Elevated Homocysteine Levels Might Be Associated with Coronary Artery Remodeling in Patients with Stable Angina: An Intravascular Ultrasound Study

Hong MK, Park SW, Lee CW, Choi SW, Song JM, Kang DH, Song JK, Kim JJ, Park SJ.

Summary Background: The relationship between plasma biologic markers and coronary artery remodeling is unknown.

Hypothesis: Plasma biologic markers are associated with coronary artery remodeling.

Methods: Preintervention intravascular ultrasound images were obtained in 44 patients with chronic stable angina. Plasma samples were collected 24 h before coronary intervention. The biologic markers included total cholesterol, low-density lipoprotein (LDL) cholesterol, triglyceride, high-density lipoprotein (HDL) cholesterol, lipoprotein(a) [LP(a)], C-reactive protein (CRP), and homocysteine. The remodeling index (RI) was defined as a ratio of the (lesion/ proximal reference) external elastic membrane cross-sectional area. Positive remodeling was defined as an RI >1.05, negative remodeling as an RI <0.95, and intermediate remodeling as an RI between 0.95 and 1.05.

Results: Total cholesterol level (r = 0.092, p = 0.557), LDL cholesterol level (r = 0.123, p = 0.426), triglyceride level (r = 0.020, p = 0.901), HDL cholesterol level (r = 0.042, p = 0.789), LP(a) level (r = 0.062, p = 0.729), and CRP level (r = 0.266, p = 0.089) did not significantly correlate with the RI. However, the plasma homocysteine level positively correlated with the RI (r = 0.398, p = 0.008). The plasma homocysteine level was significantly lower in the lesions with negative remodeling and higher in the lesions with positive remodeling (10.8 ± 0.7 µmol/l in negative remodeling, 13.1 ± 0.6 µmol/l in intermediate remodeling, and 18.1 ± 2.8 µmol/l in positive remodeling, p = 0.021).

Conclusions: Elevated homocysteine levels might be associated with coronary artery remodeling in patients with stable angina.

Key words: homocysteine, coronary artery disease, intravascular ultrasound
The degree of residual plaque burden outside of a stent might be correlated with the degree of intimal hyperplasia. However, the relation between residual plaque burden and angiographic restenosis are still unknown in a large number of patients. Therefore, we evaluated the effect of residual plaque burden after stenting on 6-month angiographic restenosis. Intravascular ultrasound (IVUS)-guided coronary stenting was successfully performed in 723 patients with 785 native coronary lesions. Six-month follow-up angiograms and evaluation of residual plaque burden by IVUS were available in 566 patients (78.3%) with 622 lesions (79.2%). Results were evaluated using conventional methods. The overall angiographic restenosis rate was 23.0% (143 of 622 lesions). There was no significant difference in residual plaque burden between the lesions with and without restenosis (52% vs 51%, respectively, P = 0.148). The angiographic restenosis rate was 20.8% (11 of 53 lesions), 21.6% (51 of 236 lesions), 22.0% (55 of 250 lesions), and 31.3% (26 of 83 lesions) in the lesions with residual plaque burden <40%, between 40% and 50%, between 50% and 60%, and >60%, respectively (p = 0.284). Using multivariate logistic regression analysis, the only independent predictor of angiographic restenosis was the IVUS stent area (odds ratio 0.807, 95% confidence intervals 0.69 to 0.95, P = 0.011). Furthermore, even in the lesions with residual plaque burden >60%, the restenosis rate was 37.3% (23 of 61 lesions) versus 13.6% (3 of 22 lesions ) in IVUS stent areas of <7 and ≥7 mm², respectively (p = 0.031). In conclusion, residual plaque burden outside the stent might not predict angiographic restenosis. IVUS stent area was the only independent predictor of angiographic restenosis.
Serial intravascular ultrasound (IVUS) was used to evaluate the influence of the vascular remodeling process on intimal hyperplasia (IH) after stenting. Serial IVUS image slices were obtained in 58 patients at the preintervention lesion site. The percent IH cross-sectional area (CSA) was 31% in adequate remodeling (n = 29) and 41% in inadequate remodeling (n = 29) (p = 0.049). The percent vessel stretching was 15% in adequate remodeling and 22% in inadequate remodeling (p = 0.007). The remodeling index inversely correlated with percent vessel stretching (r = 20.435, p = 0.001). Compared with adequate remodeling, inadequate remodeling was associated with increased percent IH CSA, which might be related to more vessel stretching.
Objectives
The aim of this study was to evaluate the feasibility and the ability of intravascular optical coherence tomography (OCT) to visualize the components of coronary plaques in living patients.

Background
Disruption of a vulnerable coronary plaque with subsequent thrombosis is currently recognized as the primary mechanism for acute myocardial infarction. Although such plaques are considered to have a thin fibrous cap overlying a lipid pool, imaging modalities in current clinical practice do not have sufficient resolution to identify thin (<65 µm) fibrous caps. Optical coherence tomography is a new imaging modality capable of obtaining cross-sectional images of coronary vessels at a resolution of approximately 10 µm.

Methods
The OCT images and corresponding histology of 42 coronary plaques were compared to establish OCT criteria for different types of plaques. Atherosclerotic lesions with mild to moderate stenosis were identified on angiograms in 10 patients undergoing cardiac catheterization. Optical coherence tomography and intravascular ultrasound (IVUS) images of these sites were obtained in all patients without complication.

Results
Comparison between OCT and histology demonstrated that lipid-rich plaques and fibrous plaques have distinct OCT characteristics. A total of 17 IVUS and OCT image pairs obtained from patients were compared. Axial resolution measured 13 ± 3 µm with OCT and 98 ± 19 µm with IVUS. All fibrous plaques, macrocalcifications and echolucent regions identified by IVUS were visualized in corresponding OCT images. Intimal hyperplasia and echolucent regions, which may correspond to lipid pools, were identified more frequently by OCT than by IVUS.

Conclusions
Intracoronary OCT appears to be feasible and safe. Optical coherence tomography identified most architectural features detected by IVUS and may provide additional detailed structural information.
This study was performed to evaluate the acute and long-term results of stenting for unprotected left main coronary artery (LMCA) bifurcation lesions. Sixty-three consecutive patients with an unprotected LMCA bifurcation lesion and normal left ventricular function were included. Stenting was performed with (n = 32) or without debulking atherectomy (n = 31) at the operator’s discretion. Slotted-tube stents, coil stents, or bifurcation stents were used. The procedural success rate was 100%. In-hospital events including stent thrombosis, Q-wave myocardial infarction, and emergency bypass surgery did not occur in any patients. The angiographic follow-up rate was 86% (43 of the 50 eligible patients), and the restenosis rate was 28% (parent vessel only 14%, side branch only 9%, and both 5%). Restenosis at the parent vessel occurred less frequently in the debulking group than in the nondebulking group (5% vs 33%, respectively, P = 0.02). In multivariate analysis, the debulking procedure was an independent predictive factor of restenosis for the parent vessel (odds ratio 0.10, 95% confidence intervals 0.01 to 0.91, P = 0.04). Clinical follow-up was obtained in all patients at 19.9 ± 13.7 months. There were 2 deaths (noncardiac origin), but no myocardial infarction during follow-up. Target lesion revascularization was required in 6 patients. The event-free survival rate (death, nonfatal myocardial infarction, and repeat revascularization) was 86% at the end of the follow-up period. In conclusion, stenting for an unprotected LMCA bifurcation lesion may be performed with a high procedural success rate and a favorable clinical outcome in selected patients with normal left ventricular function, suggesting that stenting would be an effective alternative to surgery in these patients.
Background The impacts of geographic miss on edge restenosis have not been sufficiently evaluated. Methodsβ-Radiation therapy with rhenium 188–filled balloon after rotational atherectomy for diffuse in-stent restenosis was performed in 50 patients. We evaluated the impacts of geographic miss on adjacent coronary artery segments beyond the stent by angiographic (QCA) and intravascular ultrasound (IVUS) analysis in 50 irradiated lesions and 100 edges. Serial IVUS and QCA comparisons between postradiation and 6 months' follow-up were available in 44 and 47 of 50 patients, respectively. QCA measurements of minimal lumen diameter (MLD) and IVUS analysis were performed in the reference and radiation segments. Edges that were touched by the angioplasty balloon but were not adequately covered by radiation constituted the geographic miss edges. Results Geographic miss was observed in 55.6% and 52.6% in QCA and IVUS analysis, respectively. Edge restenosis after radiation therapy in 3 patients was associated with geographic miss. In contrast to uninjured edges (postradiation 2.9 ± 0.6 mm to follow-up 2.8 ± 0.6 mm, P = .292), MLD in the radiation segment by QCA analysis significantly decreased from 2.7 ± 0.4 mm to 2.4 ± 0.6 mm in geographic miss edges (P = .002). IVUS analysis showed that significant positive remodeling in the radiation segment occurred in uninjured edges (vessel area from 15.4 ± 4.4 mm² to 15.8 ± 4.4 mm², P = .001) but not in geographic miss edges (vessel area from 12.8 ± 3.6 mm² to 13.0 ± 3.6 mm², P = .119). Conclusion The geographic miss might be one of the predictors, which resulted in decreased MLD at follow-up in β-radiation therapy. Sufficient lesion coverage with radiation might be associated with positive remodeling in the radiation segment. (Am Heart J 2002;143:327-33.)
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Comparison of Gold-Coated NIR Stents With Uncoated NIR Stents in Patients With Coronary Artery Disease.
Park SJ, Lee CW, Hong MK, Kim JJ, Park SW, Tahk SJ, Jang YS, Seung KB, Yang JY, Jeong MH

Stainless steel stents are widely used for coronary intervention because of their relatively inert properties and high mechanical stability within the vasculature. However, radiopacity is poor with stainless steel, making stent deployment difficult. Gold-coated stents are attractive for the interventional cardiologist because of their better visibility and user-friendly design. Furthermore, initial studies have reported that gold-coating may decrease thrombus formation as well as neointimal hyperplasia within the stents. 1–3 However, a recent clinical trial showed that gold-coated stents may be associated with a considerable increase in the risk of restenosis over the first year after stenting. 4 Therefore, it still remains uncertain whether gold-coating should be used for coronary stents. In the present study, we conducted a multicenter, prospective, randomized trial to determine whether gold-coating increases in-stent restenosis in patients with coronary artery disease.
To evaluate the prevalence and clinical significance of echo-free space (EFS) in aortic intramural hematoma (AIH) during transesophageal echocardiography (TEE), TEE performed during the acute phase in 71 consecutive patients with type B AIH was reviewed. Forty-four patients (62%) had EFS including 24 patients with a large EFS occupying >1/2 of the hematoma thickness. Among 59 patients who also underwent computed tomography, focal contrast enhancement in the hematoma area was observed in only 7 patients with a large EFS. Hospital mortality and incidence of surgical intervention in patients with EFS were 0% and 2%, respectively, which was similar to 4% in those without EFS. Follow-up imaging studies in 57 patients (80%) revealed development of typical aortic dissection (AD) in 6 patients and complete resorption of hematoma in 35; the incidence of either the development of AD or a complete resorption of hematoma was not significantly different between those with and without EFS. EFS by TEE is not rare in patients with type B AIH. It is not a poor prognostic factor and is not associated with the development of AD.
We investigated the influence of collateral flow on restenosis in 156 consecutive acute myocardial infarction (AMI) patients treated with primary angioplasty within 12 hr of symptom onset. Collateral flow was quantitatively assessed using the pressure-derived fractional collateral flow (PDCF) index. Follow-up angiography was performed at 6 months. The patients were classified into two groups according to the PDCF index: group I (PDCF index > 24%; n = 55) with good collaterals and group II (PDCF index ≤24%; n = 101) with poor collaterals. Baseline characteristics were similar between the two groups, with the exception of peak levels of creatine kinase, angiographic collaterals, and TIMI flow 3 after intervention. The binary restenosis rate was 31.8% in group I and 32.9% in group II (P = NS). Use of the stents was the only independent predictor of binary restenosis. In conclusions, well-developed collaterals measured by PDCF may not predict restenosis following primary angioplasty for AMI.
In acute myocardial infarction (AMI), timely reperfusion is a prerequisite to limit the extent of infarct size. However, there is concern that at the time of reperfusion, further injury may occur to the myocardium. Reperfusion injury is in part mediated by platelet activation, neutrophil infiltration, and tissue edema, being a target for pharmacologic modification. Treatment with abciximab at the time of reperfusion significantly limits reperfusion injury and contributes to the attenuation of infarct size in experimental models. In the present study, we tested the hypothesis that abciximab, given at the time of primary angioplasty for AMI, may produce a greater degree of myocardial salvage.
We evaluated the impact of different intravascular ultrasound (IVUS) criteria on 6-month angiographic restenosis in 511 patients with 560 lesions. Seven IVUS criteria were evaluated in this study; stent area at lesion segment 1) ≥100% of distal reference lumen area, 2) ≥90% of distal reference lumen area, 3) ≥80% of average reference lumen area, 4) ≥90% of average reference lumen area, 5) ≥55% of average reference vessel area, 6) ≥7 mm², and 7) ≥9 mm². Using the relative measurement (criteria 1-5), the angiographic restenosis rate was not statistically different. However, absolute measurement of stent area ≥7 or 9 mm² (criteria 6 and 7) were associated with significantly lower restenosis rate (14.8% vs. 30.9%, P = 0.001, and 13.5% vs. 24.6%, P = 0.006, respectively). In conclusions, using the relative measurement of IVUS criteria, the occurrence of angiographic restenosis might not be predicted. The absolute measurement of IVUS stent area was the predictor of angiographic restenosis.
Progressive ventricular dilatation is an important prognostic factor in patients with acute myocardial infarction. We evaluated clinical, angiographic, echocardiographic and thallium-201 single-photon emission tomography (SPET) imaging variables predictive of the change in left ventricular volume during a 7-month follow-up period after primary angioplasty in patients with acute myocardial infarction. Thirty-six patients with first acute myocardial infarction treated with primary angioplasty within 12 h of onset underwent $^{201}$TI SPET imaging (5.8±2.1 days after angioplasty). Changes in left ventricular volume were assessed over the 7-month period. The left ventricle dilated significantly after angioplasty ($P<0.001$). Multivariate analysis revealed that the number of segments with $^{201}$TI uptake <40% of peak activity was a single independent predictor of increase in end-diastolic volume index between 1 week and 7 months ($R^2=0.41$, $P<0.001$). The presence of two or more segments with $^{201}$TI uptake <40% predicted an increase in end-diastolic volume index of $\geq 6$ ml/m$^2$ with positive and negative predictive values of 85% (17/20) and 75% (12/16), respectively. It is concluded that, following primary angioplasty in patients with acute myocardial infarction, the extent of myocardial infarction assessed by $^{201}$TI SPET can identify those who will develop ventricular dilatation during the subsequent 7 months.

