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Everolimus-Eluting Bioresorbable Scaffolds Versus Everolimus-Eluting Metallic Stents

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ABSTRACT

BACKGROUND Recent evidence suggests that bioresorbable vascular scaffolds (BVS) are associated with an excess of thrombotic complications compared with metallic everolimus-eluting stents (EES).

OBJECTIVES This study sought to investigate the comparative effectiveness of the Food and Drug Administration–approved BVS versus metallic EES in patients undergoing percutaneous coronary intervention at longest available follow-up.

METHODS The authors searched MEDLINE, Scopus, and web sources for randomized trials comparing BVS and EES. The primary efficacy and safety endpoints were target lesion failure and definite or probable stent thrombosis, respectively.

RESULTS Seven trials were included: in sum, 5,583 patients were randomized to receive either the study BVS (n = 3,261) or the EES (n = 2,322). Median time of follow-up was 2 years (range 2 to 3 years). Compared with metallic EES, risk of target lesion failure (9.6% vs. 7.2%; absolute risk difference: +2.4%; risk ratio: 1.32; 95% confidence interval: 1.10 to 1.59; number needed to harm: 41; p = 0.003; I^2 = 0%) and stent thrombosis (2.4% vs. 0.7%; absolute risk difference: +1.7%; risk ratio: 3.15; 95% confidence interval: 1.87 to 5.30; number needed to harm: 60; p < 0.0001; I^2 = 0%) were both significantly higher with BVS. There were no significant differences in all-cause or cardiovascular mortality between groups. The increased risk for ST associated with BVS was concordant across the early (<30 days), late (30 days to 1 year), and very late (>1 year) periods ($p_{interaction}$ = 0.49).

CONCLUSIONS Compared with metallic EES, the BVS appears to be associated with both lower efficacy and higher thrombotic risk over time. (Bioresorbable vascular scaffold compare to everolimus stents in long term follow up; CRD42017059993). (J Am Coll Cardiol 2017;69:3055–66) © 2017 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

ARD = absolute risk difference

BVS = bioresorbable vascular scaffold(s)

EES = everolimus-eluting stent(s)

FDA = Food and Drug Administration

ID-TLR = ischemia-driven target lesion revascularization

MI = myocardial infarction

NNH = number needed to harm

PCI = percutaneous coronary intervention

RCT = randomized controlled trial

RR = risk ratio

ST = stent thrombosis

TLF = target lesion failure

Bioresorbable vascular scaffolds (BVS) have emerged as a new technology in the field of percutaneous coronary intervention (PCI) (1). The pathobiological rationale that led to the creation of BVS developed from the concept of providing transient mechanical support and drug delivery early after PCI (within 6 to 12 months), followed by progressive bioresorption of the scaffold from the coronary artery (2). The potential advantages of the progressive dissolution of the scaffold (initially anticipated to be measured in months) include the ultimate return of cyclic pulsatility and vasoregulation of the native coronary artery, as well as the possibility of surgical coronary bypass of the target lesion. Therefore, the anticipated benefits of BVS versus conventional metallic drug-eluting stents were expected to emerge in the later period, after dissolution of the implanted scaffold. However, recent reports indicated that delays in reabsorption process of up to 3 years are associated with scaffold discontinuity and ensuing malapposition, restenosis, or thrombosis (3,4).

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Regulatory approval of the first BVS, the Absorb BVS (Abbott Vascular, Santa Clara, California), was achieved on the basis of noninferiority in terms of target lesion failure (TLF) at 1 year versus the comparator metallic, everolimus-eluting stent (EES), which was demonstrated in prior trials to be associated with low rates of stent thrombosis (ST) compared with first-generation drug-eluting stents (5). Recently, the 2-year follow-up of the ABSORB III (A Clinical Evaluation of Absorb™ BVS, the Everolimus Eluting Bioresorbable Vascular Scaffold in the Treatment of Subjects With de Novo Native Coronary Artery Lesions) trial demonstrated that BVS are associated with significantly higher rates of TLF and a nonsignificant greater absolute risk of ST compared with EES (6). In addition, BVS were associated with increased risk of thrombosis compared with metallic EES in the European AIDA (Amsterdam Investigator-initiateD Absorb Strategy All-comers) trial (7), leading to early study termination due to safety concerns.

On the basis of the 2-year data from the ABSORB III trial, the Food and Drug Administration (FDA) released a safety alert on the performances of BVS and recommended adherence to dual antiplatelet therapy to prevent major adverse cardiac events while further investigations are ongoing (8). The individual randomized controlled trials (RCTs) investigating BVS thus far have been underpowered to detect statistical differences in hard clinical endpoints, as most were powered only for angiographic outcomes and composite endpoints. Giving the overall clinical context, we have undertaken a systematic review and meta-analysis of the available evidence on BVS using the longest available follow-up to better characterize the performance of the currently FDA-approved BVS in comparison with metallic EES in patients undergoing PCI.

METHODS

STUDY DESIGN. In accordance with the PRISMA guidelines (9), we searched MEDLINE, Scopus, and oral presentations from the latest international conferences for papers published or posted until March 18, 2017 (Online Table 1). The following key words were used for the search: *bioresorbable vascular scaffold*, *bioresorbable stent*, *BVS*, *everolimus-eluting stent(s)*, and *randomized trial*. To avoid the effect of selection and confounding bias on treatment effect estimates, only RCTs comparing the FDA-approved BVS versus metallic EES were included. Full-length papers and meeting presentations were both included in the analysis. Main exclusion criteria were observational study design (including single-arm pilot studies), non-English-language studies, editorials, letters, expert opinions, case reports or series, studies with duplicated data, and studies using metallic stents with bioresorbable polymer coatings. Two authors (S.S. and M.F.) independently evaluated studies for eligibility, and discrepancies were resolved by a third reviewer (G.G.). Studies that met the inclusion criteria were selected for the analysis.

Pre-specified data elements were extracted from each trial and included in a structured dataset; these elements included baseline population and procedural characteristics and clinical outcome at longest available follow up. The primary efficacy outcome was TLF (device-oriented composite endpoint) including cardiac death, target vessel myocardial infarction (MI), or ischemia-driven target lesion revascularization (ID-TLR). The primary safety endpoint was definite or probable ST or scaffold thrombosis according to the Academic Research Consortium criteria (10). Secondary efficacy endpoints were ID-TLR, any MI, and target vessel MI. Secondary safety endpoints were all-cause mortality, cardiovascular mortality, and a patient-oriented composite endpoint, including all-cause mortality, any MI, or any revascularization.

Risk for bias for each trial for both primary endpoints was evaluated using the Cochrane tool, as described by Higgins et al. (11). The following