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General Surgery

P R E S E N T S

Dr. Mufa T. Ghadiali is skilled in all aspects of General Surgery.
His General Surgery Services include:

- General Surgery
- Advanced Laparoscopic Surgery
- Surgical Oncology
- Gastrointestinal Surgery
- Hernia Surgery
- Endoscopy

What is Off-Pump Coronary Artery Bypass Surgery All About?

Multimedia Health Education

Disclaimer

This movie is an educational resource only and should not be used to manage cardiac health. All decisions about the management of Off-Pump Coronary Artery Bypass Surgery must be made in conjunction with your Physician or a licensed healthcare provider.

Mufa T. Ghadiali, M.D., F.A.C.S

Diplomate of American Board of Surgery

6405 North Federal Hwy., Suite 402
Fort Lauderdale, FL 33308

Tel: 954-771-8888

Fax: 954- 491-9485

www.ghadialisurgery.com

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MULTIMEDIA HEALTH EDUCATION MANUAL

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INTRODUCTION

Off-Pump Coronary Artery Bypass (OPCAB), also called “Beating Heart” surgery, is an operation to treat narrowed or blocked coronary arteries by going around or “bypassing” the blocked artery to increase blood flow to the heart.

Traditionally, open-heart surgery is performed with the heart stopped and the patient on cardiopulmonary bypass (CPB) to oxygenate and circulate the blood while the heart is stopped.

OPCAB surgery is performed without the patient on cardiopulmonary bypass (CPB) and with the heart still beating.

This surgery may be performed on an emergency basis following a heart attack, or on an elective basis when conservative treatment measures have failed to relieve symptoms of Coronary Artery Disease such as chest pain and shortness of breath. To learn more about Off-Pump Coronary Bypass Surgery, let us first learn about the normal anatomy of the heart.

Unit 1:

Normal Heart Anatomy

Normal Heart Anatomy

The main function of the heart is to deliver oxygen-rich blood to every cell in the body.

The arteries are the passageways through which the blood is delivered to the cells in the body and the veins are the passageways through which the blood is collected and returned to the heart.

The coronary arteries supply blood to the heart muscle. When the coronary arteries become narrow or blocked, blood flow to the heart is reduced. This decrease in blood flow to the heart deprives the heart muscle of oxygen. The heart responds to the lack of oxygen by sending out signs in the form of pain called angina, shortness of breath, or a heart attack.

(Refer fig.1)

Vena Cava:

The vena cava is a large vein that brings deoxygenated (impure) blood back to the heart and empties it into the right atrium.

(Refer fig.2)

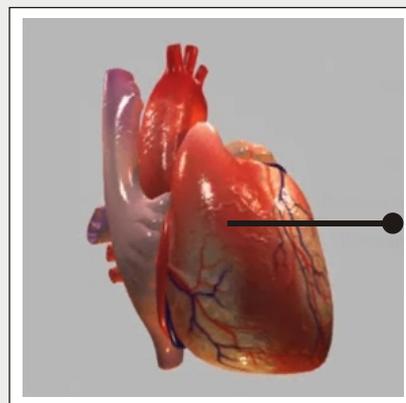
Atria:

There are two atria (right and left) that are two of the four muscular chambers of the heart.

The right atrium collects the impure blood from the vena cava and delivers it to the right ventricle. This delivery is regulated by the tricuspid valve.

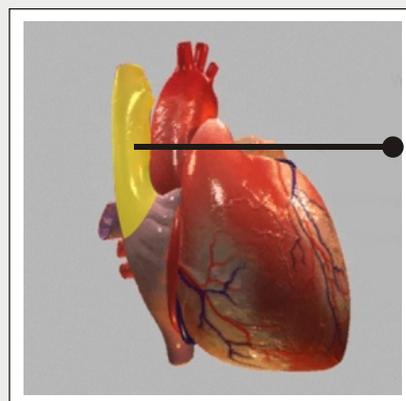
The left atrium collects the oxygenated blood from the lungs via the pulmonary veins and delivers it to the left ventricle. This delivery is regulated by the mitral valve.

(Refer fig.3)



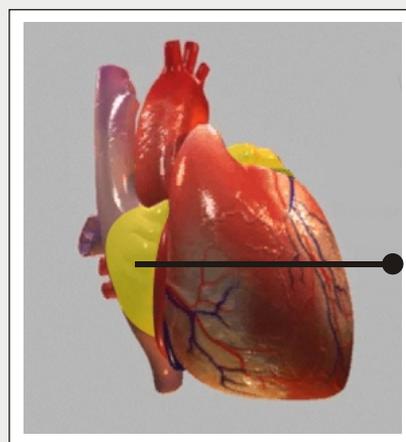
Normal Heart Anatomy

(Fig.1)



Vena Cava

(Fig.2)



Atria

(Fig.3)

Unit 1:

Normal Heart Anatomy

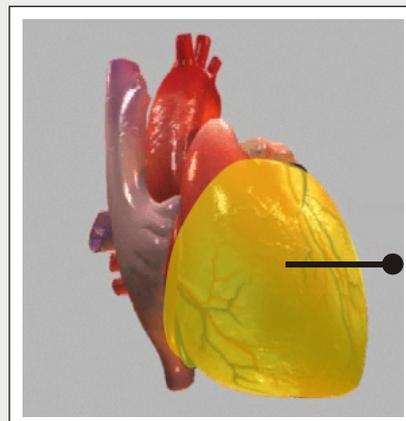
Ventricles:

There are two ventricles (right and left) that are two of the four muscular chambers of the heart.