**Keywords.** Myocardial infarction - Primary angioplasty - Left ventricular remodelling - Thallium-201 SPET
Diabetic retinopathy as a predictor of late clinical events following percutaneous coronary intervention.

Kim YH, Hong MK, Lee CW, Song JM, Han KH, Kang DH, Song JK, Kim JJ, Park SW, Park SJ

Diabetic retinopathy has been shown to be associated with increased cardiovascular mortality in diabetes mellitus (DM) patients. However, it is not well known whether the presence of retinopathy is a predictor of adverse cardiovascular events in diabetic patients after percutaneous coronary intervention (PCI). We divided 365 non-insulin dependent DM patients who underwent PCI and fundoscopic examination into 2 groups: 115 patients with retinopathy and 250 patients without retinopathy. We assessed the relationship between the presence of retinopathy and the occurrence of major adverse cardiac and cerebrovascular events (MACCE) including death, myocardial infarction (MI), cerebrovascular event and target lesion revascularization (TLR). Patients with retinopathy had longer duration of DM and more insulin dependency. The 2-year cumulative survival rate was 96.3% and 99.6% for patients with retinopathy and without retinopathy, respectively (p = 0.02). The 2-year MACCE-free survival rates
Objectives: The goal of this study was to assess the prognostic value of ergonovine echocardiography (Erg Echo) for diagnosis of coronary vasospasm (CVS) in patients without significant fixed coronary stenosis.

Material and Methods: Medical records of 650 patients who underwent Erg Echo were reviewed. Before Erg Echo, absence of significant fixed coronary stenosis was confirmed by invasive coronary angiography (CAG) in 316 patients (49%) or by noninvasive confirmation of negative treadmill or normal myocardial perfusion scan in 334 patients (51%). The cardiac events after Erg Echo were tabulated and these included cardiac death, myocardial infarction (MI), readmission due to intractable chest pain.

Results: The average age was 54 ± 10 years, with 223 women and 427 men. Erg Echo was positive in 237 patients (36%), for whom long-acting calcium channel blocker and nitrates were prescribed. During follow-up (46 ± 23 months), cardiac events developed in 13% (30 of 237) of the positive Erg Echo group and 3% (14 of 413) of the negative Erg Echo group (P < .001). Incidence of cardiac death was higher in the positive Erg Echo group (3.4% vs 0.7%, P = .022). The 5-year survival rate (93% ± 3% vs 99% ± 1%, P = .013) and event-free survival rate (94% ± 2% vs 77% ± 6%, P < .001) were significantly lower in the positive Erg Echo group. Smoking (hazards ratio 6.3; 95% CI 1.7-23.5) and multivessel spasm (hazards ratio 37.2, 95% CI, 8.1 to 170.4) were independent factors associated with cardiac death and/or MI.

Conclusion: Erg Echo for noninvasive diagnosis of CVS in the differential diagnosis of chest pain provides useful prognostic information for patients without significant fixed coronary stenosis and can play a role as a cost-effective diagnostic strategy in these selected patients.
Paclitaxel coating reduces in-stent intimal hyperplasia in human coronary arteries: a serial volumetric intravascular ultrasound analysis from ASPECT.
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**Background**— The aim of this study was to use serial volumetric intravascular ultrasound (IVUS) to evaluate the effect of a paclitaxel coating on in-stent intimal hyperplasia (IH).

**Methods and Results**— Patients were randomized to placebo (bare metal stents) or 1 of 2 doses of paclitaxel (low dose: 1.28 µg/mm²; high dose: 3.10 µg/mm²). Complete post-stent implantation and follow-up IVUS were available in 81 patients, including 25 control patients and in 28 receiving a low-dose and 28 receiving a high dose. Volumetric analysis of the stented segment and of both reference segments was performed. Baseline stent measurements and both reference measurements were similar among the groups. With increasing doses, there was a stepwise reduction in IH accumulation within the stented segment (31±22 mm³ in control, 18±15 mm³ in low dose, and 13±14 mm³ in high dose, P<0.001). Post hoc analysis showed less IH accumulation when low- and high-dose patients were compared with control (P=0.009 and P<0.001, respectively), but not when low-dose patients were compared with high-dose patients (P=0.2). Focal late malapposition was seen in 1 high-dose patient. With increasing doses, there was no significant change in the reference segments.

**Conclusions**— Paclitaxel-coated stents are effective in reducing in-stent neointimal tissue proliferation in humans. They are not associated with edge restenosis or significant late malapposition.

**Key Words:** stents • restenosis • ultrasonics
The purpose of this study was to analyze long-term follow-up information from patients treated with stenting for unprotected left main coronary artery (LMCA) stenosis. Stenting of unprotected LMCA stenosis is often performed in selected patients, but the long-term safety of this therapy is not yet established. Between January 1995 and September 2000, 270 consecutive patients with unprotected LMCA stenosis and normal left ventricular function who underwent treatment at 4 clinical centers were included in this study. Data were forwarded to the coordinating center using a standard case report form. The procedural success rate was 98.9%. There were no deaths, 3 stent thromboses, and 3 Q-wave myocardial infarctions during the hospitalization. Angiographic follow-up was performed in 237 patients (follow-up rate 87.8%), and the restenosis rate was 21.1%. The reference size was an independent predictor of binary restenosis (odds ratio 0.543, 95% confidence interval 0.308 to 0.957, \( P = 0.03 \)). During the follow-up period (32.3 ± 18.5 months), there were 20 deaths (8 cardiac, 12 noncardiac) and 5 nonfatal myocardial infarctions. Target and new lesion revascularizations were required in 45 (16.7%) and 31 (11.5%) patients, respectively. The cumulative probabilities free from major adverse cardiac events were 81.9 ± 2.4%, 78.4 ± 2.6%, and 77.7 ± 2.7%, respectively, at 1, 2, and 3 years. Combined coronary artery disease and postprocedural minimal luminal diameter were the significant predictors of major adverse cardiac events. Thus, the long-term prognosis of patients after stenting of unprotected LMCA stenosis was favorable in selected patients with normal left ventricular function.
Background and Objectives[1] Intracoronary Stenting has been established as an effective treatment modality for the reduction of restenosis in patients with acute myocardial infarction. This study was performed in order to evaluate the long-term outcomes of stenting for infarct-related artery (IRA) lesions using intravascular ultrasound (IVUS) and compare these results with the stenting of non-infarct-related artery (non-IRA) lesions. Subjects and Methods[1] IVUS-guided coronary stenting was successfully performed in 510 native coronary lesions (105 IRA vs. 405 non-IRA). A six-month angiography was performed in 419 lesions (82.2%) of 87 IRA lesions (82.9%) and 332 non-IRA lesions (82.0%). The results were evaluated using clinical, angiographic and IVUS methods. Results[1] There were no significant differences in the clinical and angiographic variables between the two groups. IVUS variables including reference vessel area and minimal stent area were also similar between the two groups. There was no significant difference in the angiographic restenosis rate between the two groups in cases of minimal stent area $\leq 7$ mm$^2$ 12.8% (6/47) in IRA vs. 19.1% (33/173) in non-IRA lesions ($p$ 0.315). However, the angiographic restenosis rate in cases of minimal stent area $<7$ mm$^2$ was 50% (20/40) in IRA lesions vs. 31.5% (50/159) in non-IRA lesions ($p$ 0.028). Conclusion[1] The rate of angiographic restenosis is significantly higher in stenting for IRA lesions as compared with that for non-IRA lesions in cases of minimal stent area $<7$ mm$^2$. 
Clinical usefulness of noninvasive measurement of coronary flow velocity reserve with transthoracic doppler echocardiography for detection of restenosis after revascularization of left anterior descending coronary artery.


Background and Objectives: The measurement of the coronary flow velocity reserve (CFR) using transthoracic Doppler echocardiography (TTDE) has been reported to be useful for assessing the physiological significance of left anterior descending coronary artery (LAD) stenosis. This study was performed to evaluate the usefulness of CFR by TTDE for diagnosis of restenosis following revascularization procedures. Subjects and Methods: Patients who were scheduled for follow-up coronary angiography following percutaneous intervention, or coronary bypass, surgery for a LAD lesion were enrolled. Prior to the follow-up coronary angiography, flow velocities in the distal LAD were measured by TTDE, both at rest and during the intravenous infusion of adenosine. CFR was defined as the ratio of the hyperemic to the basal peak diastolic velocities. Angiographic restenosis was defined as a diameter stenosis of more than 50% of the normal value by a quantitative coronary angiography. Of 142 consecutive patients, measurement of the CFR was possible in 95% (n=135), with 39 patients having a myocardial infarction in the LAD territory. The remaining 96 patients were used as the subjects of this study. Results: The diameter stenosis was 41±26%, with angiographic restenosis found in 33 patients (34%). The mean CFR by TTDE was 2.5±1.1. CFR <2.0 was used to diagnose restenosis, with a sensitivity and specificity of 79% (26/33) and 89% (56/63), respectively. Conclusion: The noninvasive measurement of the CFR with TTDE is highly feasible, and can be a useful diagnostic modality for restenosis of a LAD following a revascularization procedure.
Background and Objectives: The aim of this study was to evaluate clinical outcomes following single long coronary stenting. Subjects and Methods: We evaluated the short- and long-term clinical outcomes in 935 consecutive patients with single long ≥18 mm coronary stents. The patients were divided into three groups according to the stent length: Group A, 445 patients, 18 mm ≤ length <25 mm; Group B, 322 patients, 25 mm ≤ length <30 mm; Group C, 168 patients, length ≥30 mm. Results: There were no significant differences in the baseline clinical characteristics between the 3 groups. Group A had larger reference vessel sizes (3.33±0.40 mm vs. 3.18±0.50 mm in the other groups, p<0.001) and stent diameters (3.46±0.40 mm vs. 3.27±0.42 mm in the other groups, p<0.001). One-year clinical follow-up and 6-month angiographic follow-up were possible in all patients, and for 578 of the lesions (62%), respectively. The longer the stent, the higher the in-stent restenosis (A:B:C=20.3%:27.1%:35.7%, respectively, p=0.008). For the cases where the stent diameter was ≥3.5 mm, the in-stent restenosis rates were similar between the 3 groups (16.2%:23.0%:21.1%, respectively, p=0.43). There were no significant differences in the 1-year cumulative TLR (8.3±1.4%:11.1±1.9%:12.8±2.8%, respectively, p=0.22) and the overall cardiac event-free survivals (89.9±1.5%:88.1±1.9%:85.3±2.9%, respectively, p=0.31) between the 3 groups. Conclusion: The long-term clinical outcomes following single long coronary stenting are acceptable. The single long coronary stents of ≥3.5 mm could be a useful therapeutic option for diffuse coronary lesions.
Automation of the synthesis of highly concentrated 188Re-MAG3 for intracoronary radiation therapy.

Oh SJ, Moon DH, Ha HJ, Park SW, Hong MK, Park SJ, Choi TH, Lim SM, Choi CW, Knapp FF Jr, Lee HK.

We have developed an efficient method and an automated synthetic system for the preparation of highly concentrated 188Re-MAG3. Routine production of 188Re-MAG3 for use in intracoronary radiation therapy was performed by compressed air driven semi-automated shielded system. 188Re-MAG3 was prepared with a commercial kit and reducing agents, purified and concentrated by C18 Sep-Pak cartridges to desired radioactivity and volume. Using this automated system, reproducible radiolabeling yields of 80-85% were obtained.

Determinants and prognostic significance of spontaneous coronary recanalization in acute myocardial infarction *

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Abstract
Spontaneous recanalization (SR) occurs after the onset of acute myocardial infarction (AMI), but its clinical significance in the reperfusion era remains uncertain. We evaluated the determinants and prognostic significance of SR in 196 consecutive patients with AMI who underwent primary angioplasty at our institution. The study population was divided into 2 groups according to the presence (group I, N = 44) or absence (group II, N = 152) of SR (Thrombolysis In Myocardial Infarction [TIMI] anterograde ≥2 flow on the preintervention angiogram). The primary end point was the occurrence, within 6-weeks after AMI, of death, nonfatal reinfarction, and congestive heart failure. Baseline characteristics were similar between the 2 groups. Peak levels of creatine kinase were lower in group I than in group II (2,500 ± 1,800 vs 4,000 ± 2,900 U/L,
respectively, p <0.05). The rate of TIMI flow grade 3 after intervention was higher in group I than in group II (93.2% vs 79.6%, respectively, p <0.05), and patients in group I had a faster corrected TIMI frame count than those in group II (22.7 ± 12.4 vs 30.3 ± 22.8, respectively, p <0.05). Preinfarction angina (odds ratio [OR] 2.18, 95% confidence interval [CI] 1.10 to 4.33, p <0.05), heavy thrombi (OR 0.10, 95% CI 0.01 to 0.74, p <0.05), and good angiographic collaterals (OR 0.12, 95% CI 0.02 to 0.89, p <0.05) were independent predictors of SR. Death, reinfarction, and severe arrhythmia were not different between the 2 groups. However, heart failure occurred more frequently in group II than in group I (15.1% vs 2.3%, respectively, p <0.05). The primary end point was also significantly lower in group I than in group II (4.5% vs 18.4%, respectively, p <0.05). In conclusion, SR in AMI is associated with faster coronary flow, smaller infarct size, and a better clinical outcome after primary angioplasty.

