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Coronary artery disease and various treatment options

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ABSTRACT

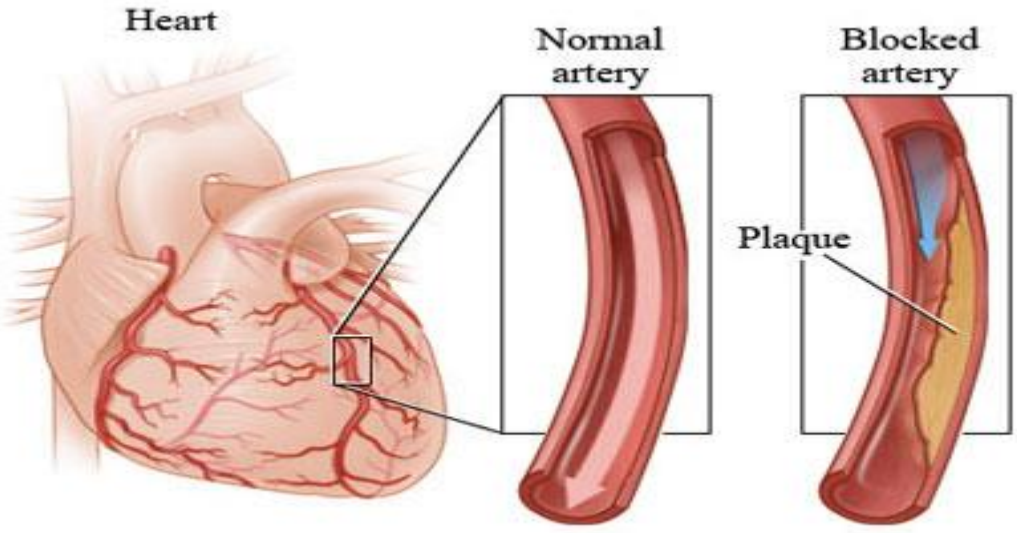
Severe state that involves narrowing of the blood vessels that nourish the heart, it can lead to heart attack or sudden death. Behind numerous deaths an innovative healing was ongoing that is Angioplasty and Stenting, which can aid in restoring normal blood flow to the heart muscle. Based on the severity of thinning or injure of the tissue, doctors choose either stent or angioplasty or CABG.

Keywords: Coronary artery, Angioplasty, Stenting, Heart attack.

INTRODUCTION

Coronary Artery Disease (CAD)

A narrowing of the coronary arteries that prevents sufficient blood supply to the heart muscle is called coronary artery disease .frequently caused by atherosclerosis; it might progress to the point where the heart muscle is injured due to be deficient in of blood supply. Such harm might result in infraction, arrhythmias and heart failure. This tightening can also be called Stenosis, and it is frequently caused by an increase of fat or calcium deposits called plaque. Eventually, this plaque is able to build an overall blockade of the artery; this process called Atherosclerosis. CAD is also called atherosclerotic heart disease or coronary atherosclerosis or coronary heart disease [1-5].



