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Original Research

One-year Outcomes of XIENCE Skypoint 48-mm Drug-Eluting Stents in Long Coronary Lesions: The SPIRIT 48 Trial

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ABSTRACT

Background: Diffuse coronary artery disease may need multiple overlapping stents, associated with less favorable outcomes than those of a single stent. The availability of longer stents can circumvent the need for overlapping stents in long lesions. This prospective, single-arm, SPIRIT 48 trial evaluated the safety and effectiveness of Abbott's next-generation drug-eluting stent, XIENCE Skypoint 48, in patients with coronary artery disease with long de novo native coronary lesions.

Methods: SPIRIT 48 enrolled 107 patients at 25 sites in 3 countries. Patients were required to have 1 target lesion treated with XIENCE Skypoint 48 (lesion length of >32.0 mm and ≤44.0 mm). The primary end point was target lesion failure (TLF; composite of cardiac death, target vessel–related myocardial infarction, or clinically indicated target lesion revascularization) at the 1-year compared with a prespecified performance goal of 20%, established through historical control data. This study recently completed its 1-year follow-up.

Results: XIENCE Skypoint 48 was implanted in 105 patients with a device success rate of 97.2%. SPIRIT 48 met its primary end point, with a TLF rate of 5.7%, and the upper bound of 95% CI at 9.5% (<performance goal of 20%). This was associated with a low rate of 5.8% (6/104 patients) for cardiac death/all myocardial infarction at 1 year. Definite or probable device thrombosis at 1 year occurred in only 1 subject (1.0%).

Conclusions: Primary end point data obtained at the 1-year follow-up from the SPIRIT 48 trial present strong evidence supporting the deliverability, safety, and effectiveness of XIENCE Skypoint 48 mm drug-eluting stent in treating long de novo coronary lesions.

Introduction

Increased rates of cardiac death and target lesion revascularization (TLR) in addition to higher fluoroscopy time are associated with overlapping multiple stent placements when compared with those of single long stent placements.[1] Moreover, the use of multiple overlapping stents can be challenging owing to longer procedure times and the need for higher contrast volumes.[2–4] The availability and use of longer stents can circumvent the need for multiple overlapping stents and facilitate interventional management of patients with long coronary artery lesions.

Advances in coronary drug-eluting stent technology have improved the clinical outcomes associated with the treatment of complex coronary artery lesions, such as long lesions. However, with only one 48-mm length stent currently approved by the US Food and Drug Administration (FDA), there are limited options in the United States for single-stent coverage of long coronary artery lesions. Previous studies have reported that the use of multiple stents can lead to increased procedural time, fluoroscopic time, contrast usage, and cost, affecting negatively both patients and health economics.[2] Räber et al[4] reported that metal stent overlap in certain situations is associated with stent fracture, malposition, restenosis, and delayed vascular healing and increased clinical event rates.

The XIENCE Skypoint Everolimus-Eluting Coronary Stent System (XIENCE Skypoint; Abbott) is a new iteration of the XIENCE family of

Abbreviations: CAD, coronary artery disease; DMR, all death, all MI, all revascularization; FAS, full-analysis set; MI, myocardial infarction; PCI, percutaneous coronary intervention; PG, performance goal; TLF, target lesion failure; TV, target vessel; TVR, target vessel revascularization; ST, stent thrombosis.

Keywords: drug-eluting stents; coronary disease; percutaneous coronary intervention.

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stents, which have been the subject of extensive clinical studies for the treatment of patients with coronary artery disease (CAD) and have shown excellent long-term outcomes.[5] Overall, the safety and effectiveness of the XIENCE family of stents have been well established. The SPIRIT 48 study is a prospective, single-arm, open-label, multicenter global (in and outside of the United States) clinical investigation to evaluate the safety and effectiveness of the 48-mm stent length of the XIENCE Skypoint. The study device is referred to as XIENCE Skypoint 48 investigational device or XIENCE Skypoint 48 IDE (also referred to as Abbott Next-Generation Drug-Eluting Stent 48 mm in the study documentation). XIENCE Skypoint 48 IDE is a balloon-expandable stent made of L-605 cobalt chromium with a poly(n-butyl methacrylate) and copolymer of vinylidene fluoride and hexafluoropropylene/everolimus coating. The objective of the SPIRIT 48 study was to evaluate the safety and effectiveness of XIENCE Skypoint 48 IDE in improving coronary artery luminal diameter in patients with CAD because of de novo native coronary artery long lesions.

