



Percutaneous Coronary Intervention with Everolimus-Eluting Versus Sirolimus-Eluting Stents in Diabetic Patients Presented with Acute Coronary Syndromes: A Short-term Comparative Clinical Outcome Study

**Karim Mohamed Fahmy Mohamed Ibrahim^{a*}, Raghda Ghonimy El Sheikh^b,
Mai Abdulmonaem Salama^b, Medhat Mohamed Ashmawy^b
and Hatem Mohamed El-Sokkary^b**

^a *Department of Cardiology, Faculty of Medicine, Helwan University, Egypt.*

^b *Department of Cardiology, Faculty of Medicine, Tanta University, Egypt.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2022/v34i2131567

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/84469>

Original Research Article

Received 23 March 2022
Accepted 12 May 2022
Published 05 September 2022

ABSTRACT

Background: The use of drug-eluting stents (DES) resulted in innovative progress in the field of interventional Cardiology. Nowadays, the most common indication for coronary stenting is acute coronary syndromes (ACS) due to the better clinical consequences of PCI compared with conservative management. However, in diabetic patients, there is a large debate in the literature regarding the selection of an optimal drug-eluting stent.

Aim: This work aimed to compare short term clinical outcome post-percutaneous Coronary intervention with Everolimus-eluting stents (EES) versus Sirolimus-eluting stents (SES) in diabetic patients presented with ACS.

Methods: The present study was carried out on 120 diabetic patients presented with acute coronary syndromes (Non-STEMI, Unstable angina) and divided into 2 groups; group 1 included patients treated with PCI with Everolimus eluting stenting (EES), and group 2 included patients treated with PCI with Sirolimus-eluting stenting (SES).

*Corresponding author;

Results: After 6 months of follow-up, the percentages of treated patients who were complicated with sudden cardiac death, congestive heart failure, and planned further PCI were 5%, 6.7%, and 6.7%, respectively in group 1, and were 3.3%, 8.3%, and 10% respectively in group 2. While no acute coronary syndrome or repeated coronary angiography was reported in both groups. In the current study, there was no statistically significant difference between the EES group and the SES group in diabetic patients either during implantation or during 6 months follow up (P-value >0.05).

Conclusion: In this current study, both EES and SES are comparable to each other regarding the treatment of ACS in diabetic patients.

Keywords: Everolimus eluting stenting; sirolimus-eluting stenting; diabetic patients.

ABBREVIATIONS

PCI : Percutaneous Coronary Intervention
DES : Drug-eluting Stenting
EES : Everolimus Eluting Stenting
SES : Sirolimus-eluting Stenting
PES : Paclitaxel-eluting Stents
LL : In-stent Late Loss
BMS : Bare-metal Stents
CABG : Coronary Artery Bypass Grafting
ACS : Acute Coronary Syndrome
MACE : Major adverse Cardiac Effect

1. INTRODUCTION

Nowadays, the use of Drug-eluting stents (DES) in interventional cardiology makes a great revolution in this field. Therefore, the development of newer stents is continuous as well as many trials are performed to improve the efficacy and safety of different stents [1] The Sirolimus-eluting stents (SES) is the most widely used first-generation DES due to fewer post stenting complications such as chest pain and dyspnea, cardiac death, fatal or non-fatal myocardial infarction [2-6]. Everolimus eluting stents (EES) are second-generation DES where the stent platform is used accompanied by a polymer coating containing Everolimus [1]. Another difference between the SES and the EES rather than the polymer coating which contains Sirolimus or Everolimus, respectively, is that the stent and the polymer platform thickness of the EES are considered the thinnest among the all available DES [7].

Diabetes Mellitus (DM) which is a common metabolic disease all over the world is usually accompanied by symptomatic coronary artery disease requiring treatment [8]. All the published randomized clinical trials performed on diabetic patients to compare the medium- to long-term outcome of PCI to that of CABG in multivessel coronary disease revealed the superiority of the surgical option particularly concerning the new

revascularizations and death. However, the decision of DES for multivessel disease in diabetic patients is still controversial [9].

