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Patient information: Recovery after coronary artery bypass graft surgery (CABG) (Beyond the Basics)

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BYPASS SURGERY OVERVIEW — Coronary artery bypass graft surgery, also known as CABG or bypass surgery, can help to restore blood flow to an area of the heart. However, surgery does not stop the progression of atherosclerosis (coronary heart disease), which deposits fatty material into artery walls, narrowing them and eventually limiting blood flow.

Patients and healthcare providers must work together after surgery to treat the underlying atherosclerosis and the factors that can cause progression of heart disease. (See ['Reduce cardiac risk factors'](#) below.)

This topic review discusses treatments that are recommended after coronary artery bypass graft surgery. These treatments can help to:

- Reduce the risk of developing complications of coronary heart disease, including having a subsequent heart attack or dying
- Help a person to feel better and have more energy.

An overview of coronary artery bypass graft surgery is discussed in detail separately. (See ["Patient information: Coronary artery bypass graft surgery \(Beyond the Basics\)"](#).)

CARE AT HOME AFTER BYPASS SURGERY — Care after bypass surgery aims to reduce the risk factors for heart disease and includes strategies to help patients and family members to stop smoking, control high blood pressure, improve cholesterol levels, begin exercising regularly, and reduce stress. Some of these changes can be made by adjusting lifestyle habits through diet and exercise. However, lifestyle changes alone may not be adequate and medications are often needed.

Discharge from the hospital — Patients with an uncomplicated heart attack usually go home after about five days in the hospital. In some cases, the hospital stay is longer. If complications have occurred, discharge is delayed until the person's condition is stable.

Before leaving the hospital, it is important for the patient and family to participate in and understand the discharge plan. Make sure all questions are answered and obtain written directions for how to take all medications (new and old). After bypass surgery, it is common to start new medications and stop or adjust the doses of previous medications.

Medications — Most people who have had bypass surgery are sent home with prescriptions for several medications, most of which are taken every day. Some of these drugs improve survival and some help to prevent or treat recurrent chest pain.

- Antiplatelet therapy — [Clopidogrel](#) (brand name: Plavix®) and [aspirin](#) are antiplatelet medications that are given to help prevent the formation of blood clots that can block either the graft or your own arteries. Clopidogrel is continued for at least one year after surgery while aspirin is usually recommended indefinitely. (See "[Patient information: Aspirin and cardiovascular disease \(Beyond the Basics\)](#)".)
- Beta blockers — Beta blockers slow the heart rate, lower blood pressure, and decrease the heart's demand for oxygen. They are given to some patients with high blood pressure, heart failure, or a heart attack, and to some patients in whom CABG is not expected to relieve all symptoms of angina. If a person cannot tolerate a beta blocker, a calcium channel blocker may be substituted.
- Nitrates — A nitrate, either as short-acting [nitroglycerin](#), or as a long-acting preparation ([isosorbide mononitrate](#) or dinitrate). These drugs dilate coronary blood vessels, bringing more blood to the heart muscle. Nitrates also reduce the amount of blood returning to the heart, which decreases the heart's demand for oxygen. Nitrates are often given to treat or prevent further episodes of chest pain. Nitrates may be given to patients after CABG if some of the coronary blood vessels could not be bypassed. (See "[Patient information: Angina treatment — medical therapy \(Beyond the Basics\)](#)".)
- ACE inhibitor — Angiotensin converting enzyme (ACE) inhibitors are often used to treat high blood pressure. Examples of ACE inhibitors include [captopril](#) (brand name: Capoten®), [enalapril](#) (brand name: Vasotec®), [lisinopril](#) (sample brand names: Zestril® or Prinivil®), and [ramipril](#) (brand name: Altace®).

Some patients who cannot tolerate an ACE inhibitor (often because of a chronic cough) may be prescribed an angiotensin II receptor blocker (ARB). These related drugs are satisfactory replacements.

Examples of ARBs include [losartan](#) (brand name: Cozaar®), [valsartan](#) (brand name: Diovan®), and [irbesartan](#) (brand name: Avapro®).