Methods

The SPIRIT 48 study was a prospective, single-arm, open-label, multicenter global study that enrolled 107 patients at 25 sites globally, with patients registered in the United States, Taiwan, and Australia. This clinical investigation was conducted in accordance with this Clinical Investigation Plan, the Declaration of Helsinki, applicable Good Clinical Practices and regulations (eg, US 21 CFR Part 50, 21 CFR Part 56, 21 CFR Part 812, and ISO14155:2011) and the appropriate local legislation(s). The conduct of the clinical investigation was approved by the appropriate institutional review board/ethics committee of the respective investigational site and by the applicable regulatory authorities (eg, FDA). The subject registration for this study started on June 17, 2020, and ended on September 17, 2021. The study is registered at www.clinicaltrials.gov as NCT04282148.

The clinical outcomes from the SPIRIT 48 study were compared with a prespecified performance goal (PG) established using historical control data from the SPIRIT PRIME Long Lesion Registry (LLR) (NCT00916370). Patients registered in the study must have experienced exactly 1 single de novo native coronary target lesion eligible to be treated by a single XIENCE Skypoint 48 IDE stent. Planned overlap was not allowed for the treatment of the target lesions. If a bailout stent was necessary for the target lesion, a XIENCE family of stent with an appropriate size (including XIENCE Skypoint 48 IDE) was allowed to be used. A nontarget lesion, if located in a different epicardial coronary vessel than the target lesion, was allowed to be treated by stents other than XIENCE Skypoint 48 IDE per site's standard of care during the index procedure. All patients were required to be treated with only 1 XIENCE Skypoint 48 IDE. A maximum of 40% of patients with 2 treated lesions could be registered in the study. Approximately 50% of the patients were registered at the US sites. Each subject is/will be followed up for a 2-year period, with all patients being scheduled for a hospital or office follow-up visit at 30 days, 6 months, 1 year, and 2 years.

Study design and procedure

Inclusion and exclusion criteria. The SPIRIT 48 trial included patients aged ≥18 years, with evidence of myocardial ischemia (eg, unstable angina, postinfarct angina, stable angina, or silent ischemia) suitable for nonemergent percutaneous coronary intervention (PCI). The angiographic inclusion criterion was a target lesion in the native coronary artery with visually estimated reference vessel diameter of ≥2.5 mm and ≤4.25 mm and estimated lesion length of >32.0 mm and ≤44.0 mm and was able to be covered by a single XIENCE Skypoint 48, with visually estimated diameter stenosis of >50% and <100% with a thrombolysis in myocardial infarction (MI) flow grade of ≥1. Patients with acute MI within 48 hours of the index procedure, left ventricular ejection fraction of <30%, or previous PCI within the target vessel (TV) during the last 12 months were excluded. Complete details on the inclusion and exclusion criteria are provided in Supplemental Appendix A. Predilation was mandatory, and postdilation was strongly encouraged. Patients requiring chronic anticoagulation were excluded from the study.

Study end points. The primary end point of the SPIRIT 48 study was target lesion failure (TLF) defined as a composite of cardiac death, TV–related MI (TV-MI) (MI per Society for Cardiovascular Angiography & Interventions [SCAI] definition),[6] and clinically indicated TLR at 1 year. A diagnosis of periprocedural MI based on SCAI definition[6] involved creatine kinase myoglobin band values of 10 times above the upper reference limit (URL) or creatine kinase myoglobin band values 5 times above the URL plus new pathologic Q-waves in ≥2 contiguous leads, new persistent non–rate-related left bundle branch block or cardiac troponin values of ≥70 times the URL or ≥35 times the URL with new pathologic Q-waves in ≥2 contiguous leads, or new persistent left bundle branch block.

