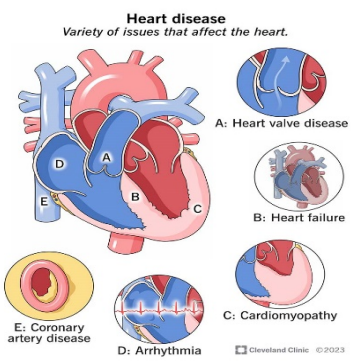
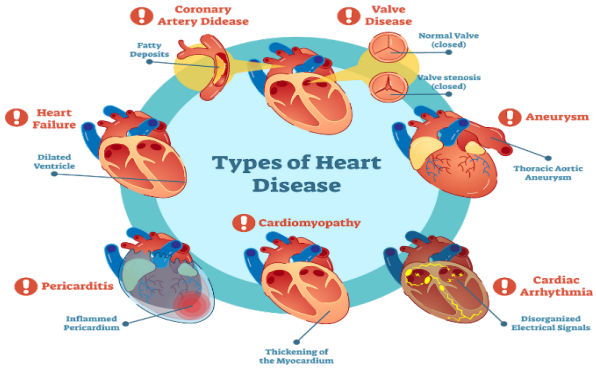
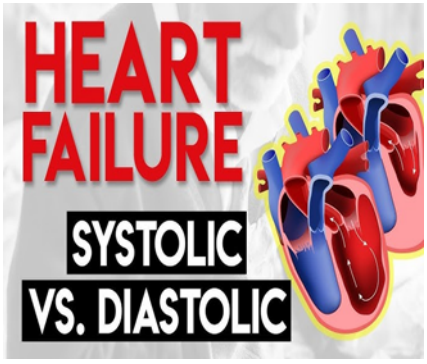
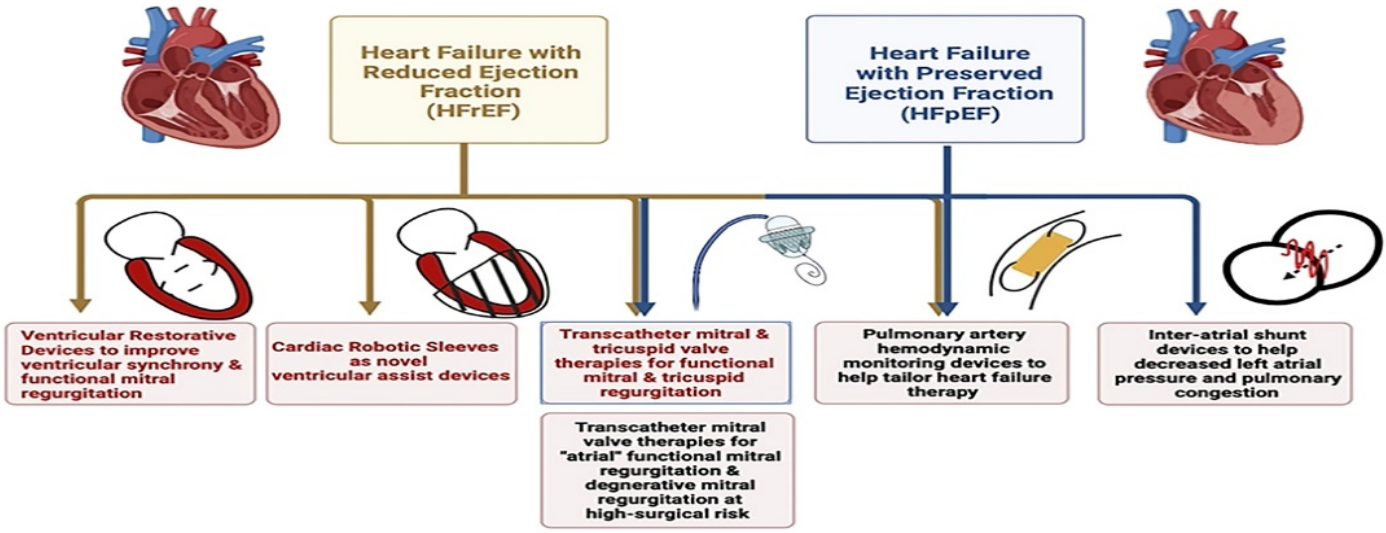
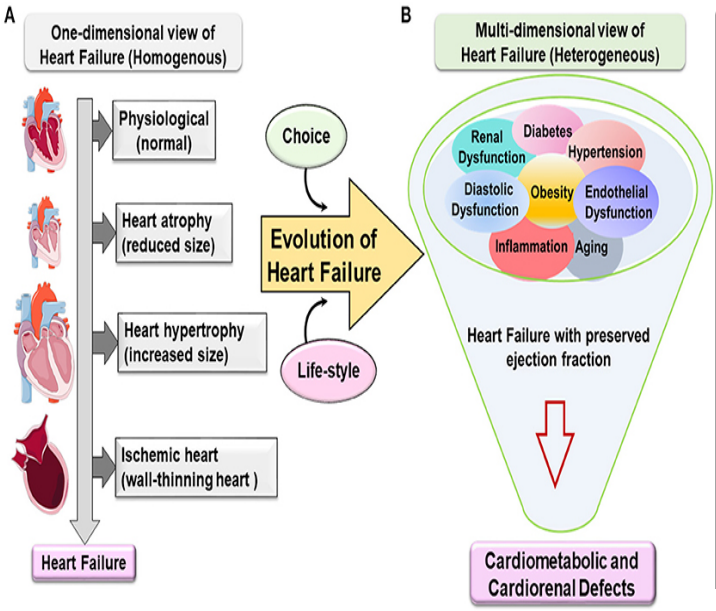
Heart failure

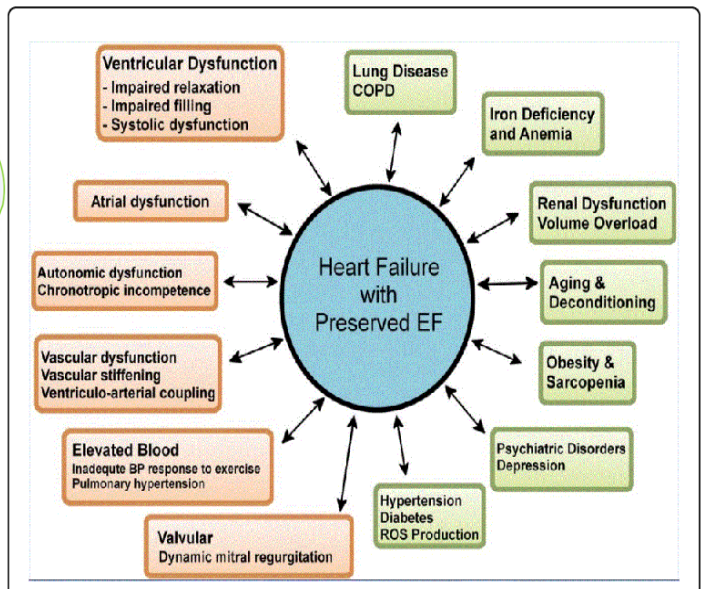












Anesthesia and **surgery** have a **wide** range of **effects** on the **cardiovascular system**. Even in **healthy patients having: a) type of operation** (minor operations), b) anesthetic agents can **cause** significant **cardiac depression** and **hemodynamic instability** (**HD**).

