CARDIAC REHABILITATION PHASE IV

Diagnostic Basics

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Diagnostics

Besides assessing the patient's general condition and check for diabetes, testing blood cholesterol the GP or specialised physician can conduct cardiac specific tests. These include:

- an electrocardiogram (ECG) or an exercise ECG
- a radioisotope scan, and
- coronary angiography (cardiac catheterisation).
- these tests are usually carried out in hospitals as a day case
- multi-tiered approach to diagnosis

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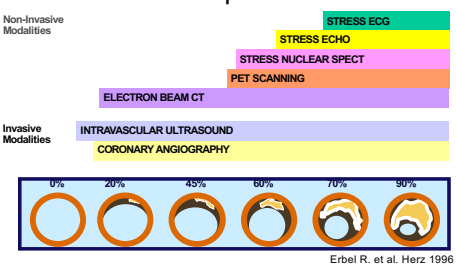
When does it start? Diagnostic Sensitivity and its Practical Consequences



Erbel R. et al. Herz 1996

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Electrocardiogram

- An electrocardiogram (ECG) records the rhythm and electrical activity of the heart. The test is painless and usually takes about five minutes. Small patches, set in sticky plaster, are put on arms, legs and chest and are connected to a recording machine. The machine then takes a reading. If the person has a narrowing of the coronary arteries, the ECG can show an abnormal reading. The ECG can provide evidence to diagnose angina and help to establish how severe it is. However a patient could have a normal ECG reading and still have coronary atherosclerosis.
- Angina often occurs with physical activity. This means that, if the ECG is done while a person is resting, it may show a normal reading. For this reason an exercise ECG might be conducted.

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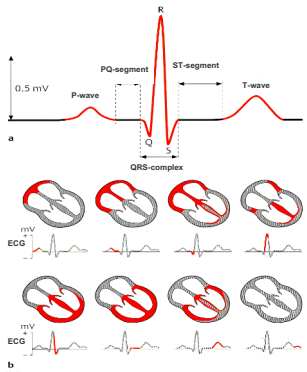

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Exercise ECG

• Also known as an exercise electrocardiogram, exercise electrocardiography, exercise tolerance testing.

• An exercise ECG is an electrocardiogram that is recorded while a person is exercising on a treadmill or on an exercise bike.

• Patients who suffer from chest pain or feels uncomfortable when being physically active, are ideal candidates for this form of testing.

• If coronary heart disease has already been diagnosed, an exercise ECG can give more information about how severe the condition is. It can also help doctors plan the treatment.

• After recent heart surgery, an exercise ECG can help the cardiologist decide what level of exercise the patient should do as part of a cardiac rehabilitation programme.

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Exercise ECG

• The test starts off at a very easy rate and is gradually made harder either by increasing the speed and slope of the treadmill or by putting a brake onto the bike. A doctor will supervise the test and will carefully check the ECG readings, blood pressure and breathing.

•The medical staff will tell the patient when to stop- usually when they have the measurements they need. They will usually interrupt the test if the patient is exhausted or very short of breath or if he/she experiences chest pain.

• The exercise ECG is a very useful test, but it is still not 100% accurate. Sometimes people with a normal heart have an exercise ECG that shows abnormalities. (For some unknown reason this often happens with young women). And sometimes a person who does have coronary heart disease may have a normal exercise ECG.

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Diagnosis

- The test show Doctors the pattern of the heart activity during exercise. As the test, the patient may be told that he/she has had a 'positive' or 'negative' exercise ECG.
- A 'positive' exercise ECG is when significant changes are seen on the ECG during exercise. This means that the patient probably has coronary heart disease
- A 'negative' exercise ECG usually means there are no unusual or obvious changes shown on the ECG during the test.

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ECG Contraindications

Conditions that preclude reliable ECG interpretation:

1. Left bundle branch block
2. Wolff-Parkinson-White
3. Physiological rate adaptive pacing
4. Left ventricular hypertrophy with ST segment changes
5. Extensive anterior wall infarction

Exercise testing may still provide useful information on exercise capacity and hemodynamic responses

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Nuclear Ventriculography

- This test uses tracers to show the heart chambers.
- It can be used to demonstrate how well blood is pumping through the chambers

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Biochemical markers

• Protein and enzyme markers can be measured in blood plasma to help determine damage to the heart muscle.

