



Complete Summary

GUIDELINE TITLE

Percutaneous coronary intervention and adjunctive pharmacotherapy in women: a statement for healthcare professionals from the American Heart Association.

BIBLIOGRAPHIC SOURCE(S)

Lansky AJ, Hochman JS, Ward PA, Mintz GS, Fabunmi R, Berger PB, New G, Grines CL, Pietras CG, Kern MJ, Ferrell M, Leon MB, Mehran R, White C, Mieres JH, Moses JW, Stone GW, Jacobs AK. Percutaneous coronary intervention and adjunctive pharmacotherapy in women: a statement for healthcare professionals from the American Heart Association. *Circulation* 2005 Feb 22;111(7):940-53. [142 references] [PubMed](#)

GUIDELINE STATUS

This is the current release of the guideline.

** REGULATORY ALERT **

FDA WARNING/REGULATORY ALERT

Note from the National Guideline Clearinghouse: This guideline references a drug(s)/intervention(s) for which important revised regulatory and/or warning information has been released.

- [February 28, 2008, Heparin Sodium Injection](#): The U.S. Food and Drug Administration (FDA) informed the public that Baxter Healthcare Corporation has voluntarily recalled all of their multi-dose and single-use vials of heparin sodium for injection and their heparin lock flush solutions. Alternate heparin manufacturers are expected to be able to increase heparin production sufficiently to supply the U.S. market. There have been reports of serious adverse events including allergic or hypersensitivity-type reactions, with symptoms of oral swelling, nausea, vomiting, sweating, shortness of breath, and cases of severe hypotension.
- [June 8, 2007, Troponin-I Immunoassay](#): Class I Recall of all lots of the Architect Stat Troponin-I Immunoassay. The assay may report falsely elevated or falsely decreased results at and near a low level, which may impact patient treatment.

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** REGULATORY ALERT **

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SCOPE

DISEASE/CONDITION(S)

Fatal and nonfatal ischemic complications in acute myocardial infarction and high-risk acute coronary syndromes (ACS)

Note: Acute coronary syndromes (ACS) are defined as unstable angina (UA) or non-ST-elevation myocardial infarction (NSTEMI)

GUIDELINE CATEGORY

Evaluation
Management
Treatment

CLINICAL SPECIALTY

Cardiology
Family Practice
Internal Medicine
Surgery

INTENDED USERS

Health Care Providers
Physicians

GUIDELINE OBJECTIVE(S)

To review what is known and not known about percutaneous coronary intervention (PCI) in women and to put published data in context with contemporary coronary intervention

TARGET POPULATION

Women with acute myocardial infarction and high-risk acute coronary syndromes (ACS)

Note: Acute coronary syndrome (ACS) is defined as unstable angina (UA) or non-ST-elevation myocardial infarction (NSTEMI)

INTERVENTIONS AND PRACTICES CONSIDERED

Percutaneous Coronary Intervention (PCI)

Interventions

1. Stents (bare metal, drug-eluting)
2. Atherectomy
3. Distal protection during saphenous vein graft
4. Thrombectomy
5. Vascular brachytherapy
6. Balloon angioplasty

Pharmacotherapy

1. Antiplatelets
 - Aspirin
 - Thienopyridines (clopidogrel, ticlopidine)
2. Glycoproteins (GP) IIb/IIIa inhibitors
3. Antithrombin agents
 - Unfractionated heparin (UFH)
 - Low-molecular-weight heparin (LMWH)
 - Direct thrombin inhibitors

MAJOR OUTCOMES CONSIDERED

- Mortality, including in-hospital mortality
- Target vessel revascularization
- Incidence of major adverse cardiovascular events (MACE)
- Myocardial infarction
- Incidence of restenosis
- Incidence of ischemic and vascular complications (such as access-site hematomas, bleeding complications)

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

By searching MEDLINE from January 1988 through January 2005, the writing group identified 2,156 relevant publications. Of these publications, 142 were selected on the basis of the following criteria: sex-specific trials in interventional cardiology and pharmacotherapy, randomized clinical trials or large-scale registries of at least 250 consecutive patients, and review articles.