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Different clinical features of aortic intramural hematoma versus dissection involving the ascending aorta

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Objectives

The goal of this study was to test the hypothesis that the absence of direct flow communication through intimal tear in aortic intramural hematoma (AIH) involving the ascending aorta has different clinical impact on clinical course compared with typical aortic dissection (AD).

Background

Although emergent surgical repair has been applied for patients with proximal AIH as if it was typical AD, the natural history of proximal AIH is not known clearly yet.

Methods

Direct comparison of the clinical data of 81 patients with proximal AD and 24 patients with AIH was performed retrospectively.

Results

Patients with AIH were older (67 ± 10 vs. 50 ± 13, P = 0.001), and female gender was more predominant in AIH (19/24 vs. 29/81, P = 0.001). The development of mediastinal hemorrhage and pericardial and pleural
effusion was more frequent in patients with AIH than it was in patients with AD. Although medical treatment was more frequently selected in the AIH group (75% vs. 15%, \( P = 0.001 \)) due to old age and other associated medical diseases, the mortality rate with medical treatment was much lower in patients with AIH than it was in patients with AD (6% vs. 58%, \( P = 0.003 \)). In follow-up imaging studies of 13 patients who survived AIH without surgical repair, seven patients showed complete resolution. Typical AD developed in three patients, and the other three patients showed focal AD only in the descending aorta. The two-year survival rate did not show significant difference (84% ± 6% in AIH vs. 76% ± 17% in AD, \( P = 0.47 \)).

Conclusions

Absence of continuous flow communication can explain a more favorable clinical course of AIH than for AD, and medical treatment with frequent imaging follow-up and timed elective surgery in cases with complications can be a rational option for patients with proximal AIH.

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Prognostic Significance of Cerebral Metabolic Abnormalities in Patients With Congestive Heart Failure

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Background-Cerebral metabolic abnormalities were proposed as a potential marker of disease severity in congestive heart failure (CHF), but their prognostic significance remains uncertain.

Methods and Results-We investigated the prognostic value of cerebral metabolic abnormalities in 130 consecutive patients with advanced CHF (100 men aged 42.6±11.9 years; left ventricular ejection fraction, 22.2±6.2%). Proton magnetic resonance spectroscopy data were obtained from localized regions (8 mL) of the occipital gray matter and the parietal white matter. The primary end point was the occurrence of death after the proton magnetic resonance spectroscopy. During follow-up (18.5±14.4 months), 21 patients died and 15 underwent urgent heart transplantation. In the Cox proportional model, occipital metabolites (N-
acetylaspartate, creatine, choline, and myoinositol), parietal N-acetylaspartate level, and the duration of CHF symptoms (>12 months) were validated as univariate predictors of death. In multivariate Cox analyses, however, the occipital N-acetylaspartate level was an independent predictor of death (hazard ratio, 0.52; 95% CI, 0.41 to 0.67; P<0.001). An analysis with respect to the combined end point of death or urgent transplantation showed similar results. The best cutoff value (9.0 mmol/kg) for occipital N-acetylaspartate level had 75% sensitivity and 67% specificity to predict mortality.

Conclusions-The occipital N-acetylaspartate level is a powerful and independent predictor of CHF mortality, suggesting that cerebral metabolic abnormalities may be used as a new prognostic marker in the assessment of patients with CHF.

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Treatment of diffuse in-stent restenosis with rotational atherectomy followed by radiation therapy with a rhenium-188-mercaptoacetyltriglycine-filled balloon *

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OBJECTIVES
This study was done to evaluate the feasibility and efficacy of beta-radiation therapy with a rhenium-188-mercaptoacetyltriglycine (188Re-MAG3)-filled balloon after rotational atherectomy for diffuse in-stent restenosis (ISR).

BACKGROUND
Rotational atherectomy has been shown to be safe and efficient for the treatment of ISR, but the recurrence rate is still high. Intracoronary beta-irradiation after rotational atherectomy may be a reasonable approach to prevent recurrent ISR.

METHODS
Fifty consecutive patients with diffuse ISR (length >10 mm) in native coronary arteries underwent rotational atherectomy and adjunctive balloon angioplasty, followed by beta-irradiation using a 188Re-MAG3-filled balloon catheter. The radiation dose was 15 Gy at a depth of 1.0 mm into the vessel wall.

RESULTS
The mean lengths of the lesion and irradiated segment were 25.6 ± 12.7 mm and 37.6 ± 11.2 mm, respectively. Radiation was delivered successfully to all patients, with a mean irradiation time of 201.8 ± 61.7 s. No adverse event, including myocardial infarction, death or stent thrombosis, occurred during the follow-up period (mean 10.3 ± 3.7 months), and nontarget vessel revascularization was needed in one patient. The six-month binary angiographic restenosis rate was 10.4%, and the loss index was 0.17 ± 0.31.

CONCLUSIONS
Beta-irradiation using a 188Re-MAG3-filled balloon after rotational atherectomy is safe and feasible in patients with diffuse ISR, and it may improve their clinical and angiographic outcomes. Further prospective, randomized trials are warranted to evaluate the synergistic effect of debulking and irradiation in patients with diffuse ISR.

The American Journal of Cardiology, 88: 3: 210-213

Determinants and prognostic implications of terminal QRS complex distortion in patients treated with primary angioplasty for acute myocardial infarction *

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Abstract
Terminal QRS complex distortion on admission has an impact on a patient’s prognosis after primary angioplasty for acute myocardial infarction (AMI). We evaluated the determinants and prognostic significance of terminal QRS complex distortion in 153 consecutive patients with AMI after primary angioplasty. The study population was divided into 2 groups according to the presence (group I, N = 41) or absence (group II, N = 112) of terminal QRS complex distortion. The primary end points were the occurrence, within 6 weeks after AMI, of death, nonfatal reinfarction, or congestive heart failure. Baseline characteristics were similar between the 2 groups. However, patients in group I had higher peak levels of serum creatine kinase than those in group II (5,100 ± 3,100 vs 3,000 ± 1,800 U/L, respectively, p <0.01). The rate of angiographic no-reflow (Thrombolysis In Myocardial Infarction flow grade ≤2) was 31.7% in group I and 10.7% in group II (p <0.01). The predischarge left ventricular ejection fraction was 45.0 ± 12.0% in group I and 54.0 ± 8.0% in group II (p <0.01). Multivariate analysis identified the pressure-derived fractional collateral flow index and the culprit lesion in the left anterior descending coronary artery as independent determinants of the terminal QRS
complex distortion. No patients died during 6 weeks of follow-up. The 2 groups were similar for life-threatening arrhythmia or reinfarction. However, there were more patients in group I than in group II with congestive heart failure (26.8% vs 5.4%, respectively, p <0.01) or who reached the primary end points (29.3% vs 5.4%, respectively, p <0.01). In conclusion, terminal QRS complex distortion on admission is associated with poor clinical outcome after primary angioplasty for AMI, and collateral flow may have a major influence on terminal QRS complex distortion during AMI.

Long-Term Follow-Up after Deferring Angioplasty in Asymptomatic Patients with Moderate Noncritical In-Stent Restenosis

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Summary
Background: Many patients with in-stent restenosis (ISR) are angina-free, but the optimal treatment for these patients remains uncertain.

Hypothesis: In cases with asymptomatic moderate noncritical ISR, deferral of the intervention may be safe and associated with favorable clinical outcome.

Methods: We evaluated the long-term clinical outcome of asymptomatic patients (Group 1, n = 98) with moderate noncritical ISR (<70% diameter stenosis) after intervention was deferred, and compared it with that of patients (Group 2, n = 655) without restenosis. After repeat angioplasty was deferred, all patients were treated medically and later underwent angioplasty only in the case of clinical recurrence.

Results: Baseline characteristics were similar between the two groups. Clinical follow-up was available in all patients at 26.3 ± 15.9 months. Twenty patients died during the follow-up: 1 in Group 1 and 19 in Group 2. Target lesion revascularization was performed in 3 patients in Group 1 and 11 patients in Group 2 during follow-up (p = NS), and new lesion revascularization in 2 patients in Group 1 and 27 patients in Group 2 (p = NS). Event-free survival rate (cardiac death, nonfatal myocardial infarction, repeat revascularization) was 86.7 ± 6.1% in Group 1 and 84.8 ± 2.2% in Group 2 at the end of follow-up (p = NS). Major adverse cardiac events were only associated with the presence of diabetic mellitus (hazards ratio 2.65, 95% confidence interval [CI]
The percentage of patients receiving antianginal medication was similar between the two groups at the end of the study (p = NS).

Conclusions: Asymptomatic patients with moderate noncritical ISR have a good prognosis and similar clinical outcome as those without ISR, suggesting that it may be safe to defer repeat angioplasty in these patients until angina recurrence.

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Six-month angiographic follow-up after intravascular ultrasound-guided stenting of infarct-related artery: Comparison with non-infarct-related artery

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Background Compared with balloon angioplasty, stenting has been established as an effective treatment modality to reduce restenosis in patients with acute myocardial infarction. However, the immediate results that predict favorable long-term outcomes in the acute infarct stenting are unknown. Therefore, we evaluated long-term outcomes of stenting for infarct-related artery (IRA) lesions by using intravascular ultrasound (IVUS) compared with that of stenting for non-IRA lesions.

Methods IVUS-guided coronary stenting was successfully performed in 510 native coronary lesions (105 IRA vs 405 non-IRA). A 6-month follow-up angiogram was performed in 419 (82.2%) lesions: 87 (82.9%) IRA lesions and 332 (82.0%) non-IRA lesions. Coronary stenting on the IRA lesions was successfully performed within 7 to 10 days after onset of infarction in 42 patients and within 12 hours in 45 patients. Results were evaluated by clinical, angiographic, and IVUS methods.

Results There were no significant differences in clinical and angiographic variables between the two groups. IVUS variables including reference vessel area and minimal stent area were also similar between the two groups. There was no significant difference in angiographic restenosis rate between the two groups in cases of minimal stent area 7 mm2: 12.8% (6 of 47) in IRA versus 19.1% (33 of 173) in non-IRA lesions (P = .315). However, the angiographic restenosis rate in cases of minimal stent area <7 mm2 was 50% (20 of 40) in IRA lesions versus 31.5% (50 of 159) in non-IRA lesions (P = .028).
Conclusions Angiographic restenosis is significantly higher in stenting for IRA lesions compared with that for non-IRA lesions in cases of minimal stent area <7 mm2

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Elective stenting of unprotected left main coronary artery stenosis: Effect of debulking before stenting and intravascular ultrasound guidance


OBJECTIVES
We sought to evaluate: 1) the long-term outcomes of 127 selected patients receiving unprotected left main coronary artery (LMCA) stenting; and 2) the impact of the debulking procedure before stenting and intravascular ultrasound (IVUS) guidance on their clinical outcomes.

BACKGROUND
The long-term safety of stenting of unprotected LMCA stenoses has not been established yet.

METHODS
A total of 127 consecutive patients with unprotected LMCA stenosis and normal left ventricular function were treated by elective stenting. The long-term outcomes were evaluated between two groups: IVUS guidance (n = 77) vs. angiographic guidance (n = 50); and debulking plus stenting (debulking/stenting; N = 40) vs. stenting only (n = 87).

RESULTS
Angiographic restenosis was documented in 19 (19%) of 100 patients. The lumen diameter after stenting was significantly larger in IVUS-guided group (p = 0.003). The angiographic restenosis rate was significantly lower in the debulking/stenting group (8.3% vs. 25%, P = 0.034). The reference artery size was the only independent predictor of angiographic restenosis. During follow-up (25.5 ± 16.7 months), there were four deaths, but no nonfatal myocardial infarctions occurred. The survival rate was 97.0 ± 1.7% at two years.

CONCLUSIONS
These data suggest that stenting of unprotected LMCA stenosis might be associated with a favorable long-term outcome in selected patients. Guidance with IVUS may optimize the immediate results, and debulking before...
stenting seems to be effective in reducing the restenosis rate. However, we need a large-scale, randomized study.

Clin. Cardiol. 24, 197-201 (2001)

Rescue Use of Abciximab Improves Regional Left Ventricular Function after Early Incomplete Reperfusion in Acute Myocardial Infarction

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Background: Abciximab was shown to have important beneficial effects beyond the maintenance of epicardial coronary artery patency. However, it remains uncertain whether abciximab may lead to a better functional outcome in patients with acute myocardial infarction (AMI) and with incomplete reperfusion after primary angioplasty (PA).

Hypothesis: The study aimed to evaluate whether rescue use of abciximab may lead to a better functional outcome in such patients.

Methods: The study included 25 patients with first AMI who met the following criteria: (1) total occlusion of the infarct-related artery, (2) PA within 12 h of symptom onset, (3) postprocedural diameter stenosis <30%, and final Thrombolysis in Myocardial Infarction (TIMI) flow grade 2. Echocardiographic examination was performed before and on Days 7 and 30 after PA. The study population was divided into two groups: Group 1 (usual care, n = 13) and Group 2 (rescue use of abciximab, n = 12). Baseline characteristics were similar between the two groups.

Results: Peak level of creatine kinase was higher in Group 1 than in Group 2 (5,800 ± 2,700 vs. 3,800 ± 2,000 U/l, p<0.05). At 1 month follow-up, infarct zone wall motion score index (2.71 ± 0.26 vs. 2.05 ± 0.63, p<0.01) and left ventricular (LV) volume indices were smaller in Group 2 than in Group 1, whereas LV ejection fraction was higher in Group 2 than in Group 1 (52.1 ± 7.8 vs. 42.1 ± 6.4, p<0.01). At 1-month, abciximab was the only independent predictor of wall motion recovery index by multiple regression analysis.