• Creatine Kinase [CK-MB] and Troponin are two such markers used routinely in patients being investigated for chest pain.

• Damage to the myocardium [heart muscle] releases these proteins/enzymes into the blood. High levels of these substances may be indicative for heart damage, even when other investigations such as ECG and exercise ECG are inconclusive.

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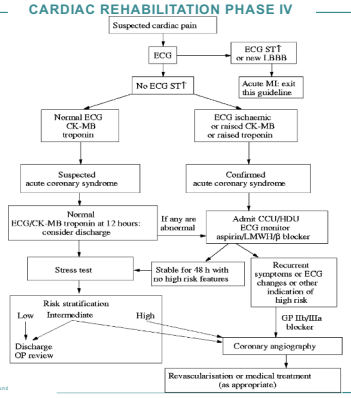

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Echocardiogram

- May be known as a Transthoracic Echocardiogram or a Surface Echo.
- This test involves a transducer placed on the chest which transmits high-frequency sound waves.
- These are reflected and transmitted as electrical impulses.
- Conversion of these impulses via an echocardiography machine allows a moving picture of the heart to be visualised and analysed.
- It is non-invasive and useful in indicating valve disease, cardiomyopathy and other cardiac abnormalities.

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Magnetic Resonance Imaging (MRI)

- A chest MRI may be taken in order to visualise the contents of the chest including the heat emitted
- MRI uses powerful magnets and radiowaves to create an image which can be analyzed.
- There is no radiation involved.
- MRI may reveal valve disorders, congenital heart problems and areas of damaged heart muscle after a heart attack.

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Heart Rate Variability

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Radioisotope Scan

• This test is also known as a 'myocardial perfusion scan'. Only about 3 or 4 in every 100 people with suspected angina have this type of scan.

• It is useful for people who cannot exercise (and who, as a result, cannot do an exercise ECG). For women, a radioisotope scan can be more useful than the exercise ECG for diagnosing angina.

• A small amount of radioactive material (isotope) - technetium, tetrofosmin, technetium MIBI or thallium - is injected into the blood, often while a patient is exercising on an exercise bike or treadmill (running machine).

• A large camera, positioned close to the chest, picks up the gamma rays the isotope produces. This shows which parts of the heart muscle are short of blood and measures how severe the condition is.

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Coronary angiography or Cardiac Catheterisation

• A fine, hollow tube called a 'catheter' is introduced into an artery in the forearm or groin. It is gently advanced until it reaches the coronary arteries. This is called 'cardiac catheterisation'.

• A dye is then injected into the coronary arteries and X-rays are taken from several angles. This allows the arteries to visualised, showing where the arteries are narrowed and how narrow they have become.

•If a serious occlusion is discovered it is possible to continue on and perform an angiography in the same procedure

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Homocysteine

• A high serum concentration of homocysteine is associated with increased risk for CHD.

• Several mechanisms whereby elevated homocysteine predisposes to CVD have been postulated. However, it remains to be proved in controlled clinical trials that a reduction in serum homocysteine levels will reduce risk for CHD.

• In some patients, nonetheless, high levels of homocysteine can be lowered by recommended daily intake of folic acid. If homocysteine levels are elevated, patients should be encouraged to consume the recommended daily intake of folic acid, as well as vitamins B_6 and B_{12}.

