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LONG-TERM OUTCOMES OF PERCUTANEOUS CORONARY INTERVENTIONS (ICP) IN PATIENTS WITH CORONARY ARTERY DISEASE AND DIABETES: A SCOPING REVIEW

Victor Arthur Ohannesian
MS, Faculdade Israelita Ciências de Saúde Albert Einstein (FICSAE), São Paulo, SP, Brazil
https://orcid.org/0009-0007-8742-1818. Email: ohannesian.victor@gmail.com

Raul Felipe Oliveira Véras
MS, Universidade Regional do Cariri (URCA), Crato, CE, Brazil
https://orcid.org/0009-0009-6218-1453

Saul Felipe Oliveira Véras
MS, Universidade Estadual da Região Tocantina do Maranhão (UEMASUL), Imperatriz, MA, Brazil
https://orcid.org/0009-0009-1121-6927

Thayse Souza dos Santos
MS, Universidade Estadual de Ciências da Saúde de Alagoas (UNCISAL), Maceió, AL, Brazil
https://orcid.org/0000-0003-0145-1666

Danilo Freire de Oliveira
MS, Faculdade Israelita Ciências de Saúde Albert Einstein (FICSAE), São Paulo, SP, Brazil
https://orcid.org/0009-0007-8414-7534

Paulyne Souza Silva Guimarães
NS, Universidade Federal de Alagoas (UFAL), Maceió, AL, Brazil
https://orcid.org/0000-0001-8190-7330

Abstract

Introduction: *Percutaneous coronary interventions (PCI), stent implantation and balloon angioplasty, are critical therapeutic strategies for managing coronary artery disease (CAD), particularly in patients with diabetes. This scoping review aims to synthesize key findings from the literature on the long-term efficacy and prognosis of drug-eluting stents in diabetic patients, highlighting risks and benefits.* ***Methods:*** *This scoping review followed PRISMA-ScR guidelines, employing a comprehensive search strategy across PubMed (MEDLINE), Embase, and Web of Science. Studies focusing on drug-eluting stents in diabetic patients with coronary artery disease were included.* ***Results:*** A total of 393 *records were identified and, after removing duplicates, 288 records were screened. Following the eligibility assessment, 26 studies were included in the review. The studies indicate that drug-eluting stents reduce restenosis and major adverse cardiac events in diabetic patients, though complications such as stent thrombosis and the need for revascularization persist. Long-term outcomes vary significantly between different generations of stents, although the differences between various drug-eluting stents were not statistically significant. Diabetic patients, particularly those*

with high bleeding and ischemic risks, require rigorous follow-up due to elevated complication rates. ***Conclusion:*** *Diabetic patients with high bleeding and ischemic risks require close monitoring and individualized antiplatelet therapy adjustments. Maintaining dual antiplatelet therapy (DAPT) for at least one year is recommended, potentially longer for high-risk patients. Optimizing glycemic control and managing hypertension and dyslipidemia can reduce long-term cardiovascular events post-stent placement.*
Keywords: Drug-Eluting Stents; Coronary Artery Disease; Diabetes; Angioplasty, Long-term

1. Introduction

PCI (Percutaneous Coronary Intervention) consists of balloon angioplasty, which temporarily widens the artery, and stent implantation, which provides permanent support to keep the artery open, thereby reducing restenosis. Drug-eluting stents (DES) have been utilized in interventional cardiology since 2002 to maintain the patency of coronary arteries narrowed by atherosclerosis. These stents integrate a metallic scaffold with a polymer coating that controls the release of an antiproliferative agent directly into the arterial wall. This mechanism effectively reduces cellular proliferation that could otherwise lead to restenosis, a common issue with conventional stents. [1–3]

The antiproliferative drugs used in drug-eluting stents (DES) work by inhibiting the proliferation of vascular smooth muscle cells, thereby preventing neointimal hyperplasia, which is the primary cause of restenosis. Sirolimus and paclitaxel, used in the first generation of DES, act at different phases of the cell cycle to inhibit cell division. Paclitaxel inhibits microtubule disassembly, causing cell cycle arrest at the G0-G1 and G2-M phases.[4] Sirolimus, on the other hand, binds to FKBP12 and inhibits the mTOR and PI3K pathways, arresting the cell cycle in the G1 phase.[5,6] The effectiveness of these agents in reducing long-term restenosis, defined as greater than one year (>1 year), has been well-documented, making DES a widely utilized intervention[7]. In this study, we will conduct a comprehensive review of findings related to the long-term outcomes of DES use, focusing on clinical results and complications observed beyond the one-year mark.

Currently, it is widely acknowledged that stents significantly reduce the risk of restenosis, particularly drug-eluting stents. However, there is a paucity of data in the literature grouping only studies that have long-term follow-up (>1 year) of patients after stent implantation, especially with drug-eluting stents. Therefore, this scoping review aims to compile the principal findings from the literature on this topic, with a specific focus on patients with diabetes, whether controlled or uncontrolled. Our objective is to present all relevant studies, highlighting pertinent information as well as the strengths and limitations of these studies.

2. Methods

This scoping review followed the ***PRISMA*** extension for scoping reviews ***(PRISMA-ScR)*** guidelines.

Eligibility Criteria: Studies were included if they met the following criteria: focus on patients with both coronary artery disease and diabetes mellitus, involved the use of drug-eluting stents, reported long-term outcomes with a minimum follow-up duration of one year, included original data encompassing randomized controlled trials, cohort studies, and case-control studies, systematic reviews and meta-analysis and excluded editorials and studies not reporting relevant long-term outcomes.

Information Sources: A comprehensive search strategy was employed across major databases, including PubMed (MEDLINE), Embase, and Web of Science.

Search Strategy: The search terms included "coronary artery disease", "CAD", "diabetes mellitus", "diabetic patients", the effectiveness of drug-eluting stents (DES), particularly everolimus-eluting stents (EES), in various diabetic subgroups undergoing angioplasty or percutaneous coronary intervention (PCI), "long-term outcomes", and "major adverse cardiovascular events" (MACE). Articles published after June 3, 2024, were excluded from this review.

Study Records and Data Extraction Process: Two reviewers independently screened the titles and abstracts. Studies were included if they reported long-term outcomes of DES in diabetic patients with CAD. Discrepancies were resolved by consensus or by involving a third reviewer. Data on study type, patient demographics, clinical methods, types of stents used, outcome measures, and adverse events were extracted by two independent reviewers. Any disagreements were resolved by consensus or by involving a third reviewer. Extracted data items included study type and setting, patient demographic characteristics, clinical and laboratory methods, types of drug-eluting stents used, and outcome measures, including major adverse cardiovascular events (MACE), stent thrombosis, restenosis, mortality, and adverse events.

Risk of bias in individual studies: In this review, no specific tool for assessing the risk of bias was used. However, the study design of all included studies was critically analyzed. The characteristics of these studies were compiled into a table, which summarizes the key design features and relevant information.

Data Synthesis: Data were synthesized using Microsoft Excel to organize the extracted information into detailed spreadsheets.

3. Results

Study Selection: The PRISMA 2020 flow diagram below describes the study selection for our review on drug-eluting stents in patients with coronary artery disease and diabetes. A total of 393 records were identified according to the descriptors, with the following numbers: PubMed: 166, Embase: 116, Web of Science: 111. After removing 105 duplicate records, 288 records were screened. Of these, 149 were excluded based on title and abstract, leaving 139 records for retrieval, of which 1 was not retrieved. Of the 138 assessed for eligibility, 112 were excluded: 65 did not include drug-eluting stents, 43 did not report long-term outcomes, and 4 did not include patients with both conditions. Finally, 26 studies were included in the review.