Virtually **all anesthetic agents have**:

1) Intrinsic **myocardial depressant** properties, although some may **mask** this with **sympathetic** stimulation. The vasodilatory **effects** of the *volatile* agents can **result** in serious **hypotension** when combined with this negative **inotropy**.

2) In the patient with **pre-existing cardiac disease**, these cardiovascular anesthetic effects **become much more serious**. **These patients** will: a) not tolerate wide **swings** of **hemodynamic** variables, and b) the **cardiodepressant** effects of anesthetics are **more pronounced** in them.

The stress of anesthesia and surgery frequently **unmasks** previously **undiagnosed heart disease**.

Surgery itself provides many **insults** to the cardiovascular system, and these may be **additive** with the effects of **anesthesia**. **These include**:

a) **Loss** of blood and other volume **shifts**,
b) **Release** of various substances into the circulation,
c) **Hypothermia**,
d) Sudden **changes** in cardiac **preload** and **afterload**,
e) Myocardial **ischemia**, and
f) Effects of **drugs** or **blood products** given for surgical reasons.

The signs and symptoms of these "surgical stresses" to the cardiovascular system are often **masked by anesthesia.**

Anesthesia for the **patient with heart disease** has become increasingly **safer** with the passage of years due to a **better knowledge** of the **physiology** of heart disease and of the **pharmacologic** action of anesthetic agents **themselves**.

The patient with **serious heart disease** usually **undergoes** a relatively **long period of "preoperative preparation"**. When ready, he is **given** **preanesthetic medication** and is **subjected** to the **administration of an anesthetic**.

The **surgical operation** is superimposed on these preliminary events. **Subsequently**, convalescence with its many **physiologic adjustments** **completes** the surgical **experience**.

يتم فرض الجراحة على هذه الأحداث الأولية. ومن ثم، فإن مرحلة النقاهة مع تعديلاتها الفسيولوجية العديدة تكمل التجربة الجراحية

Quizzes: define General anesthesia? It is defined as complete anesthesia affecting the entire body **with** ***loss of consciousness, *analgesia, *amnesia, and *muscle relaxation.** There is a wide spectrum of **agents** able to *partially or *completely induce general anesthesia.

Presently, there is **not a single** universally accepted **technique** for anesthetic management during cardiac surgery. **Instead**, the *drugs and *combinations of drugs used are **derived** from the "**pathophysiologic state**" of the patient and ***individual preference** and ***experience** of the **anesthesiologist**.

According to the definition of general anesthesia, current practices **consist** of **four main components**: ***hypnosis** التنويم الاصطناعي, ***analgesia**, ***amnesia**, and ***muscle relaxation**. Although many of the **agents** highlighted in this review are capable of producing more than one of these effects, it is logical that drugs producing these effects are **given** in **combination** to **achieve** the most beneficial **effect**.

"Anesthetic problems" may **originate** in any of the aforementioned **phases** of the operative experience. These problems have been briefly reviewed. The most important **factor** in minimizing the **problems** of **anesthesia** itself is *the **skill** and ***knowledge** with **which** the **anesthetic agents** are chosen and administered **rather than** the ***actual pharmacologic** and ***physiologic** effects of the **agents** themselves.

On a **background** of thorough medical preparation **safe anesthesia** for the **patient** with **heart disease** **consists of** (1) the **careful selection** of preanesthetic medication, (2) **flawless technic** بلا عيب , and (3) use of **minimal quantities of anesthetic agents** and **adjuncts**.

Despite the attainment تحقيق هدف of these **goals**, ***circulatory** and ***respiratory problems** will be **encountered** واجهت. **These may be related to:**

(a) the heart **disease** itself, (b) to medical **preparation**, (c) pharmacologic **side effects**, and (d) to a multitude of **undesirable** respiratory and circulatory **reflexes**.
The latter in turn **reside** يقيم in *anesthetic and *surgical **manipulation**. **Knowledge** of these factors enables the internist طبيب باطني **to understand the problems of anesthesia** and to **prepare** the patient for the **operative experience.**

Heart "Failure" occurs when **the heart isn't able to supply enough oxygen-rich blood to the body through difficulties with ventricular *filling or *ejecting blood (E).**
Heart failure **means** that the heart is unable to pump blood around the body properly. It usually **happens** because the heart has become **too weak** or **stiff**. It's sometimes called "**congestive heart failure"**, although this name is not widely used now. Heart failure **does not mean** your heart has **stopped working**.

What do the terms mean?

HFpEF= Heart Failure with Preserved Ejection Fraction (EF)
HFmrEF= Heart Failure with Mildly Reduced EF
HFrEF= Heart Failure with Reduced EF
HFimpEF= Heart Failure with Improved EF
The proposed universal nomenclature above offers a more precise way to **classify EF**.
An **echo of the heart** is **able** to **estimate** left ventricular **ejection fraction** (LVEF). **LVEF measures** how much blood is **pumped out** of the **left ventricle** and used interchangeability التبادلية with **ejection fraction** (**EF**).
Heart failure occurs when the heart muscle **doesn't pump blood** as well as **it should**. When this happens, **blood often backs up** and **fluid** can build up in the **lungs** (left side), causing **shortness of breath**.
Certain heart conditions gradually leave the heart too weak or stiff to fill and pump blood properly. These **conditions** include (1**) narrowed arteries** in the heart and (2) **high blood pressure**.
Proper treatment may improve the symptoms of heart failure and may help some people live longer. **Lifestyle changes** can improve quality of life(QoL). Try to lose weight, exercise, use less salt and manage stress.
But heart failure can be life-threatening. People with heart failure may have severe symptoms. Some may need **a heart transplant** or **a device** to help the heart pump blood.

