Safety of Magnetic Resonance Imaging One to Three Days After Bare Metal and Drug-Eluting Stent Implantation

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Despite emerging evidence that magnetic resonance imaging (MRI) is safe within 8 weeks after bare metal coronary stenting, there are limited data on the safety of MRI imaging very early (1 to 3 days) after stent implantation and no published studies to date on the safety of MRI after insertion of drug-eluting stents (DESs). Forty-nine patients underwent cardiovascular MRI (1.5 T) at a median of 1 day after complex percutaneous coronary intervention. The average number of stents per patient was 2.2 ± 1.1, and the average stent length per patient was 37.8 ± 19.7 mm. In 15 of these patients ≥1 DES was used: paclitaxel DESs in 14 and sirolimus DESs in 1. In the DES group, the average number of stents was 1.75 ± 1.0 per patient (3 patients received 3 DESs), and average DES length was 36.5 ± 14.8 mm per patient. No acute thrombosis was recorded, and at 9-month clinical follow-up only 2 patients (4%) developed adverse events (1 target vessel restenosis and 1 nontarget vessel revascularization); these patients were in the non-DES group. **(Am J Cardiol 2005;96:366–368)**

This study reviewed in-hospital and 9-month outcome data in a cohort of patients who underwent cardiac magnetic resonance imaging (MRI) 1 to 3 days after complex contemporary percutaneous coronary intervention (PCI), including drug-eluting stent (DES) implantation.

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These data were collected as a part of a clinical study to quantify myocardial necrosis after PCI. Fifty patients at our institution underwent cardiovascular MRI before and 1 to 3 days after complex PCI.[1] One patient refused the second scan and thus was excluded from this analysis. True fast imaging with steady-state processing cine and contrast-enhanced MRI were performed with a 1.5-T clinical scanner with advanced, fast gradient systems (Siemens Sonata, Siemens Medical Solutions, Erlangen, Germany).

Inclusion criteria were ≥1 of the following: 2-vessel PCI, planned insertion of a >30-mm stent to a single vessel, or planned treatment of a segment that involved ≥1 side branch >2.0 mm. Patients who had significantly impaired left ventricular function on echocardiogram were excluded, as were those who had planned intervention of a saphenous vein graft.

Characteristics of the 49 patients were as follows: mean age was 64 ± 11 years; 17 (35%) had diabetes; 14 (29%) had a recent acute coronary syndrome (within 4 weeks); 22 (45%) underwent 2- or 3-vessel PCI; 13 (27%) underwent therapy for a bifurcation lesion; 10 (20%) underwent therapy for total occlusion; the average number of stents per patient was 2.2 ± 1.1; and average stent length per patient was 38 ± 20 mm, indicating a population at relatively high risk for stent thrombosis and restenosis. In 15 of these patients (31%), ≥1 DES was used: paclitaxel DES (TAXUS, Boston Scientific, Natick, Massachusetts) in 14 and sirolimus DES (Cypher, Cordis, Johnson & Johnson, New Brunswick, New Jersey) in 1. Patient data for the DES group are listed in Table 1. In the DES group, average number of DESs was 1.75 ± 1.0 per patient (3 patients received 3 DESs), and average DES length was 37 ± 15 mm per patient. Intraprocedural abciximab (weight-adjusted bolus plus infusion) and double antiplatelet therapy with aspirin and clopidogrel were used in all patients. Patients not already on long-term therapy were preloaded with 300 mg of clopidogrel ≥48 hours before the index procedure. Patients who received a DES and their referring doctors were instructed not to withdraw from clopidogrel for ≥6 months.

In-hospital events were recorded, and all patients were contacted by telephone for long-term follow-up of major adverse cardiac events, including death from any cause, myocardial infarction, or repeat revascularization. For repeat PCI, catheterization reports and films were reviewed. Possible stent thrombosis was defined as sudden death without clear noncardiac cause or myocardial infarction at the site of stent implantation. Presence of Canadian Cardiovascular Society class III to IV stable angina was also noted. No acute stent thrombosis (<48 hours) occurred. No serious adverse events were reported during MRI examination. Telephone interviews at a median of 9 months (range 6 to

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Table 1
Characteristics and follow-up of patients who underwent drug-eluting stent implantation*