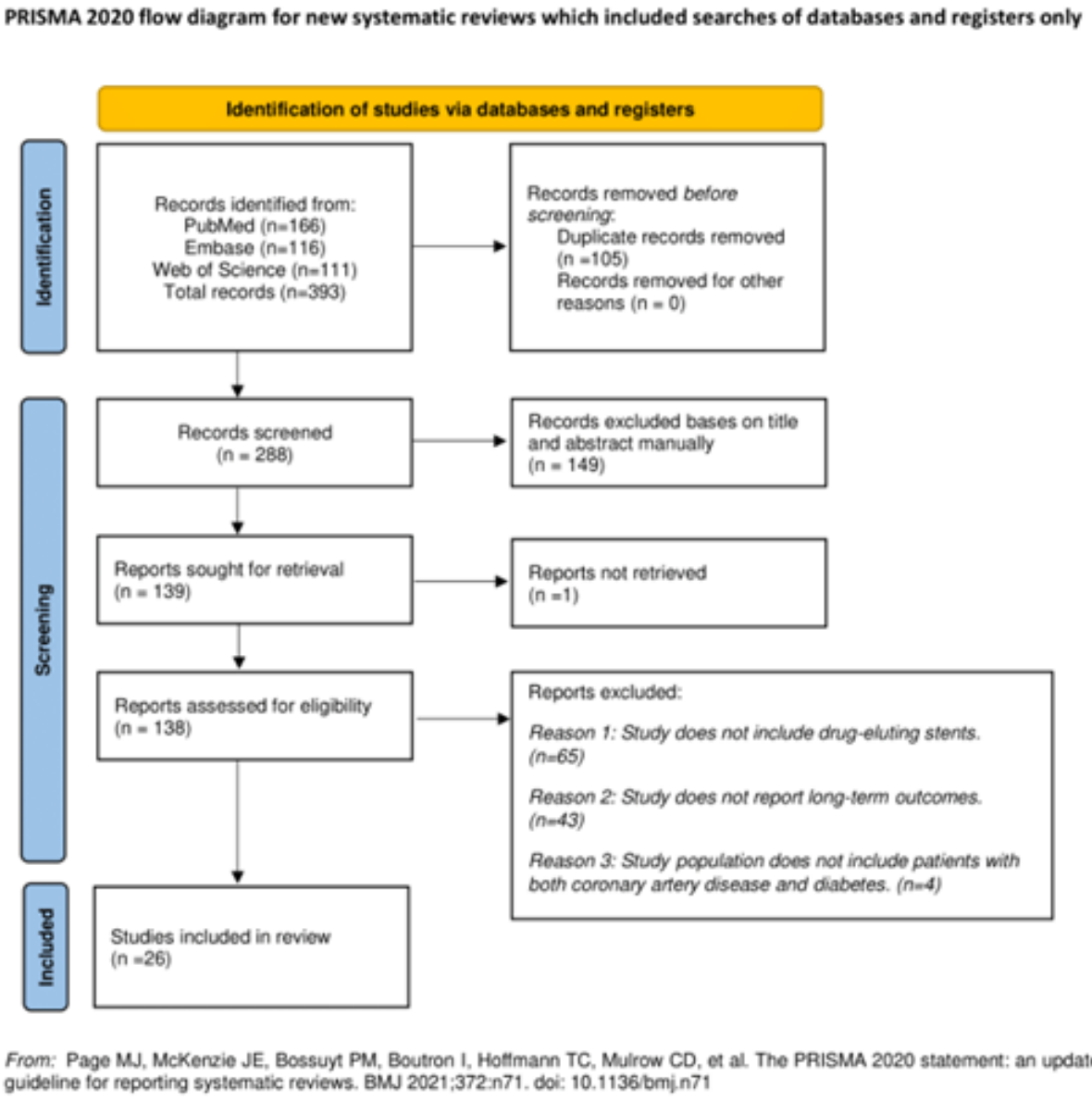

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram for the selection of studies on drug-eluting stents in patients with coronary artery disease and diabetes.

Comparative Analysis of Studies: The 26 included studies were grouped into a comparative table with their main characteristics, interventions, and outcomes. This table highlights the main interventions on the effectiveness and safety of different drug-eluting stents (EES, SES, PES, ZES) in diabetic patients with coronary artery disease. It provides an overview of study designs, patient populations, and limitations