Symptoms

If you have heart failure, your **heart can't supply enough blood to meet** your **body's needs**.
Symptoms may develop **slowly**. Sometimes, heart failure symptoms **start suddenly**. Heart failure symptoms may **include**:

1. Shortness of breath with activity or when lying down.
2. Fatigue and weakness.
3. Swelling in the legs, ankles and feet.
4. Rapid or irregular heartbeat.
5. Reduced ability to exercise.
6. Wheezing.
7. A cough that doesn't go away or a cough that brings up white or pink mucus with spots of blood.
8. Swelling of the belly area.
9. Very rapid weight gain from fluid buildup.
10. Nausea and lack of appetite.
11. Difficulty concentrating or decreased alertness.
12. Chest pain if heart failure is caused by a heart attack.

When to see a doctor?
See your health care provider if you think you might have symptoms of heart failure. If you have any of the following:

1. **Chest pain.**
2. **Fainting** or severe **weakness**.
3. ***Rapid** or ***irregular heartbeat with** *shortness of breath, *chest pain or *fainting.
4. **Sudden, severe shortness of breath** and **coughing up white or pink, foamy mucus**.

These symptoms may be **due to heart failure**. But there are many other possible causes.

Causes:

Heart failure can be **caused by** a *weakened, *damaged or *stiff heart.

If the heart is damaged or weakened, the heart chambers may stretch and get bigger. The heart can't pump out the needed amount of blood.

If the main pumping chambers of the heart, called the **ventricles**, are stiff, they can't fill with enough blood between beats.

The heart muscle can be **damaged by** certain *infections, *heavy alcohol use, *illegal drug use and some *chemotherapy medicines. Your *genes also can play a role.

Any of the following conditions also can damage or weaken the heart and **cause heart failure**.

1. **Coronary artery disease and heart attack**. Coronary artery disease is the most common cause of heart failure. The disease results from the buildup of fatty deposits in the arteries. The deposits narrow the arteries. This **reduces** blood flow and can lead to heart attack.
2. **A heart attack** occurs **suddenly** when an artery feeding the heart becomes **completely blocked. Damage** to the heart **muscle** from a heart attack may mean that the heart can no longer pump as well as it should.
3. **High blood pressure.** Also called **hypertension**, this condition **forces** the heart to work **harder** than it should to pump blood through the body. Over time, the extra work can make the heart muscle **too stiff** or **too weak** to properly pump blood.
4. **Heart valve disease**. The valves of the heart keep blood flowing the right way. **If a valve** isn't working properly, the heart must work **harder** to pump blood. This can weaken the heart over time. **Treating** some types of heart valve problems may reverse heart failure.
5. **Inflammation of the heart muscle,** also called **myocarditis**. Myocarditis is most commonly caused by a virus, including the COVID-19 virus, and can **lead to left-sided heart failure**.
6. **A heart problem** that you're born with, also called a **congenital heart defect**. If the heart and its chambers or valves haven't formed correctly, the other parts of the heart have to work harder to pump blood. This may lead to heart failure.
7. **Irregular heart rhythms,** called **arrhythmias**. Irregular heart rhythms **may cause** the heart to beat too fast, creating extra work for the heart. A slow heartbeat also may lead to heart failure. **Treating** an irregular heart rhythm may reverse heart failure in some people.
8. **Other diseases**. Some long-term diseases may contribute to chronic heart failure. Examples are diabetes, HIV infection, an overactive or underactive thyroid, or a buildup of iron or protein.

Causes of sudden heart failure also include:

1. **Allergic** reactions.
2. Any **illness** that affects the whole body.
3. Blood **clots** in the **lungs** (pulmonary embolism).
4. Severe **infections**.
5. Use of certain **medicines**.
6. **Viruses** that attack the heart muscle.

Heart failure usually **begins** with the lower left heart chamber, called the ***left ventricle**. This is the **heart's main pumping chamber.** But heart failure also **can affect the right side**. The lower **right heart chamber** is called the ***right ventricle**. Sometimes heart failure **affects *both sides** of the heart.

Types of HF:

1. **Right-sided** heart failure
2. **Left-sided** heart failure
3. Heart failure with **reduced ejection fraction (HFrEF),** also called **systolic heart failure**
4. Heart failure with **preserved ejection fraction (HFpEF),** also called **diastolic heart failure**

Type of heart failure	Description
Source: American Heart Association	
Right-sided heart failure	This type affects the **lower right heart chamber**, called the right ventricle. **Fluid** may back up into the **belly**, **legs** and **feet**, causing **swelling**.
Left-sided heart failure	This type affects the **lower left heart chamber**, called the left ventricle. **Fluid** may back up in the **lungs**, causing **shortness of breath.**
Heart failure with reduced ejection fraction (HFrEF), also called systolic heart failure	This is a type of **left-sided heart failure**. The left ventricle can't squeeze as strong as it should. The heart isn't strong enough to pump enough blood to the body.
Heart failure with preserved ejection fraction (HFpEF), also called diastolic heart failure	This is a type of **left-sided heart failure**. The left ventricle can't relax or fill fully. The heart has a problem filling with blood.

Complications

If you have health failure, it's important to have regular health checkups, even if symptoms improve. Your health care provider can examine you and run tests to **check for complications**.

Complications of heart failure **depend** on your **age**, **overall health** and the **severity of heart disease**. They may **include**:

1. **Kidney damage or failure**. Heart failure can reduce the blood flow to the kidneys. Untreated, this can cause kidney failure. Kidney damage from heart failure can require dialysis for treatment.
2. **Other heart problems**. Heart failure can cause **changes** in the heart's size and function. These changes may damage heart valves and cause irregular heartbeats.
3. **Liver damage.** Heart failure can cause fluid buildup that **puts too much pressure on the liver**. This fluid backup can lead to scarring, which **makes it more difficult for the liver to work properly**.
4. **Sudden cardiac death.** If the heart is weak, there is a **risk of dying suddenly** due to a dangerous irregular heart rhythm.

Diagnosis

To diagnose heart failure, your health care provider **examines** you and asks questions about your symptoms and **medical history.** Your provider **checks** to see if you have risk factors for heart failure, such as high blood pressure, coronary artery disease or diabetes.

Examine the sign of HF: your care provider listens to your lungs and heart with a device called a **stethoscope**. A **whooshing sound** called a murmur may be heard when listening to your heart. Your provider may look at the veins in your **neck and check** for swelling in your legs and belly.