Conclusions: Rescue use of abciximab may reduce the infarct size in patients with AMI and TIMI grade 2 flow after PA, which may improve the recovery of regional LV function.
We evaluated the efficacy of -radiation therapy (188Re-MAG3) to inhibit intimal hyperplasia (IH) in diffuse in-stent restenosis by intravascular ultrasound (IVUS) analysis in 50 patients. Nine patients who did not agree with radiation therapy, and therefore underwent rotational atherectomy and balloon angioplasty for diffuse in-stent restenosis in the same study period, were selected for control groups. Serial IVUS comparisons were available in 44 of 50 patients with radiation therapy and 7 of 9 control patients. At 6-month follow-up, there was less significant increase of IH area in patients with radiation therapy than in control patients (IH area = 0.1 ?0.8 mm2 vs. 2.6 ?1.8 mm2, P > 0.001 in mean values, and 0.6 ?1.4 mm2 vs. 2.9 ?2.1 mm2, P = 0.026 in values of follow-up lesion site, respectively). In conclusion, -radiation therapy might be an effective treatment modality to inhibit intimal hyperplasia in patients with diffuse in-stent restenosis. Cathet Cardiovasc Intervent 2001;54:169-173. (c) 2001 Wiley-Liss, Inc.
Background: The impact of vascular remodeling pattern on intimal hyperplasia (IH) after coronary stenting is unknown.

Hypothesis: The preintervention remodeling pattern of the lesion might be associated with IH after the coronary stenting procedure.

Methods: Serial (pre-, post-stent implantation, and follow-up) intravascular ultrasound (IVUS) images were obtained in 58 patients with single-stent implantation (GFX stents in 41 and NIR in 17). The matching IVUS image slices at the preintervention lesion site were selected for serial comparisons. The remodeling index (RI) was defined as lesion/proximal reference external elastic membrane cross-sectional area (CSA) at preintervention lesion site. Adequate remodeling was defined as a RI >0.95 and inadequate remodeling as a RI ≤0.95. Vessel stretching, percent vessel stretching, and percent IH CSA, as well as pre- and postintervention IVUS variables were evaluated according to the remodeling pattern.

Results: The percent IH CSA was 31% in adequate remodeling (n = 29, mean RI = 1.05) and 41% in inadequate remodeling (n = 29, mean RI = 0.88) (p = 0.049). Percent vessel stretching was 15% in adequate remodeling and 22% in inadequate remodeling (p = 0.007). The RI inversely correlated with percent vessel stretching (r = -0.435, p = 0.001).

Conclusions: Compared with preintervention adequate remodeling, inadequate remodeling was associated with increased percent IH CSA, which might be related with more vessel stretching.

Visualization of coronary atherosclerotic plaques in patients using optical coherence tomography: comparison with intravascular ultrasound *

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Objectives
The aim of this study was to evaluate the feasibility and the ability of intravascular optical coherence tomography (OCT) to visualize the components of coronary plaques in living patients.

Background
Disruption of a vulnerable coronary plaque with subsequent thrombosis is currently recognized as the primary mechanism for acute myocardial infarction. Although such plaques are considered to have a thin fibrous cap overlying a lipid pool, imaging modalities in current clinical practice do not have sufficient resolution to identify thin (<65 µm) fibrous caps. Optical coherence tomography is a new imaging modality capable of obtaining cross-sectional images of coronary vessels at a resolution of approximately 10 µm.

Methods
The OCT images and corresponding histology of 42 coronary plaques were compared to establish OCT criteria for different types of plaques. Atherosclerotic lesions with mild to moderate stenosis were identified on angiograms in 10 patients undergoing cardiac catheterization. Optical coherence tomography and intravascular ultrasound (IVUS) images of these sites were obtained in all patients without complication.

Results
Comparison between OCT and histology demonstrated that lipid-rich plaques and fibrous plaques have distinct OCT characteristics. A total of 17 IVUS and OCT image pairs obtained from patients were compared. Axial resolution measured 13 ± 3 µm with OCT and 98 ± 19 µm with IVUS. All fibrous plaques, macrocalcifications and echolucent regions identified by IVUS were visualized in corresponding OCT images. Intimal hyperplasia and echolucent regions, which may correspond to lipid pools, were identified more frequently by OCT than by IVUS.

Conclusions
Intracoronary OCT appears to be feasible and safe. Optical coherence tomography identified most architectural features detected by IVUS and may provide additional detailed structural information.

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Impact of geographic miss on adjacent coronary artery segments in diffuse in-stent restenosis with -radiation therapy: Angiographic and intravascular ultrasound analysis

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Background The impacts of geographic miss on edge restenosis have not been sufficiently evaluated.

Methods - Radiation therapy with rhenium 188-filled balloon after rotational atherectomy for diffuse in-stent restenosis was performed in 50 patients. We evaluated the impacts of geographic miss on adjacent coronary artery segments beyond the stent by angiographic (QCA) and intravascular ultrasound (IVUS) analysis in 50 irradiated lesions and 100 edges. Serial IVUS and QCA comparisons between postradiation and 6 months?follow-up were available in 44 and 47 of 50 patients, respectively. QCA measurements of minimal lumen diameter (MLD) and IVUS analysis were performed in the reference and radiation segments. Edges that were touched by the angioplasty balloon but were not adequately covered by radiation constituted the geographic miss edges.

Results Geographic miss was observed in 55.6% and 52.6% in QCA and IVUS analysis, respectively. Edge restenosis after radiation therapy in 3 patients was associated with geographic miss. In contrast to uninjured edges (postradiation 2.9 ± 0.6 mm to follow-up 2.8 ± 0.6 mm, P = .292), MLD in the radiation segment by QCA analysis significantly decreased from 2.7 ± 0.4 mm to 2.4 ± 0.6 mm in geographic miss edges (P = .002). IVUS analysis showed that significant positive remodeling in the radiation segment occurred in uninjured edges (vessel area from 15.4 ± 4.4 mm2 to 15.8 ± 4.4 mm2, P = .001) but not in geographic miss edges (vessel area from 12.8 ± 3.6 mm2 to 13.0 ± 3.6 mm2, P = .119).

Conclusion The geographic miss might be one of the predictors, which resulted in decreased MLD at follow-up in radiation therapy. Sufficient lesion coverage with radiation might be associated with positive remodeling in the radiation segment.

The American Journal of Cardiology, 89: 7: 872-875

Comparison of gold-coated NIR stents with uncoated NIR stents in patients with coronary artery disease *

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There is no abstract for this article. The text below is the first paragraph of text within the article.
Stainless steel stents are widely used for coronary intervention because of their relatively inert properties and high mechanical stability within the vasculature. However, radiopacity is poor with stainless steel, making
stent deployment difficult. Gold-coated stents are attractive for the interventional cardiologist because of their better visibility and user-friendly design. Furthermore, initial studies have reported that gold-coating may decrease thrombus formation as well as neointimal hyperplasia within the stents. However, a recent clinical trial showed that gold-coated stents may be associated with a considerable increase in the risk of restenosis over the first year after stenting. Therefore, it still remains uncertain whether gold-coating should be used for coronary stents. In the present study, we conducted a multicenter, prospective, randomized trial to determine whether gold-coating increases in-stent restenosis in patients with coronary artery disease.

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The Characteristics of Spontaneous Action Potential of Cardiac Myocytes in Rabbit Pulmonary Veins

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Background and Objectives
Atrial fibrillation is one of the most prevalent arrhythmia with clinical significance. Recently, some subset of paroxysmal atrial fibrillation was reported to be originated from a focal, rapidly firing source inside the large thoracic veins, such as pulmonary veins, superior vena cava and coronary sinus. The pulmonary veins are known to be the most frequent source of this type of atrial fibrillation. The proximal segment of pulmonary vein was reported to be made up with cardiac muscle cells. This study was performed 1)to define the characteristics of action potential of cardiac myocytes inside the rabbit pulmonary vein in single cell preparation, 2)to observe the changes in action potential and current activation to acetylcholine and isoproterenol, and 3)to compare these changes with those in atrial myocytes.

Method and Results
In most of rabbit specimens, myocardial tissue extended over the pulmonary vein for a few millimeters(1-2.5mm). Single atrial myocyte and myocyte in pulmonary vein were successfully isolated. With using whole cell patch clamp technique, spontaneous activities of action potentials(APs) with diastolic depolarization were observed in 75% of pulmonary vein myocytes, in contrast to the absence of spontaneous activity in atrial myocytes. During spontaneous APs of pulmonary vein myocytes, the maximal diastolic potential was -50.5±6.5 mV and peak potential was 32.5±9.5 mV, and the frequency of APs was 1-2.5 Hz. During perfusion of isolated pulmonary vein myocytes with acetylcholine, resting membrane potential was hyperpolarized and
spontaneous APs activity was markedly reduced or completely disappeared. These effects were observed in very low concentration of acetylcholine, even with 1-2 nM. The analysis of change of currents by applying step pulse revealed this response was mediated by activation of IK(ACh) and the current change was more prominent in pulmonary vein myocytes than atrial myocytes. The responses of these cells to isoproterenol were variable from increased spontaneous APs to inhibition of APs.

Conclusion

This study revealed that pulmonary vein myocytes was another automatic pacemaking focus, same as sinoatrial nodal and Purkinje cells. These characteristics explain why focal atrial fibrillation was frequently initiated inside pulmonary veins.

Korean Circul Jour 31(2)166-172, 2001

Long-term Outcomes of Minor Dissection at the Edge of Coronary Stents Detected with Intravascular Ultrasound

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The impacts of minor non-flow limiting dissections at the edge of stents on the late clinical outcomes are unknown. Therefore, we evaluated the influences of minor edge dissections on late angiographic in-stent restenosis.

Subjects & methods

Intravascular ultrasound (IVUS) guided single coronary stenting was successfully performed in 390 consecutive patients with 420 native coronary lesions. Six-month follow-up angiogram was performed in 327 patients (83.9%) with 348 lesions (82.9%). Results: Proximal or distal minor edge dissections were observed in 67 of 348 lesions (19.3%) (proximal in 26 lesions, distal in 37 and both in 4). In distal reference segments, lumen areas and diameters were significantly smaller in the lesions with minor edge dissection (p=0.037 and 0.025, respectively). The overall angiographic restenosis rate was 26.2% (91/348); 29.9% (20/67) in the lesions with minor edge dissections vs. 25.3% (71/281) in the lesions without minor edge dissections (p=0.540). All minor dissections disappeared and were completely healed at follow-up IVUS study.

Conclusion
Minor non-flow limiting dissections at the edge of stents might not be associated with the development of late angiographic in-stent restenosis.

Korean Circul Jour 31(2)182-190, 2001

Intravascular Ultrasound Findings of Arterial Remodeling at the Sites of Focal Coronary Spasm in Patients with Vasospastic Angina

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There is little data about the intravascular ultrasound (IVUS) findings in the patients with vasospastic angina, especially with respect to patterns of vascular remodeling.

Methods
Coronary spasm was documented by angiography and ECG evidence of ischemia in 36 patients after administration of ergonovine (cumulative doses up to 350 g). After relief of spasm using 1,000 g of intracoronary nitroglycerin, IVUS imaging was performed and analyzed using standard methodology. The 36 focal spasm sites were compared to the proximal and distal reference segments.

Results
The angiographic baseline minimum lumen diameter measured 1.78 ± 0.66 mm, which decreased to 0.66 ± 0.38 mm with ergonovine provocation (p < 0.0001), increased to 2.66 ± 0.64 mm after intracoronary nitroglycerin (p < 0.0001 compared to baseline and post-ergonovine), and did not change after the IVUS imaging (2.66 ± 0.63 mm, p = 0.9). Coronary artery spasm was observed in angiographically normal segments in 6 patients and near normal segments (<10% angiographic diameter stenosis by visual estimate) in 30. Atherosclerotic lesions were observed at all coronary spasm sites; the mean plaque burden measured 56% at the spasm site and 35% at the reference site. The plaque composition of spasm site was hypoechoic in 31 and hyperechoic, noncalcific in 5; there was no calcium. Positive remodeling (spasm site arterial area > proximal reference) was present in 5; intermediate remodeling (proximal reference > spasm site > distal reference arterial area) was present in 7; and negative remodeling (spasm site arterial area

Conclusions
Sites of focal vasospasm in patients with vasospastic angina showed characteristics of early atherosclerosis except for an unusually high incidence of negative arterial remodeling.
Long-term Outcome of Minor Plaque Prolapsed within Stents Documented with Intravascular Ultrasound

June Hong Kim, Myeong-Ki Hong, Sung-Tae Cho, Kyoung-Seok Rhee, Jong-Min Song, Cheol Whan Lee, Duk-Hyun Kang, Jae-Kwan Song, Jae-Joong, Kim Seong-Wook Park, Seung-Jung Park

Background
The direct relationship between minor plaque prolapsed within stents and late in-stent restenosis is unknown. Therefore, we evaluated the impact of minor plaque prolapse on late angiographic in-stent restenosis.

Materials and methods
Intravascular ultrasound (IVUS) guided single-coronary stenting was successfully performed in 384 consecutive patients with 407 native coronary lesions. Six-month follow-up angiogram was performed in 315 patients (82.0%) with 334 lesions (82.1%). Minor plaque prolapsed within stent occurred in 75 of 334 lesions (22.5%). Results were evaluated using angiographic and IVUS methodology.

Results
The development of minor plaque prolapse was significantly associated with infarct-related artery (p=0.000) and smaller pre-intervention minimal lumen diameter (p=0.001). The overall angiographic restenosis rate was 23.1% (77/334); 21.3% (16/75) in the lesions with plaque prolapse vs. 23.6% (61/259) in the lesions without plaque prolapse (p=0.806).

Conclusion
Minor plaque prolapsed within stents might not be associated with late angiographic in-stent restenosis.
restenosis or intimal hyperplasia (IH) after stenting. However, independent factors to predict IH have not been reported. Therefore, we evaluated the independent predictors of IH after stenting.

Methods
The serial (pre- and post-intervention, and follow-up) IVUS images were obtained in 77 patients with single stent implantation (GFX in 46 patients and NIR in 31). The matching IVUS image slices at 4 different sites within the same stent (follow-up lesion site, center of the stent and within 2 mm of proximal and distal margin of stent) were selected for serial comparisons. Total 308 matching images were obtained. A number of pre- and post-intervention IVUS variables including remodeling index = (lesion / proximal reference segment) pre-intervention vessel area were entered into multivariate linear regression analysis model to predict percent IH.