Estudo	Ano	Tipo	Registro	N	Intervenção	Controle	Limitações
Jimenez-Quevedo et al	2019	Post-hoc RCT	NCT00828087	Total (n=1497) Diabetic (n=258) Non diabetic (n=1239)	Everolimus-eluting stent (EES) and bare-metal stent (BMS) were the main interventions. All patients received dual antiplatelet therapy with aspirin and clopidogrel for at least 1 year.	There was no placebo group.	The small sample size of diabetic patients may lack sufficient power to detect significant differences in clinical events. There is a possibility of diabetic misclassification errors, with up to one-third of patients potentially misclassified, impacting the comparative risk. The lack of information on glycemic control and insulin use complicates the assessment of their influence on the 5-year clinical outcomes..
Goel et al	2020	Post-hoc RCT	NCT00676520,NCT01086228, NCT00631228, NCT01249027	3,704 patients with diabetes mellitus (DM). (LBR/LIR) N = 798 (LBR/HIR) N = 1443 (HBR/LIR) N = 578 (HBR/HIR) N = 885	Everolimus-eluting stents (XIENCE V®)	There was no placebo group	This study was a post hoc analysis, implying that the results are hypothesis-generating and cannot establish definitive causality. Due to the limited sample size, type 2 error (false negative) cannot be excluded, which may affect the ability to detect significant differences in some outcomes. Differences in antiplatelet medication use over time may have influenced adverse outcomes.
Nguyen et al	2019	Retrospective cohort	X	491 patients (507 lesions ISR)	Paclitaxel-coated balloons, specifically Pantera Lux (PL) and SeQuent Please (SP).	There was no placebo group	The study did not evaluate angiographic or intravascular imaging data during follow-up, which could provide more information on neointimal growth or the progression of neoatherosclerosis, affecting long-term outcomes. The study does not explicitly mention the sample size calculation. It is a retrospective study that included all patients who met the inclusion and exclusion criteria from the institutional database during the period.
Hommels et al	2020	Post-hoc RCT	NTR5447 (ABSORB DM Benelux Study), NTR1256/NCT01066650 (TWENTE) e NTR2413/NCT01331707 (DUTCH PEERS).	Total population: 499 patients EE-BRS (n=150) EES (n=249)	Everolimus-eluting bioresorbable scaffolds (EE-BRS) and everolimus-eluting metal stents (EES).	There was no placebo group	The study did not provide sufficient information on differences between devices beyond scaffold resorption in most EE-BRS patients. Additionally, outcomes were presented in patient-years, which theoretically could obscure time-related adverse events. Considering the need for prolonged DAPT (dual antiplatelet therapy) after PCI (percutaneous coronary intervention) with EE-BRS, the risk of bleeding is a factor that may vary significantly between younger and older patients.
Bangalore et al	2015	Retrospective cohort	X	Total patients: 16,089 PCI com EES: 7326 (45%) CABG: 8763 (55%)	Everolimus-eluting stents (EES) were used for PCI, compared with coronary artery bypass grafting (CABG).	There was no placebo group	The study is non-randomized, hence subject to selection and measurement biases. Higher-risk patients may have been directed towards CABG, leading to worse outcomes in the CABG group. Conversely, patients who were not good candidates for CABG (due to comorbidities) may have been directed towards PCI, resulting in worse outcomes in the PCI group. The sample size of insulin-using matched patients was too small to perform subgroup analysis based on insulin use. Estimates for MI (myocardial infarction) and repeat revascularization likely overestimate event rates for these outcomes because they do not account for the competing risk of death.
Bangalore et al	2019	RCT	CTRI/2011/06/001830	Total number of diabetic patients (N=1821)	Stents eluidores de everolimus (EES - Everolimus Eluting Stents) e stents eluidores de paclitaxel (PES - Paclitaxel Eluting Stents).	There was no placebo group	This analysis was a pre-specified subanalysis of a randomized trial, but the subgroup did not have sufficient statistical power to show a difference between everolimus-eluting stents (EES) and paclitaxel-eluting stents (PES). Although the trial compared EES against PES, the PES tested was the 3rd generation (Taxus Element) with a strut thickness of 81 μm made from a platinum-chromium platform.
Bartorelli et al	2016	Retrospective cohort	X	Total patients (N=15147) Diabetic: 4,577 (30% Non diabetic: 10,506 (70%)	Everolimus-eluting stents (EES - Everolimus Eluting Stents) and paclitaxel-eluting stents (PES - Paclitaxel Eluting Stents).	There was no placebo group	The stent used in the study has been withdrawn from the market in most countries, limiting the applicability of current results. Monitoring was conducted in only a random sample of 20% of patients, potentially leading to underreporting of adverse events. Only patients who successfully underwent stent implantation and had no contraindications to prolonged antiplatelet therapy were included, restricting the generalizability of results to specific subgroups. Follow-up was limited to one year, which may not fully capture the relative risks of stent thrombosis (ST) and major adverse cardiovascular events (MACE) after discontinuation of dual antiplatelet therapy (DAPT).
Bavishi et al	2016	Meta-analysis	X	Population (N = 8095)	Everolimus-eluting stents (EES) and zotarolimus-eluting stents (ZES).	There was no placebo group	The analysis could not assess the severity of presentation, complexity of lesions, and timing of stent thrombosis relative to the duration of dual antiplatelet therapy due to lack of patient-level data. These findings cannot be extrapolated to other second-generation stents, and further studies are needed to evaluate other stent technologies. The finding of greater beneficial effect of everolimus-eluting stents (EES) in insulin-dependent diabetic patients should be viewed as hypothesis-generating and requires further investigation.
Buronova et al	2015	Retrospective cohort	X	Total de patients (N = 489)	Sirolimus-eluting stent (SES): Cypher, Cordis/Johnson & Johnson	There was no placebo group	The number of patients at risk was relatively small, which may affect statistical robustness and the ability to detect significant differences between groups. Patients on hemodialysis had a higher prevalence of severe comorbidities such as insulin-treated diabetes mellitus, heart failure, and peripheral arterial disease, which are known negative prognostic factors
Campos et al	2017	Multicenter RCT	NCT01023789; NCT00180310; NCT00180479; NCT00307047	Total Population (N=432)	Scaffold vascular bioabsorvível eluído com everolimus (Absorb BVS). Stent metálico eluído com everolimus (XIENCE V EES); Clopidogrel.	There was no placebo group	The anatomical complexity of the included trials was relatively low, therefore, the results should not be extrapolated to more complex scenarios where XIENCE EES was used, such as left main coronary artery disease and three-vessel disease. The results of this study should be considered hypothesis-generating due to the exploratory nature and long follow-up period
Fanari et al	2014	Meta-analysis	X	Population (N = 5123)	Drug-eluting stents (DES): sirolimus-eluting stents (SES) and paclitaxel-eluting stents (PES).	There was no placebo group	The inclusion of a small percentage of patients with bare-metal stents (BMS) in the 5-year cohort. Utilization of published event rates instead of individual patient data, which limits the possibility of subgroup analyses and propensity assessments
Jensen et al	2020	RCT	NCT02623140	(N=3,151) Diabetes (N=608)	BioFreedom Stent: Biolimus A9-coated stent (a lipophilic version of sirolimus) without polymer. Orsiro Stent: Biodegradable polymer-coated stent with sirolimus.	There was no placebo group	The study was unable to assess the influence of ultra-thin stents versus thicker stents on peri-procedural myocardial infarction due to the absence of procedure-related PCI biomarkers.
Koch et al	2021	RCT	NCT00598533	Total Population (N = 3002) Diabetes Mellitus (N = 870, 29.0%)	Sirolimus and probucol-eluting stents without polymer (PF-SES) and zotarolimus-eluting stents with durable polymer (DP-ZES)	N/A	This study was a post hoc analysis, not specifically designed to compare clinical outcomes in subgroups of patients with or without diabetes mellitus, vulnerable to inherent methodological flaws associated with this type of analysis.
Krackhardt et al	2017	RCT	NCT02629575	(N = 515)	Sirolimus-eluting stents without polymer (PF-SES)	There was no placebo group	The scheduled clinical follow-up was 9 months compared to the more common 12-month follow-up. This may have impacted the detection of late events
Maeng et al	2015	RCT	NCT00552877	Diabetic patients: 213 patients	Everolimus-eluting stents (EES) and sirolimus-eluting stents (SES).	N/A/	The study was powered to detect differences in angiographic outcomes but not clinical outcomes. Subgroup analysis may not be representative due to sample size limitations. Power calculation was based on angiographic late lumen loss, assuming that everolimus-eluting stents (EES) would have similar late lumen loss to paclitaxel-eluting stents, which was not confirmed.
Mahmoud et al	2017	Meta-analysis	X	N = 17,682 Patients; Diabetics: 4,774 (27%)	Everolimus-eluting stents (EES) and zotarolimus-eluting stents (ZES).	N/A	The definition of major adverse cardiac events (MACE) varied among the included studies. It was not possible to assess differences in outcomes related to acute coronary syndromes versus non-acute syndromes, as this was not specified in most studies.
MIyasaki et al	2015	Historical cohort	X	Total patients: 400 Diabetics: 100%	Everolimus-eluting stents (EES) and zotarolimus-eluting stents (ZES)	N/A	Susceptible to selection bias, as the choice of stent type was at the discretion of the operator. Relatively small sample size may not have sufficient power to detect small differences in clinical outcomes
Rajesh et al	2018	Prospective cohort	X	Total patients (N): 343 Diabetes mellitus: 158 patients (46%)	Sirolimus-eluting stents (SES) and everolimus-eluting stents (EES).	N/A	Non-randomized, single-center study. Small number of patients. Heterogeneous population regarding the type of stents used. Loss of follow-up data in 9% of patients.
Meelu et al	2014	Retrospectiv cohort	X	Patients (N=135) Diabetics: 135	Everolimus-eluting stents (EES)	N/A	Lack of routine angiographic follow-up: Inability to compare angiographic restenosis between groups. Limited sample size: Potential for type II error, where the study may not have sufficient power to detect significant differences
Rha et al	2020	Retrospective cohort	X	Total: (N = 3271) Diabetics: 1139 patients (34.8%)	Drug-eluting stents eluting sirolimus, paclitaxel, zotarolimus, and everolimus;	N/A	The study was based on retrospective data. Determination of risk factors and medical history relied primarily on patient self-reporting. While the 12-month results are promising, longer follow-ups are needed to validate the findings.
Tarantini et al	2024	Prospective cohort	X	N (population): 425 patientes: Diabetes mellitus: 124 (29.2%)	Coroflex ISAR NEO stent (sirolimus-eluting), dual antiplatelet therapy (DAPT) with aspirin and P2Y12 inhibitors (clopidogrel, prasugrel, ticagrelor)	N/A	Possible underestimation of sample size may have led to bias in underreporting adverse events. The relatively short follow-up period does not include very late stent thrombosis, which will be evaluated in subsequent analyses with longer follow-up. The observational nature of the study and its small sample size do not allow for robust subgroup analyses.
Testa et al	2021	Prospective cohort	X	Total patients: (N= 2500) Diabetic patients (NIDDM + IDDM): (N= 859)	Abluminus DES+ stent (sirolimus-eluting drug-eluting stent).	N/A	Being a prospective registry study, there may be selection bias and uncontrolled residual confounding. The study was conducted exclusively in centers in India, limiting the generalizability of results to other populations. Variability in diabetes diagnosis and treatment management among different centers may influence the results.
Uthamalingam et al	2015	Prospective cohort	X	Population (N=320) Age: Octogenarians (>80 anos) Diabetes Mellitus: 48.1%	Drug-eluting stents (DES).	N/A	Retrospective, single-center study. Sample Size: Relatively small. Follow-up: Only one year, potentially missing long-term events.
Waltenberger et al	2019	RCT	NCT01553526	Total number of patients:(N=1356) Diabetic Patients: 402 (29.6%)	Orsiro stent eluting sirolimus (sirolimus-eluting).	N/A	Non-randomized observational nature, making direct comparison with other coronary stents challenging. Follow-up angiographic evaluation was not performed. The registry was not stratified nor had statistical power for predefined subgroups
Wiebe et al	2015	Prospective cohort	X	N total (population): 120 patients; Number of diabetic patients: 120 patients	Bioabsorbable poly-lactic acid (PLLA)-based stents eluting everolimus."	N/A	Some patients were lost to follow-up, making it impossible to exclude clinical events in these individuals. Routine angiographic follow-up was not conducted. Available data are from medium-term follow-up, requiring long-term follow-up to assess therapy success. Non-randomized
Yano et al	2017	Retrospective cohort	X	Total Population:730 patients Diabetic Patients: 309 patients (42.3%)	Stents eluting everolimus (XIENCE Alpine)	N/A	Low Number of Adverse Events: The low incidence of adverse events may have led to a type II error. Patients were categorized by stent length instead of lesion length.