Secondary end points included TLF in hospital, at 30 days, and 180 days and were descriptive without a prespecified statistical assumption. Additional end points included acute success (device and procedural success) and clinical end points, such as composite all death, all MI, and all revascularization (DMR) and cardiac death/MI at 1 year. Individual end points included any death considering cardiac, vascular, and non-cardiovascular related; all MI (Q-wave MI and non–Q-wave MI) and TV-MI; any revascularization, such as all target vessel revascularization (TVR), TLR, and non-TVR; and stent thrombosis (ST; per the Academic Research Consortium [ARC] definition: definite, probable, or possible) and timing (acute [≤1 day], subacute [>1 day to ≤30 days], late [>30 days to ≤365 days], and very late [>365 days]).

Device/procedural success. Device success was defined as the achievement of a final in-stent residual diameter stenosis of <50% (by quantitative coronary angiography), using only study device(s) without device malfunction. Procedural success was the achievement of final in-stent residual diameter stenosis of <50% (by quantitative coronary angiography) using the assigned device and with any adjunctive device, without the occurrence of cardiac death, TV-MI (per ARC 2 definition), or repeat coronary revascularization of the target lesion during the hospital stay (≤7 days if a subject was still in the hospital). All procedural angiograms were evaluated using an independent core angiographic laboratory (Beth Israel Deaconess Medical Center), and reported lesion characteristics were based on core laboratory assessment.

Statistical methods

The full-analysis set (FAS) population is the analysis set that included all registered patients in whom XIENCE Skypoint 48 IDE had been successfully delivered to the treatment site and deployed. A registered subject without a successful delivery of the XIENCE Skypoint 48 IDE stent was retained as registered but not included in the FAS. The per-protocol (PP) population is defined as the patients in the FAS who did not have any major protocol deviations (Supplementary Appendix A).

The primary analysis of the primary end point is based on the FAS. All other descriptive analyses on the baseline characteristics and clinical end points were performed on both FAS and PP groups, except for that of the acute success end point, being analyzed based on all registered populations with attempted study device implantation.

The primary end point for this study was TLF at a 1-year follow-up. The Com-Nougue method[7] was used to test the null hypothesis at 1-sided 5% significance level to evaluate this hypothesis for the FAS population. A P value of <.05 was considered significant. The

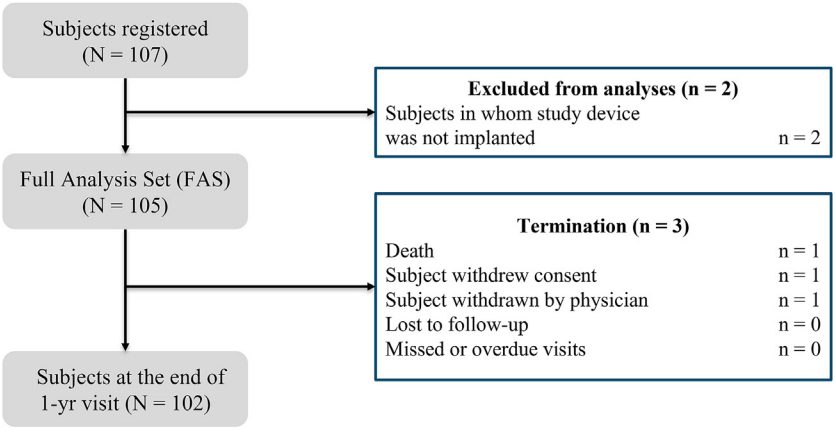


Figure 1.
SPIRIT 48 study enrollment and follow-up. FAS, full-analysis set.

Com-Nougue survival method, using the Kaplan-Meier estimate and Greenwood variance, was used to construct the 1-sided 95% confidence limit to compare against the PG for the primary end point evaluated at 1 year. This time-to-event analysis method was used to consider early termination and censoring of the COVID-confounded follow-up information.