In fact, the Sirolimus, Everolimus, or Zotarolimus-eluting stents which are known as Limus-eluting stents are superior to paclitaxel-eluting stents (PES) in the treatment of coronary artery disease. However, this is not typical in diabetic patients as it was proven from large randomized trials, meta-analyses, pooled analyses, and registries where the diabetics were represented as small subgroups that both stents have the same efficacy and safety in the diabetics [10-12].

However, despite the preceding trials, they are not sufficient to evaluate the clinical consequences of stenting in diabetic patients. However, to the best of our knowledge, no comparison has been carried out between the SES and the EES. Therefore, we carried out a prospective, randomized trial to compare SES with ESE in diabetic patients.

2. PATIENTS AND METHODS

This study was carried out on 120 diabetic patients presented with acute coronary syndromes (Non-STEMI, Unstable angina) during the period from October 2018 to September 2020 at the Cardiology department at Tanta University Hospital. This study was encompassed, two groups; group 1, included patients treated with PCI with Everolimus eluting stenting (EES), and group 2, included patients treated with PCI with Sirolimus-eluting stenting (SES). Clinical follow-up post-PCI for both groups for 6 months' duration was done for major adverse cardiac events (MACE) including sudden cardiac death, acute coronary syndromes, Congestive heart failure, coronary angiography, and revascularization (PCI or CABG).

All the patients in the study were subjected to the following: full history taking, full clinical

examination, standard supine 12-lead ECG, laboratory investigations, Transthoracic Echocardiography (TTE), diagnostic coronary angiography, PCI with stenting with either EES or SES, and clinical follow up for 6 months' post PCI. In the present study, all the included patients were with eligible coronary anatomy for PCI and successfully deployed either Sirolimus or Everolimus stents.

Statistical analysis of the data: Data were collected, coded, revised, and entered into the Statistical Package for Social Science (R studio) version 2.3.2. The data were presented as numbers and percentages for the qualitative data, mean, standard deviations, and ranges for the quantitative data with parametric distribution and median with interquartile range (IQR) for the quantitative data with the non-parametric distribution.

3. RESULTS

Demographic personal data are demonstrated in Table 1. There was a statistically significant difference between both groups only as regards BMI (P-value=0.003).

Table 2 illustrates all studied risk factors. There was a statistically significant difference between the two groups only as regards the LDL level. All patients in both groups are overweight.

No statistically significant difference was recorded between both groups as regards the laboratory results (Table 3).

Regarding Echocardiographic findings, the mean ejection fraction (EF) was 59.4% ± 11.3 while in group 2 was 58.2±12.2. Concerning the

clinical indication, there was no statistical difference between both groups (Table 4).

Table 5 demonstrated **the angiographic variables** in both studied groups. Single vessel disease was more common in both groups than the Multivessel disease. The total stent length was shorter in group 1 compared to group 2 (37.1 ± 24.4 vs 41.5 ± 26.2 with a p-value of 0.28). Also, the lesion length was shorter in group 1 than group 2 (35.3 ± 23.3 vs 38.9 ± 24.7 with a p-value of 0.98). The prior balloon inflation was more common in both groups than the direct stenting with no recorded statistical difference. The inflation pressure of stents was higher in group 1 than group 2 (13.2±7.1 ATMOS vs 12. ±1.4 ATMOS). In group 1, we put 1 stent in 50 cases, 2 stents in 6 patients, and 3 stents in 4 cases, while in group 2, we put 1 stent in 46 patients and 2 stents in 8 cases, and 3 stents in 6 cases. Stenosis was 70% in 46 patients (76.7%) in group 1 while it was 70 % in 42 patients (70 %) in group 2. Stenosis was 90 % in group 1 in 14 patients (23.3%) and in group 2 in 18 patients (30%). Regarding the complexity of the lesions, in both groups, the simple lesions were more common than the tortuous lesions.

In the present study, radial access was used more than femoral access in both groups with no access complications. The left anterior descending artery (LAD) was the commonest site of stents in both groups (Table 6).