Table 1. Comparative Table of Studies on Drug-Eluting Stents in Diabetic Patients

Legends: RCT: Randomized Controlled Trial; EES: Everolimus-Eluting Stent ; SES: Sirolimus-Eluting Stent ; MACE: Major Adverse Cardiac Events ; TLR: Target Lesion Revascularization ; BMS: Bare Metal Stent ; PCI: Percutaneous Coronary Intervention ; CABG: Coronary Artery Bypass Grafting ; ISR: In-Stent Restenosis; EE-BRS: Everolimus-Eluting Bioresorbable Scaffold (Scaffold Bioabsorvível Eluidor de Everolimus); DAPT: Dual Antiplatelet Therapy ;

ZES: Zotarolimus-Eluting Stent ; PES: Paclitaxel-Eluting Stent ; PLLA: Poly-L-Lactic Acid; NIDDM: Non-Insulin Dependent Diabetes Mellitus; IDDM: Insulin Dependent Diabetes Mellitus.

The analyzed studies demonstrate a diversity of interventions with drug-eluting stents (DES) in diabetic patients, highlighting varied clinical outcomes. Jimenez-Quevedo et al. (2019)[8] and Goel et al. (2020)[9] conducted retrospective analyses of randomized controlled trials, focusing on the effectiveness of everolimus-eluting stents (EES) in various diabetic subgroups, while Nguyen et al. (2019)[10] compared paclitaxel-coated balloons in a retrospective cohort. Studies such as those by Hommels et al. (2020)[11] and Campos et al[17]. (2017) explored the performance of bioresorbable scaffolds versus metallic everolimus-eluting stents, revealing similar rates of major adverse cardiac events (MACE). Fanari et al. (2014)[18] conducted a meta-analysis comparing percutaneous coronary intervention (PCI) with coronary artery bypass grafting (CABG) in patients with multivessel coronary artery disease, showing a higher target vessel revascularization (TVR) rate with PCI. Bavishi et al. (2016)[15] and subsequent studies reinforced the superiority of second-generation stents, such as EES and zotarolimus-eluting stents (ZES), in reducing MACE, myocardial infarction (MI), and stent thrombosis (ST) compared to first-generation and bare-metal stents. Buronova et al. (2015)[16] highlighted elevated mortality in hemodialysis patients, while Bangalore et al. (2015[12], 2019[13]) and emphasized the need for personalized management and rigorous follow-up to optimize clinical outcomes in high-risk populations.

4. Discussion

4.1. Considerations on Long-Term Follow-Up Data

Goel et al. (2020)[9], Bartorelli et al. (2016)[14], and Mahmoud et al. (2017)[23] are studies that included over 1,000 diabetic patients, demonstrating their ability to accumulate robust data, enabling more reliable analyses and the identification of significant clinical trends. However, even in these large studies, the post-hoc nature limits causal inference, as these analyses are susceptible to selection biases and residual confounding. The lack of randomization in prospective studies and the absence of rigorous control for confounding variables compromise the internal validity of the results, a common and understandable limitation. The consistent use of drug-eluting stents, such as everolimus, sirolimus, and zotarolimus, reflects an effective and well-established treatment pattern, contributing to uniformity in the management of diabetic patients with heart disease. The heterogeneity in outcome definitions and variability in glycemic control and insulin use across studies introduce inconsistencies in the findings, requiring caution in generalizing the results to the broader diabetic population. Long-term follow-up (≥ 1 year) generally presented reliable data from well-conducted clinical trials with a larger number of participants, showing excellent outcomes but with important factors to be considered, which will be presented below:

4.2. Impact of Bleeding and Ischemic Risks on Major Adverse Cardiac Events (MACE) in PCI

The long-term outcomes (≥ 1 year) for diabetic patients undergoing percutaneous coronary intervention (PCI) with everolimus-eluting stents were analyzed by Ridhima Goel et al[9]. Patients with high bleeding risk and low ischemic risk (HBR/LIR) exhibited a major adverse cardiac events (MACE) rate of 11.6% (HR 2.17; 95% CI 1.45-3.24), while those with high bleeding risk and high ischemic risk (HBR/HIR) had a rate of 13.9% (HR 2.69; 95% CI 1.87-3.86). The rates of major bleeding (MB) were 5.2% (HR 2.56; 95% CI 1.38-4.73) for HBR/LIR and 5.6% (HR 2.74; 95% CI 1.55-4.84) for HBR/HIR, with p-values < 0.05, indicating statistical significance in the association between bleeding risk factors and adverse outcomes, especially in the long term. Patients with high bleeding risk (HBR) were frequently on dual antiplatelet therapy (DAPT) and other antithrombotic medications. According to the study, over 80% of patients were on DAPT at the 1-year follow-up, except in the HBR/LIR group (75%). At the 4-year follow-up, 46% of low bleeding risk (LBR) patients and 41% of high bleeding risk (HBR) patients continued on DAPT.

The study by Bartorelli et al[14]. evaluated the long-term outcomes (≥1 year) of sirolimus-eluting stents (SES) in diabetic patients enrolled in the e-SELECT registry, demonstrating higher rates of major adverse cardiac events (MACE) in diabetics (6.8%) compared to non-diabetics (3.9%, P < 0.001), particularly in insulin-treated diabetics (10.6%, P < 0.001). Stent thrombosis (ST) was also higher in diabetics (1.7%) versus non-diabetics (0.7%, P < 0.001), primarily driven by insulin-treated diabetics (3.4%, P < 0.001). Despite these elevated risks, the overall response to SES was deemed acceptable, with a slightly higher but low bleeding rate (1.1%, P = 0.1), indicating the efficacy of SES while underscoring the need for personalized management in diabetic subgroups.

The long-term results (mean of 45.7 months) of Mahmoud et al[23].'s study on the efficacy and safety of second-generation drug-eluting stents (DES) compared to bare-metal stents (BMS) indicate that DES significantly reduced the incidence of major adverse cardiac events (MACE) compared to BMS (17.3% vs. 22.3%, RR: 0.78, 95% CI: 0.69-0.88, P < 0.0001). Additionally, DES were associated with a lower incidence of definite stent thrombosis (0.7% vs. 1.5%, RR: 0.57, 95% CI: 0.41-0.78, P < 0.0001). The study also found that DES reduced the rates of myocardial infarction (RR: 0.67, 95% CI: 0.48-0.95, P = 0.02) and target lesion revascularization (RR: 0.47, 95% CI: 0.42-0.53, P < 0.0001).

