

The Human Heart



A
700-cc
Engine
that
Powers
Your body

UNDERSTAND HOW IT WORKS

Patient Education Series
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Secunderabad

The Heart Pump – the human drivetrain:

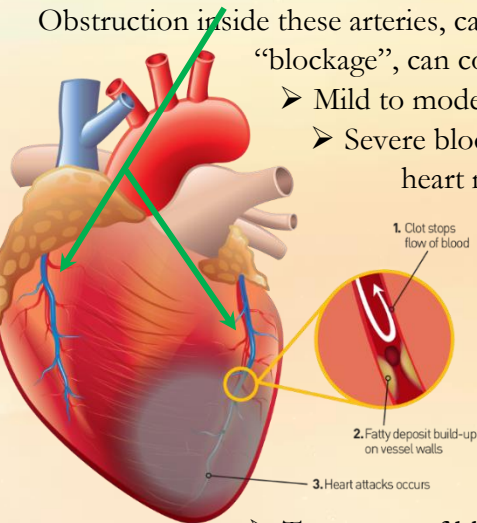
Like an engine, the heart provides power to the human body. The primary function of the heart is to pump vital oxygen-rich blood to all the body organs. A compromised heart will cause a reduction in blood supply to body organs rendering them dysfunctional. In this regard, the 'heart-pump' is the most vital organ. The basic aim of cardiovascular medicine is to keep this pump healthy so that adequate blood supply to the body is maintained.

- Pumping power of the heart can be checked by 2D-echo.
- Similar to an engine, the heart also needs fuel (blood), current (electrical signal), and components (valves etc.) for smooth functioning. Abnormalities in these can lead to weak heart muscle (known as heart failure).
- Treatment of heart failure starts with fixing the cause. Other treatment includes lifestyle modification, medicines, fluid, and salt restriction etc.

A cut section of the heart showing heart muscle (star)

Heart's plumbing system (fuel):

The heart, like other body organs, need blood supply (fuel) to function properly. Blood vessels (arteries) running across the surface of the heart do this job. Obstruction inside these arteries, called coronary artery disease (CAD) or “blockage”, can compromise the blood supply of the heart itself.

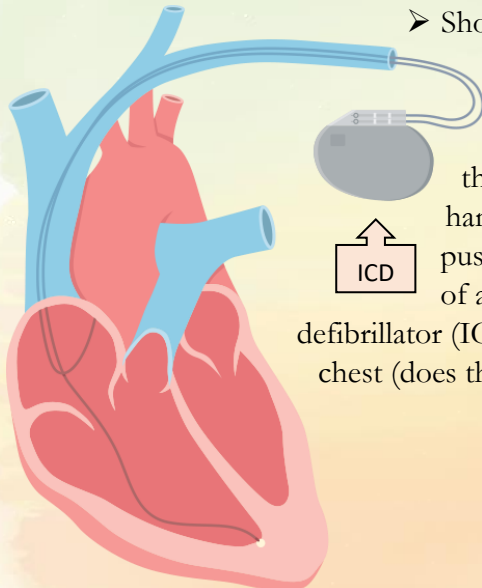
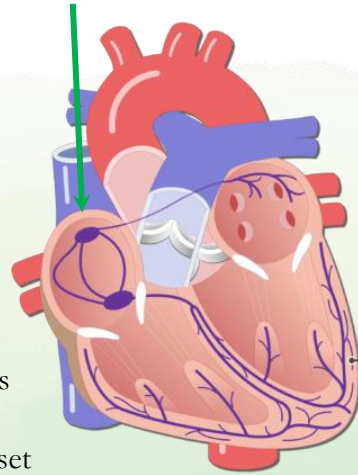


- Mild to moderate CAD don't cause any symptoms.
- Severe blockage can lead to heart attack (damage to the heart muscle).
- Blockages happen mostly due to cholesterol build-up inside the arteries.
- Definitive way to diagnose CAD is either CT scan of the heart, or coronary angiography.
- Indirect way to check for significant blockages is to do stress test like Treadmill test (TMT), Dobutamine stress echo (DSE), or Myocardial perfusion imaging (SPECT).
- Treatment of blockages include lifestyle measures, medicines, angioplasty (stent), or bypass surgery (CABG).

Heart's electrical system:

Just as concealed wiring inside any engine, heart also has an intricate network of electrical circuit which transmit signals. These signals command the heart to function as desired.

- If the heart's electrical system is damaged for some reason, it will lead to erratic signal transmission within the heart muscle, causing 'engine-failure'.
- Electrical impulse inside the heart can become too slow (bradycardia) leading to pulse rate dropping below 50, or too fast (tachycardia) which manifests as very high pulse rate. In both the situations, the heart does not pump enough blood out to meet body's demand.
- Major electrical abnormalities can have a sudden onset and may be life threatening in minutes to hours.
- Heart's electrical system can be checked by routine ECG, or a Holter test. Rarely, electrophysiology study is required where catheters are placed inside the heart (like angiography) to directly study the current pattern.
- Slow heartbeat is treated with pacemaker.
- Fast heartbeat is treated with medicines and/or an electrical shock. An electrical shock 'resets' the fast heart rhythm, bringing an unconscious person back to life.



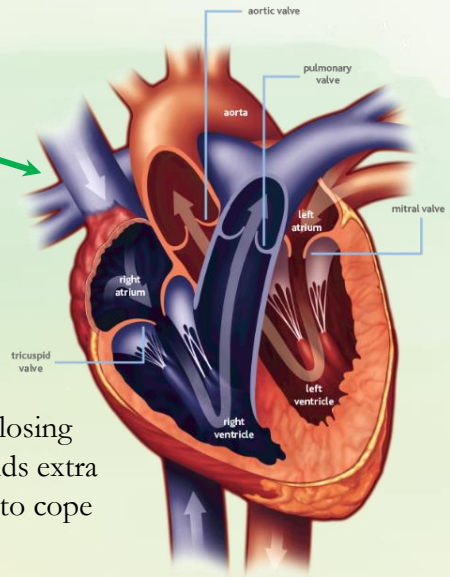
- Shock can be delivered via an external defibrillator (the kind you see in the movies where hand-paddles are pushed-on to the chest of an unconscious person) or an internal defibrillator (ICD) which is implanted inside a person's chest (does the same job as an external defibrillator).



External Defibrillator

Valves inside the heart:

As the heart muscle contracts, blood flows from one chamber to another (arrows in the image). This flow is regulated by a set of 4-valves inside the heart. The basic function of any valve is to open wide when blood flows through it, and close shut to prevent blood from leaking back. These valves open and close with each heartbeat, more than 1 lakh times per day. Over years, valves degenerate leading to valve not opening properly (stenosis) or not closing completely (regurgitation). Degenerated valve adds extra workload to the heart. When the heart is unable to cope with this extra burden, it 'fails.'



- Valve function can be diagnosed by routine echocardiogram, or a trans-esophageal echocardiogram (TEE).
- A dysfunctional valve (either stenosis or regurgitation) needs to be replaced with an artificial valve. Medicines don't work in these scenarios.
- Valve replacement can be done via open-heart surgery, or via minimally invasive technique called Transcatheter Valve Replacement. For example, if aortic valve doesn't open properly (called aortic stenosis), the diseased aortic valve can be replaced by open-heart surgery or using a specially designed valve that is squeezed inside a small plastic tube and placed inside the heart just like an angioplasty (procedure called TAVR).

Understand your heart better

Be a part of shared decision making with your doctor

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