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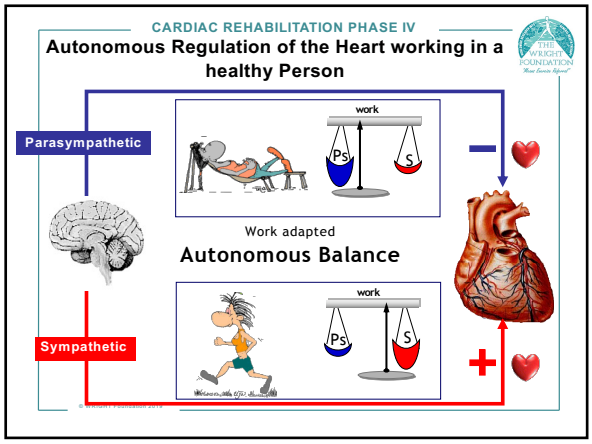
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Autonomous Regulation of the Heart working in a healthy Person
Parasympathetic
Sympathetic
work
Ps
S
Work adapted
Autonomous Balance
work
Ps
S
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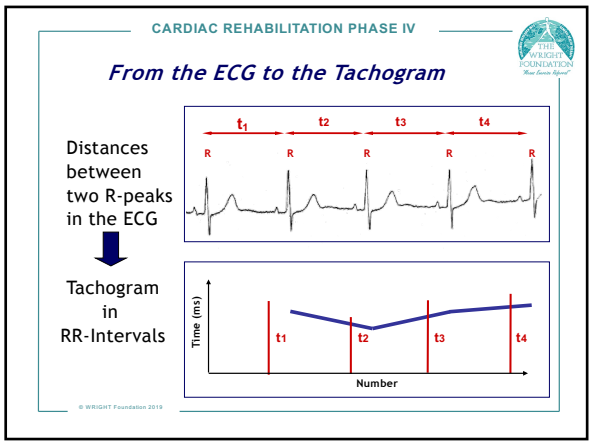
CARDIAC REHABILITATION PHASE IV
From the ECG to the Tachogram
Distances between two R-peaks in the ECG
Tachogram in RR-Intervals
t1
t2
t3
t4
R
R
R
R
R
Time (ms)
t1
t2
t3
t4
Number
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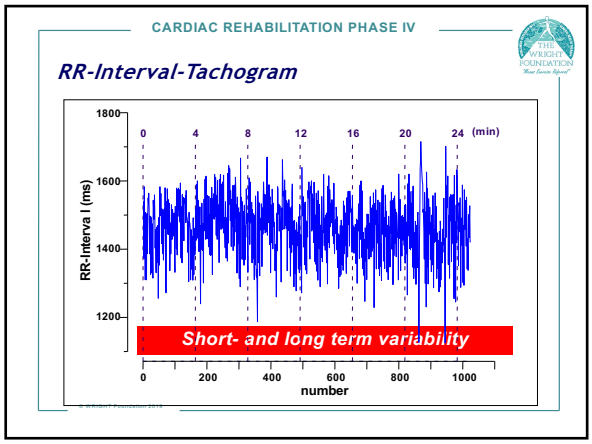
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RR-Interval-Tachogram
1800
1600
1400
1200
RR-Interva l (ms)
0
4
8
12
16
20
24
(min)
Short- and long term variability
0
200
400
600
800
1000
number
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Heart Rate Variability

- Practical exercise

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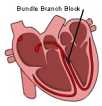
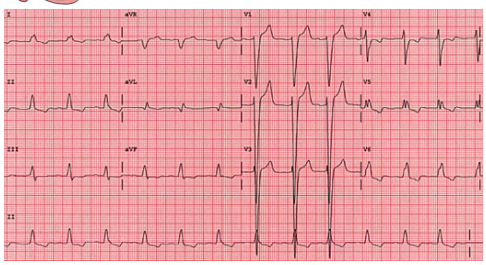


Left Bundle Branch Block



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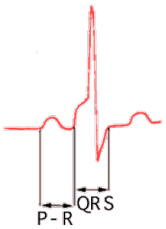
Wolff-Parkinson-White Syndrome

- Electrically active muscle fibers bridge the atria and ventricles and cause pre-excitation of the ventricles.
- This accessory pathway is able to conduct faster than the AV node.
- WPW is a reentry mechanism with an accessory pathway.
  - Can be difficult to diagnose in some children because of the higher normal sinus rates and rapid AV node conduction.



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Wolff-Parkinson-White Syndrome

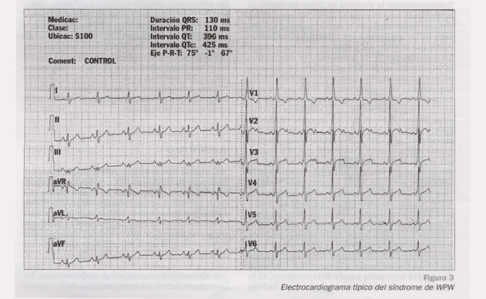

Figura 3
Electrocardiograma típico del síndrome de WPW

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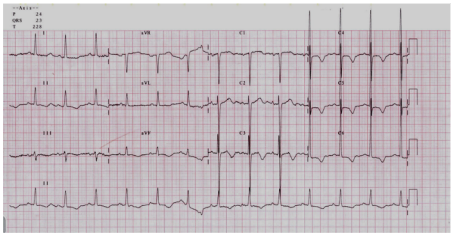
LVH with ST segment changes



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Any questions?

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