Etiology

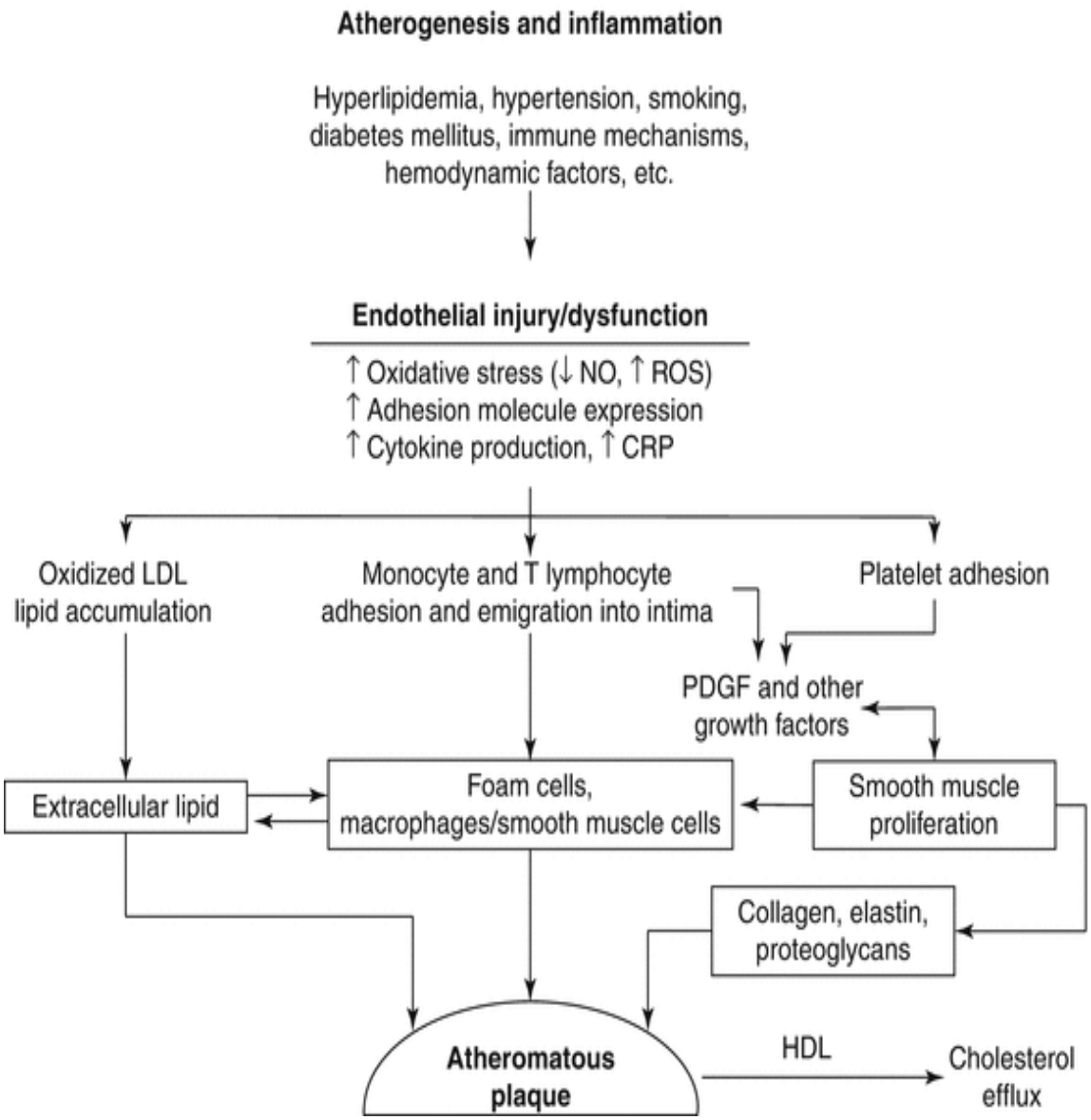
Atherosclerosis is the major reason of coronary artery disease. It is characterized by the deposition of cholesterol and lipids mainly in the intimal wall of the artery [6-10].