- Lipid lowering therapy — Almost all patients are given a medication to lower lipids after CABG. Cholesterol lowering can be beneficial both before and after CABG because it can halt the progression of atherosclerosis in both native and graft vessels.
- Other medications — Other medications may be given on a short term basis to prevent the development of an irregular heart, to manage discomfort associated with healing incisions, or to allow for regular bowel movements.

Lipid therapies are recommended even for patients who have values that are in the "normal" range. The goal level for "bad" cholesterol (called LDL or low density lipoprotein) is less than 70 mg/dL (1.8 mmol/L). (See "[Patient information: High cholesterol and lipids \(hyperlipidemia\) \(Beyond the Basics\)](#)".)

Statins are the most common medications used to lower cholesterol levels. Other drugs may be used as well ([table 1](#)).

Wound care — After discharge from the hospital, the patient is usually given instructions about how to care for their chest and/or leg wounds. It is important to follow these instructions closely and to notify a healthcare provider immediately if there are questions or concerns.

- Avoid heavy lifting and extremes of shoulder movement (eg, as in tennis, baseball, and golf) for six to eight weeks after surgery to allow for complete healing of the breast bone (sternum)

When to seek help — If the patient develops any of the following signs or symptoms of wound infection, a healthcare provider should be contacted immediately. Most wound infections develop within 14 days of the surgery.

- Fever greater than 100.4° F (38° C)
- New or worsened pain in the chest or around the incision
- A rapid heart rate
- Reddened skin, bleeding or pus-like drainage from the incision

CARDIAC REHABILITATION — Most people who have undergone bypass surgery benefit from participating in a structured, comprehensive cardiac rehabilitation program. People who participate in cardiac rehabilitation usually have appointments several times per week in a hospital or clinic, allowing the person to live and sleep at home. The potential benefits of rehabilitation include an improvement in heart function, a lowering of the heart rate at rest and during exercise, and a reduced risk of dying or developing complications from heart disease.

There are several components to cardiac rehabilitation, including exercise, reducing risk factors, and dealing with stress, anxiety, and depression. The benefits of cardiac rehabilitation are seen only when this multifactorial approach is used. In other words, one component alone is not enough.

Exercise — Exercise has consistently been shown to improve cardiovascular health. Importantly, the first step in starting to exercise is to determine the potential risk of heart and/or blood vessel complications from exercise. This is usually done by undergoing a monitored exercise test on a treadmill. Although nearly everyone can exercise safely after discharge, the intensity and duration of exercise should be adjusted according to the severity of a person's heart disease.

Risk categories for exercise — Risk categories are a way of describing a person's risk of cardiovascular (heart-related) complications related to activity. Each category has a unique requirement for supervision and exercise restrictions. People in risk category A are generally healthy, do not require medical supervision during exercise, and have no limitations on the duration or intensity of exercise. Conversely, people in exercise category D have strict limits on activity and should not exercise, even with close medical supervision. Most people who have had bypass surgery are in category B or C.

- Class A — Individuals who are apparently healthy and in whom there is no evidence of increased heart-related risk with exercise.
- Class B — Individuals with established coronary heart disease that is stable. These individuals are at low risk of heart-related complications with vigorous exercise.
- Class C — Individuals who are at moderate or high risk of heart-related complications during exercise. Examples of people who would be in this category are those who have had several heart attacks and those who have chest pain at a relatively low level of exercise. Patients with certain positive findings on an exercise test may also be in this group.
- Class D — Individuals with unstable disease who should not participate in an exercise program.

Exercise — During cardiac rehabilitation, a trained clinician will work with the patient and physician to develop an exercise program that is safe and beneficial. The program will consider the patient's fitness level, heart health, any physical limitations, the amount, intensity and duration of exercise needed to improve heart health, and the need for supervision.