Results
The independent IVUS predictors of percent IH were pre-intervention plaque burden at follow-up lesion site \( r=0.252, p=0.027 \) and proximal margin of the stent \( r=0.245, p=0.034 \), and pre-intervention plaque burden \( r=0.334, p=0.003 \) and remodeling index \( r=-0.353, p=0.002 \) at the center of stent, and remodeling index at distal margin of the stent \( r=-0.230, p=0.046 \). The percent IH positively correlated with pre-intervention plaque burden and inversely with remodeling index.

Conclusions
The independent IVUS predictors of greater percent IH are larger pre-intervention plaque burden and smaller remodeling index.

Korean Circul Jour 31(4)434-441, 2001

Multicenter Clinical Trial of Atorvastatin in Patients with Hypercholesterolemia

Background & Objectives[] The aim of this study was to investigate the efficacy & safety of a new HMG-CoA reductase inhibitor, atorvastatin, to improve serum lipid profiles in patients with primary hypercholesterolemia.

Materials & Methods[] Three hundred and six patients from 21 hospitals, all with total cholesterol level over 240 mg/dl and triglyceride level below 400 mg/dl were enrolled in the study. Following diet therapy for 2 weeks, atorvastatin 10 mg was taken for 6 weeks if the total cholesterol level remained higher than 240 mg/dl. The percent change of total cholesterol, triglyceride, LDL-cholesterol and HDL-cholesterol from baseline to 6 weeks of treatment were evaluated. Patients were monitored for safety through careful
Results

The study was completed in a total of 166 patients. The mean age of patients the was 58.5 years and the percent of male and female patients was 37%, 37% and 63%, respectively. The baseline mean values of total cholesterol, triglyceride, LDL-cholesterol, HDL-cholesterol following diet therapy for 2 weeks were 280±34 mg/dl, 172±77 mg/dl, 190±35 mg/dl, 56±13 mg/dl, respectively. After 6 weeks treatment, the level of total cholesterol, triglyceride, LDL-cholesterol, HDL-cholesterol were 195±34 mg/dl, 150±67 mg/dl, 110±33 mg/dl, 55±12 mg/dl, respectively, and the rates of change were 30%, 7%, 42%, 0.2%, respectively.

The level of LDL-cholesterol at the end of treatment was below 100 mg/dl in 44%, 100-130 mg/dl in 33%, 130-160 mg/dl in 14%, over 160 mg/dl in 9% of patients. 77% of total patients achieved the target goal of LDL cholesterol (below 130 mg/dl) according to the NCEP guideline. The reduction rate of LDL-cholesterol was different among the patients. At the end of treatment, the patients with initial LDL-cholesterol below 100 mg/dl achieved a higher reduction rate (52%) as compared with those patients with initial LDL-cholesterol level were higher. There was only 1 patient who showed 3 times a three-fold increase of liver enzyme and no patient showed an increase of creatine kinase. Conclusion: Atorvastatin is effective and safe in improving the lipid profiles in patients with hypercholesterolemia without serious side effects.

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Treatment of Diffuse In-stent Restenosis with Rotational Atherectomy Followed by Radiation Therapy with a 188Re-MAG3-Filled Balloon

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Background

Rotational atherectomy has been shown to be safe and efficient for the treatment of ISR, but the recurrence rate is still high. Intracoronary -irradiation after rotational atherectomy may be a reasonable approach to prevent
recurrent ISR.

Subjects & methods
Fifty consecutive patients with diffuse ISR (length > 10 mm) in native coronary arteries underwent rotational atherectomy and adjunctive balloon angioplasty followed by -irradiation using a 188Re-MAG3-filled balloon catheter. The radiation dose was 15 Gy at 1.0 mm deep into vessel wall.

Results
Mean length of the lesion and irradiated segment was 25.6 12.7 mm and 37.6 11.2 mm, respectively. The radiation was delivered successfully to all patients, with a mean irradiation time of 201.8 61.7 seconds. No adverse event including myocardial infarction, death, or stent thrombosis occurred during the follow-up period (mean 10.3 3.7 months) and non-target vessel revascularization was needed in one patient. Six-month binary angiographic restenosis rate was 10.4 % and loss index was 0.17 0.31.

Conclusions
-irradiation using 188Re-MAG3-filled balloon following rotational atherectomy is safe and feasible for patients with diffuse ISR, and it may improve the clinical and angiographic outcomes. Further prospective randomized trials are warranted to evaluate the synergistic effect of debulking and irradiation in patients with diffuse ISR.

Korean Circul Jour 31(8)815-823, 2001

Clinical analysis on infections after cardiac transplantation

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Background:
The heart transplantation is now accepted as a definite therapeutic modality in patients with terminal heart failure. With use of immunosuppressive agent, the incident of rejection deceased but risk of infection increased. Infection has been the most common cause of death in heart transplant patient, especially during the first year. The purpose of this study is to evaluate the infection of 91 patients who had heart transplantation at our hospital.

Methods:
Of the total 91 patients, there were 75 males and 16 females, and the mean age was 39.8±14.1 years ranged from 14 to 62 years. All patients were in NYHA functional class III or IV preoperatively. The most common
underlying heart diseases were dilated cardiomyopathy (72/91). The mean follow-up duration was 36.4 months (range; 0.6 ~ 103 months) and 10 patients died during this period.

Result:
There were 35 patients with infections (early infections in 4 and late infections in 32). The most common infection was skin infection of herpes virus (15 cases). Pneumonia occurred in 8 patients and responded well to antibiotics. But multiple empyema developed in one patient with bacterial pneumonia despite of antibiotics, chest tube insertion was needed. There were 4 patients with tuberculosis, 2 with tuberculous pericardial effusion, 1 with pulmonary tuberculosis and 1 with miliary tuberculosis. Sepsis was noted in 3 patients, 2 with bacterial sepsis and 1 with candidial sepsis. They all died despite of antibiotic treatment. There were 2 cases with wound infections and 1 with perianal abscess, and 1 with aortitis with paraaortic abscess due to Aerococcus viridans. Two patients with cryptococcal meningitis were successfully treated with liposomal amphotericin B and oral fluconazole, one of them also had invasive aspergillosis. There were 6 cases with cytomegalovirus (CMV) disease. Three of them had CMV viremia, 2 had CMV disease (retinitis and colitis) and 1 had viremia and disease.

Conclusion:
There were 35 patients (38.5%) with infections and among them, 21 patients (23%) had one or more episodes of major infection. Infection was a major cause of death (30%) after heart transplantation. Careful control of infection is vital in the care of transplant recipients because infections result in increased morbidity and mortality.

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Clinical Characteristics of Surgically Corrected Mitral Regurgitation Due to Myxomatous Degeneration in Korea

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Background and Objectives
Although the clinical significance of mitral regurgitation (MR) due to prolapse or chordae rupture with myxomatous degeneration (MD) is increasing significantly, the clinical features of patients with MD in Korea
have not been characterized.

Materials and Method

A retrospective analysis was performed of the clinical data of 90 patients who underwent surgical correction of significant MR due to MD. Lesion sites of MD were confirmed during surgery: anterior (A) and posterior (P) mitral leaflets were divided into lateral (A1 & P1), middle (A2 & P2), and medial segments (A3 & P3).

Results

The mean age was 51±14 years and the male/female ratio was 1:1. Age distribution showed a typical bimodal pattern with two peaks at the mid-thirties and the mid-fifties each. MD was confined to P leaflet in 36 (40%), A leaflet in 20 (22%), and both leaflets in 34 patients (38%). Forty-six patients (51%) showed MD in a single segment, and 37 (41%) in 2 segments. 7 patients (8%) showed MD in more than 2 segments. In 90 patients, pathologic MD was confirmed in 139 mitral segments: among these, P3 was the most commonly involved segment (30%), followed by A3 (17%), P2 (14%), A2 (14%), A1 (14%), and P1 (12%). Chordae rupture was observed in 71 patients (79%), and was associated with hypertension (HT). Younger patients (age<45 years, N=31) showed a lower prevalence of HT and a higher incidence of MD involving multiple segments.

Conclusion

MD develops preferentially in the medial part of the mitral valve, and patterns of clinical presentation can change according to the age and existence of HT in selected patients with significant MR.

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Echocardiographic Prediction of Severe Mitral Regurgitation after Percutaneous Mitral Valvuloplasty with the Inoue Balloon

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Background and Objectives

This study was designed to predict the development of severe mitral regurgitation (MR) following percutaneous mitral valvuloplasty (PMV) in patients with a favorable morphology of the mitral valve (MV).

Subjects and Methods

We prospectively examined 253 patients with severe mitral stenosis from 1997 to 2000. Echocardiographic evaluation of MV morphology was performed prior to PMV. We proposed commissural calcification, severe relative prolapse, and uneven thickening of MV as predictors of MR following PMV and
defined the MR risk group as patients with any of these 3 features. The balloon size was expressed as the value of the effective balloon dilating area divided by the body surface area. The larger balloon group was defined as patients in whom balloon size > 3.8 cm²/m² was selected for PMV. The development of severe MR was defined as the presence of MR ≥ 3+ on echocardiography following PMV.

Results: Severe MR developed in 14 (5.5%) patients. On multiple logistic regression analysis, the MR risk group (p < 0.001) and balloon size (p = 0.009) were the only significant independent predictors of severe MR following PMV. A sensitivity and specificity of a Padial MR score > 8 and MR risk group was 43%, 88% and 71%, 86% respectively. In the MR risk group, severe MR developed in 8 (53.3%) of 15 patients of the larger balloon group as compared with 2 (6.9%) of 29 patients of the smaller balloon group (p = 0.001).

Conclusion: Echocardiography can identify patients with a high risk of developing MR after PMV and the use of a smaller Inoue balloon may prevent severe MR in selected patients

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Effects of cilostazol treatment on angiographic restenosis after coronary stent placement

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Background and Objectives
Cilostazol is a potent antiplatelet agent with antiproliferative properties. Few data are available about the effect of cilostazol on post-stenting restenosis. The aim of this study was to evaluate the impact of cilostazol on post-stenting restenosis.

Materials and Method
Four hundred and nine patients (494 lesions) scheduled for elective stenting were randomized to receive aspirin plus ticlopidine (group A, n = 201, 240 lesions) or aspirin plus cilostazol (group B, n = 208, 254 lesions), starting 2 days before stenting. Ticlopidine was given for 1 month and cilostazol for 6 months. Follow-up angiography was performed at 6 months, and clinical evaluation at regular intervals.

Results
Baseline characteristics were similar between the two groups. Procedural success rate was 99.6% in group A and 100% in group B. There were no cases of stent thrombosis after stenting. Angiographic follow-up was
performed in 380 of the 494 eligible lesions and angiographic restenosis rate was 27% in group A, and 22.9% in group B (p=NS). However, diffuse type in-stent restenosis was more common in group A than in group B (54.2% vs 26.8%, respectively, p<0.05). In diabetic patients, angiographic restenosis rate was 50% in group A and 21.7% in group B (p<0.05). Clinical events during the follow-up did not differ between the two groups.

Conclusion
The combination therapy with aspirin plus cilostazol seems to be an effective antithrombotic regimen with comparable results to aspirin plus ticlopidine, but it does not reduce the overall angiographic restenosis rate after elective coronary stenting.

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Effects of Percutaneous Balloon Mitral Valvuloplasty and Exercise Training on the Kinetics of Recovery Oxygen Consumption after Exercise in Patients with Mitral Stenosis

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Aims. Kinetics of recovery oxygen consumption after exercise plays an important role in determining exercise capacity. This study was performed to assess the kinetics of recovery oxygen consumption in mitral stenosis and evaluate the effects of percutaneous balloon mitral valvuloplasty and exercise training on the kinetics.

Methods and Results. Thirty patients with mitral stenosis (valve area \( \leq 1.0 \text{ cm}^2 \)) and same sized age- and size-matched healthy volunteers were included for this study. All subjects performed maximal upright graded bicycle exercise. Thirty consecutive patients who underwent successful percutaneous balloon mitral valvuloplasty (valve area \( \geq 1.5 \text{ cm}^2 \)and mitral regurgitation grade \( \leq 2 \)), were randomized to an exercise training group or non-training group. The exercise group performed daily exercise training for 3 months. Half-recovery time of peak oxygen consumption was significantly delayed in mitral stenosis as compared to normal subjects (120±42 s vs 59±5, P<0.01). Peak oxygen consumption (ml. min-1. kg-1) was significantly increased in both the training (16.8±4.9 to 25.3±6.9) and non-training groups (16.3±5.1 to 19.6±6.0) 3 months after percutaneous balloon mitral valvuloplasty. Half-recovery time of peak oxygen consumption was significantly shortened in the training group (124±39 to 76±13, P<0.01), but not in the non-training group (114±46 to 109±44 s, P=0.12) at 3 months follow-up. The degrees of symptomatic improvement after percutaneous balloon mitral valvuloplasty were more closely correlated with the changes of the half-recovery time of peak oxygen consumption than those of peak oxygen consumption.
Conclusion. Kinetics of recovery oxygen consumption was markedly delayed in mitral stenosis, which was improved after exercise training but not after percutaneous balloon mitral valvuloplasty alone. These results suggest that adjunctive exercise training may be useful for improvement of recovery kinetics and subjective symptoms after percutaneous balloon mitral valvuloplasty.

The American Journal of Cardiology, 83:8:1220-1223

Improvement in Exercise Capacity and Exercise Blood Pressure Response after Transcoronary Alcohol Ablation Therapy of Septal Hypertrophy in Hypertrophic Cardiomyopathy

Jae-Joong Kim, Cheol Whan Lee, Seong-Wook Park, Myeong-Ki Hong, Hee-Young Lim, Jae-Kwan Song, Young-Soo Jin, Seung-Jung Park

Transcoronary alcohol ablation (TAA) therapy of septal hypertrophy was recently proposed as a therapeutic modality for obstructive hypertrophic cardiomyopathy (HC). However, questions remain about the effect of TAA on exercise performance. We performed a time-course analysis of exercise capacity and exercise hemodynamics in 20 patients with symptomatic obstructive HC after TAA. Symptom-limited bicycle exercise testing was performed before and 3 and 12 months after TAA, and cardiac catheterization at 3-month follow-up. The pressure gradient of the left ventricular outflow tract immediately decreased from $58\pm 8$ to $4\pm 1$ mm Hg at rest ($p<0.01$) and from $143\pm 11$ to $30\pm 6$ mm Hg after extrasystole ($p<0.01$), but partially recovered at 3-month follow-up ($14\pm 4$ and $40\pm 9$ mm Hg, respectively). Left ventricular end-diastolic pressure was not changed after TAA. Peak oxygen consumption increased from $19\pm 2$ to $23\pm 1$ ml/kg/min ($p<0.01$) and exercise duration from $573\pm 47$ to $742\pm 46$ seconds ($p<0.01$) at 3-month follow-up, but thereafter reached a plateau. Abnormal patterns of exercise blood pressure response were shown in 9 patients but normalized after TAA. Major complications occurred in 4 patients: no reflow to the left anterior descending coronary artery in 2 patients and ventricular tachycardia requiring cardioversion in 2 patients. During the follow-up period, all patients survived with symptomatic improvement in 17 patients. Thus, TAA is a promising therapeutic modality with improvement in exercise capacity and abnormal exercise blood pressure response in obstructive HC. However, potential serious complications should be considered in the application of TAA.