The right ventricle collects the impure blood from the right atrium and delivers it to the lungs for purification (oxygenation). The pulmonary valve regulates this delivery.

(Refer fig.4)

The left ventricle collects the pure blood from the left atrium and delivers it to the aorta (main artery) from where it is pumped to the rest of the body. The aortic valve regulates this delivery.



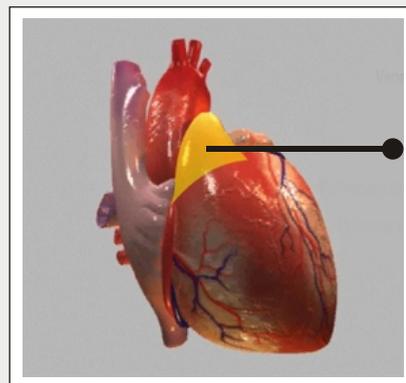
Ventricles

(Fig.4)

Pulmonary Arteries:

As part of the pulmonary circulation, pulmonary arteries carry the deoxygenated blood from the right ventricle to the lungs for oxygenation.

(Refer fig.5)



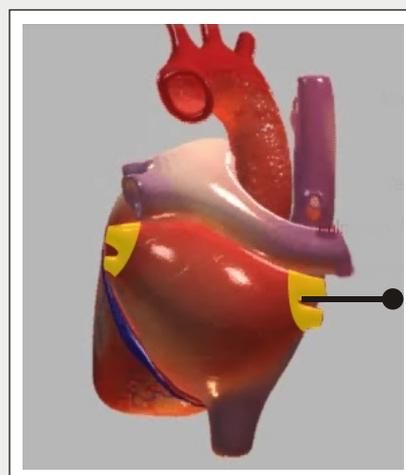
Pulmonary Arteries

(Fig.5)

Pulmonary Veins:

After oxygenation in the lungs, blood is brought back to the heart by pulmonary veins and delivered to the left atrium.

(Refer fig.6)



Pulmonary Veins

(Fig.6)

Unit 1: Normal Heart Anatomy

Aorta:

The Aorta, the largest artery in the body, collects blood pumped from the left ventricle to branch and deliver the oxygen rich blood to various organs and tissues in the human body.

(Refer fig.7)

Coronary Circulation

The coronary circulation consists of the blood vessels that supply blood to, and remove blood from, the heart tissue. Coronary arteries supply oxygen - rich blood to the heart and the coronary veins remove the deoxygenated blood from the heart.

Serious heart damage may occur when the coronary circulation is blocked.

(Refer fig.8)

Coronary Arteries:

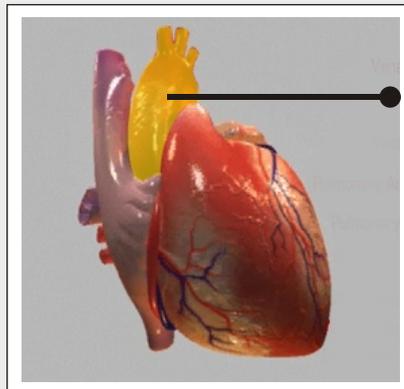
Blood is supplied to the heart via the coronary arteries. Two main coronary arteries branch off the aorta then branch into several smaller arteries that supply oxygen rich blood to the heart.

(Refer fig.9)

Coronary Veins:

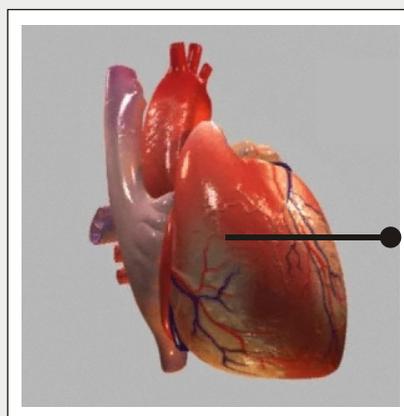
The deoxygenated blood from the heart muscle is collected by the coronary veins and drained into the right atrium.

(Refer fig.10)



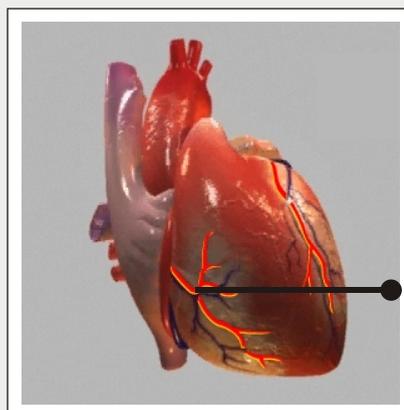
Aorta

(Fig.7)



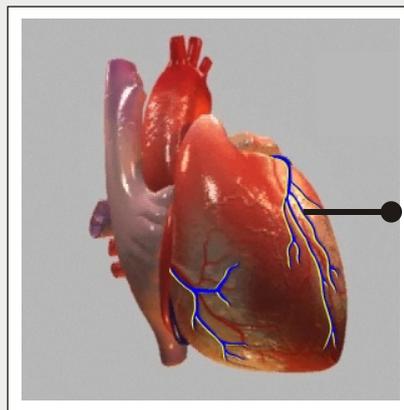
Normal Heart Anatomy: Coronary Circulation

(Fig.8)



Coronary Arteries

(Fig.9)



Coronary Veins

(Fig.10)

Unit 2:

Coronary Artery Disease

What is Coronary Artery Disease?