- Type of exercise — The exercise should use large muscle groups and include aerobic exercise. Walking, jogging, cycling, rowing, and stair climbing are some examples.
- Frequency — The recommended frequency of exercise is three to five times a week.
- Content and duration — It is important that each session consist of a 5- to 10-minute warm-up phase, a

conditioning phase of at least 20 minutes, and a 5- to 10-minute cool-down phase. Eliminating the cool-down phase can increase the risk of heart-related complications.

- **Intensity** — One of the most important components of the exercise prescription is the intensity of exercise. This is based upon the patient's heart rate or the level of exertion. A number of formulas exist to calculate the appropriate maximum heart rate for each patient.

The patient gauges the level of exertion during an activity by rating it on a standardized scale called the rating of perceived exertion (RPE) ([table 2](#)). Moderate-intensity exercise (an RPE of 12 to 13) is needed to achieve cardiovascular health benefits. The benefits of very high intensity exercise are small; intense exercise is not recommended because it leads to muscle fatigue and increases the risk of physical injury and cardiovascular complications.

- **Exercise progression** — Over time, most people can gradually increase the level of exercise in the workout. Beneficial exercise can also be built in to the daily routine by taking a brisk walk or enjoying active play with children or grandchildren.
- **Supervision** — Patients who are in Class C should be in a medically supervised program where the electrocardiogram (ECG) is monitored during exercise. Advanced life support equipment (eg, a defibrillator, medications, personnel trained to use this equipment) should be on hand. This level of supervision should continue for at least 8 to 12 weeks.

Lower-risk patients (Class B) benefit from a medically supervised, ECG monitored program for the first 6 to 12 sessions. Following this, a home-based exercise program is safe and effective.

REDUCE CARDIAC RISK FACTORS — A number of factors increase the risk of developing or speeding the progression of heart disease. Reducing or eliminating these risk factors can be helpful, even if a person already has heart disease or has had a heart attack. Strategies to reduce risks are discussed below.

Follow a heart healthy diet — Diet counseling is helpful for people who need to lose weight or reduce cholesterol levels. A registered dietitian is the best person to consult about foods that are helpful and harmful, appropriate portion sizes, total calorie recommendations, and realistic ways to change bad eating habits.

Most cardiac rehabilitation programs have a dietitian who is knowledgeable and experienced in advising people who are recovering from a heart attack. (See "[Patient information: Diet and health \(Beyond the Basics\)](#)".)

Stop smoking — Cigarette smoking significantly increases the risk coronary heart disease and heart attack, and stopping smoking can rapidly reduce these risks. One year after stopping smoking, the risk of dying from coronary heart disease is reduced by about one-half and the risk continues to decline with time. In some studies, the risk of heart attack was reduced to the rate of nonsmokers within two years of quitting smoking.

Cardiac rehabilitation programs can recommend a treatment to help stop smoking, such as group programs, nicotine patches, gum, or nasal spray, or a prescription medication. (See "[Patient information: Quitting smoking \(Beyond the Basics\)](#)".)

Treat high blood pressure and high cholesterol — Medicines to control high blood pressure and high cholesterol are usually recommended after bypass surgery (see "[Medications](#)" above). It is important to take these medications exactly as prescribed. (See "[Patient information: High blood pressure treatment in adults \(Beyond the Basics\)](#)" and "[Patient information: High cholesterol and lipids \(hyperlipidemia\) \(Beyond the Basics\)](#)".)

Manage diabetes — People with diabetes are at an increased risk of developing complications after bypass surgery. Tight control of blood glucose levels can help to reduce the risk of these and other types of complications. Tight control can be achieved by losing weight, managing the diet, exercising, monitoring blood glucose levels regularly, and taking oral hypoglycemic medications (for people with type 2 diabetes) or insulin (for people with type

1 and sometimes type 2 diabetes). (See "[Patient information: Preventing complications in diabetes mellitus \(Beyond the Basics\)](#)".)

Psychosocial treatment — Feelings of depression, anxiety, and denial are common after bypass surgery, occurring in up to 40 percent of people. Depression can reduce a person's ability to exercise, decrease energy levels, cause more fatigue, or reduce a person's quality of life and sense of well-being. Women, and in particular younger women, are at an especially high risk for depression.