The American Journal of Cardiology, 83:4:502-506

Immediate Results and Late Clinical Outcomes After New Crossflex Coronary Stent Implantation
This study evaluates the safety and efficacy of the new CrossFlex stent in the treatment of native coronary artery disease. The CrossFlex stent is a flexible, balloon-expandable new device with an excellent flexibility, radial strength, conformability, and radio-opacity. Little data are available concerning the clinical and angiographic outcomes of this device. The CrossFlex stent was implanted in 209 consecutive patients with 226 lesions. Follow-up angiography was performed at 6 months, and clinical evaluation was undertaken at regular intervals after stent implantation. Procedural success was achieved in all lesions without in-hospital complications. Angiographic follow-up data were available in 153 of the 187 eligible lesions (follow-up rate, 82%), and the overall angiographic restenosis rate was 16.3%. Minimal lumen diameter immediately after stent placement was the only predictor of angiographic restenosis. Clinical follow-up was obtained in all patients at 10.5±5.2 months. There were 4 deaths (1 cardiac in origin, the others noncardiac in origin), and 1 nonfatal myocardial infarction (nonstented artery) during follow-up. Target lesion revascularization was required in 15 patients (7%), and the overall event-free survival rate (death, myocardial infarction, and repeat revascularization) was 87% at the end of the follow-up period. The CrossFlex stent is a safe and effective device with a high procedural success rate, and a favorable late clinical outcome for treatment of native coronary artery disease. Further randomized trials are needed to compare the CrossFlex stent with standard slotted-tube stents.
(AIH) developed in the descending thoracic aorta was compared to test the hypothesis that absence of intimal tear and flow communication in AIH may have different impact on the remodeling of the affected aorta after the acute event. In 25 patients with AD and 20 with AIH involving distal descending thoracic aorta stabilized with medical treatment, follow-up (mean 9 months) transesophageal echocardiography was performed to measure the maximal dimensions of aorta, true lumen, false lumen in AD, and abnormal wall thickening in AIH. The sex ratio, prevalence of hypertension, baseline maximal dimension, and longitudinal extent of the affected aorta did not show any significant difference in both groups. Patients with AIH were older than those with AD (63±10 vs 50±9, p<0.01). Disappearance of abnormal wall thickening with complete restoration of the aorta occurred in 70% (14 of 20) patients with AIH, which was significantly more frequent than in AD (8%, p<0.01). In AD, progressive dilatation of the aorta with continuous flow communication in the false lumen resulted in larger dimension of the aorta than in AIH (44±13 vs 35±7 mm, p<0.01). Absence of persistent flow communication resulted in a favorable remodeling process in AIH affecting distal descending aorta. This finding, along with different mean age in AIH and AD, may suggest that AIH is not just a precursor of overt AD but a distinct disease entity with different pathophysiology.

Catheter-based Reperfusion of Unprotected Left Main Stenosis During an Acute Myocardial Infarction (the ULTIMA Experience)

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The ULTIMA registry was a prospective, multicenter, international registry of 277 patients who underwent percutaneous coronary interventions of unprotected left main trunk stenosis. The 40 patients who underwent an emergency percutaneous left main intervention for acute myocardial infarction are the focus of this study. We compared the results of primary angioplasty with primary stenting, characterizing both the short-term (in-hospital) and long-term (12-month) outcomes. Of the 40 patients, 23 underwent primary angioplasty, whereas 17 underwent primary stenting. The angiographic success rate was an 88% for the cohort. The in-hospital death or coronary artery bypass grafting rate was 65% for the entire group, 74% for the percutaneous transluminal coronary angioplasty group (PTCA), and 53% for the stent group (p = 0.2). The in-hospital death rate was 55% for the entire cohort, 70% for the PTCA group, and 35% for the stent group (p = 0.1). The 12-month rate of death
or bypass surgery was 83% and 58% for the PTCA and stent groups, respectively (p = 0.047). The 12-month survival rate was 35% and 53% for the PTCA and stent groups, respectively (p = 0.18). Bypass surgery was required in 6 patients in the PTCA group and 2 patients in the stent group (p = 0.07). Patients undergoing percutaneous interventions for unprotected left main myocardial stenosis during an acute myocardial infarction are critically ill; an initial percutaneous revascularization approach appears feasible and may be the preferred revascularization strategy. Primary stenting was associated with improved clinical outcomes.

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A Prospective Randomized Trial of Corticosteroids for the Prevention of Restenosis After Intracoronary Stent Implantation

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Background. Inflammatory responses have been implicated as one of the major contributors to neointimal hyperplasia after coronary stenting. The aim of this study was to evaluate the effect of pretreatment with single-dose intravenous methylprednisolone on preventing in-stent restenosis.

Methods. One hundred and forty consecutive patients for elective coronary stenting (focal, de novo lesion and reference diameter ≥3 mm) were randomly assigned to either a methylprednisolone or a placebo group. Either 1 g methylprednisolone or placebo was intravenously infused 6 to 12 hours before stenting with one of two types of stents. Follow-up angiography was performed at 6 months and clinical evaluation made at regular intervals.

Results. Baseline characteristics were similar between both groups. Stenting was successful in all patients, and in-hospital events did not occur in any patients. Follow-up angiography was performed in 127 patients (follow-up rate of 91.4%). The minimal lumen diameter increased from 0.86±0.50 mm before intervention to 3.34±0.42 mm after intervention (P = .02). At follow-up, minimal lumen diameter decreased to 2.14±0.78 mm (P < .01). Angiographic restenosis rate was 17.5% in the steroid group and 18.8% in the placebo group (P = .85), with no differences between the 2 types of stent. Clinical follow-up was available in all patients (10.3±2.5 months) and clinical events during the follow-up period were similar in both groups.

Conclusions. Single-dose pretreatment with intravenous methylprednisolone before coronary stenting had no effect on the change in minimal lumen diameter at a mean follow-up time.
Predictors of Diffuse-Type In-Stent Restenosis After Coronary Stent Implantation

Sang-Gon Lee, MD, Cheol Whan Lee, MD, Myeong-Ki Hong, MD, Hoon-Ki Park, MD, Jae-Joong Kim, MD, Seong-Wook Park, MD, Seung-Jung Park, MD

Diffuse-type in-stent restenosis (ISR) is associated with higher rate of restenosis after balloon angioplasty, requiring new therapeutic modalities; therefore, it is clinically important to identify the determinants of diffuse-type ISR. We evaluate the clinical and angiographic variables to predict diffuse-type ISR after coronary stent placement. Two hundred and ten ISR lesions in 196 patients (diffuse ISR, 114 lesions; focal ISR, 96 lesions) were reviewed in this study. Clinical, procedural and quantitative coronary angiographic parameters were analyzed. Diffuse-type ISR was defined as a ≥50% lumen narrowing and ≥10-mm length. Univariate analysis revealed that initial lesion length, smaller vessel size, diabetes, multivessel disease, multiple stents, and long stent were significantly associated with diffuse-type ISR. However, diabetes was the only independent predictor of diffuse-type ISR by stepwise multiple regression analysis (OR, 3.3; 95% CI, 1.4-7.4, P = 0.001). Diabetes was associated with diffuse-type ISR after coronary stent placement. It may reflect enhanced rate of neointimal hyperplasia within the stent in diabetic patients.

Key words. diabetes mellitus; stents; restenosis; coronary disease
Initially, it was believed that chronic stent recoil contributed to in-stent restenosis. However, subsequent serial intravascular ultrasound (IVUS) studies have shown that in vivo chronic stent recoil was negligible in the slotted-tube Palmaz-Schatz stent. These IVUS studies also have shown that the main mechanism of restenosis in Palmaz-Schatz stents was neointimal proliferation. Since then, a number of new stent designs have been introduced; these new designs have supplanted the classic slotted-tube Palmaz-Schatz stent. However, the magnitude of chronic recoil and the potential contribution of chronic recoil to in-stent restenosis in these new designs have not been studied. The objective of the present study is to use serial (poststent implantation and follow-up) IVUS to evaluate chronic recoil of newer stent designs versus the Palmaz-Schatz stent.

Journal of the American College of Cardiology, 35:1:169-175

Long-term Clinical and Echocardiographic Outcome of Percutaneous Mitral Valvuloplasty: Randomized Comparison of Inoue and Double-Balloon Techniques

Duk-Hyun Kang, Seong-Wook Park, Jae-Kwan Song, Hyun-Sook Kim, Myeong-Ki Hong, Jae-Joong Kim, Seung-Jung Park

Objectives. The purpose of the present study was to compare the long-term clinical and echocardiographic results of the Inoue and the double-balloon techniques.

Background. The large randomized trial comparing the extent of commissurotomy and the long-term results between the double-balloon and Inoue balloon techniques has not been reported.

Methods. We conducted a prospective, randomized trial comparing two procedures in 302 consecutive patients who underwent percutaneous mitral valvuloplasty (PMV) using Inoue (n=152; group I) or double-balloon technique (n=150, group D) between 1989 and 1995. The sample size was planned to provide the study with approximately 80% power for the detection of a 10% difference between the two groups.

Results. There were no significant differences in baseline characteristics between the two groups. Immediately after PMV, mitral valve area (MVA) increased from 0.9±0.2 to 1.8±0.3 cm² in group I and from 0.9±0.2 to 1.9±0.3 cm² in group D. No significant differences existed between the two groups in terms of development of commissural splitting, commissural mitral regurgitation (CMR), moderate to severe mitral regurgitation (MR) and MVA after PMV. The successful immediate results (MVA ≥1.5 cm² and MR ≤2) were achieved in 127 (84%) patients of group I and 122 (81%) patients of group D (p=NS). Annual clinical and echocardiographic
evaluation was completed for 290 (96%) patients with mean follow-up of 51±27 months. Adverse events occurred in 19 (13%) patients of group I (3 deaths, 7 mitral valve replacements, 5 repeat PMV, 2 NYHA class ≥3, 2 technical failures) and 16 (11%) patients of group D (2 deaths, 10 mitral valve replacements, 3 repeat PMV, 1 NYHA class ≥3). Estimated actuarial seven-year event-free survival was 75±7% in group I and 82±6% in group D (p=NS). Estimated actuarial seven-year restenosis-free survival was 67±7% in group I and 76 ±6% in group D (p=NS). On multivariate analysis, unsuccessful immediate result (p<0.001) and absence of CMR (p<0.01) were independently related with events. Absence of CMR and smaller mitral valve area after PMV were independently related with restenosis (p<0.001).

Conclusion. The Inoue and double-balloon techniques were equally effective in commissurotomy and produced similar, excellent long-term results. The achievement of complete commissurotomy with development of CMR or larger post-PMV mitral valve area is important to optimize the long-term results of PMV.

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Change of QT Dispersion After PTCA in Angina Patients

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Background. QT dispersion (QTd) represents the inhomogeneity of ventricular repolarization and has been reported to predict ventricular tachyarrhythmias in postmyocardial infarction patients. This study investigates the short-term effect of percutaneous transluminal coronary angioplasty (PTCA) on QTd in patients with coronary artery disease (CAD) and no history of previous myocardial infarction.

Methods. In 84 anginal patients (65 men and 19 women, mean age 58.3±9.0 years) who underwent successful PTCA of a single coronary artery, ECG was recorded in baseline, immediate, 1 day, and 1 month after PTCA for measurement of QTd and corrected QTd(c- QTd).

Results. PTCA was performed at the left anterior descending artery (LAD) in 56, left circumflex artery (LCx) in 12, and right coronary artery (RCA) in 16 patients. QTd(c-QTd) at baseline, immediately, 1 day, and 1 month of following PTCA was 51.3±4.5 (50.7±4.1), 54.2±4.5 (52.8±4.5), 47.7±4.3 (48.5±4.8), and 36.3±4.5 (37.5±4.6) ms, respectively. QTd and c- QTd significantly decreased at 1 month following PTCA. The difference was more prominent in patients with LAD lesion than LCx or RCA lesion, independent of gender, severity of stenoses, and use of beta-blocker.
Conclusions. QTd decreases in CAD patients who no history of myocardial infarction at 1 month following successful PTCA. This suggests that PTCA facilitates a favorable recovery from inhomogeneous repolarization due to myocardial ischemia. This finding calls for long-term follow-up of QTd and risk of ventricular tachyarrhythmias and sudden death following successful PTCA.

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Comparison of Cilostazol versus Ticlopidine Therapy After Stent Implantation

Seong-Wook Park, Cheol Whan Lee, Hyun-Sook Kim, Hyo-Jung Lee, Hoon-Ki Park, Myeong-Ki Hong, Jae-Joong Kim, Seung-Jung Park

The aim of this study was to evaluate the efficacy of cilostazol for prevention of stent thrombosis compared with ticlopidine. Cilostazol is a potent antiplatelet agent with less serious side effects. However, few data are available about the effect of cilostazol in preventing stent thrombosis after coronary stent implantation. Four hundred ninety patients selected for elective stent placement were randomized to receive aspirin plus ticlopidine (n=243) or aspirin plus cilostazol (n=247) for 1 month. Clinical and laboratory evaluations were performed at regular interval. There were no differences in baseline characteristics between the 2 groups. During the first 30 days after stent implantation, major cardiac events or adverse drug effects were similar between the 2 groups: ticlopidine (2.9%) vs cilostazol (1.6%) group, p= NS; stent thrombosis (0.4% vs 0.8%, p =NS, respectively), myocardial infarction (0.4% vs 0.8%, p= NS), severe leukopenia (1.2% vs 0%, p= NS), severe thrombocytopenia (0.4% vs 0%, p = NS), and cerebral hemorrhage (0.4% vs 0 %, p= NS). Adverse effects led to drug withdrawal in 7 patients in the ticlopidine group (2.9%) and in 5 in the cilostazol group (2.0%). There was no death during the follow-up period. Thus, aspirin plus cilostazol may be an effective antithrombotic regimen with comparable results to aspirin plus ticlopidine after elective coronary stenting.