Clinical manifestations

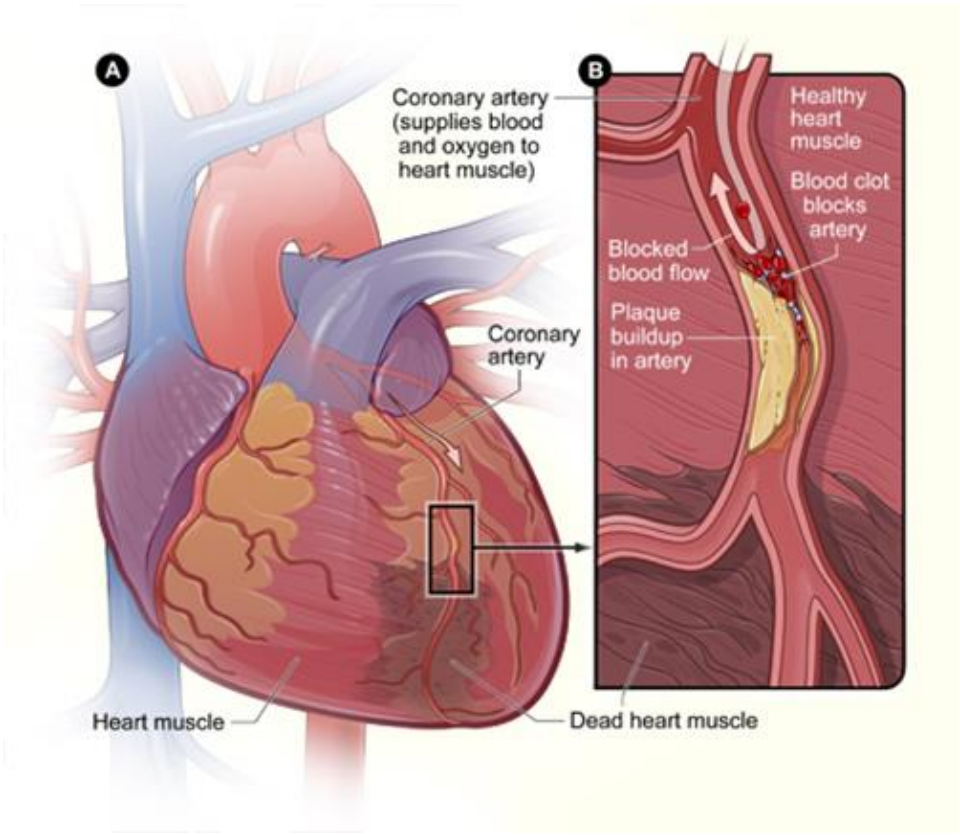
- Angina pectoris
- Acute coronary syndrome
- Dizziness
- Dyspnea
- Anxiety
- Nausea
- Vomiting
- Tachycardia
- Dsyrhythmia

Risk factors

Modifiable	Non –modifiable
Elevated blood cholesterol intensity	Family past
Cigarette smoking, tobacco use	Increasing age
Hypertension	Gender (male)
Diabetes mellitus	Race(non white populations)
Be short of estrogen in women	
physical activity	
Obesity	



Pathological anatomy and pathogenesis of CAD



A-Heart; B –Narrowed artery

Pathophysiology

Due to etiological factors

↓

Injury to the endothelial cell that linning the artery

↓

Inflammation and immune reactions

↓

Accumulation of lipids in the intima of arterial wall

↓

T lymphocytes and monocytes that becomes as macrophages infiltrate (the area to ingest the lipids and die.)

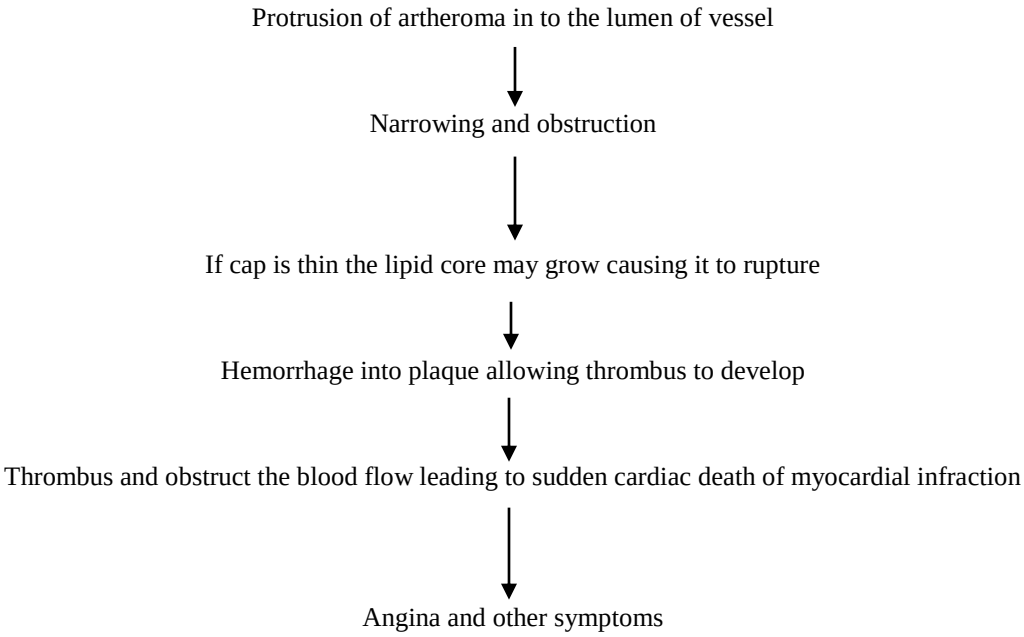
↓

Proliferation of smooth muscle cells within the vessel

↓

Formation of fibrous cap over dead fatty core (atheroma)

↓



DIAGNOSIS

A physical assessment is performed by means of listening to heart. There is no analysis that is able to analyze coronary artery disease. Tests are given below [11-15].