Tests: Tests that may be done to diagnose heart failure may include:

1. **Blood tests**. Blood tests can help diagnose diseases that can affect the heart. Blood tests also can look for a specific protein made by the heart and blood vessels. In heart failure, the level of this protein goes up.
2. **Chest X-ray**. X-ray images can show the condition of the lungs and heart.
3. **Electrocardiogram** (ECG or EKG). This quick and painless test records the electrical signals in the heart. It can show how fast or how slowly the heart is beating.
4. **Echocardiogram**. Sound waves create images of the beating heart. This test shows the size and structure of the heart and heart valves and blood flow through the heart.

5. **Ejection fraction**. Ejection fraction is a measurement of the percentage of blood leaving your heart each time it squeezes. This measurement is taken during an echocardiogram. The result helps classify heart failure and guides treatment. An ejection fraction of 50% or higher is considered ideal. But you can still have heart failure even if the number is considered ideal.
6. **Exercise tests or stress tests**. These tests often involve walking on a treadmill or riding a stationary bike while the heart is monitored. Exercise tests can show how the heart responds to physical activity. If you can't exercise, you might be given medicines.
7. **CT scan of the heart**. Also called a cardiac CT scan, this test uses X-rays to create cross-sectional images of the heart.
8. **Heart MRI scan**, also called a cardiac MRI. This test uses magnetic fields and radio waves to create detailed images of the heart.
9. **Coronary angiogram**. This test helps spot blockages in the heart arteries. The health care provider inserts a long, thin flexible tube called a catheter into a blood vessel, usually in the groin or wrist. It's then guided to the heart. Dye flows through the catheter to arteries in the heart. The dye helps the arteries show up more clearly on X-ray images and video.
10. **Myocardial biopsy.** In this test, a health care provider removes very small pieces of the heart muscle for examination. This test may be done to diagnose certain types of heart muscle diseases that cause heart failure.

During or after testing for heart failure, your health care provider may tell you the **stage of disease.** **Staging** helps determine the most appropriate treatment. There **are two main ways to determine the stage of heart failure**:

1) **New York Heart Association (NYHA) classification**

This system groups heart failure into four categories by number. You may see Roman numerals used for these category names.

Class 1 HF. There are **no** heart failure symptoms.

Class 2 HF. Everyday activities can be done without difficulty. But **exertion** causes shortness of breath or fatigue.

Class 3 HF. It's difficult to complete **everyday activities**.

Class 4 HF. Shortness of breath occurs even at **rest**. This category includes the most severe heart failure.

2) **American College of Cardiology/American Heart Association classification**

This stage-based classification system uses letters A to D. It includes a category for people who are at risk of developing heart failure.

Stage A. There are several risk factors for heart failure but no signs or symptoms.

Stage B. There is heart disease but no signs or symptoms of heart failure.

Stage C. There is heart disease and signs or symptoms of heart failure.

Stage D. Advanced heart failure requires specialized treatments.

Health care providers often use the classification systems together to help decide the most appropriate treatment options. Your provider can help you interpret your stage.

Treatment

Treatment of heart failure may **depend on the cause**. Treatment often **includes** lifestyle changes and medicines. **If another health condition** is causing the heart to fail, **treating it may reverse heart failure**.

Some people with heart failure **need surgery** to open blocked arteries or to place a device to help the heart work better.

With treatment, symptoms of heart failure may improve.

Medications

A combination of medicines may be used to treat heart failure. The specific medicines used **depend on** the ***cause** of heart failure and the ***symptoms**.

Medicines to treat heart failure include:

1. **Angiotensin-converting enzyme (ACE) inhibitors**. These drugs relax blood vessels to lower blood pressure, improve blood flow and decrease the strain on the heart. Examples include enalapril (Vasotec, Epaned), lisinopril (Zestril, Qbrelis) and captopril.
2. **Angiotensin II receptor blockers (ARBs).** These drugs have many of the same benefits as ACE inhibitors. They may be an option for people who can't tolerate ACE inhibitors. They include losartan (Cozaar), valsartan (Diovan) and candesartan (Atacand).
3. **Angiotensin receptor plus neprilysin inhibitors (ARNIs).** This medicine uses two blood pressure drugs to treat heart failure. The combination medicine is sacubitril-valsartan (Entresto). It's used to treat some people with heart failure with reduced ejection fraction. It may help prevent the need for a hospital stay in those people.
4. **Beta blockers.** These medicines slow the heart rate and lower blood pressure. They reduce the symptoms of heart failure and help the heart work better. If you have heart failure, beta blockers may help you live longer. Examples include carvedilol (Coreg), metoprolol (Lopressor, Toprol-XL, Kapspargo Sprinkle) and bisoprolol.
5. **Diuretics.** Often called **water pills**, these medicines make you urinate more frequently. This **helps** prevent fluid buildup in your body. (a) Diuretics, such as **furosemide (Lasix, Furoscix**), also decrease fluid in the lungs, so it's easier to breathe.

   Some diuretics make the body lose potassium and magnesium. Your health care provider may recommend supplements to treat this. If you're taking a diuretic, you may have regular blood tests to check your potassium and magnesium **levels**.

   (b) Potassium-sparing diuretics. Also called **aldosterone antagonists**, these drugs include **spironolactone** (Aldactone, Carospir) and **eplerenone** (Inspra). They may help people with **severe heart failure** with reduced ejection fraction (HFrEF) live longer. Unlike some other diuretics, these medicines can raise the level of potassium in the blood to dangerous levels. Talk to your health care provider about your diet and potassium intake.

   (c) Sodium-glucose cotransporter-2 (SGLT2) inhibitors. These medicines help lower blood sugar. They are often **prescribed** with diet and exercise to treat type 2 diabetes. But they're also one of the first treatments for heart failure. That's because several studies showed that the medicine lowered the risk of hospital stays and death in people with certain types of heart failure — even if they didn't have diabetes. These medicines include **canagliflozin** (Invokana), **dapagliflozin** (Farxiga), and **empagliflozin** (Jardiance).
6. **Digoxin (Lanoxin).** This drug, also called **digitalis**, helps the heart squeeze better to pump blood. It also tends to slow the heartbeat. Digoxin **reduces** heart failure symptoms in *people with HFrEF. It may be more likely to be given to someone *with a heart rhythm problem, such as **atrial fibrillation**.
7. **Hydralazine and isosorbide dinitrate (BiDil).** This drug combination helps relax blood vessels. It may be added to your treatment plan **if *you have severe heart failure symptoms** and ***ACE inhibitors or beta blockers haven't helped.**
8. **Vericiguat (Verquvo).** This medicine for **chronic heart failure** is taken once a day by mouth. It's a type of drug called an oral soluble guanylate cyclase (sGC) stimulator. In studies, people with high-risk heart failure who took this medicine had fewer hospital stays for heart failure and heart disease-related deaths compared with those who got a dummy pill.
9. **Positive inotropes.** These medicines may be given by IV to people with **certain types of severe heart failure** who are in the hospital. Positive inotropes can help the heart pump blood better and maintain blood pressure. **Long-term use** of these medicines has been linked to an increased risk of death in some people. Talk to your health care provider about the benefits and risks of these drugs.