All medications are demonstrated in Table 7. There was no statistically significant difference between both groups as regards the medication of DM, in-hospital medications, or the discharge medications (P-value > 0.05 for all).

Table 1. Demographic and personal data of the studied groups

	Group 1 EES (n = 60)		Group 2 SES (n = 60)		Student t. test	
					t- sig	p-value
Age						
Mean ± SD	64.3 ± 9.7		63.9 ± 9.6		0.184	0.85
Gender	No.	%	No.	%	Chi-square test	
Male	48	80%	48	80%	X²	p-value
Female	12	20%	12	20%	0	1
BMI	25.6 ± 0.4		26.2 ± 0.7		Student t. test	
Mean ± SD					t-sig	p-value
					-3.04	0.003*
Duration of DM	10.6 ± 2.1		10.9 ± 1.9		Student t. test	
Mean± SD					t-value	p-value
					0.4	0.69

Table 2. Risk factors distribution of the studied groups

	Group 1 EES (n = 60)		Group 2 SES (n = 60)		Chi-square test	
	No.	(%)	No.	(%)	X ²	p-value
Smoking						
Current Smoking	42	70%	46	76.7%	0.526	0.47
Non smoking	18	30%	14	23.3%		
Hypertension					X ²	p-value
Present	46	76.7%	41	68.1%	0.669	0.41
No hypertension	14	23.3%	19	31.7%		
Family history					0.588	0.44
Present	7	11.7%	11	18.3%		
Absent	53	88.3%	49	81.7%		
LDL	112 ± 2.7		117 ± 1.1		Student t. test	
Mean ± SD					t-sig	p-value
					-13.7	<0.0001*
Over weight(>25)	60	100%	60	100%	1	

Table 3. Laboratory results of the studied groups

	Group 1 EES (n =60) Mean ± SD		Group 2 SES (n =60) Mean ± SD		Student t. test	
					t-sig	P-value
Creatinine	1.1 ± 0.1		1.2 ± 0.2		1.06	0.113
HbA1c	8.4 ± 1.6		8.6 ± 1.4			
	Group 1 EES (n = 60)		Group 2 SES (n = 60)		Chi-square test	
	No.	(%)	No.	(%)	X ²	p-value
Troponin & CKMB						
Positive	14	23.3%	22	36.7%	1.94	0.16
Negative	46	76.7%	38	63.3%		

Table 4. Distribution of the studied groups according to clinical manifestation

EF	Group 1 (EES) (n =60)		Group 2 (SES) (n =60)		Student t. test	P-value
	Mean ± SD					
	No.	(%)	No.	(%)	Chi-square test	P-value
	59.4 ± 11.3%		58.2 ± 12.2%		1.013	0.31
Unstable angina	46	76.7%	38	63.3%	1.94	0.16
Non-ST-elevation myocardial infraction	14	23.3%	22	36.7%		

Table 5. Comparison between the studied groups according to angiographic variables, prior balloon, direct stent, number of stents

	Group 1 EES n =60		Group 2 SES n =60		Chi-square test	
	No.	(%)	No.	(%)	X ²	P-value
	Single vessel disease	44	73.3%	38		
Multi vessel disease	16	26.7%	22	36.7%		

	Group 1 EES n =60		Group 2 SES n =60		Chi-square test	
	No.	(%)	No.	(%)	X ²	P-value
stent length	37.1 ± 24.4		41.5 ± 26.2		Student t. test	
Mean± SD					t-value	p-value
					-1.08	0.28
Lesion length	35.3 ± 23.3		38.9 ± 24.7		0.03	0.98
Mean ± SD						
Prior balloon inflation	No.	%	No.	%	Chi-square test	
	53	88.3%	52	86.7%	X²	p-value
Direct stenting	7	11.7%	8	13.3%	0	1
Inflation pressure of stent	13.2 ± 7.1		12.9 ± 1.4		Student t. test	
Mean ± SD					t-sig	p-value
					-0.16	0.87
Number of stent	No.	%	No.	%	Chi-square test/fisher test	
1 stent	50	83.3%	46	76.7%	X²	p-value
2 stent	6	10%	8	13.3%	0.85	0.65
3 stent	4	6.7%	6	10%		
Percent of stenosis	No.	%	No.	%	Chi-square test	
70%	46	76.7%	42	70%	X²	P-value
90%	14	23.3%	18	30%	0.38	0.54
Complexity	No.	%	No.	%	Chi-square test	
Tortuous	19	31.7%	12	20%	X²	P-value
Simple	41	68.3%	48	80%	1.57	0.21