EKG (electrocardiogram)

This is the easy and trouble-free examination so as to monitors heart beat and rhythm. This tests the timing of heart as well as potency of heart electrical signals. This involves putting electrodes' (minute pads attached to wires) on the chest. The pads are held in position by a sultry substance [16, 17].

Stress test

In this test patient is asked to do exercise to provide heart a workout .patient is connected to heart, blood pressure, and oxygen monitor throughout the test .these monitor be able to notice changes heart rate, rhythm, electrical action or blood pressure all through the test. Shortness of breath and chest tenderness is as well monitored. If the patient is not capable to do exercises due to medical reasons, staff will administer the medicine to amplify the heart rate. Here the hearts response to workout might propose to the physician that patient is having probable blockages and require additional testing.

Echocardiogram

This test is trouble-free .it's an examination that uses sound effect to see an image of your heart while it's beating. The image will give doctors a look at the mass and form of heart .it also shows chambers and values.

Chest X –ray

This is the x-ray paying attention on the region of heart .this analysis can identify the signs of heart failure.

Blood tests

Sample of blood is reserved from the patient and sends to the lab. The lab examination is able to make known the circumstances that elevate your threat of coronary artery disease .These comprise testing certain fats, cholesterol, sugar, and proteins.

Coronary arteries

Coronary arteries enfold in the region of the surface of the heart. Their job is to provide the heart muscle with oxygen –rich blood. The amount oxygen heart needs depends on how tough it's working .Ex: exercise makes the heart beat faster, rising the muscles necessitate for oxygen. Healthy arteries meet this need. They contain soft, elastic walls and can accommodate changes in blood flow.

Treatment options for cad

There are several special treatment options for management CAD. The options spotlight on increasing blood flow to the heart, all along with changes to on a daily basis life style, as well as diet, physical activity and medications. The category of healing depends on patient symptoms and severity of injure to the heart.

Options include

- Medications
- Ballon angioplasty
- Coronary artery stenting
- Coronary artery bypass graft surgery (CABG)

Medications

Nitroglycerin could be specified to reduce chest discomfort due to coronary blockage. It does not treat the blockage itself. Some of the drugs are aspirin, beta-blockers, lipid lowering drugs etc to slender blood in addition to assist prevent blockage of the arteries.

Pharmacological therapy

- Nitrates : nitroglycerine
- Morphine
- Beta –blockers
- Calcium channel blockers :Diltiazem,verapamil
- Ranolazine
- Angiotensin –converting enzyme inhibitors and angiotensin 2receptors blockers
- Statins
- Anti –platelet drugs
- Clot-dissolving drugs
- Anti coagulants