10. **Other medicines**. Your health care provider may prescribe other medicines **to treat specific symptoms**. For example, some people may *receive **nitrates** for chest pain, ***statins** to lower cholesterol or *blood thinners to help prevent blood clots.

Your health care provider may need to change your medicine doses frequently. This is more common when you've just started a new medicine or when your condition is getting worse.

You **may be admitted to the hospital if you have a flare-up of heart failure symptoms**. While in the hospital, you may **receive**:

1. **Medicines** to relieve your **symptoms**.
2. More **medicines** to help your heart pump better.
3. **Oxygen** through a ***mask** or small ***tubes** placed in your nose.

If you have severe heart failure, you may need to use supplemental oxygen for a long time.

Surgery or other procedures

Surgery or other treatment to place a **heart device** may be recommended to treat the problem that led to heart failure.

Surgery or other procedures for heart failure may **include**:

1. **Coronary bypass surgery**. You may need this surgery if severely blocked arteries are causing your heart failure. The surgery involves taking a healthy blood vessel from the leg, arm or chest and connecting it below and above the blocked arteries in the heart. The new pathway improves blood flow to the heart muscle.
2. **Heart valve repair or replacement**. If a damaged heart valve causes heart failure, your provider may recommend repairing or replacing the valve. There are many different types of heart valve repair. The type needed depends on the cause of the heart valve problem.
   Heart valve repair or replacement may be done as ***open-heart** or ***minimally invasive surgery**.
3. **Implantable cardioverter-defibrillator (ICD).** An ICD is used to prevent complications of heart failure. It isn't a treatment for heart failure itself. An ICD is a device similar to a pacemaker. It's implanted under the skin in the chest with wires leading through the veins and into the heart.
   The ICD monitors the heartbeat. If the heart starts beating at a dangerous rhythm, the ICD tries to correct the beat. If the heart stops, the **device shocks it back** into regular rhythm. An ICD can also **work as a pacemaker and speed up a slow heartbeat**.
4. **Cardiac resynchronization therapy (CRT).** Also called "**biventricular pacing**", CRT is a treatment for heart failure in people whose lower heart chambers **aren't pumping** in sync with each other. **A device sends** electrical signals to the lower heart chambers. The signals **tell** the chambers to squeeze in a more coordinated way. This **improves** the pumping of blood out of the heart. **CRT** may be used with an **ICD**.
5. **Ventricular assist device (VAD).** A VAD helps pump blood from the lower chambers of the heart to the rest of the body. It's also called **a 'mechanical circulatory support device".** Although a VAD can be placed in one or both lower chambers of the heart, it's usually placed in the lower **left** one.
   Your health care provider may **recommend** a VAD if you're waiting for a heart transplant. Sometimes, a VAD is used as a permanent treatment for people who have heart failure but **who aren't good candidates** for a **heart transplant**.
6. **Heart transplant.** Some people have such severe heart failure that surgery or medicines don't help. These people may **need to have their hearts replaced with a healthy donor heart**.

A heart transplant **isn't the right treatment for everyone**. A team of health care providers at a transplant center helps **determine** whether the **procedure may be safe and beneficial for you.**

Quizzes:

How long can a person live with heart failure?

Left untreated, it can be life-threatening. While no one can predict exactly how heart failure will affect someone's life or how it may shorten a life, in general, more than half of all people diagnosed with congestive heart failure will survive for five years. About 35% will survive for 10 years.

What defines heart failure?

Heart failure occurs when the heart muscle doesn't pump blood as well as it should. Blood often backs up and causes fluid to build up in the lungs and in the legs. The fluid buildup can cause shortness of breath and swelling of the legs and feet.

What are the 2 types of heart failure?

Heart failure with reduced pumping ability is sometimes referred to as "systolic" heart failure, and heart failure with preserved pumping ability is also known as "diastolic" heart failure.

How to diagnose heart failure?

Tests that may be done to diagnose heart failure may include:

1. Blood tests. Blood tests can help diagnose diseases that can affect the heart. ...
2. Chest X-ray. ...
3. Electrocardiogram (ECG or EKG). ...
4. Echocardiogram. ...
5. Ejection fraction. ...
6. Exercise tests or stress tests. ...
7. CT scan of the heart. ...
8. Heart MRI scan, also called a cardiac MRI .

مزيد من العناصر...

What is treatment for heart failure?

Medicines are the main treatment for heart failure, but for some people **surgery** may help. Operations that can help with heart failure include: heart valve surgery. a coronary angioplasty or bypass.

What is the best treatment for heart failure?

Currently, the main treatments for heart failure **with preserved ejection fraction** are **diuretics**. Your doctor also may **prescribe blood pressure medicines** to help relieve your symptoms.

What is the most common heart failure?

Left-sided heart failure involves the left ventricle (bottom left chamber of the heart). When the left ventricle doesn't pump enough blood, it backs up in the blood vessels that carry blood away from the lungs. It's the most common type of heart failure, and tends to cause breathing symptoms.

What is end stage heart failure?

If a patient has **end-stage heart failure** it **means** they are at high risk of dying in the next 6 to 12 months. These are the common **symptoms** of end-stage heart failure: ***pain. *breathlessness on minimal exertion or at rest**.

What blood test is done for heart failure?

BNP (B-type natriuretic peptides) tests – show the level of a hormone in your blood, which if elevated, can be a sign of heart failure. Blood glucose (HbA1C) test - measures your average blood sugar levels over the past **three months**, which can help find out if you have prediabetes or diabetes.

What is normal BNP?

For people who don't have heart failure, **normal BNP levels are less than 100 picograms per milliliter (pg/mL).** BNP levels **over 100 pg/mL may be a sign of heart failure.** For NT-proBNP, normal levels are less than 125 pg/mL for people under 75 years old and less than 450 pg/mL for people over age 75.