Coronary Artery Disease (CAD) is usually caused from a condition called atherosclerosis. Atherosclerosis is a condition in which fatty material is deposited along the walls of arteries. This fatty material (often called plaque) thickens, hardens, and may eventually block the arteries.

(Refer fig. "11 & 12")

When atherosclerosis occurs within the coronary arteries, the condition is referred to as Coronary Artery Disease, or CAD.

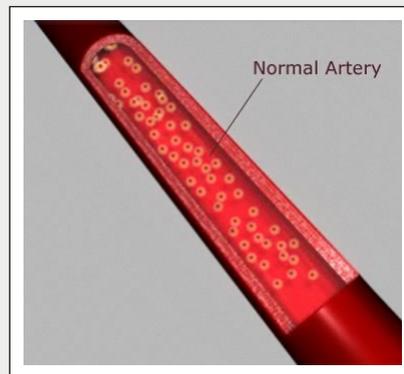
Symptoms of CAD include chest pain (angina), shortness of breath, and, if left untreated, heart attack.

(Refer fig.13)

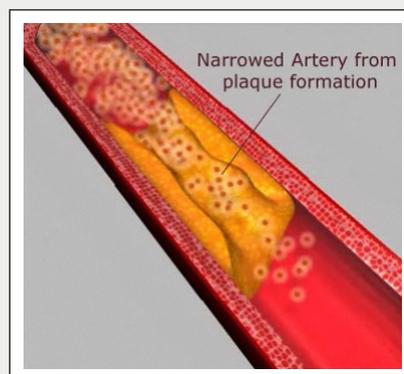
CAD is the most common cause of angina and Heart Attack.

Refer to the diagram to see the difference between a normal artery and a narrowed artery caused by plaque formation

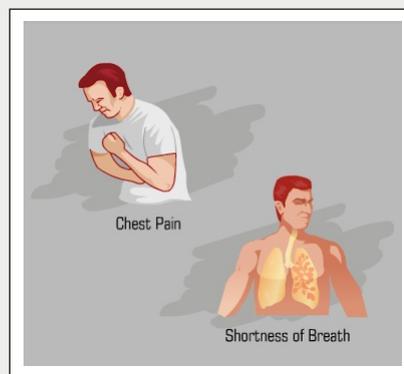
(Refer fig.14)



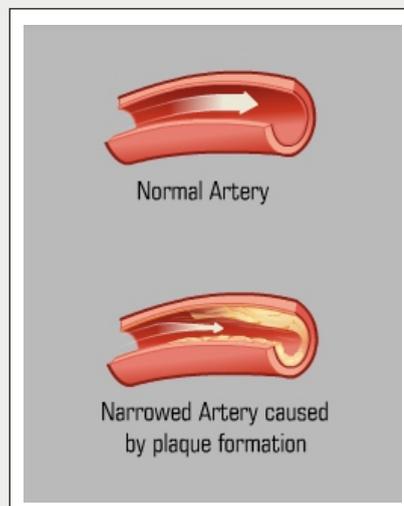
(Fig.11)



(Fig.12)



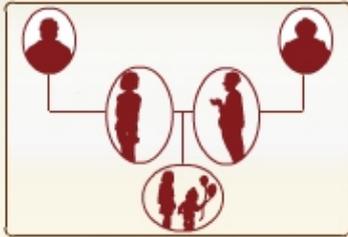
(Fig.13)



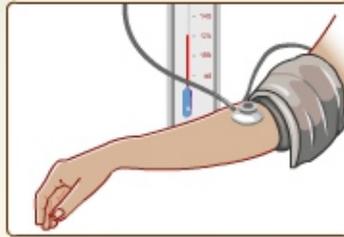
(Fig.14)

Risk Factors

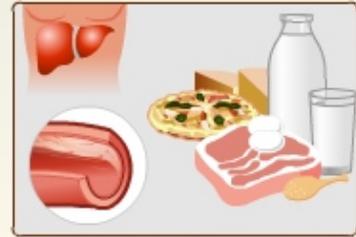
Risk factors for Coronary Artery Disease include the following:



Family history



**Hypertension
(High Blood Pressure)**



**High Cholesterol or other
fat levels in blood**



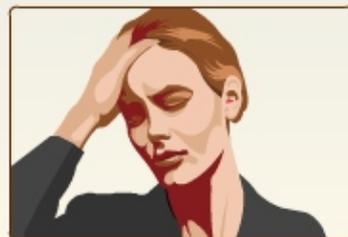
**Inactive lifestyle- Obesity/
overweight/ lack of exercise**



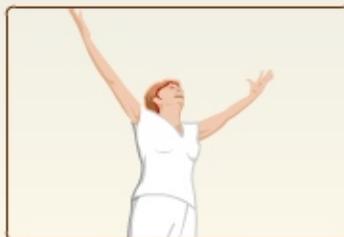
**Diabetes
(High blood sugar)**



Cigarette Smoking



Stress



Menopause



**Non-compliance
with medicines to treat
hypertension and high cholesterol.**

(Fig.15)

Signs and Symptoms

Coronary Heart Disease is the most common cause of Angina and Heart Attack.