Angioplasty

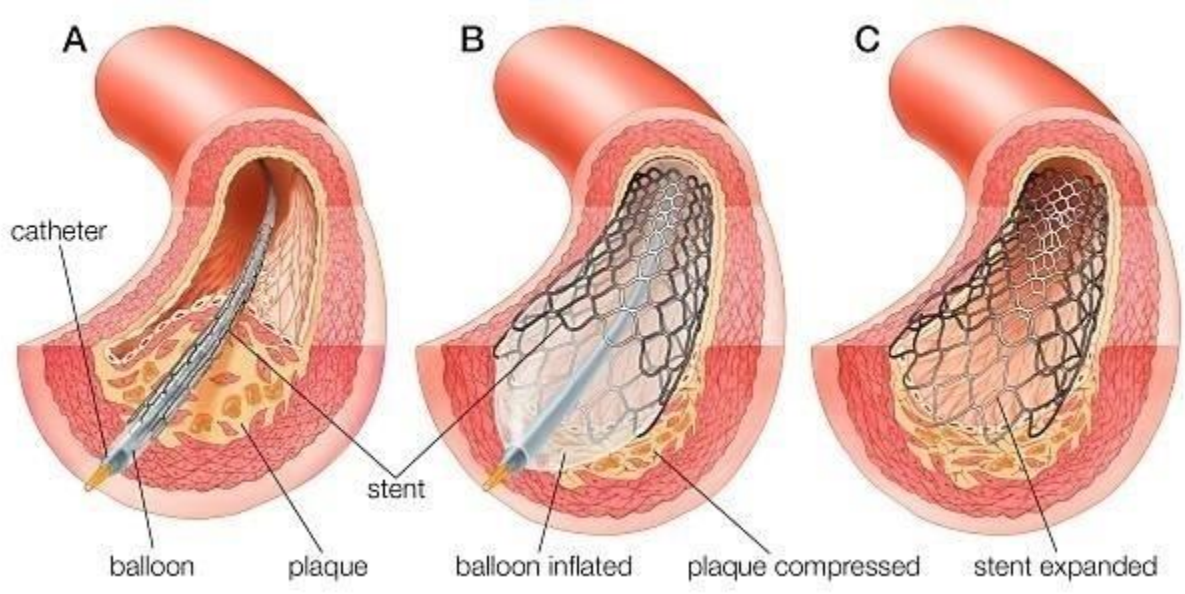
Artery narrowing is known as angioplasty. A slim tube known as a guide catheter is inserted into artery at the groin or wrist. A small ballon positioned on the top of a next catheter to the site of the narrowing. The ballon is then puffed up to decrease the obstruction. The ballon is deflated and detached after the angioplasty is completed .the patient remains wakeful whereas the cardiologist performs the process .the method finish here and patient may well have a bare –metal or drug –eluting stent surrounded to help keep the artery unlock.

Stenting

A stent provides support for the artery. It's done to reduce the risk of **restenosis**. **(**Narrowing of the artery in the same place). Stenting after an angioplasty is common. But in a growing number of cases, stents are placed directly, without angioplasty being done first.

Stent

A stent is a small, elastic wire network tube. It remains in position eternally, to remain the artery unbolt. Several stents are drug –eluting. These stents slowing release medication over a episode of time. The medicines reduce the amount of scar tissue that forms within the artery. This help prevents restenosis.



Coronary artery stenting

For the duration of this process a little network tube is implanted into the artery to expand the artery and renovate sufficient blood flow to the heart. This mesh tube is called stent .Once the stent is placed into the coronary artery; it is prolonged with the inflation of a ballon catheter. The stent is left in the artery to remain it unlock and help prevent further tightening of the coronary artery.

Polymer coating

The stent is covered with a proprietary polymer, which was developed purposely for drug –eluting stents. The polymer carries and protects the drug before and during the process. Once the stent is entrenched, it helps manage drug release into the coronary arterial wall. This contributes to still and Consistent allocation of the drug from the stent.

Drug Release

The drug-eluting stent is coated by means of a medicine and polymer designed to agree to for a reliable and controlled release of the drug from the stent surface into the artery walls. Both the amount of drug and release rate comprise determined so that curing can happen whereas allowing the processes foremost to restenosis to be minimized, therefore falling they require for further management in the stented area.

Coronary artery by-pass graft surgery (CABG)

This surgical procedure is also called a heart bypass or open heart surgery. Here, a small length of artery from the internal chest wall and or a vein beginning the leg is taken and attached it above and beneath the blocked region of the heart artery.

Risks and complications of CABG

- Extreme bleeding
- infectivity of the incision cells
- Pneumonia (lung infection)
- quick and uneven heart beat
- Nerve injury or muscle spams
- Breathing troubles
- Memory problems or confusion
- Heart attack ,stroke, death

Expectations after a stent procedure

Behind either sort of stent process (for arteries narrowed by plaque or aortic aneurysm), previously the stent has be positioned and the ballon and catheter contain been detached, the tube inclusion spot will be bandaged. A little sand bag or other form of mass may be position on the top of the dressing to be relevant pressure to help prevent flow of blood.

Whereas patient is in revival, a nurse will make sure heart rate and blood pressure frequently. Nurse also checks any blood loss from the site .this region might feel sore or tender for about a week.

Common precautions after a stent procedure

Behind a stent method, doctor prescribes blood tightening or anticlotting medicines for at least a few months' .These medicines help to stop the growth of blood clots in the stent. If your stent is covered with medicine, doctor might advice patient to get aspirin and an anticlotting medicine for months to years to lesser the threat of blood clots.