NUMBER OF SOURCE DOCUMENTS

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Publications were reviewed and summarized by dedicated medical writers.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Publications were reviewed and summarized by dedicated medical writers (P.A.W., C.G.P.). The summary was used as the basis of a draft manuscript, which was written by the writing group chair. The manuscript was subsequently submitted for review to the entire writing group, and each member was assigned a specific section. Each section was reviewed by at least 2 group members, and the final document was fact-checked by the medical writers. The data presented are sex specific and consistent with relevant current American College of Cardiology (ACC)/American Heart Association (AHA) guidelines. Practice recommendations or trial results without supporting sex-specific data are specified. The writing group contacted the investigators of eligible studies that did not report findings separately by sex to obtain these data; these citations are marked with the symbol § in the original guideline document.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Expert peer review of American Heart Association (AHA) Scientific Statements is conducted at the AHA National Center. For more on AHA statements and guidelines development, visit [AHA Web site](#).

This statement was approved by the AHA Science Advisory and Coordinating committee on December 28, 2004.

RECOMMENDATIONS**MAJOR RECOMMENDATIONS**

The following tables summarize the findings for women drawn from the literature. See the original guideline document for detailed discussion of each intervention.

Table: Outcomes in Women by Device, Lesion Type, and Clinical Syndrome

Elective Coronary Interventions	
Percutaneous coronary intervention (PCI)	<ul style="list-style-type: none"> • Indications for PCI in women are same as for men.
Bare metal stent	<ul style="list-style-type: none"> • Stent implantation improves acute angiographic success in women. • Long-term benefits of stenting (compared with balloon angioplasty) in reducing restenosis are presumed generalizable to women. • No sex-based data on small-vessel stenting are available.
Drug-eluting stent	<ul style="list-style-type: none"> • Compared with bare metal stents, CYPHER (sirolimus-eluting) and TAXUS (paclitaxel-eluting) stents reduce restenosis and major adverse cardiovascular events (MACE) at 1 year in women.
Atherectomy	<ul style="list-style-type: none"> • Optimal directional atherectomy* is associated with modest improvements in restenosis; women have lower procedural success and more vascular complications than men. • Women treated with excimer laser coronary angioplasty experience more coronary perforations than men. • No sex-specific data on rotational atherectomy, transluminal extraction atherectomy, or thrombectomy (AngioJet) devices are available.
Saphenous Vein Graft	
Stenting	<ul style="list-style-type: none"> • Short mortality and complications are increased in

	women.
Distal protection	<ul style="list-style-type: none"> Distal protection with PercuSurge GuardWire during saphenous vein graft (SVG) intervention reduces rate of myocardial infarction (MI) at 30 days in women.
Thrombectomy	<ul style="list-style-type: none"> No data are available in women
In-stent Restenosis	
Vascular brachytherapy	<ul style="list-style-type: none"> Vascular brachytherapy with BetaCath system reduces restenosis after treatment of in-stent restenosis in women and men.
Acute Coronary Syndromes	
Unstable angina/non-ST-elevation myocardial infarction (UA/NSTEMI)	
PCI	<ul style="list-style-type: none"> Women with high-risk features appear to benefit from early invasive strategy (intervention within 48 h) with stenting, if appropriate, and adjunctive glycoprotein (GP) IIb/IIIa inhibition.
ST-segment-elevation myocardial infarction (STEMI)	
Balloon angioplasty	<ul style="list-style-type: none"> Timely primary angioplasty by a skilled team results in improved outcomes as compared with fibrinolysis in women.
Stent	<ul style="list-style-type: none"> Primary stenting reduces target vessel revascularization and major adverse cardiovascular events as compared with primary balloon angioplasty in women.
Drug-eluting stent	<ul style="list-style-type: none"> No data are available in women.
Shock	<ul style="list-style-type: none"> Women benefit from early revascularization for cardiogenic shock due to pump failure.

*Optimal directional atherectomy indicates final residual stenosis <30% after intervention.

Note: This table summarizes the findings for women drawn from the literature review. It is not the intention of the writing group to provide formal treatment recommendations; rather this table should serve as a convenient point of reference. Refer to text in the original guideline document for discussion and citations.