These symptoms can cause problems within the family, marriage, and the workplace. Individual or group therapy, and sometimes treatment with an antidepressant medication, can be helpful. Many cardiac rehabilitation programs have trained personnel, including psychologists, psychiatrists, or social workers, to help manage these issues. Treating depression and anxiety can improve a person's long-term outlook and general sense of well-being. (See "[Patient information: Depression in adults \(Beyond the Basics\)](#)".)

Reduce stress — Long-term stress in the home, at work, or with finances can increase the risk of heart attack, stroke, and chest pain. Many cardiac rehabilitation programs teach patients how to reduce stress in an attempt to lower these risks.

Stress reduction techniques may include one or more of the following:

- Psychotherapy involves meeting with a psychologist, psychiatrist, or social worker to discuss emotional responses to living with stress, treatment successes or failures, and/or personal relationships.
- Group psychotherapy allows patients to compare their experiences with stress and heart disease, overcome their tendency to withdraw and become isolated, and support one another's attempts at more effective management.
- Relaxation techniques can relieve musculoskeletal tension, and may include meditation, progressive muscle relaxation, self-hypnosis, and biofeedback. Biofeedback may be especially helpful for people with chronic stress.
- Group skill-building exercises help patients to learn about living with stress and heart disease, including ways to improve relationships and build strength, ways to avoid negative thinking, and learning to deal with stress.

WHEN IS SEX SAFE? — An important issue for many patients who have had bypass surgery is when sexual activity can be safely resumed. In the first two weeks after an **uncomplicated** heart attack, most people are at high risk of heart-related problems during sex as a result of a rise in the heart rate and blood pressure. However, this risk becomes much smaller by six weeks after the MI.

Patients with complications of a heart attack, such as recurrent chest pain, abnormal heart rhythms (arrhythmias), or heart failure are at intermediate or high risk of heart-related problems during sex. People in these risk groups need further evaluation and/or treatment before attempting to have sex. A cardiologist or internal medicine specialist can help a person to know when sex is safe.

Sexual problems — Sexual problems after a bypass surgery are common, occurring in one-half to three-quarters of patients. Both men and women may have less sex or feel less satisfied with sexual activity. A variety of factors may contribute, including side effects of drugs (such as beta blockers), depression, and fears about triggering a new heart attack or dying. Since sexual activity is a type of physical activity, exercise testing can be used to determine if a person is at any risk of heart problems related to sex.

Use of Viagra®, Cialis® or Levitra® — For many men with erectile dysfunction, medications such [sildenafil](#) (brand name: Viagra®), [tadalafil](#) (brand name: Cialis®) or [vardenafil](#) (brand name: Levitra®) are highly effective. There have been concerns that these agents might cause side effects or increase the risk of heart attack in people with CHD. However, if used appropriately, these drugs appear to be well tolerated and safe. (See "[Patient](#)

[information: Sexual problems in men \(Beyond the Basics\)".](#).)

Unfortunately, these medications are not usually helpful for women with sexual problems after a heart attack or bypass surgery. Other treatments are available for women. (See "[Patient information: Sexual problems in women \(Beyond the Basics\)".](#).)

Nitrates and medications for erectile dysfunction — None of the medications for erectile dysfunction (eg, Viagra, Cialis, Levitra) should be used if a person regularly or intermittently requires nitrates (such as [nitroglycerin](#) or isosorbide) for recurrent chest pain. This combination of medications can cause a life-threatening drop in blood pressure.

Thus, if a man develops chest pain after taking Viagra, Cialis or Levitra, he should not take nitrates for 24 hours (or longer in some cases). Instead, the man should rest and wait 10 minutes to see if the pain resolves. If the pain does not resolve or if the chest pain is severe, he should immediately call for emergency medical services (in the United States by calling 911).

FOLLOW-UP CARE — Following the discharge plan and participating in a cardiac rehabilitation program are the best ways to recover from bypass surgery. In addition, it is important to schedule and attend periodic visits with an internal medicine provider and/or cardiac specialist (cardiologist).

