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CLINICAL RESEARCH

CORONARY

Stent Thrombosis With Drug-Eluting Stents and Bioresorbable Scaffolds

Evidence From a Network Meta-Analysis of 147 Trials

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ABSTRACT

OBJECTIVES This study sought to perform a systematic review and network meta-analysis to compare the relative safety and efficacy of contemporary DES and BVS.

BACKGROUND To improve outcomes of patients undergoing percutaneous coronary revascularization, there have been advances in the design of drug-eluting stents (DES), including the development of drug-eluting bioresorbable vascular scaffolds (BVS).

METHODS Prospective, randomized, controlled trials comparing bare-metal stents (BMS), paclitaxel-eluting stents (PES), sirolimus-eluting stents (SES), Endeavor zotarolimus-eluting stents (E-ZES), cobalt-chromium (CoCr) everolimus-eluting stents (EES), platinum-chromium (PtCr)-EES, biodegradable polymer (BP)-EES, Resolute zotarolimus-eluting stents (R-ZES), BP biolimus-eluting stents (BP-BES), hybrid sirolimus-eluting stents (H [Orsiro]-SES), polymer-free sirolimus- and probucol-eluting stents, or BVS were searched in online databases. The primary endpoint was definite or probable stent thrombosis at 1 year.

RESULTS A total of 147 trials including 126,526 patients were analyzed in this study. All contemporary DES were superior to BMS and PES in terms of definite or probable stent thrombosis at 1 year. CoCr-EES, PtCr-EES, and H-SES were associated with significantly lower risk than BVS. CoCr-EES and H-SES were superior to SES and BP-BES. The risk of myocardial infarction was significantly lower with H-SES than with BVS. There were no significant differences regarding all-cause or cardiac mortality. Contemporary devices including BVS showed comparably low risks of repeat revascularization.

CONCLUSIONS Contemporary DES, including biocompatible DP-DES, BP-DES, and polymer-free DES, showed a low risk of definite or probable stent thrombosis at 1 year. BVS had an increased risk of device thrombosis compared with CoCr-EES, PtCr-EES, and H-SES. Data from extended follow-up are warranted to confirm the long-term safety of contemporary coronary devices. (J Am Coll Cardiol Intv 2016;9:1203–12) © 2016 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

BMS = bare-metal stent(s)

BP-BES = biodegradable polymer biolimus A9-eluting stent(s)

BP-EES = biodegradable polymer everolimus-eluting stent(s)

BVS = bioresorbable vascular scaffolds

CoCr-EES = cobalt-chromium everolimus-eluting stent(s)

CrI = credible interval

DES = drug-eluting stent(s)

DP = durable polymer

Dual DES = polymer-free sirolimus- and probucol-eluting stent(s)

E-ZES = endeavor zotarolimus-eluting stent(s)

H-SES = hybrid sirolimus-eluting stent(s)

MI = myocardial infarction

PES = paclitaxel-eluting stent(s)

PtCr-EES = platinum-chromium everolimus-eluting stent(s)

R-ZES = Resolute zotarolimus-eluting stent(s)

SES = sirolimus-eluting stent(s)

ST = stent thrombosis

Drug-eluting stents (DES) have become an essential component in the treatment of coronary artery disease (1,2). The main advantage of DES is the reduction of repeat revascularization compared with bare-metal stents (BMS). However, concerns about the long-term safety of earlier generation DES have provoked recent advances in DES (3). Thin-strutted devices have replaced previous thick-strutted ones. Because studies suggested that polymer may trigger local inflammation and, subsequently, late stent thrombosis, there has been diversification in polymer choice and coating technology, including durable but biocompatible polymers, biodegradable polymers (BP), and even polymer-free devices (4). The latest development was the introduction of bioresorbable vascular scaffolds (BVS), which provide transient mechanical support and antirestenotic drug delivery followed by complete resorption for years (5–7).

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Previous network meta-analyses showed that BP-DES and BMS were not necessarily safer than biocompatible durable polymer (DP)-DES (8–10). After publication of those studies, a growing amount of clinical experience and research have led to a better understanding of the advantages and disadvantages of diverse devices. First, clinical data regarding second-generation DES with biocompatible permanent polymers have accumulated. Second, DES with novel designs have been introduced, such as BP-DES with better profiles, polymer-free DES, and everolimus-eluting BVS. In particular, the use of BVS has steeply increased with the expectations of its safety (11,12). However, data regarding BVS are still limited. Recent studies have shown that BVS is as efficacious as cobalt-chromium everolimus-eluting stents (CoCr-EES) in terms of repeat revascularization, but safety concerns have been raised as well (11–14).

In this study, we compared the safety of various contemporary DES including BVS in terms of the risk of stent thrombosis (ST) or device thrombosis. Due to the low incidence rates of ST, a very large sample size was required to detect differences in a single trial setting. A network meta-analysis has the advantage of providing comprehensive information by combining data from a complex network of multiple trials. For this purpose, we performed a systematic literature review of randomized controlled trials and updated a multiple-treatment network meta-analysis using a Bayesian framework.

METHODS

ELIGIBILITY CRITERIA. Randomized controlled trials comparing 2 or more coronary stents or scaffolds in patients undergoing percutaneous coronary intervention were analyzed. In this study, we focused on stents of interest as follows: (1) BMS; (2) paclitaxel-eluting stents (PES) (Boston Scientific, Natick, Massachusetts); (3) sirolimus-eluting stents (SES) (Cordis, Warren, New Jersey); (4) Endeavor zotarolimus-eluting stents (E-ZES) (Medtronic, Santa Rosa, California); (5) CoCr-EES (Abbott Vascular, Santa Clara, California and Boston Scientific); (6) platinum-chromium everolimus-eluting stents (PtCr-EES) (Boston Scientific); (7) BP-EES (Boston Scientific); (8) Resolute zotarolimus-eluting stents (R-ZES) (Medtronic); (9) BP biolimus A9-eluting stents (BP-BES) (Biosensors, Newport Beach, California and Terumo, Tokyo, Japan); (10) hybrid SES (H-SES) (Orsiro model; Biotronik, Newport Beach, California); (11) polymer-free sirolimus- and probucol-eluting stents (dual DES; B. Braun, Newport Beach, California); and (12) BVS (Abbott Vascular). Some of the currently available devices such as the polymer-free biolimus A9-coated stent (BioFreedom, Biosensors) and DESolve bioresorbable coronary scaffold (Elixir Medical, Sunnyvale, California), which have been approved by major regulatory authorities, were not included in this study, because they had limited comparisons with other devices (15,16). Exclusion criteria included studies comparing 2 stents with different stent designs within the same category described here, studies in which the specific type of DES was not predefined and the choice among available DES was left to the investigators' discretion (e.g., BMS vs. any DES), and studies published in a language other than English. No restrictions were imposed on study period, sample size, publication status, or patient or lesion criteria.

DATA SOURCES AND SEARCHES. An electronic search was performed in PubMed, Embase, Cochrane Central Register of Controlled Trials, and relevant Websites (www.crtonline.org; www.clinicaltrialresults.com; www.tctmd.com; www.cardiosource.com; and www.pcronline.com) from the inception of each database to December 2015 (search terms are described in Online Table 1). A manual review of reference lists of included articles complemented the search. References of recent reviews, editorials, and meta-analyses were also examined. Two investigators (S.H.K. and D.Y.K.) screened titles and abstracts, identified