Table 6. Comparison between the studied groups according to access and site of stents

	Group 1 EES n =60		Group 2 SES n =60		Chi-square test/ Fisher test		
	No.	(%)	No.	(%)	X ²	P-value	
Access							
Femoral access	50	83.3%	47	78.3%	0.215	0.64	
Radial access	10	16.7%	13	21.7%			
Site of stents							
1 stent	LAD	23	38.3%	19	76.7%	0.53	0.77
	RCA	18	30%	16	26.7%		
	LCX	9	15%	11	18.3%		
2 stents	LAD	4	6.7%	4	6.7%	-	0.37
	LAD D1	2	3.3%	1	1.7%		
	RCA	0	0%	3	5%		
3 stents	LAD	4	6.7%	6	10%	-	1
	RCA	4	6.7%	6	10%		
	LCX	4	6.7%	6	10%		

LAD: Left anterior descending artery.

RCA: Right coronary artery.

LCX: Left circumflex artery.

D1: Ostial diagonal

Table 7. Comparison between the studied groups according to medications

	Group 1 EES n =60		Group 2 SES n =60		Chi-square test/ Fisher test	
	No.	(%)	No.	(%)	χ^2	P-value
Diabetic Medications						
Oral medication	48	80%	53	88.3%	1.005	0.32
Insulin	12	20%	7	11.7%		
Inhospital Medications						
Enoxaparin	48	80%	46	76.7%	0.83	
Unfractionated heparin	12	12%	14	23.3%		
Glycoprotein IIB IIIA	0	0%	0	0%		
Discharge medications						
Aspirin	60	100%	60	100%	0	1
Clopidogrel	53	88.3%	48	80%	1.0005	0.31
Ticagrelor	7	11.7%	12	20%	1.0005	0.31
β- blockers	37	61.7%	40	66.7%	0.145	0.7
ACE inhibitor	42	70%	47	78.3%	0.696	0.41
Angiotensin receptor antagonist	14	23.3%	9	15%	0.861	0.35
Statins	60	100%	60	100%	0	1
Anti-hyperglycemic agents	60	100%	60	100%	0	1