Stent Placement for Ostial Left Anterior Descending Coronary Artery Stenosis: Acute and Long-term (2-year) Results
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This study was performed to assess the acute and long-term results of elective stenting for the treatment of ostial left anterior descending coronary artery (LAD) stenosis. One hundred and eleven consecutive patients with ostial LAD stenting were included for this study. Follow-up angiography was performed at 6 months and clinical evaluation at regular intervals after stenting. Procedural success rate was 97.3%. Four patients developed non-Q myocardial infarction and one patient underwent emergency bypass surgery due to a large dissection after stenting. Angiographic restenosis rate was 26.1% (18/69), and target lesion revascularization rate 11.7%. The final luminal diameter after stenting was the only predictor of angiographic restenosis. Clinical follow-up was obtained in all patients at 21.5±16.0 months. Two patients died during the follow-up. Event-free survival rate was 84.6±3.8%. In conclusion, stenting with or without debulking atherectomy may be considered as an acceptable therapeutic option for the treatment of ostial LAD stenosis.


Hyperpolarization Caused by Serotonin Contributes to Endothelium-Dependent Relaxations in the Porcine Coronary Artery

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Aim. The present study was designed to investigate the contribution of membrane hyperpolarization to endothelium-dependent relaxations induced by serotonin in the porcine coronary artery.

Methods. Rings with and without endothelium of porcine coronary arteries were suspended in conventional organ chambers for the measurement of isometric force. The cell membrane potential of the vascular smooth muscle cells was measured using glass microelectrodes, in the presence of indometacin, ketanserin, and/or Nω-nitro-L-arginine.

Results. Serotonin induced a transient endothelium-, and concentration-dependent relaxation in rings
contracted with prostaglandin F2α in the presence of η-nitro-L-arginine (maximal relaxation: 19 %). The η-nitro-L-arginine resistant relaxation was abolished by high K+ and tetrabutylammonium chloride. Serotonin also caused an endothelium-, concentration-dependent membrane hyperpolarizations with a maximal amplitude of -8.8 mV. The nitro-L-arginine resistant relaxations and hyperpolarizations were abolished by methiothepin, but not by glibenclamide. The time course of the endothelium-dependent relaxations and hyperpolarizations was similar.

Conclusion. These results suggest a contribution of cell membrane hyperpolarization to the endothelium-dependent relaxations induced by serotonin in the porcine coronary artery.


Hyperfibrinogenemia is an Independent Risk Factor for Atherosclerotic Renal Artery Stenosis.

Park JS, Park JH, Kang JY, Yang WS, Kim SB, Park SW, Park SJ

It is important to identify patients at risk for atherosclerotic renal artery stenosis because renal artery stenosis is a progressive disease and a potentially correctable problem. To determine the risk factors for atherosclerotic renal artery stenosis, we performed renal arteriography at the time of cardiac catheterization in 270 patients (M:F, 193:77, mean age: 59 years) with clinical ischemic heart disease. Before the procedure, demographic data, medical history, physical findings and laboratory data were obtained. The degree of coronary artery stenosis and renal artery stenosis was quantified with automatic edge detection technique. Significant renal artery stenosis, defined as a narrowing of the diameter by more than 50%, was identified in 28 (10%) patients. Three patients (1%) had bilateral disease. Significant coronary artery disease, defined as a narrowing of the diameter by more than 50%, was present in 231 patients (85%). By univariate logistic regression analysis, older age (68±8 vs. 58±10 years), the presence of hypertension (61% vs. 38%), the extent of coronary artery disease, a high fibrinogen level (391±93 mg/dl vs. 335±109 mg/dl), a low albumin level (3.9±0.4 g/dl vs. 4.1±0.4 g/dl), and a low hemoglobin level (12.5±1.6 g/dl vs. 13.5±1.6 g/dl) were associated with the presence of renal artery stenosis (p<0.05). Serum lipids, lipoprotein(a), creatinine, sex, smoking, or diabetes were not associated. By multivariate logistic regression analysis, older age (OR: 2.43 analyzed by 10 years increment, p=0.0001), the presence of hypertension (OR: 2.68, p=0.039) and a higher fibrinogen level (OR: 1.63 analyzed by 100 mg/dl increment, p=0.038) were significant risk factors of renal artery stenosis. Fibrinogen level was negatively correlated with albumin level (r=-0.18, p=0.004). These results suggest that hyperfibrinogenemia as well as old
age and hypertension are independent risk factors for atherosclerotic renal artery stenosis.


Endothelin-1 Releases Endothelium-Derived Endoperoxides and Thromboxane A2 in Porcine Coronary Arteries with Regenerated Endothelium

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Aim. To determine the role of endothelium-derived contracting factor (EDCF) in the response to endothelin-1 in arteries with regenerated endothelium.

Methods: Rings of porcine coronary arteries, with and without endothelium of previously deendothelialized left anterior descending coronary arteries and native left circumflex coronary arteries, were suspended in conventional organ chambers for the measurement of isometric force.

Results. In quiescent rings of the previously deendothelialized left anterior descending coronary artery treated with the NO-synthase inhibitor nitro-L-arginine, endothelin-1 caused contractions which were larger in rings with than that in those without endothelium. Under the same experimental conditions, in the left circumflex coronary artery, the contractions to endothelin-1 were augmented markedly by the removal of the endothelium. In rings with endothelium of the previously deendothelialized left anterior descending coronary artery, indometacin (inhibitor of cyclooxygenase) and ridogrel (thromboxane A2 receptor antagonist and inhibitor of thromboxane synthase) inhibited contractions to endothelin-1. Dazoxiben (inhibitor of thromboxane synthase) inhibited, to the same extent as indometacin and ridogrel, the response to higher concentrations of endothelin-1. The endothelium-dependent component of the response to lower concentrations of endothelin-1 was inhibited by indometacin and ridogrel, but not by dazoxiben. In rings without endothelium of both previously deendothelialized left anterior descending and native left circumflex coronary arteries, indometacin and ridogrel did not affect the contractions to endothelin-1.

Conclusion. These findings suggest that in regenerated endothelium, high concentrations of endothelin-1 stimulate the release of thromboxane A2. Endoperoxides generated by activation of endothelial cyclooxygenase may be the endothelium-derived contracting factor(s) released in regenerated endothelium by lower concentrations of the peptide.
Immediate and Long-Term Outcomes of Rotational Atherectomy Versus Balloon Angioplasty Alone for Treatment of Diffuse In-Stent Restenosis

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This study was performed to compare the effects of rotational atherectomy (RA) plus balloon angioplasty (BA) with those of BA alone for treatment of diffuse in-stent restenosis. RA+BA or BA alone was performed in a consecutive, prospective (not randomized) manner in 81 patients with 81 diffuse in-stent restenotic lesions (lesion length >10 mm): 36 patients underwent RA+BA, and 45 patients BA. Clinical recurrence was the primary end point of this study, and was defined as angina associated with objective evidence of myocardial ischemia on stress testing. Mean follow-up duration was 277 ± 109 days. In the BA group, acute lumen gain after repeat intervention was significantly lower than that of the original stenting procedure (1.94 ± 0.63 vs 2.37 ± 0.51 mm, p <0.05). In the RA+BA group, however, acute lumen gain of repeat intervention was similar to that of the original stenting procedure (2.16 ± 0.52 vs 2.26 ± 0.66 mm). Clinical recurrence rate at 6 months follow-up was significantly lower in the RA+BA group than in the BA group (25% vs 47%, p <0.05). Clinical events (death, myocardial infarction, repeat intervention) occurred in 6.7% (3 of 45) of patients in the BA group, but in no patient in the RA+BA group during the follow-up period. The long-term angina-free survival rate was significantly higher in the RA+BA group than in the BA group (72% vs 49%, p = 0.02). In conclusion, RA+BA seems to be a more effective therapeutic modality than BA alone for treatment of diffuse in-stent restenosis.

Comparison of Slotted Tube versus Coil Stent Implantation for Ostial Left Anterior Descending Coronary Artery Stenosis: Initial and Late Clinical Outcomes

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Balloon angioplasty of ostial left anterior descending coronary artery (LAD) lesions has been associated with a high rate of acute complications and late restenosis. Recently, coronary stenting has been proposed as an effective treatment modality for ostial LAD lesions. To evaluate the effects of stent design on the development of late restenosis, we retrospectively analyzed the efficacy of slotted-tube stent implantation (40 patients, Palmaz-Schatz stent) and coil stent implantation (15 patients, tantalum Cordis stent) of ostial LAD stenosis. Six-month angiographic follow-up data were obtained in 31 patients (82%) with slotted-tube stent implantation and 12 patients (86%) with coil stent implantation. Angiographic restenosis was defined as \( \geq 50\% \) diameter stenosis. The angiographic restenosis rate was significantly lower in slotted-tube stent implantation (32%) than in coil stent implantation (67%) (\( p<0.05 \)). Target lesion revascularization rate of slotted tube stent implantation was significantly lower (26%) than that of coil stent implantation (57%) (\( p<0.05 \)). Coil stent implantation of ostial left anterior descending artery lesions was associated with higher late restenosis compared with slotted tube stent implantation. In conclusion, slotted-tube stent implantation might be considered to improve late clinical outcomes of ostial LAD lesions.

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Update on Percutaneous Intervention in Left Main Artery Stenosis

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Advances in percutaneous intervention make it possible to expand the use of angioplasty to multiple and complex coronary artery lesions. Unfortunately, unprotected left main coronary artery (LMCA) stenosis has been regarded as a contraindication of percutaneous intervention because of its potential risk of early cardiac death and poor late clinical outcomes. However, LMCA stenosis is an attractive target for percutaneous intervention because of its larger caliber, short lesion length, and lack of tortuosity. Recently, stenting of unprotected LMCA stenoses has been reported with promising results in carefully selected patients. It now can be considered as a therapeutic option of unprotected LMCA stenoses in selected centers. This article summarizes the current status, technical considerations, and future directions of percutaneous intervention in
the treatment of unprotected LMCA stenoses.

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Diagnosis of Coronary Vasospasm in Patients with Clinical Presentation of Unstable Angina Pectoris using Ergonovine Echocardiography

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Although coronary vasospasm can contribute to the development of unstable angina, the definite diagnostic method has not been established. The purpose of this study was to determine if ergonovine echocardiography (detection of regional wall motion abnormality during bedside ergonovine challenge) after angiographic confirmation of insignificant fixed disease would be useful and safe in detecting coronary vasospasm in patients with unstable angina. After control of chest pain with medications in patients admitted to the coronary care unit under the tentative diagnosis of unstable angina, diagnostic coronary angiography was performed. All patients with normal or insignificant fixed disease underwent ergonovine echocardiography after discontinuation of medications for 4 ± 1 days. Among 208 consecutive patients enrolled for this study, 75% (156 of 208) showed significant fixed disease in the angiography. Ergonovine echocardiography was performed in 52 patients with insignificant disease, and coronary vasospasm was documented in 33 (63%, 33 of 52). No serious procedure-related arrhythmia or myocardial infarction occurred. Esophageal motility disorder and hypertrophic cardiomyopathy were diagnosed in 6 and 3 patients, respectively. Chest pain of undetermined etiology was the final diagnosis at discharge in 10 patients (5%, 10 of 208); among them chest pain redeveloped in 2 patients, and repeated ergonovine echocardiography revealed positive results. Our data suggest that among patients with the clinical presentation of unstable angina, coronary vasospasm is the main cause of myocardial ischemia in a considerable number of patients with a normal or near-normal angiogram, and ergonovine echocardiography after confirmation of absence of significant fixed disease is useful and safe for noninvasive diagnosis of coronary vasospasm in this setting.

Impaired Flow-Mediated Vasodilation of Epicardial Coronary Artery in Vasospastic Angina
To evaluate whether the flow-mediated vasodilation and coronary flow reserve are impaired or not in patients with vasospastic angina (VA), we measured the changes of epicardial coronary artery diameter and flow reserve in spasm related-left anterior descending coronary artery (LAD). The flow-mediated-response of epicardial coronary arteries in 15 VA were compared with 15 controls. Using quantitative coronary angiography, we measured the diameter of proximal (pLAD) and middle segment (mid-LAD) of LAD under baseline conditions, during increased blood flow after distal adenosine injection and after proximal administration of nitroglycerin. An increased fraction of average peak velocity after injection of adenosin was similar in both groups [control 340 (mean)±24 (SEM)%; VA 330±19%]. Flow-mediated vasodilation was preserved in all controls (pLAD 13.1±1.4%; mid-LAD 15.8±2.5%) but it was significantly impaired in patients with VA (pLAD -1.0±1.8%; mid-LAD 0.1±3.5%). The vasodilator response to nitroglycerin was comparable in controls (pLAD 25.8±2.8%; mid-LAD 27.2±2.8%) and VA (pLAD 26.2±5.2%; mid-LAD 26.7±3.5%). Coronary flow reserve is preserved with VA. However, the flow-mediated response of spasm related-epicardial coronary artery is impaired. This may play an important role in the pathogenesis of coronary artery spasm.

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Effects of percutaneous balloon mitral valvuloplasty and exercise training on the kinetics of recovery oxygen consumption after exercise in patients with mitral stenosis

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Aims. Kinetics of recovery oxygen consumption after exercise plays an important role in determining exercise capacity. This study was performed to assess the kinetics of recovery oxygen consumption in mitral stenosis...
and evaluate the effects of percutaneous balloon mitral valvuloplasty and exercise training on the kinetics.