Chest pain is the most common complaint in heart attack. Unlike angina, pain does not subside on resting. However, the symptoms may be different.

- Fullness, uncomfortable pressure, squeeze in the middle of the chest
- Tightness, burning or a heavy weight over your chest
- Pain may radiate to your shoulders, neck, arms, upper abdomen, back or jaw.

20% of the patients with heart attack have no pain. This is seen in diabetics, high blood pressure, and elderly patients.

Heart attack is a medical emergency and if you suspect symptoms of heart attack, you should call for an ambulance or seek immediate medical help.

Diagnosis

A Cardiologist should evaluate all heart conditions for proper diagnosis and treatment.

Your Cardiologist will perform the following:

- Medical History
- Physical Examination

Diagnostic Studies may include:

Blood tests:

Routine blood tests may be done for blood counts, electrolytes, cholesterol and cardiac enzymes. The cardiac enzymes in blood are markers of heart damage.

(EKG or ECG) Electrocardiogram :

EKG is a test to measure the electrical activity of the heart and provides your doctor with information about your heart rate, rhythm, size of the heart chambers and previous damage to the heart. It is non-invasive and painless and is performed by attaching electrodes to various parts of the body.

Nuclear Heart Scans:

This test shows blood flow to the heart, any damage to the heart muscle, and how well your heart pumps blood to the rest of your body. A radioactive dye is injected into your bloodstream. A special camera can see the dye and find areas where blood flow is reduced to the heart muscle, which may indicate the presence of CAD.

Angiography (Also called Angiogram or Cardiac Catheterization):

Angiography is a test that enables your doctor to take x-ray images of the inside of your blood vessels. This procedure is performed by a cardiologist and involves threading a tiny catheter through a small incision into a large artery, usually in your groin. Once the catheter reaches the site of the blood vessel to be viewed, a dye is injected and x-ray images are taken. Angiography enables your doctor to view how blood circulates in the vessels in specific areas of the body. An angiogram is the only test that shows the blood vessels of the heart.

Conservative Treatment Options For CAD

Management of Coronary Artery Disease includes:

- Lifestyle Modifications
- Medications

Lifestyle Modifications

Healthy life choices will improve your overall health and your heart health and can help you slow the progression of your heart disease.

The following life style modifications can help to prevent or lower your risk for heart disease and heart attack and improve your heart health:

Healthy Diet Choices:

Eating a low fat, low salt, low cholesterol diet.

(Refer fig.16)



Healthy Diet Choices

(Fig.16)

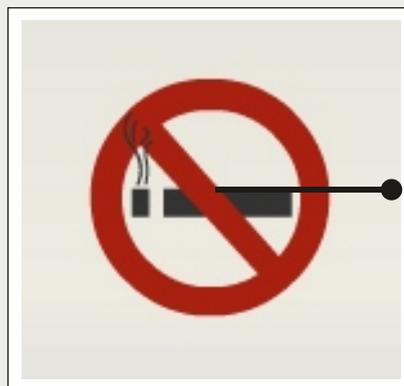
Unit 2:

Coronary Artery Disease

Don't Smoke:

If you do smoke, talk to your doctor about available options to help you quit. You will immediately lower your risk of heart disease as soon as you quit.

(Refer fig.17)



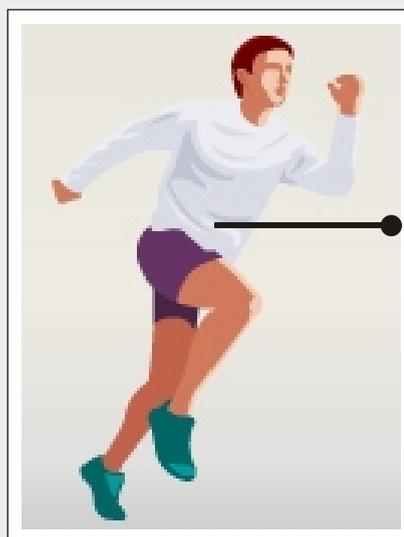
Don't Smoke

(Fig.17)

Exercise:

Increasing your physical activity is a great way to reduce stress, improve sleep, lose weight, and improve your overall sense of well-being. Always discuss with your doctor before beginning any new exercise program.