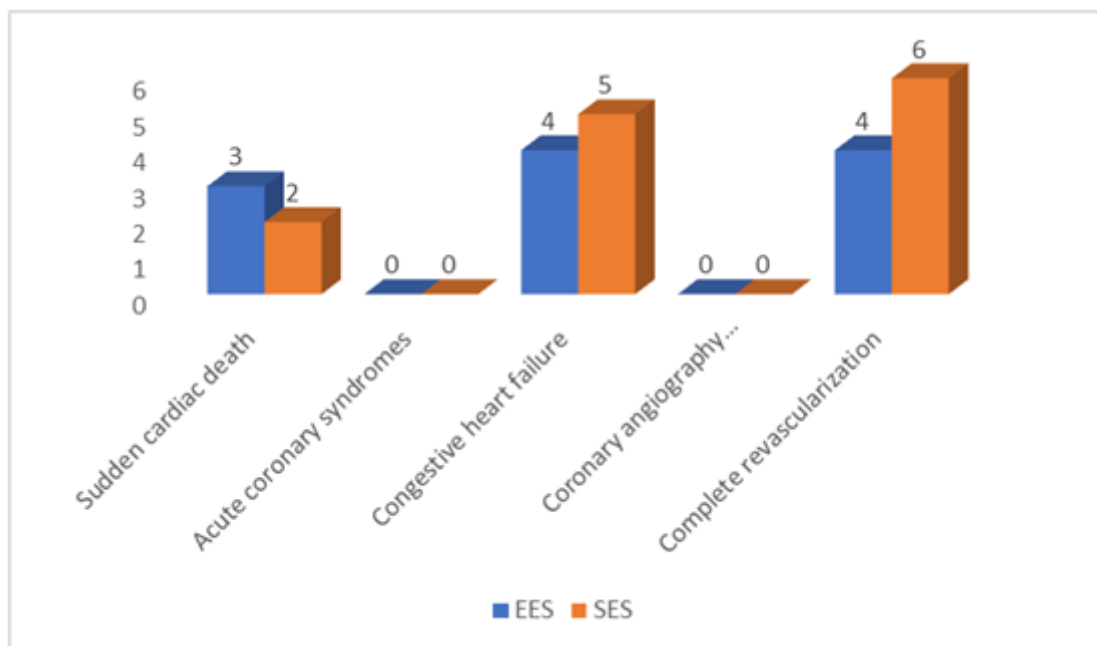


Fig. 1. MACE after 6 months Follow up

After following up in 6 months regarding MACE, 3 patients had sudden cardiac death in group 1 (5%) while 2 patients had sudden cardiac death in group 2 (3.3%). No **acute coronary syndrome** was encountered or coronary angiography was done in the follow-up period. 4 patients had **congestive heart failure** symptoms in group 1 (6.7%) while 5 patients had congestive heart failure symptoms in group 2 (8.3). **Planned further PCI** for other lesions in the multivessel disease cases was done in 4 cases in group 1 (6.7). And in 6 cases in group 2 (10%). No patients got needed **repeated coronary angiography** with further revascularization in both groups. All reported MACE after 6 months follow up are simplified in Fig. 1.

4. DISCUSSION

Diabetes mellitus is considered a significant independent risk factor resulting in adverse consequences of PCI irrespective of the type of used stent [13]. The incidence of coronary artery disease is increased from 2-4 times with diabetes Mellitus [14]. Unfortunately, diabetic patients had the worst major adverse cardiac effect (MACE) after PCI. So, the complete management, including medications plus interventional and surgical procedures, of diabetic patients with CAD is not a simple matter. Despite the reduction of repeated revascularization need after using DES in diabetics, the risk of MACE with diabetic patients undergoing PCI remains high [15-17].

The SPIRIT II (Clinical Evaluation of the Xience V Everolimus Eluting Coronary Stent System in the Treatment of Patients With de novo Native Coronary Artery Lesions) [18] and SPIRIT III [19] randomized trials proved the superiority of EES compared to Paclitaxel-eluting stents (PES) concerning the in-stent late loss (LL) within 180 days. In addition, the SPIRIT IV [20] and COMPARE (Comparison of the Everolimus eluting Xience V stent with the paclitaxel-eluting Taxus Liberte stent in all-comers: A randomized open-label trial) [21] trials reported that regarding the reduction in the clinical consequences, the EES is more preferred than the PES which represented by 38% and 31%, respectively.

Regarding the cardiovascular complications, the ZEST (Comparison of the Efficacy and Safety of Zotarolimus-Eluting Stent with Sirolimus-Eluting and Paclitaxel-Eluting Stent for Coronary Lesions) [22] and SORTOUT III (Danish

Organization for Randomized Trials with Clinical Outcome) [23] randomized trials compared between both SES and Zotarolimus-eluting stents ZES. Both trials found rates of MACE were lower in cases treated with SES than cases treated with ZES.

In the present study, we tried to compare short term clinical outcome post-Percutaneous Coronary intervention with Everolimus-eluting stents (EES) versus Sirolimus-eluting stents (SES) in diabetic patients presented with acute coronary syndromes.

Regarding the baseline characters, our study showed no significant differences between the two groups as regards age and gender. Also; the possible risk factors of the two studied groups showed no statistical difference between the two groups as regard hypertension, smoking, and positive family history of coronary artery disease. It also showed no statistical difference between the two groups as regard left ventricular ejection fraction.