Moreover, Maeng et al.[22] conducted a study with 213 diabetic patients comparing everolimus-eluting stents (EES) and sirolimus-eluting stents (SES) in diabetic patients. At 10 months, the late lumen loss was similar between EES (0.20 ± 0.53 mm) and SES (0.11 ± 0.49 mm; P = 0.28). At 4 years, major adverse cardiac events (MACE) occurred in 20.4% of EES patients and 23.8% of SES patients (HR 0.84; P = 0.55). Target lesion revascularization (TLR) was

required in 5.6% of EES patients versus 9.5% of SES patients (HR 0.57; P = 0.28). Myocardial infarctions were less frequent in the EES group (P = 0.067). There was no significant difference in mortality between the groups. The results indicate that both stents are effective and safe, with EES showing a trend toward better outcomes in myocardial infarctions and TLR.

Goel et al. (2020) reported and reinforced that patients with high bleeding risk (HBR) and high ischemic risk (HIR) have a significantly higher rate of stent thrombosis (HR 2.74, 95% CI 1.55-4.84) and an increased incidence of target lesion revascularization (TLR) (HR 2.69, 95% CI 1.87-3.86) in the long term.

Bartorelli et al. (2016)[14] observed a stent thrombosis rate of 1.7% in diabetics versus 0.7% in non-diabetics, with an overall increase in MACE suggesting a continuous need for revascularization. Mahmoud et al. (2017)[23] demonstrated variable but consistently higher stent thrombosis rates in diabetics, with a greater need for TLR in patients treated with bare-metal stents compared to drug-eluting stents (RR 1.75, 95% CI 1.25-2.45). Conclusively, diabetic patients, especially those with HBR and HIR, exhibit a higher risk of stent thrombosis and revascularization, underscoring the need for rigorous follow-up in this subgroup, again as other studies have reported.

In summary, to optimize the treatment of diabetic patients undergoing percutaneous coronary intervention (PCI), it is crucial to consider both bleeding and ischemic risks. Patients with high bleeding risk (HBR) and high ischemic risk (HIR) should be closely monitored due to their increased incidence of major adverse cardiac events (MACE) and stent thrombosis. The use of second-generation drug-eluting stents, such as everolimus-eluting stents (EES), is recommended as they have been shown to significantly reduce adverse events compared to bare-metal stents. Additionally, dual antiplatelet therapy (DAPT) should be carefully assessed, with personalized adjustments to balance bleeding and thrombosis risks, especially in HBR patients. Long-term DAPT should be periodically re-evaluated based on the patient's evolving clinical status. Personalized management and rigorous follow-up are essential to improve clinical outcomes and reduce the need for revascularization in diabetic patients.

4.3. Effectiveness and Safety of Stents in Diabetic Patients: Comparative Evidence

In the study by Jimenez-Quevedo et al., a 5-year follow-up of 1,497 STEMI patients showed that diabetics (n=258) treated with everolimus-eluting stents (EES) and bare-metal stents (BMS) exhibited similar rates of patient-oriented composite endpoints (POCE) (32.8% vs. 32.2%; p=0.88) and all-cause mortality (7.0% vs. 12.1%; p=0.014). In the study by Nguyen et al[10]., involving 491 patients with coronary in-stent restenosis treated with paclitaxel-coated balloons, there was no significant difference between the Pantera Lux (PL, n=127) and SeQuent Please (SP, n=364) groups in major adverse cardiac events (MACE): PL-DCB had 16 MACEs (61 per 1000 person-years) vs. SP-DCB with 55 MACEs (60 per 1000 person-years),

p=0.895. In the study by Hommels et al.[11], an aggregate analysis of 499 diabetic patients with coronary artery disease, those treated with everolimus-eluting bioresorbable scaffolds (EE--BRS, n=150) and everolimus-eluting stents (EES, n=249) showed no significant difference in target lesion failure (TLF) rates (7.2 vs. 5.2 events per 100 patient-years, p=0.39) and major adverse cardiac events (MACE) (9.1 vs. 8.3 events per 100 patient-years, p=0.83).

Bavishi et al. (2016)[15] studied 8,095 diabetic patients comparing everolimus-eluting stents (EES) with first-generation drug-eluting stents (DES), finding that EES reduced MACE by 18% (RR: 0.82, 95% CI: 0.70–0.96), myocardial infarction by 43% (RR: 0.57, 95% CI: 0.39–0.84), and stent thrombosis by 46% (RR: 0.54, 95% CI: 0.35–0.82). In the TUXEDO Trial by Bangalore et al.[12], involving 1,821 diabetic patients, 344 with chronic kidney disease (CKD), EES were superior to paclitaxel-eluting stents (PES), reducing TVF, myocardial infarction, stent thrombosis, and TVR. Patients with CKD had a 102% increase in MACE and a 140% increase in cardiac death/myocardial infarction compared to those without CKD. In a meta-analysis by Bangalore et al.[12], with 22,844 patient-years of follow-up, EES and zotarolimus-eluting stents (ZES) were superior to first-generation stents and bare-metal stents (BMS), particularly in reducing restenosis and stent thrombosis, significantly improving clinical outcomes in diabetic patients.

For diabetic patients with STEMI undergoing PCI, everolimus-eluting stents (EES) and bare-metal stents (BMS) show similar outcomes in major events and mortality. Paclitaxel--coated balloons also perform similarly, regardless of the type used. In diabetic patients with coronary artery disease, both everolimus-eluting bioresorbable scaffolds (EE-BRS) and EES are effective, with no significant differences in outcomes. EES significantly reduce major cardiac events, myocardial infarction, and stent thrombosis compared to first-generation drug-eluting stents (DES). The TUXEDO trial found EES better than paclitaxel-eluting stents (PES), especially in patients with chronic kidney disease. A meta-analysis confirms that EES and zotarolimus-eluting stents (ZES) are superior to older stents, reducing restenosis and stent thrombosis, thus improving outcomes in diabetic patients. Second-generation DES like EES and ZES are recommended for better long-term results.

4.4. Comparative Analysis of Stent Efficacy and Outcomes in Diabetic and Hemodialysis Patients with Recent Studies

Campos et al[17]. compared diabetic patients treated with Absorb BVS and XIENCE EES, finding a similar incidence of MACE (HR 0.75; 95% CI 0.37-1.5; P=0.40), cardiac death (HR 0.72; 95% CI 0.19-2.70; P=0.62), and ID-TLR (HR 0.86; 95% CI 0.35-2.13; P=0.75). Buronova et al.[16] highlighted that patients on hemodialysis had higher cardiac mortality (9.3% vs. 3.9%) and non-cardiac mortality (32.6% vs. 6.3%) compared to non-hemodialysis patients. Fanari et al[18]. identified higher TVR with PCI (RR=2.31; 95% CI 1.80-2.96; P<0.0001) and lower stroke

rates (RR=0.35; 95% CI 0.19-0.62; P=0.0003) at 1 year, as well as higher mortality (RR=1.3; 95% CI 1.10-1.54; P=0.0026) and MI (RR=2.21; 95% CI 1.75-2.79; P<0.0001) at 5 years compared to CABG. Bavishi et al[15]. showed that EES reduced MACE (RR=0.82; 95% CI 0.70-0.96), MI (RR=0.57; 95% CI 0.39-0.84), and stent thrombosis (RR=0.54; 95% CI 0.35-0.82) in diabetics compared to first-generation DES.