(Refer fig.18)



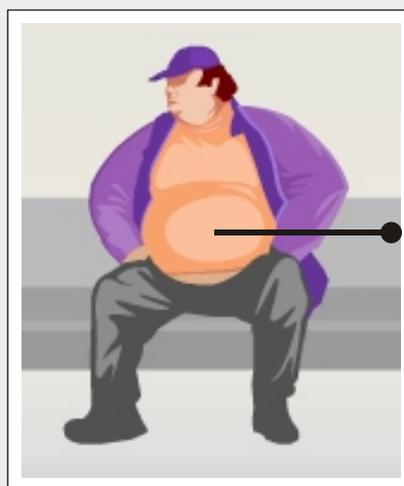
Exercise

(Fig.18)

Weight Loss:

Being overweight puts extra strain on your heart. Discuss weight loss options with your doctor and follow his advice.

(Refer fig.19)



Weight Loss

(Fig.19)

Unit 2:

Coronary Artery Disease

Diabetes Control:

Take your diabetic medications, check with your doctor for exercises and physical activity as well as nutrition advice.

(Refer fig.20)



Diabetes Control

(Fig.20)

Medications

Along with life style modification, medications may be needed to control symptoms and improve the heart health. More than one medication may be prescribed. Some common medications are listed below.

Anticoagulants or Thrombolytic Agents:

These blood thinning medicines are given during a heart attack to break up a blood clot in a coronary artery in order to restore blood flow.

Aspirin:

Aspirin reduces the tendency of small blood cells called platelets to stick together, which helps prevent the formation of a blood clot (thrombosis).

Nitroglycerin (NTG):

This quick acting sublingual tablet or spray relax the arteries of the heart and relieve angina attacks. Sublingual means it is administered under the tongue for quick absorption and action.

Digitalis:

Digitalis makes the heart contract harder and is used when the heart's pumping function has been weakened; it also slows some fast heart rhythms.

ACE (angiotensin converting enzyme) Inhibitor:

Ace Inhibitors stops the production of a chemical that makes blood vessels narrow and is used to help control high blood pressure and in cases of heart failure.

Long-acting Nitrates:

Long-acting nitrates reduce the frequency of angina attacks. These can be in the form of tablets or patches and are very effective. Their main side effect is headache, but this often disappears once the nitrate has been taken for some weeks.

Beta-Blockers:

Beta-blockers work by slowing down the heart rate and decreasing the force of the heart muscle. This reduces the heart's need for oxygen and improves the supply of blood to the heart muscle.

Calcium Channel Blockers:

Calcium Channel Blockers reduce the frequency and severity of chest pain. They reduce the muscle tension in the coronary arteries, expanding them and creating more room. They also slightly relax the heart muscle, reducing the heart's need for oxygen and reducing blood pressure.

What is OPCAB?

If conservative treatment options for coronary artery disease are unsuccessful and you continue to have chest pain or are at risk of having a heart attack, your cardiologist may refer you to a Cardiothoracic surgeon for coronary artery bypass surgery. One type of bypass surgery that may be recommended is called Off-Pump Coronary Artery Bypass.

Off-Pump Coronary Artery Bypass (OPCAB), also called “Beating Heart” surgery, is an operation to treat narrowed or blocked coronary arteries. This is accomplished by going around or “bypassing” the blocked artery with a healthy vessel called a “graft” that is taken from the leg, arm or chest. The graft will now carry the blood around the blockage to improve the blood flow to the heart muscle.

Traditionally, coronary artery bypass surgery is performed with the heart stopped and the patient on a heart-lung bypass pump. The pump’s function is to oxygenate and circulate the blood while the heart is stopped. This is referred to as cardiopulmonary bypass or CPB. Because there are certain risks associated with CPB, specially trained Cardiothoracic surgeons are now performing bypass surgery “off-pump”, meaning without the bypass machine.

OPCAB surgery is open-heart surgery performed without the patient on cardiopulmonary bypass (CPB) and with the heart still beating.

“Open Heart Surgery” is a common term used when referring to Coronary Artery Bypass surgery. Many people believe the heart is “opened up” in “open heart surgery”. However, this is not the case. The name actually refers to the fact that the surgery is performed through a large, open, chest incision. Since the surgery is actually performed on the vessels on the outside of the heart there is no need to cut the heart open.

Some surgeons are performing minimally invasive coronary bypass surgery (MICABG) through tiny incisions called portals enabling a quicker recovery time with decreased trauma to the tissues and bones. This surgery is not yet widely available and research is ongoing to evaluate and improve minimally invasive techniques.

Risks of CPB

Cardiopulmonary bypass or CPB has been shown to have associated risks. Some risks that may be related to CPB include:

Neurocognitive Changes:

Impaired mental capability including memory loss, decreased attention span, depression etc.

CVA or Stroke:

The risk of CVA while on CPB is believed to be from micro-embolisms of air or debris that block blood flow to the brain.

Systemic Inflammation Response Syndrome (SIRS):

A serious condition causing inflammation throughout the whole body that may lead to multiple organ failure and shock.

Coagulopathy:

A defect in the blood clotting ability of the body causing heavy and prolonged bleeding.

Pulmonary Dysfunction:

Respiratory problems including increased work of breathing, shallow breaths, hypoxemia (low blood oxygen), and ineffective coughing.