TLF was compared with a prespecified PG of 20%, which was based on comparable patients assessed as part of the SPIRIT PRIME LLR (internal Abbott data) that assessed patients with 33.0-mm and 38.0-mm XIENCE stents. The observed 1-year TLF rates were 7.7% and 12.5% per the WHO MI definition and the protocol ARC definition, respectively. A 0.4% TLF rate increase for every 1.0-mm lesion length was estimated. Given the lesion length difference between the stents of 33.0 or 38.0 mm and the stents of 48.0 mm, the adjusted 1-year TLF rate in SPIRIT 48 was estimated to be 10%. The PGs for SPIRIT PRIME LLR were 19.2% and 26% per WHO MI and ARC MI definition, respectively. Given the estimated true rate of 10% for SPIRIT 48, the PG for SPIRIT 48 was set at 20%. A sample size of 107 was calculated to have ~93% statistical power through simulation. To avoid undue influence from a single study site, any single site was allowed to register $\leq$20% of the total patients. Secondary end points were summarized descriptively with counts, percentages, and exact 95% Clopper-Pearson CIs. The secondary end point was evaluated according to the specified denominator rule: for in-hospital and 30-day follow-up, the total number of subjects in the analysis population was used. For the 180-day follow-up (visit window 180 $\pm$ 14 days) and beyond, subjects who were terminated before the early visit window (eg, day 166) without experiencing any DMR events (all death, all MI regardless of MI definition, and all revascularization) were excluded from the denominator. Subgroup analyses were performed to examine the consistency of the primary end point across age (<65 years vs $\geq$65 years), sex (female vs male), and race (White vs non-White). In addition to the aforementioned prespecified analyses, an analysis to compare patients with or without diabetes was conducted.

Results

The SPIRIT 48 study enrolled 107 patients at 25 sites (Figure 1). Of the 107 registered subjects, the study device was successfully implanted in 105 subjects. In the remaining 2 subjects, the study device could not be advanced and deployed at the lesion. Although these 2 subjects were retained as registered, they were excluded from the FAS and any end point analyses. Hence, the FAS population comprised 105 subjects. After excluding those patients with major protocol deviations, the primary end point was assessed in 86 patients, which encompassed the PP population. Most of the protocol deviations, 12 deviations, were because of cardiac biomarkers being outside the study protocol.

Clinical and lesions characteristics

Baseline clinical characteristics are listed in Table 1. Patients had a mean age of 67.3 years (range, 35-91 years), and 72.4% were male patients, with 72.4% with stable angina and 15.2% unstable angina. Furthermore, 91.4% of patients received a P2Y12 inhibitor, of which 69.5% received clopidogrel, 19% ticagrelor, and 2.9% prasugrel. After the index procedure, 100% of the patients were on a P2Y12 inhibitor and 95.2% of the patients were on aspirin. Approximately 97.1% of patients were on dual antiplatelet therapy at discharge, 99% at 1 month, 98.1% at 6 months, and 84.8% at 1 year. Of the 105 patients, 132 lesions were treated (105 target lesions, 27 nontarget lesions).

Table 1. Baseline clinical characteristics

Patient characteristics	N = 105
Age, y	67.3 $\pm$ 10.8 (105/105)
Female sex	27.6 (29/105)
Not Hispanic or Latino	97.1 (102/105)
Body mass index, kg/m^2	28.97 $\pm$ 6.88
Medical history	
Current/former smoker	53.3 (56/105)
Diabetes	34.3 (36/105)
Hyperlipidemia	88.6 (93/105)
Hypertension	82.9 (87/105)
Cardiac history	
Previous myocardial infarction	14.6 (15/105)
Coronary artery disease	66.0 (68/105)
Previous coronary intervention	41.7 (43/103)
Lipid-lowering agents	81.9 (86/105)
β-Blockers	57.1 (60/105)

Values are mean $\pm$ SD or % (n/N).

Table 2. Baseline target lesion and procedural characteristics (adjudicated by the angiographic core laboratory)