Patient No.	Age (yrs)/ Sex	Lesion Classification† (location)	DES Type	DES Diameter × Length	Other Lesions Treated With Non-DES	Bifurcation	Total Occlusion	9-Month MACEs
1	64/M	C (RCA)	TAXUS	3.0 × 16	Yes (LCx)	No	Yes (RCA)	No
			TAXUS	3.0 × 28				
2	61/M	B2 (LAD-D1)	TAXUS	3.0 × 24	No	Yes	No	No
3	59/M	C (LAD)	TAXUS	3.0 × 28	Yes (RCA)	No	No	No
4	43/M	C (LAD)	TAXUS	3.0 × 32	No	No	Yes (LAD)	No
5	68/M	C (LAD)	TAXUS	3.5 × 8	No	No	No	No
			TAXUS	3.5 × 32				
			TAXUS	3.0 × 32				
6	68/M	B1 (RCA)	TAXUS	2.75 × 12	No	Yes (LAD-D1)	No	No
		B2 (LAD-D1)	TAXUS	3.0 × 16				
			TAXUS (LAD)	3.0 × 16				
7	70/F	B2 (RCA)	TAXUS	3.5 × 24	No	No	No	No
			TAXUS	3.5 × 32				
8	73/M	B2 (LAD)	TAXUS	3.0 × 32	No	No	No	No
		B2 (RCA)	TAXUS	3.5 × 12				
9	47/M	B1 (LAD)	TAXUS	3.5 × 12	No	No	No	No
		C (RCA)	TAXUS	3.0 × 24				
			TAXUS	3.0 × 32				
10	60/M	B2 (LAD-D1)	TAXUS	3.5 × 16	No	Yes (LAD-D1)	No	No
			TAXUS (D1)	3.0 × 12				
11	55/M	C	TAXUS	3.0 × 24	No	Yes (LAD-D1)	No	No
12	68/M	B1 (LAD)	TAXUS	3.5 × 32	No	No	No	No
		B2 (RCA)	Cypher	3.0 × 13				
			Cypher	3.0 × 13				
13	64/M	C (LAD-D1)	TAXUS	3.5 × 16	No	Yes (LAD-D1)	No	No
			TAXUS (D1)	3.0 × 16				
		B1 (RCA)	TAXUS	3.5 × 20				
14	64/M	C	TAXUS	3.0 × 12	Yes (LM-OM)	Yes (LM-OM)	No	No
15	59/M	B2	TAXUS	3.5 × 28	No	No	No	No

* All measurements are in millimeters.
† According to the American Heart Association.
LAD = left anterior descending artery; LCx = left circumflex artery; LM = left main artery; MACE = major adverse cardiac events; OM = obtuse marginal; RCA = right coronary artery.

12) showed that only 2 of 49 patients (4%) developed a major adverse cardiac event, and these patients were in the non-DES group. No certain or suspected subacute or late stent thrombosis occurred. Patient 1 had repeat nontarget vessel revascularization at 8 months and then underwent coronary bypass surgery (including revascularization of the target vessel, which showed severe restenosis) at 14 months. Patient 2 had an episode of unstable angina and underwent repeat revascularization of a nontarget vessel 2 months after the index procedure. Survival rate was 100% at the time of repeat follow-up, and all patients were free of disabling angina.

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The safety of MRI soon after stent implantation has been a source of debate for a long time. Our series, the largest reported to date in patients who underwent MRI very soon after stent implantation, shows that there is a very low rate of major adverse cardiac events at 9-month follow-up (2 of 49, 4%), with no occurrence of definite or suspect stent thrombosis. Long-term follow-up also suggests no significant effect of MRI on restenosis and late stent thrombosis, because only 1 patient had clinically determined target vessel revascularization. In the only other large available series, Gerber et al[2] reported a low rate of 30-day cardiac adverse events (6 of 111 patients, 5%), with no stent thrombosis.[2] However, in their analysis, mean time interval from stent placement to MRI was 21 ± 17 days (median 18, range 0 to 54), and only 15 of 111 patients (14%) had MRI performed within 2 days after PCI. Risk of stent thrombosis peaks during the first 24 to 48 hours (acute stent thrombosis) and decreases abruptly after 3 to 4 days, when reendothelialization starts.[3] Moreover, although all of our patients underwent cardiac MRI (where there would be higher energy deposition in the region of the heart), only a minority (9%) of patients in the study by Gerber et al[2] underwent MRI of the chest region. Our study extends the results of Gerber et al[2] to a higher risk population that is more representative of contemporary PCI procedures, especially those involving longer stents (22 ± 15 vs 38 ± 20 mm), 2- or 3-vessel interventions, bifurcations, and chronic total occlusions (no data were available for these categories in Gerber et al[2]). Our data also provide reassurance to clinicians and patients that MRI can safely be performed very soon after bare metal stent and DES implantation.

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