Benefits of OPCAB

Benefits of OPCAB surgery may include:

- Lessens the risks associated with the use of cardiopulmonary bypass pump.
- Less blood loss and need for transfusions post operatively
- Lower rate of wound infections
- Lower incidence of kidney complications
- Avoidance of systemic inflammatory response syndrome (SIRS)
- Decreased risk of Atrial Fibrillation (irregular, fast, ineffective heart beat)
- Faster recovery
- Shorter operating time
- Shorter hospital stay
- Less costly than traditional coronary bypass surgery.

Are you a candidate?

OPCAB surgery is not for everyone and your surgeon will discuss with you whether this surgery is a good option for your particular situation.

Candidates for OPCAB may include the following:

- Elderly patients (over 70) with multiple diseased vessels
- Patients with lung disease such as COPD or emphysema.
- Patients with kidney disease or who are on dialysis.
- Patients with a high risk of stroke (CVA) or with a previous history of stroke or transient ischemic attacks (TIA or "mini-stroke)
- Patients with a low EF (ejection fraction) indicating poor heart function
- Patients with heavy atherosclerosis in the aorta
- Immunosuppressed patients
- Patients who refuse blood transfusions for religious or other reasons.

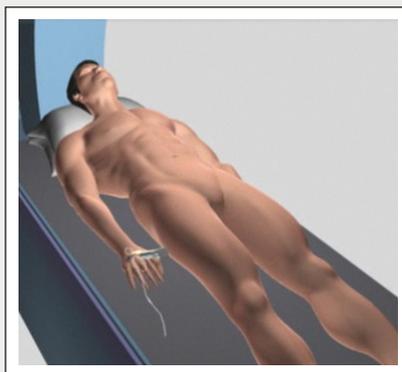
OPCAB is not recommended in the following patients:

- Patients with enlarged hearts
- Patients with valve disease
- Patients who require long grafts
- Patients with blockages extending into the heart muscle

Surgical Procedure: How is it done?

The goal of Off-Pump Coronary Artery Bypass surgery is:

- To relieve symptoms of CAD
- Improve blood flow to the heart
- To lengthen the patient's life



(Fig.21)

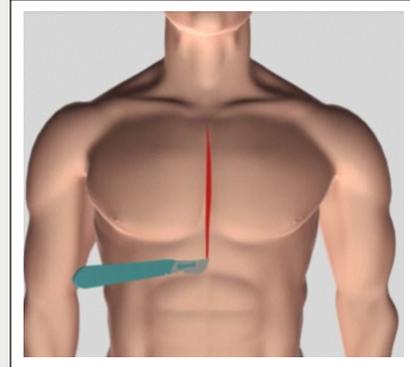
Off-Pump Coronary Bypass surgery is performed by Cardiothoracic surgeons in the operating room with the patient under general anesthesia. The operation usually takes about 3 hours but may be longer depending on the number of bypasses to be done.

During OPCAB, the patient is placed lying on their back on the operating table. The chest and graft area are shaved and scrubbed with antiseptic. You will be given a general anesthetic so you will be asleep and not feel any pain.

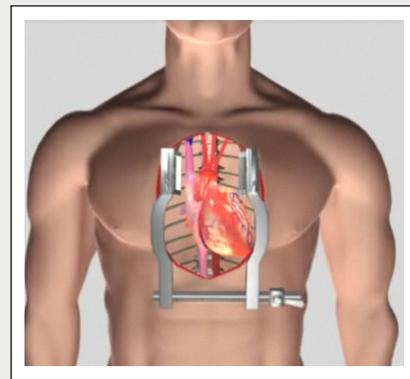
Unit 3: Off-Pump Coronary Artery Bypass Surgery

Your surgeon will make a long incision down the middle of your chest bone (sternum). This is called a median sternotomy. Special instruments called retractors are used to spread the ribs apart so the surgeon can access the heart.

(Refer fig. "21 to 23")



(Fig.22)



(Fig.23)



(Fig.24)



(Fig.25)

Unit 3: Off-Pump Coronary Artery Bypass Surgery

At the same time, another surgeon will "harvest" (remove) a vessel from either your arm (radial artery) or leg (long saphenous vein) to be used as the graft. This may be done through a large "open" incision or endoscopically through a much smaller incision.

Your surgeon may choose to use an artery in the chest called the internal thoracic artery. In this case you will not have a "graft site" incision on your arm or leg unless you are having multiple bypasses performed.

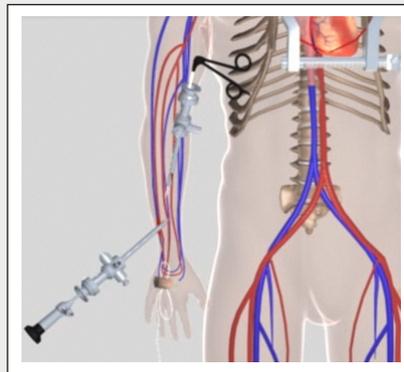
(Refer fig. "24 to 27")

With the heart beating, your surgeon will stabilize the heart muscle on either side of the blockage with a special device. This enables the surgeon to work on a small area with minimal movement but with the heart still beating and pumping blood throughout the body.