On the other hand, the EXCELLENT registry [13] reported that hypertension and smoking were higher in the EES group. In addition, the mean age was higher in the non-diabetic patients treated with EES, and although the patients of this group had a lower rate of preceding MI, they reported a higher rate of congestive heart failure. As for the clinical indications (unstable angina, and Non-ST-elevation myocardial infarction), there was no statistically significant difference between the two studied groups where the p-value was 0.16. Besides, the angiographic variables, with the exclusion of previously stented or CABG, our study showed no statistical difference between the two groups, although, the single vessels disease was relatively higher in the Everolimus group than the Sirolimus group (73.3% vs 63.3% with p-value 0.33) and the Multivessel Disease was relatively lower in group 1 than group 2 (26.7% vs 36.7% with p-value 0.33), and the total stent length was shorter in the Everolimus group compared to the Sirolimus group (37.1 ± 24.4 vs 41.5 ± 26.2 with p-value 0.28). This was in agreement with ESSENCE-DIABETES randomized trial conducted by Kim et al., [24] who reported that both Everolimus and Sirolimus did not differ notably regarding angiographic outcomes. In addition, a sub-study of the SORT OUT IV trial [25] compared between EES and SES in diabetic or non-diabetic patients. The study reported the insignificant difference between both

stents as regards the clinical outcomes. Also, Kufner et al., [26] in the ISAR-TEST-4 trial found similar outcomes between the EES and the SES in diabetics. However, the results of these previous studies ignored the EES problem of attenuated efficacy. However, this was in disagreement with the EXCELLENT registry [13] which reported the significance of the clinical and angiographic factors in PCI patients. However, the diabetic patients in the EXCELLENT registry were represented 36.8% of all cases, but in our study, all the patients were diabetics [13].

Concerning the discharge medications, all patients in both groups were maintained on aspirin, statin, and antidiabetic drugs and our statistical results were mostly comparable between the two groups.

In the present study, it was notable that there was no significant difference between the EES and the SES regarding the risk of device-specific clinical events (i.e., TLR, TVR, and ST). This result was similar to a pooled analysis of RESOLUTE programs [27] that concerning the risk of device-specific clinical events found no statistically significant difference between both stents either in diabetic or nondiabetic patients. However, in real life, the incidence of these events remains statistically high and the risk ratio did not show any improvement as the TLR, and TVR relative risk remains between 1.2-1.5 and of ST remains approximately 1,5 [27].

Future Prospective Although, it is well noticed that there is a great revolution in the field of interventional cardiology, however, this study showed that the treatment of coronary artery disease with PCI in diabetic patients remains to represent some sort of difficulty. We hope further development of the technology of the used stents may overcome these problems. We recommended that future trials should solve the debate regarding the strict glycemic control would obviously result in advances in the PCI outcome in diabetic patients or not.

The limitation of this study was that all the included patients were had DM type 2, while patients with insulin-dependent DM were not involved in the current study. Another concern was that the late stent problems such as stent thrombosis and stent restenosis which is considered the main reflection of DES safety were not captured in the present study. As the main concern of our study was restricted to

clinical follow-up within 6 months. Also, the angiographic follow-up was not mandatory in this study, despite the high rate of silent ischemia in diabetics. Besides, the rates of post-DES events were lower than expected, accordingly, we cannot exclude that the study was underpowered. Also, all the used Everolimus stents in our study were Xience Expedition. This was due to the unavailability of other brands of Everolimus stents. Finally, the study did not include a nondiabetic control group. So, the statistical significance of the study may be negatively affected.

5. CONCLUSION

In this study, we found that using either Everolimus or Sirolimus-eluting stents in patients with diabetes mellitus presented by unstable angina/Non-STEMI were with no statistically significant difference either during the in-hospital stay or in 6 months follow up. Both EES and SES are comparable to each other regarding the treatment of acute coronary syndrome in diabetic patients.

CONFERENCE DISCLAIMER

Abstract part of this manuscript was previously presented and published in the following conference.

