Influence of Stent Length to Lesion Length Ratio on Angiographic and Clinical Outcomes After Implantation of Bare Metal and Drug-Eluting Stents (the TAXUS-IV Study)

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Longer bare metal stent lengths have been associated with greater restenosis. However, the effect of the ratio of stent length to lesion length on clinical and angiographic restenosis after implantation of bare metal and drug-eluting stents has not been clearly defined. Patients in the TAXUS-IV study who underwent single-study stent placement were categorized into tertiles based on ratios of stent length to lesion length. Clinical results at 1 year and angiographic outcomes at 9 months were compared across the 3 groups. The median ratios of stent length to lesion length were 1.20, 1.58, and 2.27 in the 3 tertiles. Analysis segment restenosis rates at 9 months were similar across the 3 tertiles with bare metal stents (24.7% vs 26.7% vs 23.8%, respectively, p = 0.90 for trend) and paclitaxel-eluting stents (11.7% vs 6.5% vs 5.4%, respectively, p = 0.24). Similarly, there were no differences in 1-year rates of target lesion revascularization across the 3 tertiles for bare metal stents (14.6% vs 14.8% vs 13.7%, respectively, p = 0.91) or paclitaxel-eluting stents (6.1% vs 3.6% vs 4.0%, respectively, p = 0.38). By multivariate analysis, the ratio of stent length to lesion length was an independent predictor of neither 9-month angiographic restenosis nor 1-year target lesion revascularization in the bare metal stent arm (odds ratio 1.21, p = 0.36, and hazard ratio 0.80, p = 0.31, respectively) or in the paclitaxel-eluting stent arm (odds ratio 0.86, p = 0.76, and hazard ratio 0.58, p = 0.21, respectively). These data do not support the arbitrary use of larger ratios of stent length to lesion length in patients who undergo implantation of drug-eluting stents. ©2005 by Excerpta Medica Inc.

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It has been hypothesized that restenosis outside the confines of the stent may be caused by incomplete lesion coverage or by balloon injury to the stent margins. Because there is little incremental restenosis with drug-eluting stents (DESs) as a function of stent length, it has been suggested that implantation of longer DESs may minimize restenosis. Using the TAXUS-IV database, we examined whether implantation of paclitaxel-eluting stents with larger ratios of stent length to lesion length may improve clinical and angiographic outcomes.

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METHODS

The TAXUS-IV study has been described in detail elsewhere.[1] In brief, TAXUS-IV was a multicenter, prospective randomized trial that compared clinical with angiographic outcomes in patients who underwent implantation of the bare metal stent Express (Boston Scientific Corp., Natick, Massachusetts) or the slow-release, polymer-based, paclitaxel-eluting stent TAXUS (Boston Scientific Corp.). Eligibility criteria included control of a single, nonostial de novo native coronary lesion that was visually estimated as 10 to 28 mm in length with a reference vessel diameter of 2.5 to 3.75 mm. Dilatation of the target lesion with a balloon angioplasty catheter before stent placement was mandatory. Study stents were available from 2.5 to 3.5 mm in diameter and in lengths of 16, 24, and 32 mm (although no stents that were 2.5 mm in diameter and 32 mm long were supplied). Stent deployment with a balloon-to-artery diameter ratio of 1:1 to 1.1:1, with at least 2 to 4 mm of stent beyond the margins of the target lesion, was recommended. Postdilatation of the deployed stent was left to the discretion of the investigator to ensure full stent to vessel apposition, with a final residual stenosis of $\leq$10% by visual estimation. Clinical follow-up was performed at 1, 4, 9, and 12 months and then yearly for 5 years. The

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TABLE 1 Selected Baseline Clinical and Angiographic Characteristics Stratified by Stent Length to Lesion Length Ratio in Tertiles in the Pooled Study Population

Variable	Tertile 1 (n = 397)	Tertile 2 (n = 397)	Tertile 3 (n = 396)	3-Way p Value	Tertile 1 vs 2	Tertile 1 vs 3	Tertile 2 vs 3
Stent:lesion length ratio*	1.20 (1.09–1.28)	1.58 (1.46–1.66)	2.27 (2.00–2.74)	<0.0001	<0.0001	<0.0001	<0.0001
Age (yrs)	62.1 ± 11.2	62.1 ± 10.9	63.0 ± 11.2	0.39	1.00	0.23	0.23
Women	25.7%	31.2%	27.5%	0.21	0.08	0.56	0.25
Current smoker	20.8%	23.8%	22.0%	0.59	0.31	0.67	0.56
Diabetes mellitus	27.7%	25.2%	19.2%	0.02	0.42	0.005	0.04
Hypertension requiring medication	69.8%	72.2%	69.1%	0.61	0.45	0.84	0.34
Hyperlipidemia requiring medication	68.1%	65.0%	66.2%	0.65	0.36	0.56	0.74
Unstable angina pectoris	32.5%	34.3%	32.6%	0.84	0.60	0.98	0.62
Stent length (mm)*	16 (16–24)	16 (16–24)	16 (16–24)	0.52	0.25	0.51	0.64
Stent length frequency distribution							
%16 mm	60.2	63.5	62.6	0.64	0.34	0.63	0.64
%24 mm	20.9	22.2	20.0	0.74	0.67	0.74	0.44
%32 mm	18.9	14.3	17.4	0.22	0.09	0.59	0.24
Lesion length (mm)*	15.15 (13.02–21.26)	10.99 (9.91–15.78)	7.82 (6.54–9.43)	<0.0001	<0.0001	<0.0001	<0.0001
Balloon:artery ratio	1.14 ± 0.15	1.17 ± 0.16	1.19 ± 0.15	<0.0001	0.007	<0.0001	0.026
Maximum inflation pressure (atm)	15.1 ± 2.8	15.0 ± 2.80	14.7 ± 2.80	0.08	0.98	0.048	0.051
Lesion location: left anterior descending	39.5%	43.8%	42.4%	0.45	0.22	0.41	0.69
Calcium: any	18.9%	17.6%	18.9%	0.87	0.65	1.0	0.63
ACC/AHA class C lesions	37.0%	14.4%	5.8%	<0.0001	<0.0001	<0.0001	<0.0001
Baseline reference vessel diameter (mm)	2.84 ± 0.51	2.75 ± 0.44	2.68 ± 0.45	<0.0001	0.0051	<0.0001	0.04
Baseline minimal luminal diameter (mm)	0.92 ± 0.35	0.94 ± 0.31	0.95 ± 0.35	0.54	0.46	0.28	0.73
Baseline diameter stenosis (%)	67.6 ± 10.1	65.6 ± 10.1	64.5 ± 11.4	0.0002	0.0074	<0.0001	0.15

*Median (interquartile range).
ACC/AHA = American College of Cardiology/American Heart Association.