What is Stage 3 of heart failure?

Stage 3 of Congestive Heart Failure

Small bouts of exercise or minimal doses of physical activity will cause the same symptoms mentioned in stage two – fatigue, shortness of breath, and heart palpitations. **In stage three**, lifestyle changes are not as effective, and a **surgical procedure may be necessary**.

What are the 3 types of CHF?

The type of CHF also affects the type of treatment.

1. Left-sided Heart Failure. Left-sided heart failure occurs when the left ventricle of the heart no longer pumps enough blood. ...
2. Right-sided Heart Failure. ...
3. Biventricular Heart Failure.

What is the difference between CHF and heart failure?

Heart failure often refers to early-stage weakening of the heart without congestion. As the damage to the **heart progresses**, it causes fluid to build up in the feet, arms, lungs, and other organs, which is **referred to as congestion**, throughout the body. This stage of heart failure is called **CHF**.

What is the first line treatment of heart failure?

Loop diuretics should be used as first-line agents, with thiazides added for refractory fluid overload. Diuretic treatment should be combined with a low-salt diet, a β-blocker, and an ACE inhibitor. The practitioner should **begin** with oral furosemide, 20 to 40 mg once daily.

Anaesthesia And Heart Failure

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17TH APRIL 2008, PDF DOWNLOAD, OFFLINE READING.

Q/ SELF-ASSESSMENT

The following true/false questions may be attempted before reading the tutorial. The answers are given at the end of the text.

1. **In the normal heart: (TFFTF)**

a. Pre-load is the same as left ventricular end-diastolic volume. T

b. Increase in pre-load has no effect on the force of the next contraction. F
c. Systemic vasoconstriction reduces afterload. F
d. Iso-volumetric ventricular contraction ends when the aortic valve opens. T
e. The ejection fraction of a normal left ventricle is approximately 40%. F

2. **Regarding diastole: (TFTTT) (TFFTT)**
a. Diastole is an active, energy consuming process. T
b. Diastolic time remains the same with increased heart rate. F
c. In the normal heart, only one third of ventricular filling occurs before atrial contraction. T
d. Atrial contraction is a part of diastole. T
e. Ventricular relaxation is a part of diastole. T

3. **Regarding heart failure: (FFFTF)**
a. The failing ventricle is invariably more compliant than normal. T
b. Central venous pressure should be kept to a minimum if diastolic failure is suspected. T
c. Allowing tachycardia is an effective way of maintaining cardiac output. F
d. Vasodilation can help restore cardiac output in the failing ventricle. T
e. Inotropes should never be used. F

1. **Regarding the management of patients with heart failure:** FTFF
a. ACE inhibitors should normally be continued throughout the perioperative period. F
b. Beta-blockers should be normally be continued throughout the perioperative period. T
c. Arrhythmias should only be treated if blood pressure is compromised. T
d. Spinal anaesthesia **reduces** perioperative risk in total knee replacement surgery. T

INTRODUCTION

Congestive cardiac failure (CCF) is a common and debilitating condition. It is characterized by impaired **ventricular** performance resulting in ***fatigue**, ***exercise** intolerance, *an **increased** incidence of **ventricular arrhythmias** and *a **shortened life expectancy**.

The **three major risk factors** for the development of heart failure are ***age**, ***hypertension** and ***coronary artery disease**.

In the UK up to **4% of deaths** are attributable to heart failure and **40% of patients will die** within one year of diagnosis.

Perioperatively (during operation, operative day) , **heart failure** is associated with a substantial **increase** in **morbidity** and **mortality**.

This review will **examine** the **underlying pathophysiological principles** of **CCF** and **apply** those principles to the clinical management of patients.

Patients with heart failure have **increased** risk for **adverse *cardiac events** including ***death**, following **non-cardiac surgery.**

The "**necessity** of surgery" **needs** to be determined **along** with *appropriate preoperative evaluation and *risk stratification. The **anaesthetic** should be **tailored** to (1) specific **haemodynamic** goals with careful **fluid** management and (2) appropriate use of **vasoactive therapies**.

Vasoactive therapy is often used **to treat** "**acute decompensated** heart failure" (**ADHF**)قصور القلب اللا تعويضي .

The authors sought **to determine** whether clinical outcomes are temporally associated with time to vasoactive therapy (vasoactive time) in ADHF. **Vasoactive medications** are routinely used in the care of critically ill patients. ***Vasopressors**, such as norepinephrine, are frequently used in patients with ***septic shock** to improve ***SVR**, **whereas** ***inotropes** are often used in patients with ***cardiogenic shock** to improve *cardiac contractility and *CO.

SVR: Systemic vascular resistance (**SVR**), also known as total peripheral resistance (**TPR**), is the amount of force exerted on circulating blood by the vasculature of the body. **Three factors determine the force**: the ***length** of the blood vessels in the body, the ***diameter** of the vessels, and the ***viscosity** of the blood within them.

Total peripheral resistance (**TPR**) is an important concept to understand **because** it plays a vital role in the ***establishment** and ***manipulation** of blood pressure. This relationship is expressed mathematically as **MAP = CO x TPR**, where **CO** stands for cardiac output, and **MAP** stands for **mean arterial pressure**.

Pathophysiology of HF:

Characteristically the chambers of the **heart** become **enlarged**, with **increased wall thickness** and **stiffness**. Underlying this is a process of *fibrosis and *myocellular hypertrophy. These morphological changes **lead** to important **functional changes** which affect **both** diastole (relaxation) and systole (contraction).

Diastole

Figure 1 shows the normal left ventricular pressure-volume relationship (LVPVR) during the cardiac cycle. Diastole can be divided into **three stages**:

*Isovolumetric ventricular relaxation: This is demonstrated by the "**vertical descending"** part of the pressure-volume loop. It is **"an active process"** requiring ATP, in which calcium is sequestered back into the sarcoplasmic reticulum. In **diastolic heart failure** this process breaks down, resulting in a ventricle which **fails to relax** and is therefore **stiff** and less compliant.

*Passive ventricular filling: In the normal heart, approximately **75%** of ventricular filling (**preload**) occurs **"passively"**.

*Atrial contraction: In the normal heart, atrial contraction contributes only a **quarter** of "**left ventricular end-diastolic volume" (LVEDV)** or **"preload"**. However, for a ventricle which is poorly compliant, due to diastolic failure, **preload** is much more dependent on **atrial contraction**.

The dotted line in figure 1 shows how the mechanics of the LVPVR change in diastolic heart failure. For any given left ventricular **volume**, there is a **"higher"** left ventricular **pressure**.