	Values
Target lesion characteristics, N = 105	
Radial access	68.6 (72/105)
Target vessels treated	
LAD	51.4 (54/105)
Circumflex/ramus	8.6 (9/105)
RCA	40.0 (42/105)
Mean number of total stents per target lesion	1.1
Patients with >1 stent[a]	12.4 (13/105)
Lesion length, mm	35.19 ± 8.03 (105/105)
Reference vessel diameter, mm	2.75 ± 0.46 (105)
Average stent diameter, mm	3.05 ± 0.48
Total study device length, mm	50.3 ± 7.1
Minimum lumen diameter, mm	1.03 ± 0.44 (105)
%diameter stenosis	62.85 ± 13.06 (105)
Pre-TIMI flow grade 3	94.3 (99/105)
Modified AHA/ACC B2/C	99.0 (104/105)
Calcification, moderate/severe	47.1 (49/104)
Procedural characteristics: 105 target lesions and 132 lesions treated	
Device success	97.2 (103/106) (91.95-99.41)
Procedural success	
ARC-2	93.4 (99/106) (86.87-97.30)
SCAI	94.3 (100/106) (88.09-97.89)
Total stent length implanted, mm	50.3 ± 7.1 (105)
Mean number of lesions treated (target and nontarget)	1.3 (132)
Predilation	94.7, (125/132)
Postdilation	93.9, (124/132)
Postprocedural characteristics	
Reference vessel diameter, mm	2.77 ± 0.44 (104)
Minimum lumen diameter, mm	
In-stent	2.4 ± 0.41 (104)
In-segment	2.20 ± 0.45 (104)
Acute gain, mm	
In-stent	1.4 ± 0.45 (104)
In-segment	1.17 ± 0.43 (104)
%Diameter stenosis	
In-stent	11.96 ± 7.63 (104)
In-segment	20.92 ± 8.89 (104)

Values are mean ± SD or % (n/N).
ACC, American College of Cardiology; AHA, American Heart Association; ARC, Academic Research Consortium; LAD, left anterior descending artery; RCA, right coronary artery; SCAI, Society for Cardiovascular Angiography & Interventions; TIMI, Thrombolysis in Myocardial Infarction.
[a] Thirteen patients had unplanned bailout used owing to longer lesions and/or geographic misses (1 with XIENCE Skypoint 48 IDE used for bailout, 11 with XIENCE Sierra used for bailout, and 1 with XIENCE Skypoint). Overall, 106 XIENCE Skypoint 48 IDE devices were implanted in 105 target lesions (105 patients).

Target lesion angiographic features and procedural characteristics are noted in Table 2. The left anterior descending artery was the TV in 51.4% of the patients, with a mean stent diameter of 3.05 ± 0.48 mm, and the total study device length at the target lesion was 50.3 ± 7.1 mm. Moderate or severe calcification was found in 47.1% of the patients. The angiographic core laboratory–adjudicated mean target lesion length was 35.19 ± 8.03 mm, with 12 patients having a target lesion length of ≥44.0 mm. The mean postprocedural in-device percentage of diameter stenosis was 11.96% ± 7.63%, and the in-device mean minimum lumen diameter was 2.44 ± 0.41 mm.

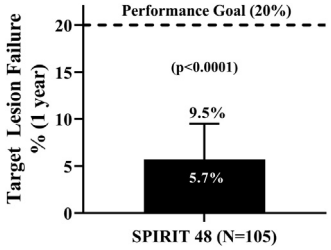


Figure 2.
Primary end point of target lesion failure (TLF) at 1 year. The *P* value was calculated from the Z test using Kaplan-Meier survival estimate together with the Greenwood method estimated variance, against the prespecified performance goal of 20% at 1-sided significance level of 5%.

Device/procedural success

Acute success included device and procedure success and was analyzed in all registered patients (N = 107) in whom XIENCE Skypoint 48 IDE implantation was attempted. For 1 subject, the angiographic core laboratory was not able to determine the in-stent residual diameter stenosis, and hence, this subject was excluded from analysis, leading to complete data in 106 patients.

Device success in the SPIRIT 48 trial was 97.2%, (95% CI, 91.95-99.41; 103/106). The 3 cases of failure included 2 patients with the inability to deliver and deploy the study device, and 1 additional subject with failure to advance the device past the lesion, which required a second device to be implanted. Procedure success in the SPIRIT 48 trial was 93.4% (95% CI, 86.87-97.30), with 99/106 patients having TV-MI per ARC 2 definition during their hospital stay. In addition, SPIRIT 48 achieved a procedural success rate of 94.3% (100/106) when TV-MI was defined per SCAI definition.