The studies investigated significant patient samples using stents, with an emphasis on diabetics and individuals on hemodialysis. Campos et al[17]. focused on diabetics treated with bioresorbable stents (Absorb BVS) and second-generation drug-eluting stents (XIENCE EES). Buronova et al[16]. included both hemodialysis patients and those not on dialysis, all utilizing stents. Fanari et al[18]. conducted a meta-analysis of randomized clinical trials comparing PCI with drug-eluting stents and CABG in patients with multi-vessel coronary artery disease, with a specific analysis for diabetics. Bavishi et al[15]. evaluated second-generation drug-eluting stents (EES) in diabetic patients, comparing them with first-generation stents and highlighting the long-term reduction of major adverse events, including myocardial infarction and stent thrombosis. Thus, the use of stents and the inclusion of diabetic patients were common features, reflecting populations with higher cardiovascular risk and advanced revascularization interventions.

4.5. Long-Term Clinical Outcomes and Challenges in Diabetic Patients Undergoing Percutaneous Coronary Interventions with Drug-Eluting Stents:

The studies collectively highlight the clinical outcomes of diabetic patients undergoing percutaneous coronary interventions (PCI) with various drug-eluting stents (DES) over extended follow-up periods, typically exceeding one year. Across these trials, it was consistently observed that diabetic patients exhibited higher rates of adverse cardiovascular events compared to non-diabetic patients, underscoring the increased risk profile of this population[19,20,21,24,26]. Despite advancements in stent technology, such as the use of new-generation zotarolimus-eluting stents (ZES) and everolimus-eluting stents (EES), the incidence of major adverse cardiac events (MACE), including cardiac death, myocardial infarction, and target lesion revascularization (TLR), remained significant. For instance, in studies comparing EES and sirolimus-eluting stents (SES), long-term results indicated comparable safety and efficacy, although stent thrombosis and restenosis rates continue to be concerns (Rajesh et al [25]; Maeng et al[22]). These findings reinforce the critical need for personalized therapeutic strategies and vigilant long-term management in diabetic patients undergoing PCI to optimize clinical outcomes and reduce the burden of cardiovascular events[27-33].

5. Conclusion

In conclusion, drug-eluting stents (DES), both everolimus-eluting and sirolimus-eluting, play distinct roles in the management of diabetic patients undergoing percutaneous coronary intervention (PCI). While everolimus-eluting stents have shown overall efficacy, particularly in patients with high bleeding risk and ischemic variables, sirolimus-eluting stents have demonstrated acceptable outcomes despite higher rates of adverse events in insulin-dependent patients. Moreover, second-generation DES have exhibited superiority in terms of long-term safety and efficacy, with significant reductions in major adverse cardiac events (MACE), stent thrombosis, and myocardial infarction compared to bare-metal stents (BMS).

The clinical application of these findings underscores the importance of careful antithrombotic treatment and the selection of stent type, especially in high-risk populations such as diabetics and hemodialysis patients. Continuation of dual antiplatelet therapy (DAPT) has shown variable results, necessitating an individualized approach. Despite the limitations presented in the studies, we recommend maintaining current practices while emphasizing the need for greater vigilance in high-risk populations and rigorous follow-up to achieve better outcomes with fewer adverse events.

6. Clinical recommendations:

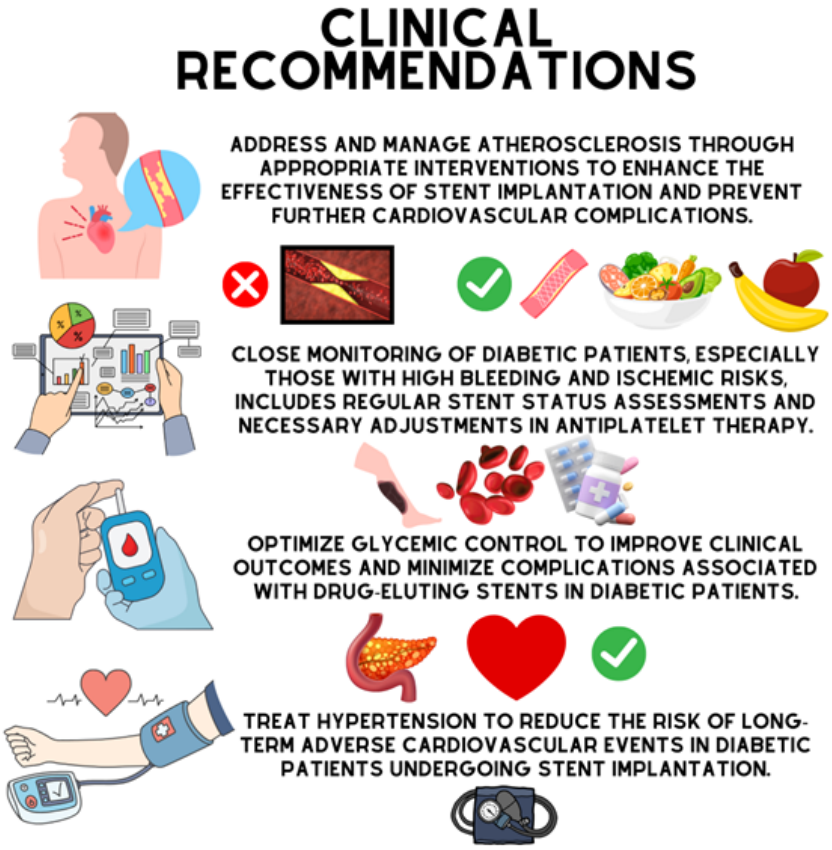

Figure 3. Synthesis clinical recommendations.

Diabetic patients, especially those with high bleeding risk (HBR) and high ischemic risk (HIR), should be closely monitored due to the elevated risk of stent thrombosis and the frequent need for target lesion revascularization (TLR). This includes regular assessments of stent status and adjustments in antiplatelet therapy as necessary to balance the risks of bleeding and ischemic events. Maintain dual antiplatelet therapy (DAPT) for an extended period as indicated by guidelines and the patient's risk profile. Most patients should continue DAPT for at least one year, with some high-risk patients continuing for longer periods. The decision on the duration of DAPT should be based on an individualized assessment of the risks of bleeding versus the benefits of preventing ischemic events. Optimize glycemic control and treat associated comorbidities such as hypertension and dyslipidemia to reduce the risk of long-term adverse cardiovascular events. Strict glucose level control and treatment of concurrent conditions are essential to improving clinical outcomes and minimizing the risk of complications associated with the use of drug-eluting stents.

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None

9. *Author's contributions:*

Conceptualizing and refining broad research objectives and aims. Creating and designing the methodology; developing models. Carrying out the research and investigative processes, including conducting experiments and gathering data/evidence. Overseeing tasks to annotate (generate metadata), clean data, and manage research data (including software code when essential for data interpretation) for both initial use and future reuse. VÉRAS, RFO; VÉRAS, SFO; FREIRE, DF, GUIMARÃES, PSS: Oversight and taking on leadership roles for planning and executing research activities, including providing mentorship outside the main team. Preparing, creating, and/or presenting published work by members of the original research group, particularly through critical review, commentary, or revision—encompassing both pre- and post-publication stages.