This **has two major consequences** which need to be understood.

Firstly, there will be a decreased left atrial (LA) to left ventricular (LV) "**pressure gradient"**. LV filling in diastole **depends on this pressure gradient.**

If LA pressure **drops**, LVEDV (**preload**) **diminishes** rapidly, along with "stroke volume" and "cardiac output". **Hypovolaemia** is therefore poorly tolerated. (A note of caution here – the situation is quite **different** in acute LV systolic failure, when a reduction of **preload** can potentially rescue the ventricle).

Secondly, there will be a susceptibilityقابلية to develop ***pulmonary oedema**", as the increased left sided heart **pressures** result in increased **pulmonary venous** and **capillary pressures**. Up to a **half** of patients presenting with *respiratory symptoms of congestive heart failure will have preserved systolic function.

Note: The definition of **stroke volume** is the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction.

Cardiac output (CO) is the amount of blood pumped by the heart minute and is the mechanism whereby blood flows around the body, especially providing blood flow to the **brain** and other **vital organs**.

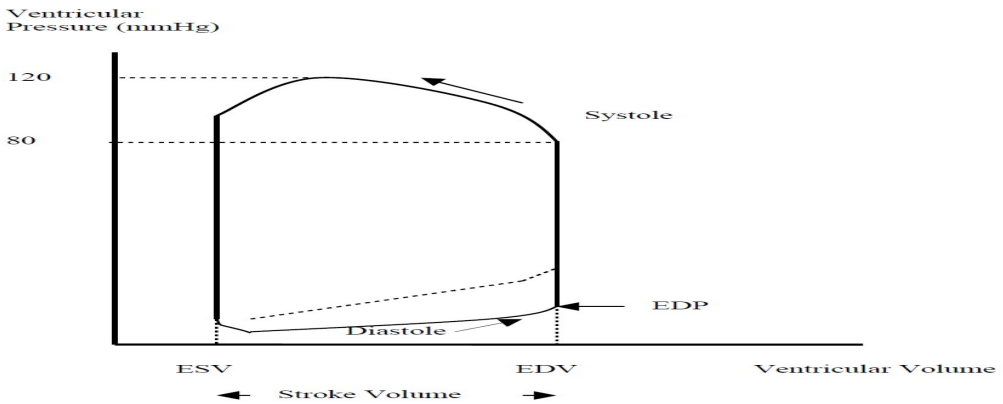

Figure 1. Left ventricular pressure-volume relationship (Dotted line indicates diastolic dysfunction)

Systole

Systole consists of **two** stages. The **first stage** consists of isovolumetric **ventricular contraction**, which **ends** with the **opening** of the *aortic valve and is represented by the "**vertically ascending"** portion of the loop. The **second stage** concerns the **ejection** of blood into the **aorta** and **ends** with the **closure** of the *aortic valve. These are **ATP consuming**, "active processes" involving the

interaction of "actin with myosin". **Systolic heart failure** occurs when there is **inadequate** force generation to **eject blood normally**. It can affect **either** **ventricle** **but** *left-sided heart failure is **more** **common**.
***Systolic failure** is likely to **co-exist** with ***diastolic failure**.
Reduction in **cardiac output**, whether *acute or *chronic, **induces** a "neuro-endocrine response". ***Baroreceptor** activity increases efferent sympathetic nervous system (**SNS**) **activity** and circulating catecholamines **increase**.
The **SNS** activates the reninangiotensin- aldosterone (RAA) system. These **responses** initially **act** to "maintain cardiac output" and "perfusion pressure" but ultimately their effects become **deleterious** ضار.
SNS activity **increases** "myocardial oxygen" consumption, which may not be met by supply. Along with a contribution from angiotensin II, the SNS also **increases** ***afterload** and therefore ***myocardial work**.
Sodium and water retention by the kidneys may **have** an adverse influence **on** ***preload** and ***exacerbate oedema**.
These processes are **attenuated** المخفف in the **medical** management of congestive cardiac failure **by:**
a. **beta blockers**, b. **ACE** **inhibitors** and c. **diuretics**.
Figure 2 shows the relationship between *LVEDV (or **preload**) and *stroke volume (**SV**) described by "**Frank and Starling"**. The dotted line **shows** the effect of **an increasing preload** on a failing ventricle. The **progressive "decrease in SV"** as a result of *overstretched, *diseased cardiac muscle fibers **results** in a higher and higher LVEDV, ***amplifying** the problem.
This describes the situation in "acute LV failure" which can be **managed** using the *vasodilatory properties of intravenous **nitrates**. Venodilation **reduces** **preload** with the aim of bringing the ventricle back along the curve to a point of increased SV at a decreased LVEDV. **Dilation** on the arterial side **reduces** **afterload** and therefore **myocardial work**.
The effect of **increased afterload** can also be understood by looking at the Frank- Starling graph. The **arrow** **downwards** from the point marked with a **cross** represents the immediate effect of an increase in afterload. The next contraction of the heart will yield a **smaller SV** as it is pumping against a **higher vascular resistance**.
A ***smaller SV** results in a *lower ejection fraction and therefore *more **blood remains** in the ventricle. This **results** in a greater LVEDV (preload) for the next contraction. The next arrow follows the mechanical path such a ventricle takes next – along the Starling curve to the right. In a **good ventricle**, SV is regained (at a higher LVEDP). **If** the ventricle is **failing**, however, an increased afterload can **lead to** rapid decompensation (further down the dotted lined curve to the right).

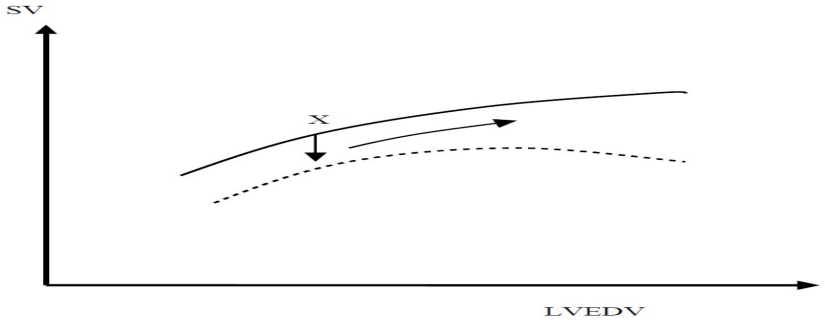

Figure 2. Frank-Starling curve (Dotted line indicates performance of failing ventricle)

Anaesthetic management of patients with heart failure

Preoperative Assessment

It is important that patients with "congestive cardiac failure" are **identified preoperatively**, especially those with **evidence** of *current (chronic) or *recent (acute) **decompensation**.
Evidence of **decompensation within 6 months of surgery** is associated with **increased risk**. There may be a ***history** of shortness of **breath** (SOB) and ***reduced exercise tolerance**.
Patients unable to sustain 4 'metabolic equivalents' (climbing a flight of stairs) are particularly **at risk** from "perioperative complications" (intraoperative). **Associated co-morbidity** such as ***(a)** ischaemic heart disease, ***(b)** hypertension and ***(c)** diabetes should be sought. **Examination** may reveal *peripheral or pulmonary **oedema** and a ***third heart sound(S3)**.