Clinical outcomes

The primary end point of TLF at 1 year in the FAS with Kaplan-Meier estimate of the TLF rate was 5.7% (95% CI upper bound of 9.5%), which was significantly lower than the PG of 20% (*P* <.0001) (Figure 2). In addition, in the PP population, the Kaplan-Meier estimate of the TLF rate was 7%, with 95% CI upper bound of 11.5%, significantly lower than the PG of 20%. These findings are consistent with the primary end point data obtained in the FAS population. In SPIRIT 48, 6 primary end point events were observed, most of which were TV-MI in the first 48 hours after the index procedure, termed as periprocedural myocardial infarction (PPMI). Furthermore, TLF results were consistent in all prespecified subgroup analyses (Supplemental Figures S1-S4). Secondary clinical outcomes at 1 year for FAS are presented in Table 3. Secondary end points of TLF in hospital, at 30 days, and at 180 days for FAS and

Table 3. Secondary clinical end points through 1 year

Events	In hospital	0-30 d	0-180 d	0-365 d
Cardiac death	0 (0/105) (0.00-3.45)	0 (0/105) (0.00-3.45)	0 (0/104) (0.00-3.48)	1 (1/104) (0.02-5.24)
All target vessel revascularization (including TLR)	0 (0/105) (0.00-3.45)	1 (1/105) (0.02-5.19)	1 (1/104) (0.02-5.24)	1 (1/104) (0.02-5.24)
All TLR	0 (0/105) (0.00-3.45)	1 (1/105) (0.02-5.19)	1 (1/104) (0.02-5.24)	1 (1/104) (0.02-5.24)
Target lesion failure (SCAI definition)	3.8 (4/105) (1.05-9.47)	4.8 (5/105) (1.56-10.76)	4.8 (5/104) (1.58-10.86)	5.8 (6/104) (2.15-12.13)

Values are mean ± SD or % (n).
In-hospital defined as hospitalization ≤7 d post-index procedure.
SCAI, Society for Cardiovascular Angiography & Interventions; TLR, target lesion revascularization.

Table 4. Composite clinical end points at 1 year

Clinical end point (FAS)	SCAI definition	ARC 2 definition	Fourth universal definition
DMR	5.8 (6/104) (2.15-12.13)	6.7 (7/104) (2.75-13.38)	6.7 (7/104) (2.75-13.38)
Composite rate of cardiac death and all MI	5.8 (6/104) (2.15-12.13)	6.7 (7/104) (2.75-13.38)	6.7 (7/104) (2.75-13.38)

Values are mean ± SD or % (n).
Stent thrombosis (ST): 1 event of definite acute/subacute ST observed in SPIRIT 48 occurred 10 days after the index procedure. In the FAS, the definite acute/subacute ST was 1.0% (1/105), and the 1-year cumulative rate for definite ST was 1.0% (1/104). In the PP, the definite acute/subacute ST was 1.2% (1/86), and the 1-year cumulative rate for definite ST was 1.2% (1/85).
DMR, composite of all death, all MI, and all revascularization; FAS, full-analysis set; PP, per-protocol.

PP by SCAI, ARC 2, and Fourth Universal definitions are noted in Supplemental Table S1.

The event rates for clinical end points, those for composites (DMR and cardiac death/MI) and ST, are summarized in Table 4. The rates of ST were also exceedingly low with 1-year rates of definite acute/subacute ST in either the FAS or PP of <2%. The 1 event of definite acute/subacute ST observed in SPIRIT 48 occurred 10 days after the index procedure when a patient developed MI that was treated with revascularization and medication, such as the modification of the antiplatelet regiment from aspirin/clopidogrel to aspirin/prasugrel after the MI. This event was adjudicated as a definite ST and possibly related to the study device.

Discussion

SPIRIT 48 was a prospective, single-arm, open-label, multicenter global study, which met the prespecified primary end point of the 1-year composite outcome of TLF in patients with diffuse coronary lesions (Central Illustration). Diffuse CAD presents both clinical and technical challenges because overlapping stents are often needed, which increases the risk of restenosis, and delivery of stents can be challenging. Reducing the number of stents needed to treat diffuse disease can reduce the risk of restenosis and lead to more adequate lesion coverage. Streamlining PCI with delivery of longer-length stents may also facilitate patient workflow, reduce fluoroscopy time and contrast exposure, and shorten procedure times.