Table: Pharmacotherapy in Women

Antiplatelets	
Aspirin	<ul style="list-style-type: none"> Women undergoing elective PCI or PCI for acute coronary syndrome (ACS) should receive aspirin 80 to 325 mg at least 2 hours before procedure. Aspirin should be continued indefinitely on a daily basis for

	secondary prevention, but exact dose after treated with drug-eluting stent (DES) has not been determined.
Thienopyridines	
Clonidogrel	<ul style="list-style-type: none"> • Women undergoing elective PCI or PCI for ACS should receive clonidogrel 300 to 600-mg load; clonidogrel, 75 mg, should be continued for at least 2 to 4 weeks after bare metal stent implantation and for several months after drug-eluting stent implantation (3 months for sirolimus, 6 month for paclitaxel). • Optimal loading dose and pretreatment time for clonidogrel remain unclear. • Clonidogrel should be withdrawn for 5 to 7 days before planned coronary artery bypass graft (CABG) to minimize bleeding complications.
Ticlopidine	<ul style="list-style-type: none"> • Ticlopidine (500-mg load, 250 mg twice daily) can substitute for clonidogrel in clonidogrel-intolerant patients.
GP IIb/IIIa Inhibitors	<ul style="list-style-type: none"> • GP IIb/IIIa inhibition reduces ischemic complications in high-risk (troponin-positive, diabetic, older adult) patients including women undergoing elective PCI or PCI for ACS with balloon angioplasty or stenting. • GP IIb/IIIa inhibition with abciximab in women with STEMI (without shock) undergoing primary balloon angioplasty or stenting may reduce ischemic complications without increasing risk of major bleeding.
Antithrombin Agents	
Unfractionated heparin (UFH)	<ul style="list-style-type: none"> • During STEMI, UFH treatment benefit is established in women. • Observational data support use of empiric UFH during PCI in women to achieve an activated clotting time (ACT) of 250 to 300 seconds. • Current guidelines advise weight-adjusted UFH (60- to 70-U/kg IV bolus; 12- to 15-U/kg/h infusion) with target activated clotting time 250 to 300 seconds for HemoTec and 300 to 350 seconds for Hemochron. • Lower doses may be considered in women and older adult patients and when UFH is combined with GP IIb/IIIa inhibitors during PCI; maximum bolus and infusion when UFH is used as adjunct to fibrinolytic therapy is 4,000-U bolus and 1,000-U/h infusion. • No established benefit of long-term UFH after PCI exists.
Low-molecular-weight heparin (LMWH)	<ul style="list-style-type: none"> • Women with unstable angina/NSTEMI treated with LMWH experience more bleeding complications than do men. • Combined LMWH and GP IIb/IIIa inhibition appears effective in women with unstable angina/NSTEMI undergoing PCI; however, it is associated with increased

	bleeding.
Direct thrombin inhibitors	<ul style="list-style-type: none"> • Bivalirudin and provisional GP IIb/IIIa results in similar outcomes compared with UFH with planned GP IIb/IIIa inhibitors during PCI and up to 6 months after PCI, and fewer bleeding complications in women.

This table summarizes the findings for women drawn from the literature review. It is not the intention of the writing group to provide formal treatment recommendations; rather, this table should serve as a convenient point of reference. Refer to text in the original guideline document for discussion and citations. When recommendations are provided, they are based on previously published American College of Cardiology/American Heart Association guidelines.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence supporting the recommendations is not specifically stated.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Increased use of percutaneous coronary intervention and adjunctive pharmacotherapy may improve outcomes for women with high-risk acute coronary syndromes and ST-elevation myocardial infarction (STEMI).

POTENTIAL HARMS

- The adverse outcomes of women undergoing percutaneous coronary intervention (PCI), including the rates of short- and long-term mortality, nonfatal myocardial infarction (MI), and emergency coronary bypass surgery, have decreased significantly over time with contemporary interventional therapies. Nevertheless, women consistently tend to have worse clinical outcomes than those of men; most of these worse outcomes are explained by the higher risk profile of women.
- Although rarely used today, directional atherectomy is associated with lower procedural success and more bleeding complications in women than in men.
- Excimer laser angioplasty, rarely performed in the current percutaneous coronary intervention era, is associated with more coronary perforations in women, primarily attributed to women's smaller vessel sizes.
- Previous guidelines recommended that the thienopyridines (preferably clopidogrel) be substituted for aspirin only in aspirin-allergic patients (men or women) for secondary prevention. Given their comparable efficacy but

