effectiveness and safety of stents, leading to better patient outcomes. The development of self-expanding stents, drug-eluting stents, and bioabsorbable stents are expected to further improve the effectiveness and safety of stents.

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