Investigations

Blood tests: **Anaemia** and **electrolyte disturbance** (especially for patients taking **diuretics**) should be identified and treated. Other blood tests which may reveal aggravating factors **include *liver** and ***thyroid** function tests and ***glucose**.
ECG: Check for arrhythmias.
CXR: Signs may include ***cardiomegaly**, ***pleural effusions**, ***prominent upper lobe veins** (upper lobe diversion), ***engorged peripheral lymphatics** and ***alveolar oedema**.
Transthoracic echocardiogram: This is the most useful test and can **provide** important **anatomical** information as well as an assessment of **function**. Heart failure can be **secondary** to **valvular disease** (usually **aortic stenosis** or **mitral regurgitation**). Patients with an **ejection fraction** (EF) of less than 40% are **considered** to have systolic failure and those with an **ejection fraction (EF)** of less than 30% have **severe disease**.
"Cardiac catheterization': May be **performed** if significant **coronary** or **valvular** heart disease is suspected as the cause of heart failure.

Optimization of treatment

Medical therapy should be *optimized to "**minimize symptoms**" of left ventricular failure and "**maximize functional capacity**". Along with "**diuretics"**, many patients with CCF will be taking a "**beta-blocker"** and an "**ACE inhibitor"** (or Angiotensin II receptor antagonist). These drugs **reduce myocardial work** by **controlling heart rate** and **reducing afterload** respectively.
Many anesthetists stop ACE inhibitors **on the day of surgery** due to problems with *blood pressure liability, **but** all other anti-failure therapy should be **continued** in the **perioperative period**. There is some evidence that "perioperative beta-blockade" **reduces** morbidity and mortality in patients at high risk of cardiac complications.
Symptomatic arrhythmias should be **treated**, and attempts made to **control** heart rate to around 80 beats per minute. Atrial fibrillation (AF) is **poorly** tolerated.
Elective surgery should be postponed until medical management has been **optimized** and **risk assessed** thoroughly against benefit. **High risk patients** undergoing elective or emergency surgery may benefit from **preoperative optimization** in ICU or HDU.

Intraoperative Management

Patients undergoing **minor** peripheral procedures should be **offered** *local or ***regional anaesthesia** where possible.
For more **major surgery** there is no evidence of the **benefits** of **general** versus **regional anaesthesia**. However, whichever technique is used, having understood the pathophysiology of cardiac failure, there are **clear haemodynamic goals** for the perioperative period. These are **aimed** at *(1) **preserving cardiac output and *(2) minimizing myocardial work.**

- **Preserving cardiac output:** There are three factors that influence cardiac output. These are ***preload**, ***afterload** and ***contractility**. The "poorly compliant ventricle" must be given the opportunity to fill in diastole. This will require a higher than usual **central venous pressure**, the avoidance of **tachycardia** (which reduces the duration of diastole) and in particular the aggressive treatment of **arrhythmias**. As discussed earlier, in the failing ventricle LVEDV is heavily reliant on **atrial contraction**. If this 'atrial kick' is **lost**, as occurs in atrial fibrillation for example, preload will be reduced with consequent decrease in cardiac output. ***Increases** in

afterload, especially acutely, can cause a dramatic **reduction** in cardiac output and should be avoided. ***Finally**, **contractility** must be maintained. Patients with cardiac failure may rely on increased **sympathetic tone** to maintain cardiac output, and are therefore **susceptible** to circulatory collapse if this is lost after induction of anaesthesia. **Agents** such as **ephedrine** should be readily available although great care should be taken with **vasopressors**. **Inotropes** such as **dobutamine** or "**phosphor-diesterase inhibitors"** may be required for patients who decompensate in the perioperative period.

- **Minimizing myocardial work**: Tachycardia **increases** myocardial oxygen demand and therefore should be avoided. **Consideration** should be given to **factors** which may precipitate tachycardia, including ***intubation**, ***surgical** stimulus, ***hypovolaemia**, ***anaemia**, ***hypoxia**, ***hypercapnia**, *post-operative **pain**, *nausea and vomiting. **Opioids** such as alfentanil **attenuate** the response to **intubation**. Effective **analgesia** is important and use of regional techniques should be considered.
Epidural infusions obtund بليدthe stress response to surgery and can provide effective post-operative analgesia. The haemodynamic effects are potentially favourableملائم . Reducing afterload by **vasodilation** can greatly reduce myocardial work. However, it is important not to compromise blood flow to circulations which have pressure-dependent autoregulation (cerebral, renal and coronary). In particular, diastolic pressure must be maintained, as the left ventricle is perfused during diastole and many patients with cardiac failure will also have coronary artery disease.
With these physiological principles in mind, invasive monitoring, including cardiac output measurement, should be considered for all major surgery.

Postoperative care

All patients should receive supplemental oxygen in the postoperative period. Careful fluid balance is also required. Patients with heart failure are susceptible to renal failure due to reduced glomerular filtration rates. **If urine output falls**, **adequate** volume status, perfusion pressure and cardiac output should be ensured **before diuretics** are used. **NSAIDs** should be **avoided** or **used** with great caution to avoid further **renal insult**.
ACE inhibitors should be reintroduced as soon as possible. If omitted for more than 3 days they should be restarted at a lower dose to avoid hypotension. There should be a low threshold for admission to ICU or HDU.

Conclusion

CCF is a major cause of morbidity and mortality worldwide and is increasing in incidence. More patients with the condition are **presenting for surgery** in both *elective and *emergency settings. **Good understanding** of the underlying physiological principles is **necessary** to manage these patients appropriately in the *perioperative period and *minimize their risk of **complications**.

MCQ ANSWERS

1. TFFTF
2. TFFTT
3. FFFTF
4. FTFF

REFERENCES

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