Follow-up care is of great importance since people who have had bypass surgery have a significantly increased risk of more cardiac events, including recurrent chest pain, heart attack, heart failure, and an increased risk of dying. The risk of these problems is greatly reduced by closely following a clinician's recommendations for rehabilitation, follow-up visits, and treatments. Over time, the treatment plan may change as heart health improves or other medical problems develop.

WHERE TO GET MORE INFORMATION — Your healthcare provider is the best source of information for questions and concerns related to your medical problem.

This article will be updated as needed on our web site (www.uptodate.com/patients). Related topics for patients, as well as selected articles written for healthcare professionals, are also available. Some of the most relevant are listed below.

Patient level information — UpToDate offers two types of patient education materials.

The Basics — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

[Patient information: Coronary heart disease \(The Basics\)](#)

Beyond the Basics — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

[Patient information: Coronary artery bypass graft surgery \(Beyond the Basics\)](#)

[Patient information: Aspirin and cardiovascular disease \(Beyond the Basics\)](#)

[Patient information: Angina treatment — medical therapy \(Beyond the Basics\)](#)

[Patient information: High cholesterol and lipids \(hyperlipidemia\) \(Beyond the Basics\)](#)

[Patient information: Diet and health \(Beyond the Basics\)](#)

[Patient information: Quitting smoking \(Beyond the Basics\)](#)

[Patient information: High blood pressure treatment in adults \(Beyond the Basics\)](#)

[Patient information: Preventing complications in diabetes mellitus \(Beyond the Basics\)](#)

[Patient information: Depression in adults \(Beyond the Basics\)](#)

[Patient information: Sexual problems in men \(Beyond the Basics\)](#)

[Patient information: Sexual problems in women \(Beyond the Basics\)](#)

Professional level information — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

[Cardiac rehabilitation in patients with heart failure](#)

[Cardiac rehabilitation: Exercise training and secondary prevention of coronary heart disease in older adults](#)

[Components of cardiac rehabilitation and exercise prescription](#)

[Efficacy of cardiac rehabilitation in patients with coronary heart disease](#)

[Exercise assessment and measurement of exercise capacity in patients with coronary heart disease](#)

[Overview of the therapy of heart failure due to systolic dysfunction](#)

[Rehabilitation after cardiac transplantation](#)

[Sexual activity in patients with cardiovascular disease](#)

The following organizations also provide reliable health information.

- National Library of Medicine

[\(www.nlm.nih.gov/medlineplus/healthtopics.html\)](http://www.nlm.nih.gov/medlineplus/healthtopics.html)

- National Heart, Lung, and Blood Institute

[\(www.nhlbi.nih.gov\)](http://www.nhlbi.nih.gov)

- American Heart Association

[\(www.americanheart.org\)](http://www.americanheart.org)

- Society of Thoracic Surgeons

[\(www.sts.org\)](http://www.sts.org)

[1-4]

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perspective: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism and the Council on Clinical Cardiology. *Circulation* 2007; 115:2358.

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GRAPHICS**Lipid lowering medications**

Statins	
Lovastatin	Mevacor®, Altoprev®
Pravastatin	Pravachol®
Simvastatin	Zocor®
Fluvastatin	Lescol®, Lescol XL®
Atorvastatin	Lipitor®
Rosuvastatin	Crestor®
Cholesterol absorption inhibitors	
Ezetimibe	Zetia®
Bile acid sequestrants	
Cholestyramine	Questran®, Questran Light®
Colestipol	Colestid®
Colesevelam	WelChol®
Nicotinic acid	
Niacin (immediate, sustained, and extended release)	
Fibrates	
Gemfibrozil	Lopid®
Fenofibrate	Tricor®, Triglide®

Rating of perceived exertion

Original scale	
6	very, very light
7	
8	
9	very light
10	
11	fairly light
12	
13	somewhat hard
14	
15	hard
16	
17	very hard
18	
19	very, very hard
20	