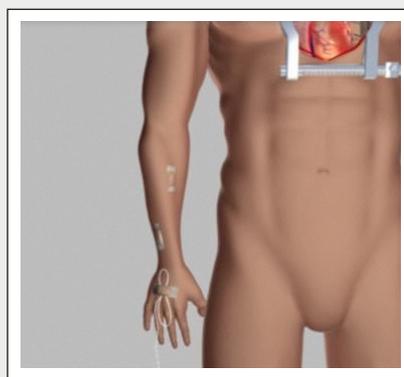
(Refer fig.28)

If a leg or arm graft is used the surgeon then attaches one end of the graft with fine sutures to the Aorta.

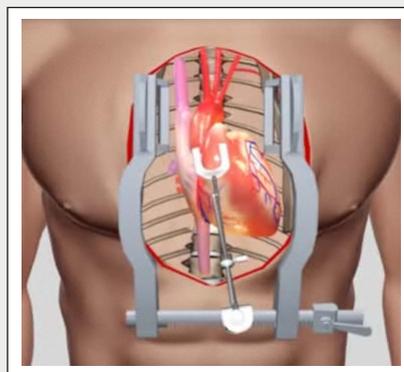
(Refer fig. "29 to 34")



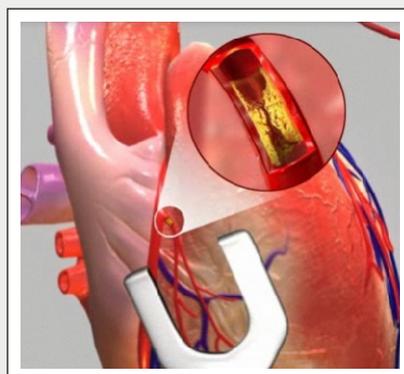
(Fig.26)



(Fig.27)



(Fig.28)



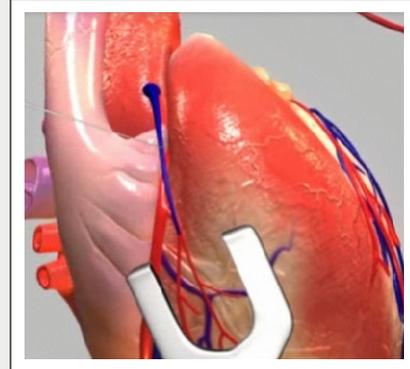
(Fig.29)

Unit 3: Off-Pump Coronary Artery Bypass Surgery

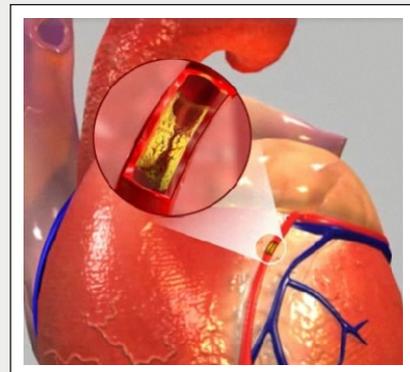
The other end of the graft is then attached to the coronary artery beyond the blockage. This enables the blood to "bypass" the blockage and flow freely to the heart muscle.

If the internal thoracic artery is used, your surgeon will redirect the artery by detaching one end of it and reattaching it below the blockage on the coronary artery.

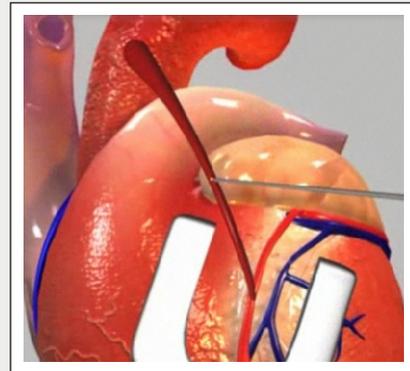
(Refer fig. "29 to 34")



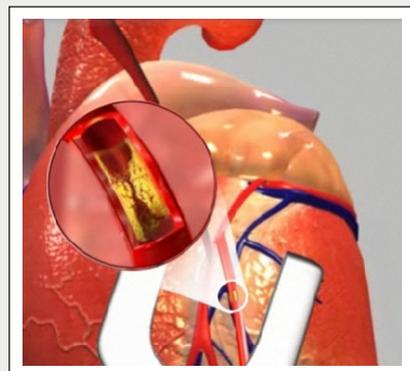
(Fig.30)



(Fig.31)



(Fig.32)



(Fig.33)

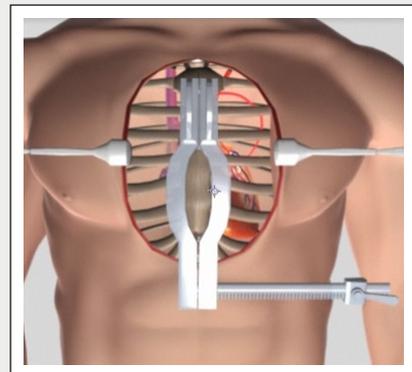
Unit 3: Off-Pump Coronary Artery Bypass Surgery

Once your surgeon has completed the number of bypasses needed the surgeon will use wires to reattach the sternum and suture the incision closed, usually with dissolvable sutures.