Conference name: PICS Society Symposium 2021

Dates: Sep 1-4, 2021

Location: Las Vegas, United States

Web Link of the proceeding: <https://www.aepc.org/events/pics-society-symposium-2021>

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Costa RA, Lansky AJ, Mintz GS, Mehran R, Tsuchiya Y, Negoita M, et al. Angiographic results of the first human experience with everolimus-eluting stents for the treatment of coronary lesions (the FUTURE I trial). *Am J Cardiol.* 2005;95(1):113-6.
2. Windecker S, Remondino A, Eberli FR, Jüni P, Räber L, Wenaweser P, et al. Sirolimus-eluting and paclitaxel-eluting stents for coronary revascularization. *N Engl J Med.* 2005;353(7):653-62.
3. Dibra A, Kastrati A, Mehilli J, Pache J, Schühlen H, von Beckerath N, et al. Paclitaxel-eluting or sirolimus-eluting stents to prevent restenosis in diabetic patients. *N Engl J Med.* 2005;353(7):663-70.
4. Morice MC, Colombo A, Meier B, Serruys P, Tamburino C, Guagliumi G, et al. Sirolimus-vs paclitaxel-eluting stents in de novo coronary artery lesions: the REALITY trial: a randomized controlled trial. *Jama.* 2006;295(8):895-904.
5. Kastrati A, Dibra A, Eberle S, Mehilli J, de Lezo JS, Goy JJ, et al. Sirolimus-eluting stents vs paclitaxel-eluting stents in patients with coronary artery disease: meta-analysis of randomized trials. *Jama.* 2005;294(7):819-25.
6. Goy J-J, Stauffer J-C, Siegenthaler M, Benoît A, Seydoux C. A prospective randomized comparison between paclitaxel and sirolimus stents in the real world of interventional cardiology: the TAXi trial. *J Am Coll Cardiol.* 2005;45(2):308-11.
7. Sperling C, Waliszewski MW, Kherad B, Krackhardt F. Comparative preclinical evaluation of a polymer-free sirolimus-eluting stent in porcine coronary arteries. *Therapeutic advances in cardiovascular disease.* 2019;13:17-25
8. Aronson D, Edelman ER. Revascularization for coronary artery disease in diabetes mellitus: Angioplasty, stents and coronary artery bypass grafting. *Rev Endocr Metab Dis.* 2010;11(1):75-86.
9. Marco B, Aleardo M, Elisabetta V. Effectiveness and safety of sirolimus-eluting stents in patients with diabetes. *Interventional Cardiology.* 2008;3(1):52-4.
10. Iakovou I, Schmidt T, Bonizzoni E, Ge L, Sangiorgi GM, Stankovic G, et al. Incidence, predictors, and outcome of thrombosis after successful implantation of drug-eluting stents. *Jama.* 2005;293(17):2126-30.
11. Daemen J, Garcia-Garcia HM, Kukreja N, Imani F, de Jaegere PPT, Sianos G, et al. The long-term value of sirolimus- and paclitaxel-eluting stents over bare metal stents in patients with diabetes mellitus. *Eur Heart J.* 2006;28(1):26-32.
12. Ong AT, Aoki J, van Mieghem CA, Rodriguez Granillo GA, Valgimigli M, Tsuchida K, et al. Comparison of short- (one month) and long- (twelve months) term outcomes of sirolimus- versus paclitaxel-eluting stents in 293 consecutive patients with diabetes mellitus (from the RESEARCH and T-SEARCH registries). *Am J Cardiol.* 2005;96(3):358-62.
13. Park KW, Chae IH, Lim DS, Han KR, Yang HM, Lee HY, et al. Everolimus-eluting versus sirolimus-eluting stents in patients undergoing percutaneous coronary intervention: the EXCELLENT (Efficacy of Xience/Promus Versus Cypher to Reduce Late Loss After Stenting) randomized trial. *J Am Coll Cardiol.* 2011;58(18):1844-54.
14. Lüscher TF, Creager MA, Beckman JA, Cosentino F. Diabetes and vascular disease: pathophysiology, clinical consequences, and medical therapy: Part II. *Circulation.* 2003;108(13):1655-61.
15. Lemos PA, Serruys PW, van Domburg RT, Saia F, Arampatzis CA, Hoye A, et al. Unrestricted utilization of sirolimus-eluting stents compared with conventional bare stent implantation in the "real world": the Rapamycin-Eluting Stent Evaluated At Rotterdam Cardiology Hospital (RESEARCH) registry. *Circulation.* 2004;109(2):190-5.
16. Ong AT, Serruys PW, Aoki J, Hoye A, van Mieghem CA, Rodriguez-Granillo GA, et al. The unrestricted use of paclitaxel- versus sirolimus-eluting stents for coronary artery disease in an unselected population: one-year results of the Taxus-Stent Evaluated at Rotterdam Cardiology Hospital (T-SEARCH) registry. *J Am Coll Cardiol.* 2005;45(7):1135-41.
17. Mack MJ, Banning AP, Serruys PW, Morice MC, Taeymans Y, Van Nooten G, et al. Bypass versus drug-eluting stents at three years in SYNTAX patients with diabetes mellitus or metabolic syndrome. *Ann Thorac Surg.* 2011;92(6):2140-6.
18. Serruys PW, Ruygrok P, Neuzner J, Piek JJ, Seth A, Schofer JJ, et al. A randomised