Methods and Results. Thirty patients with mitral stenosis (valve area $\leq 1.0 \text{cm}^2$) and same sized age- and size-matched healthy volunteers were included for this study. All subjects performed maximal upright graded bicycle exercise. Thirty consecutive patients who underwent successful percutaneous balloon mitral valvuloplasty (valve area $\geq 1.5 \text{cm}^2$, mitral regurgitation grade $\leq 2$), were randomized to an exercise training group or non-training group. The exercise group performed daily exercise training for 3 months. Half-recovery time of peak oxygen consumption was significantly delayed in mitral stenosis as compared to normal subjects ($120\pm42 \text{ s vs } 59\pm5$, $p<0.01$). Peak oxygen consumption (ml. min$^{-1}$·kg$^{-1}$) was significantly increased in both the training ($16.8\pm4.9$ to $25.3\pm6.9$) and non-training groups ($16.3\pm5.1$ to $19.6\pm6.0$) 3 months after percutaneous balloon mitral valvuloplasty. Half-recovery time of peak oxygen consumption was significantly shortened in the training group ($124\pm39$ to $76\pm13$, $p<0.01$), but not in the non-training group ($114\pm46$ to $109\pm44$ s, $p=0.12$) at 3 months follow-up. The degrees of symptomatic improvement after percutaneous balloon mitral valvuloplasty were more closely correlated with the changes of the half-recovery time of peak oxygen consumption than those of peak oxygen consumption.

Conclusion. Kinetics of recovery oxygen consumption was markedly delayed in mitral stenosis. Which was improved after exercise training but not after percutaneous balloon mitral valvuloplasty alone. These results suggest that adjunctive exercise training may be useful for improvement of recovery kinetics and subjective symptoms after percutaneous balloon mitral valvuloplasty.

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Novel Application of Breath-Hold Turbo Spin-Echo T2 MRI for Detection of Acute Myocardial Infarction

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To assess the clinical utility of the breath-hold turbo spin-echo T2-weighted MRI in patients with acute myocardial infarction, the results of MRI were compared with those of electrocardiography, coronary angiography, and thallium-201 single photon emission tomography (SPECT) in 23 patients and 5 healthy volunteers. To compare MRI and thallium-SPECT, the left ventricle was divided into five segments, and the presence of myocardial infarction was determined in each segment. MRI demonstrated an abnormally bright signal in 49 of 140 segments (five segments each from 23 patients and 5 volunteers); thallium-SPECT showed a
fixed perfusion defect in 52 segments, for an 85% diagnostic concordance rate. The size of the myocardial infarction measured on MRI corresponded well to that measured on thallium-SPECT ($r = .70$, $p < .01$). Breath-hold turbo spin-echo T2 MRI can be used for detection of acute myocardial infarction in conjunction with thallium-SPECT, especially when accurate localization of lesion, increased spatial resolution, and anatomic landmarks are needed.

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Cerebral metabolic abnormalities in congestive heart failure detected by proton magnetic resonance spectroscopy

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Objectives. Using proton magnetic resonance spectroscopy, we investigated cerebral metabolism and its determinants in congestive heart failure (CHF), and the effects of cardiac transplantation on these measurements.

Background. Few data are available about cerebral metabolism in CHF.

Methods. Fifty patients with CHF (ejection fraction $\leq 35\%$) and 20 healthy volunteers were included for this study. Of the patients, 10 patients underwent heart transplantation. All subjects performed symptom-limited bicycle exercise test. Proton magnetic resonance spectroscopy (1H MRS) was obtained from localized regions (8 to 10 ml) of occipital gray matter (OGM) and parietal white matter (PWM). Absolute levels of the metabolites (N-acetylaspartate, creatine, choline, myo-inositol) were calculated.

Results. In PWM only creatine level was significantly lower in CHF than in control subjects, but in OGM all four metabolite levels were decreased in CHF. The creatine level was independently correlated with half-recovery time and duration of heart failure symptoms in PWM ($r = -0.56$, $p < 0.05$), and with peak oxygen consumption and serum sodium concentration in OGM ($r = 0.58$, $p < 0.05$). Cerebral metabolic abnormalities were improved after successful cardiac transplantation.

Conclusions. This study shows that cerebral metabolism is abnormally deranged in advanced CHF and it may serve as a potential marker of the disease severity.
Coronary Stenting (Cordis) Without Anticoagulation

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We evaluated the effect of antithrombotic regimens on subacute thrombosis and short-term clinical courses after successful implantation of the Cordis coronary stent, which is a flexible, balloon expandable, radiopaque tantalum stent. Two hundred seventy-five consecutive patients with 290 lesions were treated with 356 Cordis stent implantations. According to poststent antithrombotic regimen, patients were divided into 3 groups; 165 patients with 175 lesions received aspirin 200 mg/day, ticlopidine 500 mg/day, and warfarin for 1 month (group 1), 66 patients with 69 lesions received aspirin and ticlopidine (group 2), and 44 patients with 46 lesions received aspirin alone (group 3), after successful Cordis stenting. The overall procedural success rates were 97.7% in group 1, 98.6% in group 2, and 100% in group 3. More than 65% of the patients were eligible for elective stenting. The overall rate of stent thrombosis was 1.8%; 1.2% in patients assigned to the treatment with aspirin, ticlopidine, and warfarin; 0% in patients with aspirin and ticlopidine; and 6.8% in patients assigned to the treatment with aspirin alone. In conclusion, the Cordis coronary stent is an effective endovascular stent in various clinical indications including unstable angina and acute myocardial infarction. Antiplatelet therapy using aspirin and ticlopidine after successful Cordis coronary stenting is a promising alternative to anticoagulation therapy to overcome the drawbacks of stenting. However, poststent antithrombotic therapy with aspirin alone is associated with a significant rate of stent thrombosis.

Successful Treatment of Coronary Artery Perforation During Angioplasty Using Autologous Vein Graft-Coated Stent

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We report a case of successful treatment of coronary artery perforation and cardiac tamponade with an autologous vein graft-coated stent, which were developed during percutaneous transluminal coronary angioplasty. The method reported here may be an effective alternative to emergency surgery and should be considered when coronary artery perforation does not respond to conventional prolonged inflation with perfusion catheter.

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Late Clinical Outcome after Intracoronary Palmaz-Schatz Stenting with High Pressure Balloon Dilation Without Anticoagulation

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ABSTRACT: In recent studies, the technique of high pressure balloon dilation for stent optimization has been shown to improve procedural success and to reduce subacute closure after stenting. The late clinical outcome, however, is still uncertain after stenting with high pressure balloon dilation. Therefore, we evaluated the effect of high pressure balloon dilation on the subsequent clinical course in patients after intracoronary stenting. One hundred ninety patients with 197 lesions were treated with Palmaz-Schatz stent implantation. Intracoronary stenting without high pressure balloon dilation and with anticoagulation was performed in 55 patients with 55 lesions (phase 1), whereas intracoronary stenting with high pressure balloon dilation, without anticoagulation was done in 135 patients with 142 lesions (phase 2). We compared the angiographic and clinical results immediately and at follow-up in both phase 1 and phase 2. Coronary angiography was repeated at 6 months in 147 patients (79%) and 150 lesions (77%). The overall incidence of angiographic restenosis was 24% (31% in phase 1 and 21% in phase 2). Angiographic restenosis occurred in 18% of elective stenting on de novo lesions (23% in phase 1 and 15% in phase 2). The target lesion revascularization rate was 19% (26% in phase 1 and 16% in phase 2). The restenosis rate was significantly reduced with high pressure balloon dilation in the infarct-related artery and for a stent size of $\geq 4.0$ mm ($p < 0.05$).
In conclusion, intracoronary stenting using high pressure balloon dilation technique without anticoagulation has good immediate results, negligible stent thrombosis and may have a tendency towards lower rates of restenosis.

Late Clinical Outcomes of Cordis Tantalum Coronary Stenting Without Anticoagulation

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The Cordis coronary stent (Cordis Corp., Miami, Florida) is a flexible, balloon expandable, and radiopaque tantalum. There has been no report of the long-term clinical outcomes after implantation of this device. The current study was designed to evaluate both the acute results and the long-term clinical outcome and angiographic restenosis rate after successful Cordis coronary stent implantation. In addition, because the Cordis tantalum stent is intensely radiopaque (potentially interfering with the angiographic assessment), this study also used intravascular ultrasound (IVUS) to evaluate the patterns of in-stent restenosis and to confirm angiographic findings.

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Clinical and Echocardiographic Outcomes of Aortic Intramural Hemorrhage Compared With Acute Aortic Dissection

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Aortic intramural hemorrhage (IMH), which presents clinical manifestations identical to those of acute aortic dissection, is different from aortic dissection in terms of the absence of intimal tear and communication of blood flow between the true and false lumen. This study was conducted for the purpose of diagnosing IMH by
transesophageal echocardiography (TEE) prospectively and comparing the clinical and echocardiographic outcome of IMH with aortic dissection. Between August 1991 and November 1996, 27 IMHs and 73 acute aortic dissections were diagnosed using TEE in 202 consecutive patients with suspected aortic dissections. The TEE diagnoses of IMH and aortic dissection were initially compared with computed tomography and magnetic resonance imaging and later confirmed by operative findings (n = 37) or follow-up changes (n = 12). In the 49 patients whose diagnosis was confirmed by operation or follow-up changes, the sensitivity and specificity of TEE for the diagnosis of IMH were 27 of 27 (100%) and 20 of 22 (91%), respectively. There were 11 deaths in 73 patients (15%) from acute aortic dissection and 1 death in 27 patients (4%) from IMH during a follow-up of 1.7 ± 1.5 years (p = NS).

Stanford classification and types of treatment were not related to death in both groups. Complications developed less often in patients with IMH (3 of 27) than in those with acute aortic dissection (24 of 73), and no death occurred in patients with uncomplicated IMH who were medically treated. A follow-up imaging study of 12 IMH patients showed complete resolution in 8, regression in 3, and progression in 1 patient. TEE is accurate in the diagnosis of IMH and IMH has a lower incidence of complications than aortic dissection because of the absence of intimal tear and communication of blood flow in the false lumen.

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Comparison of Outcomes of Percutaneous Mitral Valvuloplasty Versus Mitral Valve Replacement After Resolution of Left Atrial Appendage Thrombi by Warfarin Therapy

Duk-Hyun Kang, MD, Jae-Kwan Song, MD, Jei-Keon Chae, MD, Sang-Sig Cheong, MD, Myeong-Ki Hong, MD, Hyun Song, MD, Jae-Won Lee, MD, Seong-Wook Park, MD, and Seung-Jung Park, MD

Percutaneous mitral valvuloplasty (PMV) has become an effective and safe alternative to surgical treatment in severe mitral stenosis (MS), but the presence of left atrial thrombus was a contraindication to PMV because of embolic risk, when catheters and wires are manipulated in the left atrium. Successful resolution of left atrial appendage (LAA) thrombus by oral anticoagulation has been recently reported in a few cases of MS, and it is suggested that PMV can be attempted after resolution of LAA thrombi by oral anticoagulation for at least 2 months. However, it is not yet known what the success rate and optimal duration of anticoagulation is in resolving LAA thrombi in MS, and the efficacy and safety of PMV after resolution of LAA thrombi has not been reported. This study assesses the efficacy of warfarin in resolving LAA thrombi and evaluates clinical outcomes of PMV after resolution of LAA thrombi compared with mitral valve replacement.
Stenting of Unprotected Left Main Coronary Artery Stenoses: Immediate and Late Outcomes

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Objectives. We examined the immediate and long-term outcomes after stenting of unprotected left main coronary artery (LMCA) stenoses in patients with normal left ventricular (LV) function.

Background. Left main coronary artery disease is regarded as an absolute contraindication for coronary angioplasty. Recently, several reports on protected or unprotected LMCA stenting, or both, suggested the possibility of percutaneous intervention for this prohibited area.

Methods. Forty-two consecutive patients with unprotected LMCA stenoses and normal LV function were treated with stents. The post-stent antithrombotic regimens were aspirin and ticlopidine; 14 patients also received warfarin. Patients were followed very closely with monthly telephone interviews and follow-up angiography at 6 months.

Results. The procedural success rate was 100%, with no episodes of subacute thrombosis regardless of anticoagulation regimen. Six-month follow-up angiography was performed in 32 of 34 eligible patients. Angiographic restenosis occurred in seven patients (22%, 95% confidence interval 7% to 37%); five patients subsequently underwent elective coronary artery bypass graft surgery (CABG), and two patients were treated with rotational atherectomy plus adjunct balloon angioplasty. The only death occurred 2 days after elective CABG for treatment of in-stent restenosis. The other patients (without angiographic follow-up) remain asymptomatic.

Conclusions. Stenting of unprotected LMCA stenoses may be a safe and effective alternative to CABG in carefully selected patients with normal LV function. Further studies in larger patient populations are needed to assess late outcome.
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1. Automation of the synthesis of highly concentrated 188Re-MAG3 for intracoronary radiation therapy.
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2. Determinants and prognostic significance of spontaneous coronary recanalization in acute myocardial infarction *
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3. Different clinical features of aortic intramural hematoma versus dissection involving the ascending aorta
   Jae-Kwan Song FACC MD ?, Hyun-Sook Kim MD ?, Duk-Hyun Kang MD ?, Tae-Hwan Lim MD †, Meong-Gun Song MD, Seong-Wook Park FACC MD ? and Seung-Jung Park FACC MD
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4. Prognostic Significance of Cerebral Metabolic Abnormalities in Patients With Congestive Heart Failure
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5. Treatment of diffuse in-stent restenosis with rotational atherectomy followed by radiation therapy with a rhenium-188-mercaptoacetyltriglycine-filled balloon *
   Seong-Wook Park FACC MD, PhD ?, Myeong-Ki Hong MD, PhD ?, Dae Hyuk Moon MD, PhD †, Seung Jun Oh PhD †, Cheol Whan Lee MD ?, Jae-Joong Kim MD, PhD ? and Seung-Jung Park FACC MD, PhD ?
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