The rates of device and procedural success were high with low rates of adverse cardiac events and ST. The results are comparable with those of previous iterations of XIENCE everolimus-eluting stent (EES). An analysis published by Gautier et al[8] in 2022 assessed the safety and efficacy of the 48.0-mm XIENCE Xpedition EES in an all-comer population, with the following results: TLF occurred (5.3%), mainly driven by TLR (4.1%); 2 cardiac deaths were noted (0.7%); patient-oriented composite end point occurred in 30 patients (11.6%) mainly driven by repeat revascularization (9.7%); and definite ST was observed in 2 patients (0.7%). These results are comparable with the data from this study and consistent with other multiple studies as well. Similarly, Hsiao et al[9] in 2022 published data from 2 sites in Taiwan, assessing 213 patients receiving 48.0-mm XIENCE Expedition EES and noting a procedural success rate of 98.6%, (TVF) rate at 1 year of 4.2%, and cardiac death in 3 patients. The rates of TV-MI, TVR, and definite/probable ST were 1.4%, 3.3%, and 0.9%, respectively, again comparable with the findings of this study.

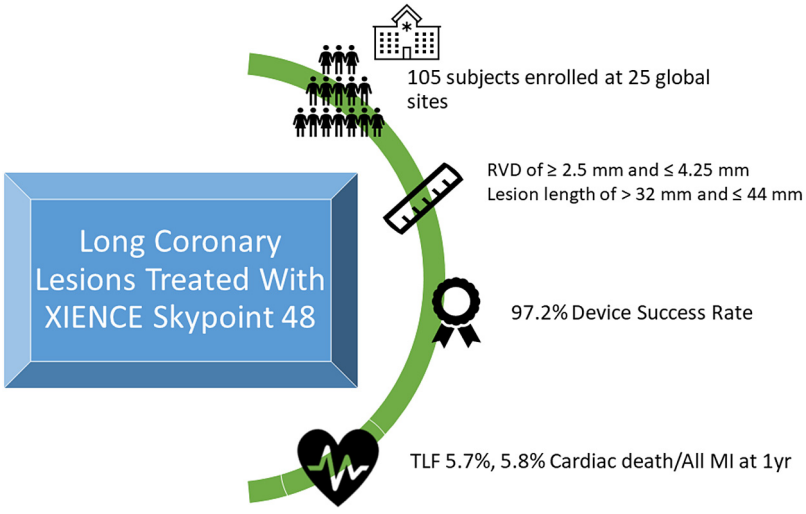
The data obtained in this SPIRIT 48 trial are also comparable with those reported recently by Karmpaliotis et al[10] in EVOLVE 48 that tested the 48.0-mm SYNERGY stent use in long coronary lesions. The patient's demographic characteristics and lesion characteristics were comparable between the 2 studies, with EVOLVE noting a TLF rate of 4.1% at 2 years. Although EVOLVE 48 presented its 2-year follow-up data but SPIRIT 48 only its 1-year follow-up data, it is notable that, similar to EVOLVE 48, low rates of TV-MI, cardiac death, and revascularization were noted.

The evaluation of PPMI has been controversial because of a lack of consensus on its definition. Similar to previous studies,[11] all 3 definitions for PPMI were used in the ongoing SPIRIT 48 study: SCAI, ARC-2 definition, and Fourth Universal definition. For the primary end point analysis, PPMI defined per SCAI was used, whereas a secondary analysis was performed using both ARC-2 and Fourth Universal definitions on all end points with MI. Consistent with the current literature, in SPIRIT 48, different event rates were identified using the 3 definitions.

This study builds on the proven clinical success of the previous generations of XIENCE stent platforms, translating this EES technology into a longer-length option for the treatment of de novo diffuse CAD. The availability of this platform length provides an alternative to the treatment of diffuse disease where other long-length stent options are limited.

Study limitations

The results presented in this study represent data obtained from a nonrandomized single-arm trial without a comparator group in a select



Central Illustration.
A summary of key findings from SPIRIT 48. MI, myocardial infarction; RVD, reference vessel diameter; TLF, target lesion failure.

population of patients with diffuse CAD within a relatively narrow window of lesion length range. The use of an additional overlapping stent was allowed only as a bailout, thus results may only be extrapolated to the 48.0-mm use in lesions that are excessively diffuse and require a stent of >50.0 mm. ST overall is a rare event, and thus, limited sample size may preclude the capture of such rare events. Significant calcified lesions that required calcium modification and bifurcation lesions were not included, which may limit generalizability to a growing subset of patients with complex disease. The use of physiology and intracoronary imaging was not mandated as part of the study.