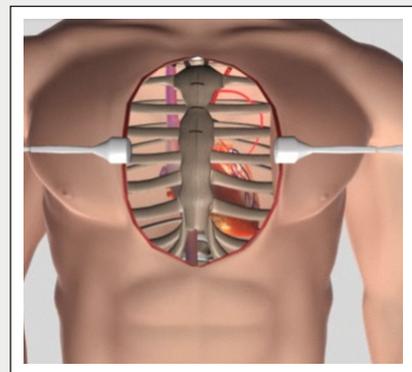
(Refer fig. "35 to 37")



(Fig.34)



(Fig.35)



(Fig.36)



(Fig.37)

Surgical Procedure: Post Operative Guidelines

After OPCAB surgery you will be taken to the intensive care unit (ICU) for monitoring.

You will probably have a tube in your throat connected to a respirator for the first day to help you breathe. You will not be able to speak while the tube is in place.

You will have drain tubes in your chest to help drain blood and fluids.

You will likely spend a few days in the hospital. Common post-operative guidelines following Off-Pump Coronary Artery Bypass surgery include the following:

- You will need someone to drive you home after you are released from the hospital. You should not drive for 2 weeks after the surgery. If you drive commercially, you may have to wait a few months. Your surgeon will give you guidelines as to when you may drive based on your situation and your surgeon's preference.
- You will be given instructions on care of your incisions. Normally, you will be able to shower without restrictions.
- Expect significant fatigue for the first two weeks after your surgery. This is common and will improve gradually over the next month.
- Your surgeon will give you activity restrictions such as no heavy lifting or strenuous exercise for the first few weeks to allow the sternum to heal completely.
- You will usually be able to resume sexual activity after a few weeks.
- Talk to your surgeon as to when you may return to work. This time frame will depend on the type of work you perform and your particular situation.
- You will have soreness and bruising around the incision and graft sites for the first month or so. You may hear a clicking sound in the chest while the sternum is healing. You will probably have chest pain with sudden movement, coughing, or sneezing. Be assured this is usually musculoskeletal pain and not angina. Your doctor will prescribe pain medications for you to take at home.
- Your doctor will prescribe blood-thinning medicines to prevent blood clots. It is very important that you adhere to your prescribed medications to prevent blood clots from forming.
- It is common to feel depressed after heart surgery. Talk with your doctor, as treatment is available through medication or therapy.
- Sleep disturbances are commonly reported. Again, discuss your concerns with your doctor should you have problems sleeping.
- You will be referred to a cardiac rehabilitation program to educate and assist you with your recovery. This usually involves exercise, lifestyle modification, and monitoring.
- It is important to know abnormal symptoms to report: Contact your doctor immediately if you have a fever, chills, purulent drainage from incisions, redness, bleeding, irregular heart beat, chest pain, shortness of breath, weakness, or dizziness.

Surgical Procedure: Risks and Complications

As with any medical procedure there are potential risks involved. The decision to proceed with the procedure is made because the advantages outweigh the potential disadvantages.

It is important that you are informed of these risks before the procedure takes place.

Most patients do not have complications after Coronary Artery Bypass Graft surgery; however complications can occur and depend on what type of surgery your doctor performs as well as the patient's health status. (i.e. obese, diabetic, smoker, etc.)

Complications can be medical (general) or specific to Coronary Bypass surgery.

Medical complications include those of the anesthesia and your general well being. Almost any medical condition can occur so this list is not complete. Complications include:

- Allergic reaction to medications or dye
- Blood loss requiring transfusion with its low risk of disease transmission
- Heart attack, strokes, kidney failure, pneumonia, bladder infections
- Complications from nerve blocks such as infection or nerve damage
- Serious medical problems can lead to ongoing health concerns, prolonged hospitalization, or rarely death.

Specific complications for Coronary Artery Bypass Graft surgery include:

- Heart Attack
- Stroke
- Bleeding
- Deep wound infection requiring IV antibiotics and possible surgical debridement.
- Arrhythmia (Irregular heart beat)
- Nerve damage causing weakness, neuropathy, or paralysis.
- Blood vessel damage requiring an operation for repair.
- Vein graft occlusion or stenosis
- Recurrent Angina
- Blood clots
- Death (less than 3%)

Risk factors that can negatively affect adequate healing after surgery include:



(Fig.38)

Although every effort is made to educate you on Coronary Artery Bypass Graft surgery and take control, there will be specific information that will not be discussed. Talk to your doctor or health care provider about any concerns you have about this surgery

YOUR SURGERY DATE

READ YOUR BOOK AND MATERIAL

VIEW YOUR VIDEO /CD / DVD / WEBSITE

PRE - HABILITATION

ARRANGE FOR BLOOD

MEDICAL CHECK UP

ADVANCE MEDICAL DIRECTIVE

PRE - ADMISSION TESTING

FAMILY SUPPORT REVIEW

Physician's Name : _____

Patient's Name : _____

Physician's Signature: _____

Patient's Signature: _____

Date : _____

Date : _____