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11. *Reference*

1. *Lindquist J, Schramm K. Drug-Eluting Balloons and Drug-Eluting Stents in the Treatment of Peripheral Vascular Disease. Semin Intervent Radiol. 2018 Dec;35(5):443-452. doi: 10.1055/s-0038-1676360. Epub 2019 Feb 5. PMID: 30728660; PMCID: PMC6363541.*

2. *Bauersachs R, Zeymer U, Brière JB, Marre C, Bowrin K, Huelsebeck M. Burden of Coronary Artery Disease and Peripheral Artery Disease: A Literature Review. Cardiovasc Ther. 2019 Nov 26;2019:8295054. doi: 10.1155/2019/8295054. PMID: 32099582; PMCID: PMC7024142.*

3. *Mohamad T, Jyotsna F, Farooq U, Fatima A, Kar I, Khuwaja S, Memon UA, Kumari V, Puri P, Aslam ZM, Elder Z, Varrassi G, Paladini A, Khatri M, Kumar S, Muzammil MA. Individualizing Medicinal Therapy Post Heart Stent Implantation: Tailoring for Patient Factors. Cureus. 2023 Aug 23;15(8):e43977. doi: 10.7759/cureus.43977. PMID: 37746355; PMCID: PMC10516147.*

4. *Rajkumar CA, Foley MJ, Ahmed-Jushuf F, Nowbar AN, Simader FA, Davies JR, O'Kane PD, et al. A Placebo-Controlled Trial of Percutaneous Coronary Intervention for Stable Angina. N Engl J Med. 2023 Nov 11;389(25):2319-2330. doi: 10.1056/NEJMoa2310610.*

5. *Calderaro D, Bichuette LD, Maciel PC, Cardozo FAM, Ribeiro HB, Gualandro DM, Baracioli LM, et al. Update of the Brazilian Society of Cardiology's Perioperative Cardiovascular Assessment Guideline: Focus on Managing Patients with Percutaneous Coronary Intervention – 2022. Arq. Bras. Cardiol. 2022;118(2):536-47.*

6. *Zacharatos H, Hassan AE, Qureshi AI. Intravascular ultrasound: principles and cerebrovascular applications. AJNR Am J Neuroradiol. 2010 Apr;31(4):586-97. doi: 10.3174/ajnr.A1810. Epub 2010 Feb 4. PMID: 20133387; PMCID: PMC7964240.*

7. *Sheth SD, Giugliano RP. Coronary artery stents: advances in technology. Hosp Pract (1995). 2014 Oct;42(4):83-91. doi: 10.3810/hp.2014.10.1145. PMID: 25502132.*

8. *Jimenez-Quevedo P, Brugaletta S, Cequier A, Iñiguez A, Serra A, Mainar V, Campo G, Tespili M, Nombela-Franco L, Del Trigo M, Gonzalo N, Escaned J, Salinas P, Nuñez-Gil I, Fernandez-Perez C, Fernández-Ortiz A, Macaya C, Serruys PW, Sabate Tenas M. Long-term impact of diabetes in patients with ST-segment elevation myocardial infarction: Insights from the EXAMINATION randomized trial. Catheter Cardiovasc Interv. 2019 Dec 1;94(7):917-925. doi: 10.1002/ccd.28194. Epub 2019 Mar 20. PMID: 30895706.*

9. *Goel R, Cao D, Chandiramani R, Roumeliotis A, Blum M, Bhatt DL, Angiolillo DJ, Ge J, Seth A, Saito S, Krucoff M, Kozuma K, Makkar RM, Bangalore S, Wang L, Koo K, Neumann FJ, Hermiller J, Stefanini G, Valgimigli M, Mehran R. Comparative influence of bleeding and ischemic risk factors on diabetic patients undergoing percutaneous coronary intervention with everolimus-eluting stents. Catheter Cardiovasc Interv. 2021 Nov 15;98(6):1111-1119. doi: 10.1002/ccd.29314. Epub 2020 Oct 10. PMID: 33038061.*

10. *Nguyen, V.P.T., Kim, C., Hong, SJ. et al. Comparison of clinical outcomes of two different types of paclitaxel-coated balloons for treatment of patients with coronary in-stent restenosis. Heart Vessels 34, 1420–1428 (2019).* https://doi.org/10.1007/s00380-019-01388-z

11. *Hommels TM, Hermanides RS, Berta B, Fabris E, De Luca G, Ploumen EH, von Birgelen C, Kedhi E. Everolimus-eluting bioresorbable scaffolds and metallic stents in diabetic patients: a patient-level pooled analysis of the prospective ABSORB DM Benelux Study, TWENTE and DUTCH PEERS. Cardiovasc Diabetol. 2020 Oct 2;19(1):165. doi: 10.1186/s12933-020-01116-2. PMID: 33008407; PMCID: PMC7532086.*

12. *Bangalore S, Guo Y, Samadashvili Z, Blecker S, Xu J, Hannan EL. Everolimus Eluting Stents Versus Coronary Artery Bypass Graft Surgery for Patients With Diabetes Mellitus and Multivessel Disease. Circ Cardiovasc Interv. 2015 Jul;8(7):e002626. doi: 10.1161/CIRCINTERVENTIONS.115.002626. PMID: 26156152; PMCID: PMC6330115.*

13. *Bangalore S, Abhaichand R, Mullasari A, Jain R, Chand RKP, Arambam P, Kaul U. Everolimus Eluting Stents in Patients with Diabetes Mellitus and Chronic Kidney Disease: Insights from the TUXEDO Trial. Cardiovasc Revasc Med. 2019 Dec;20(12):1075-1080. doi: 10.1016/j.carrev.2019.02.017. Epub 2019 Feb 28. PMID: 31036397.*

14. *Bartorelli AL, Egidy Assenza G, Abizaid A, Banning A, Džavík V, Ellis S, Gao R, Holmes D, Ho Jeong M, Legrand V, Neumann FJ, Spaulding C, Worthley SG, Urban P; e-SELECT Investigators. One-year clinical outcomes after sirolimus-eluting coronary stent implantation in diabetics enrolled in the worldwide e-SELECT registry. Catheter Cardiovasc Interv. 2016 Jan 1;87(1):52-62. doi: 10.1002/ccd.26026. Epub 2015 May 27. PMID: 26012537.*

15. *Bavishi C, Baber U, Panwar S, Pirrotta S, Dangas GD, Moreno P, Tamis-Holland J, Kini AS, Sharma SK. Efficacy and safety of everolimus and zotarolimus-eluting stents versus first-generation drug-eluting stents in patients with diabetes: A meta-analysis of randomized trials. Int J Cardiol. 2017 Mar 1;230:310-318. doi: 10.1016/j.ijcard.2016.12.116. Epub 2016 Dec 27. PMID: 28062139.*

16. *Buronova N, Kamishima K, Yamaguchi J, Jujo K, Watanabe E, Inagaki Y, Kishi S, Wada A, Hatakeyama S, Watanabe M, Nakao M, Okayama D, Arashi H, Yamada N, Takagi A, Ogawa H, Hagiwara N. Effect of Hemodialysis on 7-Year Clinical Outcomes After Sirolimus-Eluting Stent Implantation. Circ J. 2015;79(10):2169-76. doi: 10.1253/circj.CJ-15-0113. Epub 2015 Aug 25. PMID: 26310781.*

17. *Campos CM, Caixeta A, Franken M, Bartorelli AL, Whitbourn RJ, Wu CJ, Li Paul Kao H, Rosli MA, Carrie D, De Bruyne B, Stone GW, Serruys PW, Abizaid A; ABSORB Cohort B and the SPIRIT II, III, and IV Investigators.. Risk and timing of clinical events according to diabetic status of patients treated with everolimus-eluting bioresorbable vascular scaffolds versus everolimus-eluting stent: 2-year results from a propensity score matched comparison of ABSORB EXTEND and SPIRIT trials. Catheter Cardiovasc Interv. 2018 Feb 15;91(3):387-395. doi: 10.1002/ccd.27109. Epub 2017 May 4. PMID: 28471086.*

18. *Fanari Z, Weiss SA, Zhang W, Sonnad SS, Weintraub WS. Short, Intermediate and long term outcomes of CABG vs. PCI with DES in Patients With Multivessel Coronary Artery Disease. Meta-Analysis of Six Randomized Controlled Trials. Eur J Cardiovasc Med. 2014 Sep 8;3(1):382-389. PMID: 25411635; PMCID: PMC4234175.*