Conclusions

The SPIRIT 48 study demonstrated the efficacy and safety of XIENCE Skypoint 48.0-mm EES for the treatment of diffuse coronary lesions with few adverse events and successfully meeting prespecified PGs at 1 year. These data support the excellent clinical and lesion outcomes of the XIENCE Skypoint 48.0-mm EES when used to treat lengthy coronary lesions.

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Declaration of competing interests

Ki Park, Chi-Jen Chang, Shih-Wa Ying, Tiessa Simoes, and Sandeep Pingle report association with Abbott. Aziz Maksoud reports association with Abbott, Pfizer, and Bristol-Myers Squibb. Chiung-Jen Wu, Bassem Chehab, and Barry Bertolet reported no financial interests.

Funding sources

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Ethics statement and patient consent

The conduct of the clinical investigation was approved by the appropriate institutional review boards/ethics committees of the respective investigational site and by the applicable regulatory authorities (eg, FDA), and appropriate patient consent was obtained per regulatory guidelines.

Supplementary material

To access the supplementary material accompanying this article, visit the online version of the *Journal of the Society for Cardiovascular Angiography & Interventions* at 10.1016/j.jscai.2023.101001.

References

1. Şaylık F, Çınar T, Selçuk M, Çiçek V, Hayıroğlu MI, Orhan AL. Comparison of outcomes between single long stent and overlapping stents: a meta-analysis of the literature. *Herz*. Published online January 11, 2023. https://doi.org/10.1007/s00059-022-05152-4
2. Hoffmann R, Herrmann G, Silber S, et al. Randomized comparison of success and adverse event rates and cost effectiveness of one long versus two short stents for treatment of long coronary narrowings. *Am J Cardiol*. 2002;90(5):460–464.
3. Jurado-Román A, Abellán-Huerta J, Requena JA, et al. Comparison of clinical outcomes between very long stents and overlapping stents for the treatment of diffuse coronary disease in real clinical practice. *Cardiovasc Revasc Med*. 2019;20(8):681–686.
4. Räber L, Jüni P, Löffel L, et al. Impact of stent overlap on angiographic and long-term clinical outcome in patients undergoing drug-eluting stent implantation. *J Am Coll Cardiol*. 2010;55(12):1178–1188.
5. Kufner S, Joner M, Thannheimer A, et al. Ten-year clinical outcomes from a trial of three limus-eluting stents with different polymer coatings in patients with coronary artery disease. *Circulation*. 2019;139(3):325–333.
6. Moussa ID, Klein LW, Shah B, et al. Consideration of a new definition of clinically relevant myocardial infarction after coronary revascularization: an expert consensus document from the Society for Cardiovascular Angiography and Interventions (SCAI). *J Am Coll Cardiol*. 2013;62(17):1563–1570.
7. Com-Nougue C, Rodary C, Patte C. How to establish equivalence when data are censored: a randomized trial of treatments for B non-Hodgkin lymphoma. *Stat Med*. 1993;12(14):1353–1364.
8. Gautier A, Hovasse T, Arroyo D, et al. Safety and efficacy of 48 mm Xience Xpedition everolimus-eluting stent for the treatment of long coronary lesions. *Catheter Cardiovasc Interv*. 2022;100(2):179–187.
9. Hsiao FC, Tsai CT, Hsu LA, et al. Procedural and one-year clinical outcomes of long 48 mm Xience Xpedition everolimus-Eluting Stent in complex long diffuse coronary artery lesions. *J Invasive Cardiol*. 2022;34(2):E80–E86.
10. Karmpaliotis D, Stoler R, Walsh S, et al. Safety and efficacy of everolimus-eluting bioabsorbable polymer-coated stent in patients with long coronary lesions: the EVOLVE 48 study. *Catheter Cardiovasc Interv*. 2022;99(2):373–380.
11. Toth GG, Wijns W. Endpoint definitions in clinical trials: consensuses, a synonym for dissensuses? *J Am Coll Cardiol Intv*. 2019;12(9):885–889.