- comparison of an everolimus-eluting coronary stent with a paclitaxel-eluting coronary stent: the SPIRIT II trial. *Euro Intervention* 2006;2(3):286-94.
19. Stone GW, Midei M, Newman W, Sanz M, Hermiller JB, Williams J, et al. Comparison of an everolimus-eluting stent and a paclitaxel-eluting stent in patients with coronary artery disease: a randomized trial. *Jama*. 2008;299(16):1903-13.
 20. Stone GW, Rizvi A, Newman W, Mastali K, Wang JC, Caputo R, et al. Everolimus-eluting versus paclitaxel-eluting stents in coronary artery disease. *N Engl J Med* 2010;362(18):1663-74.
 21. Kedhi E, Joesoef KS, McFadden E, Wassing J, Van Mieghem C, Goedhart D, et al. Second-generation everolimus-eluting and paclitaxel-eluting stents in real-life practice (COMPARE): A randomised trial. *The Lancet*. 2010; 375(9710):201-9.
 22. Interventions EAfPC. The task force on myocardial revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J*. 2010;31:2501-55.
 23. De Luca G, Dirksen MT, Spaulding C, Kelbæk H, Schalij M, Thuesen L, et al. Impact of diabetes on long-term outcome after primary angioplasty: insights from the DESERT cooperation. *Diabetes Care*. 2013;36(4):1020-5.
 24. Kim WJ, Lee SW, Park SW, Kim YH, Yun SC, Lee JY, et al. Randomized comparison of everolimus-eluting stent versus sirolimus-eluting stent implantation for de novo coronary artery disease in patients with diabetes mellitus (ESSENCE-DIABETES): results from the ESSENCE-DIABETES trial. *Circulation*. 2011;124(8): 886-92.
 25. Jensen LO, Thayssen P, Junker A, Maeng M, Tilsted HH, Kaltoft A, et al. Comparison of outcomes in patients with versus without diabetes mellitus after revascularization with everolimus- and sirolimus-eluting stents (from the SORT OUT IV trial). *Am J Cardiol*. 2012;110(11):1585-91.
 26. Kufner S, Byrne RA, Mehilli J, Massberg S, Birkmeier KA, Schulz S, et al. Second-versus first-generation "Limus"-eluting stents in diabetic patients with coronary artery disease: a randomized comparison in setting of ISAR-TEST-4 trial. *Catheter Cardiovasc Interv*. 2013;82(6):E769-76.
 27. Silber S, Serruys PW, Leon MB, Meredith IT, Windecker S, Neumann FJ, et al. Clinical outcome of patients with and without diabetes mellitus after percutaneous coronary intervention with the resolute zotarolimus-eluting stent: 2-year results from the prospectively pooled analysis of the international global RESOLUTE program. *JACC Cardiovasc Interv*. 2013;6(4):357-68.

© 2022 Ibrahim et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/84469>