- increased rates of neutropenia, thrombotic thrombocytopenia, and aplastic anemia with ticlopidine, clopidogrel is used in most cases.
- Dual antiplatelet therapy is associated with increased bleeding risk as the dose of aspirin increases, and reducing the aspirin dose (75 to 100 mg/day) 1 month after percutaneous coronary intervention should be considered for patients who have not received a drug-eluting stent (DES).
 - Clopidogrel administered before coronary artery bypass graft (CABG) has been associated with significant increase in perioperative bleeding, and should be discontinued 5 to 7 days before elective coronary artery bypass graft unless the urgency for revascularization outweighs the bleeding risk.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

It is not the intention of the writing group to give specific treatment recommendations but rather to compile and collate the available sex-specific data on the safety and efficacy of interventional therapies in women.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Lansky AJ, Hochman JS, Ward PA, Mintz GS, Fabunmi R, Berger PB, New G, Grines CL, Pietras CG, Kern MJ, Ferrell M, Leon MB, Mehran R, White C, Mieres JH, Moses JW, Stone GW, Jacobs AK. Percutaneous coronary intervention and adjunctive pharmacotherapy in women: a statement for healthcare professionals from the American Heart Association. *Circulation* 2005 Feb 22;111(7):940-53. [142 references] [PubMed](#)

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2005 Feb 22

GUIDELINE DEVELOPER(S)

American Heart Association - Professional Association

SOURCE(S) OF FUNDING

American Heart Association

GUIDELINE COMMITTEE

Not stated

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The American Heart Association (AHA) makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

Table: Author Disclosures

Writing Group Member Name	Employment	Research Grant	Other Research Support	Speakers Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board
Alexandra J. Lansky	Columbia University Medical Center	Cordis/Johnson & Johnson; Boston Scientific; Medtronic, The Medicines	None	None	None	None

Writing Group Member Name	Employment	Research Grant	Other Research Support	Speakers Bureau/Honoraria	Ownership Interest	Consultant/Ad Board
		Company; Guidant				
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Morton J.	St. Louis	None	None	None	None	None

Writing Group Member Name	Employment	Research Grant	Other Research Support	Speakers Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board
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Margaret Ferrell	Massachusetts General	None	None	None	None	None
Martin B. Leon	Columbia University Medical Center	Medtronic; Biorest	None	None	Guidant; MediVas	Cordis/Johnson; Or Medtronic; Guid Cell Technolo
Roxana Mehran	Cardiovascular Research Foundation; Columbia University Medical Center	None	None	Tyco/ Mallinckrodt; The Medicines Company	None	None
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Jeffrey W. Moses	Columbia University	None	None	Cordis/ Johnson & Johnson; Boston Scientific; Sanofi	None	Cordis/ Johnson Johnson
Gregg W. Stone	Cardiovascular Research Foundation	None	None	None	None	Guidant; Bo Scientific; Abbo Medicines Con
Alice K. Jacobs	Boston University	None	None	None	None	None

This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit.

Table: Reviewer Disclosures

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David L. Brown	State University of New York - Stony Brook	None	None	None	Volcano Therapeutics	None
David P. Faxon	University of Chicago	None	None	Boston Scientific; Sanofi-Synthelabo	REVA Medical	Johnson & Johnson

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David J. Malenka	Dartmouth-Hitchcock Medical Center	None	None	None	None	None

This table represents the relationships of peer reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit.

ENDORSER(S)

American College of Cardiology Foundation - Medical Specialty Society

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the [American Heart Association Web site](#).

Print copies: Available from the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596; Phone: 800-242-8721

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on May 18, 2005. This summary was updated by ECRI Institute on June 22, 2007 following the U.S. Food and Drug Administration (FDA) advisory on heparin sodium injection. This summary was updated by ECRI Institute on July 12, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Troponin-1 Immunoassay. This summary was updated by ECRI Institute on March 14, 2008 following the updated FDA advisory on heparin sodium injection.

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