19. *Jensen Lisette Okkels, Maeng M, Raungaard B, Kahlert J, Ellert J, Jakobsen L, Villadsen AB, Veien KT, Kristensen SD, Ahlehoff O, Carstensen S, Christensen MK, Terkelsen CJ, Engstroem T, Hansen KN, Bøtker HE, Aaroe J, Thim T, Thuesen L, Freeman P, Aziz A, Eftekhari A, Junker A, Jensen SE, Lassen JF, Hansen HS, Christiansen EH; Sort Out IX Study Group. Randomized Comparison of the Polymer-Free Biolimus-Coated BioFreedom Stent With the Ultrathin Strut Biodegradable Polymer Sirolimus-Eluting Orsiro Stent in an All-Comers Population Treated With Percutaneous Coronary Intervention: The SORT OUT IX Trial. Circulation. 2020 Jun 23;141(25):2052-2063. doi: 10.1161/CIRCULATIONAHA.119.040241. Epub 2020 May 21. PMID: 32434381.*

20. *Koch T, Lenz T, Joner M, Xhepa E, Koppara T, Wiebe J, Coughlan JJ, Aytekin A, Ibrahim T, Kessler T, Cassese S, Laugwitz KL, Schunkert H, Kastrati A, Kufner S; Intracoronary Stenting and Angiographic Results: Test Efficacy of Sirolimus- and Probucol-Eluting Versus Zotarolimus- Eluting Stents (ISAR-TEST 5) Investigators. Ten-year clinical outcomes of polymer-free versus durable polymer new-generation drug-eluting stent in patients with coronary artery disease with and without diabetes mellitus : Results of the Intracoronary Stenting and Angiographic Results: Test Efficacy of Sirolimus- and Probucol- and Zotarolimus-Eluting Stents (ISAR-TEST 5) trial. Clin Res Cardiol. 2021 Oct;110(10):1586-1598. doi: 10.1007/s00392-021-01854-7. Epub 2021 Jun 22. PMID: 34156521; PMCID: PMC8484170.*

21. *Krackhardt F, Waliszewski M, Rischner J, Piot C, Pansieri M, Ruiz-Poveda FL, Boxberger M, Noutsias M, Ríos XF, Kherad B. Nine-month clinical outcomes in patients with diabetes treated with polymer-free sirolimus-eluting stents and 6-month vs. 12-month dual-antiplatelet therapy (DAPT). Herz. 2019 Aug;44(5):433-439. English. doi: 10.1007/s00059-017-4675-x. Epub 2018 Jan 22. PMID: 29356832.*

22. *Maeng M, Baranauskas A, Christiansen EH, Kaltoft A, Holm NR, Krusell LR, Ravkilde J, Tilsted HH, Thayssen P, Jensen LO. A 10-month angiographic and 4-year clinical outcome of everolimus-eluting versus sirolimus-eluting coronary stents in patients with diabetes mellitus (the DiabeDES IV randomized angiography trial). Catheter Cardiovasc Interv. 2015 Dec 1;86(7):1161-7. doi: 10.1002/ccd.25875. Epub 2015 May 6. PMID: 25640050.*

23. *Mahmoud AN, Shah NH, Elgendy IY, Agarwal N, Elgendy AY, Mentias A, Barakat AF, Mahtta D, David Anderson R, Bavry AA. Safety and efficacy of second-generation drug-eluting stents compared with bare-metal stents: An updated meta-analysis and regression of 9 randomized clinical trials. Clin Cardiol. 2018 Jan;41(1):151-158. doi: 10.1002/clc.22855. Epub 2018 Jan 25. PMID: 29369375; PMCID: PMC6489746.*

24. *Miyazaki T, Latib A, Panoulas VF, Miyazaki S, Costopoulos C, Sato K, Naganuma T, Kawamoto H, Daida H, Colombo A. Comparison of 2-year outcomes between zotarolimus-eluting and eve-*

rolimus-eluting new-generation cobalt-chromium alloy stents in real-world diabetic patients. Catheter Cardiovasc Interv. 2015 Jul;86(1):E11-8. doi: 10.1002/ccd.25797. Epub 2015 Jan 30. PMID: 25534499.

25. *Rajesh GN, Sulaiman S, Vellani H, Sajeev CG. One-year clinical outcome of percutaneous coronary intervention with very long (≥ 40mm) drug-eluting stent. Indian Heart J. 2018 Dec;70 Suppl 3(Suppl 3):S285-S289. doi: 10.1016/j.ihj.2018.05.016. Epub 2018 May 28. PMID: 30595276; PMCID: PMC6309145.*

26. *Meelu OA, Tomey MI, Sartori S, Kherada N, Mennuni MG, Theodoropoulos KN, Sayeneni S, Baber U, Pyo RT, Kovacic JC, Moreno P, Krishnan P, Mehran R, Dangas GD, Kini AS, Sharma SK. Comparison of provisional 1-stent and 2-stent strategies in diabetic patients with true bifurcation lesions: the EES bifurcation study. J Invasive Cardiol. 2014 Dec;26(12):619-23. PMID: 25480989.*

27. *Rha SW, Choi BG, Choi SY, Choi CU, Gwon HC, Chae IH, Kim HS, Park HS, Lee SH, Kim MH, Hur SH, Jang Y; K-CTO Registry. Multicenter experience with percutaneous coronary intervention for chronic total occlusion in Korean population: analysis of the Korean nationwide multicenter chronic total occlusion registry. Coron Artery Dis. 2020 Jun;31(4):319-326. doi: 10.1097/MCA.0000000000000838. PMID: 31913165.*

28. *Tarantini G, Cardaioli F, De Iaco G, Tuccillo B, De Angelis MC, Mauro C, Boccalatte M, Trivisonno A, Ribichini F, Vadalà G, Caramanno G, Caruso M, Lombardi M, Fischetti D, Danesi A, Abbracciavento L, Lorenzoni G, Gregori D, Panza A, Nai Fovino L and Esposito G (2024) A more-Comers populAtion trEated with an ultrathin struts polimer-free Sirolimus stent: an Italian postmaRketing study (the CAESAR registry). Front. Cardiovasc. Med. 10:1326091. doi: 10.3389/fcvm.2023.1326091*

29. *Testa L, Casenghi M, Popolo Rubbio A, Dani S, Desai D, Pandya R, et al. Targeting "diabetic" coronary artery disease merging the properties of sirolimus coated balloon with sirolimus eluting stent. Minerva Cardiol Angiol 2021;69:525-32. DOI: 10.23736/S2724-5683.20.05413-4*

30. *Uthamalingam S, Ahmado I, Selvaraj V, Dewey R, Flynn J. Long term outcomes in octogenarians undergoing percutaneous coronary intervention: comparison of bare metal versus drug eluting stent. Int J Cardiol. 2015 Jan 20;179:385-9. doi: 10.1016/j.ijcard.2014.11.012. Epub 2014 Nov 5. PMID: 25464492.*

31. *Waltenberger J, Brachmann J, van der Heyden J, Richardt G, Fröbert O, Seige M, Friedrich G, Erglis A, Winkens M, Hegeler-Molkewehrum C, Neef M, Hoffmann S; BIOFLOW-III Investigators. Five-Year Results of the Bioflow-III Registry: Real-World Experience with a Biodegradable Polymer Sirolimus-Eluting Stent. Cardiovasc Revasc Med. 2020 Jan;21(1):63-69. doi: 10.1016/j.carrev.2019.03.004. Epub 2019 Mar 15. PMID: 30922870.*

32. *Wiebe J, Gilbert F, Dörr O, Liebetrau C, Wilkens E, Bauer T, Elsässer A, Möllmann H, Hamm CW, Nef HM. Implantation of everolimus-eluting bioresorbable scaffolds in a diabetic all-comers*

population. Catheter Cardiovasc Interv. 2015 Nov 15;86(6):975-81. doi: 10.1002/ccd.26140. Epub 2015 Aug 13. PMID: 26269391.

33. *Yano H, Horinaka S, Ishimitsu T. Impact of everolimus-eluting stent length on long-term clinical outcomes of percutaneous coronary intervention. J Cardiol. 2018 May;71(5):444-451. doi: 10.1016/j.jjcc.2017.10.011. Epub 2017 Nov 22. PMID: 29174595.*

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