Avoid vigorous exercise and weighty lifting for a small time behind the process. If it is metal stent positioned, patient is supposed to not contain magnetic resonance imaging (MRI) test inside the first couple of months later than the procedure. Metal detectors used in airports and other screening areas do not involve stents.

Robotics

Robots comprise been placed in mass production industries for several years. In cardiology they contain been in use for more than a decade for surgeries like mitral value repair, coronary artery bypass graft and septal defect closing. The technology is quick developing with reports promising about their potential application in percutaneous coronary involvement and arterial fibrillation ablation. Robotics provides the operator through advantages such as enhanced ergonomics, accuracy and now and again reduction of intraoperative time. Robot assist surgery be able to shorten patient hospital stay and improve patient awareness.

In the field of interventional cardiology, robotics is being used for catheter –based surgical procedures. Conventional angiography radiation exposure for CAD patients is predictable at 7 mSV, and this experience can be amplified by up to 5 times in complicated surgeries. Robot guided surgical procedure has potential to limit this radiation experience and it be able to also decrease contrast induced nephrotoxicity and linked mortality in patients. It can also precisely calculate the mass of the lesions and they decrease radiation exposure for the surgeon and the patient as a well as get better correctness by representation accurate dimensions of lesions.

Robotics has also be used to carry out CABG in CAD patients .the process include harvesting of the mammary arteries and anastomosis, can be perform endoscopically .the present state of robotic surgical procedure is hopeful in the management of CAD. These systems are of outstanding value with high-end technology. However, their transformation into full-fledged clinical usage is repressed by high price and the learning curve wanted to master these actions.

Nanotechnology

Nanotechnology has been revolutionizing a number of fields together with medication. Its involves the engineering of nano level molecules with definitely dissimilar properties than size molecules of the equal composition. These inherent differences offer distinct benefits which are tough reason for the boom in nanotechnology explore. This technology has been calculated in CAD for its possible benefits in medical (non-invasive) and invasive management modalities, drug delivery application, percutaneous coronary intervention and coronary artery bypass graft (CABG).

Cholesterol is the essential feature occupied in the pathogenesis of coronary artery ailment. High levels of low-density lipoproteins (LDL) are implicated in coronary artery disease where as high-density lipoproteins (HDL) are thought to contain a defensive role ever since they are concerned in transportation of cholesterol away from the marginal tissues. Nanotechnology has been elderly in the synthesis of a dimyristoyl phosphatidylcholine, which mimics the surface characteristics of HDL by mediating the removal of cholesterol from the peripheral tissues and transfer it to liver.

It has been led to a promising direction in the treating CAD. It has expensive potential in deliver drugs that are limited by their pharmacokinetics. Their applications in stent and gene therapy are potentially helpful for the future therapeutics based on these modalities. As the technology as well as evidence develops an era where existing established management modalities could be replaced by nano therapeutics.

Stem cells

Research in cardiovascular disease has sought to repair myocardial injure and intensify blood provide in ischemic circumstances of the heart, the by reverse the effects of CAD. Vascular growth factors and stem cells have generated a group of attention as a form of in patients with CAD. The

rationale behind such treatment is get better the blood deliver to ischemic areas of the heart by stem cells, as well as encourage cardiac cell regeneration .this be capable of be achieved in one of two ways –By a straight outcome of the stem cells, or by paracrine factors secreted by these stem cells.

The stem cells studied in cardiovascular research ranged from bone marrow to adipose tissue to skeletal muscle stem cells. Bone marrow derived mononuclear cells are the most willingly available cells for transplantation in the body. In recent times, there has been an attention to expand and insert several stem cells that can correspond with each other, termed as a Cardiocluster. These Clusters are cocktails of cells contain cardiac progenitor cells, mesenchymal stem cells, endothelial progenitor cells and fibroblasts .they have potential to promote cardiac cell regeneration in disease states where cell function is reduced such as CAD.

Antioxidants

Clinical use of antioxidant vitamin supplementation may help to prevent coronary artery disease. These antioxidants include ascorbic acid (vitamin C), α-tocopherol (vitamin E), folate, and β-carotene, ubiquinone (coenzyme Q10), bioflavonoids and selenium.

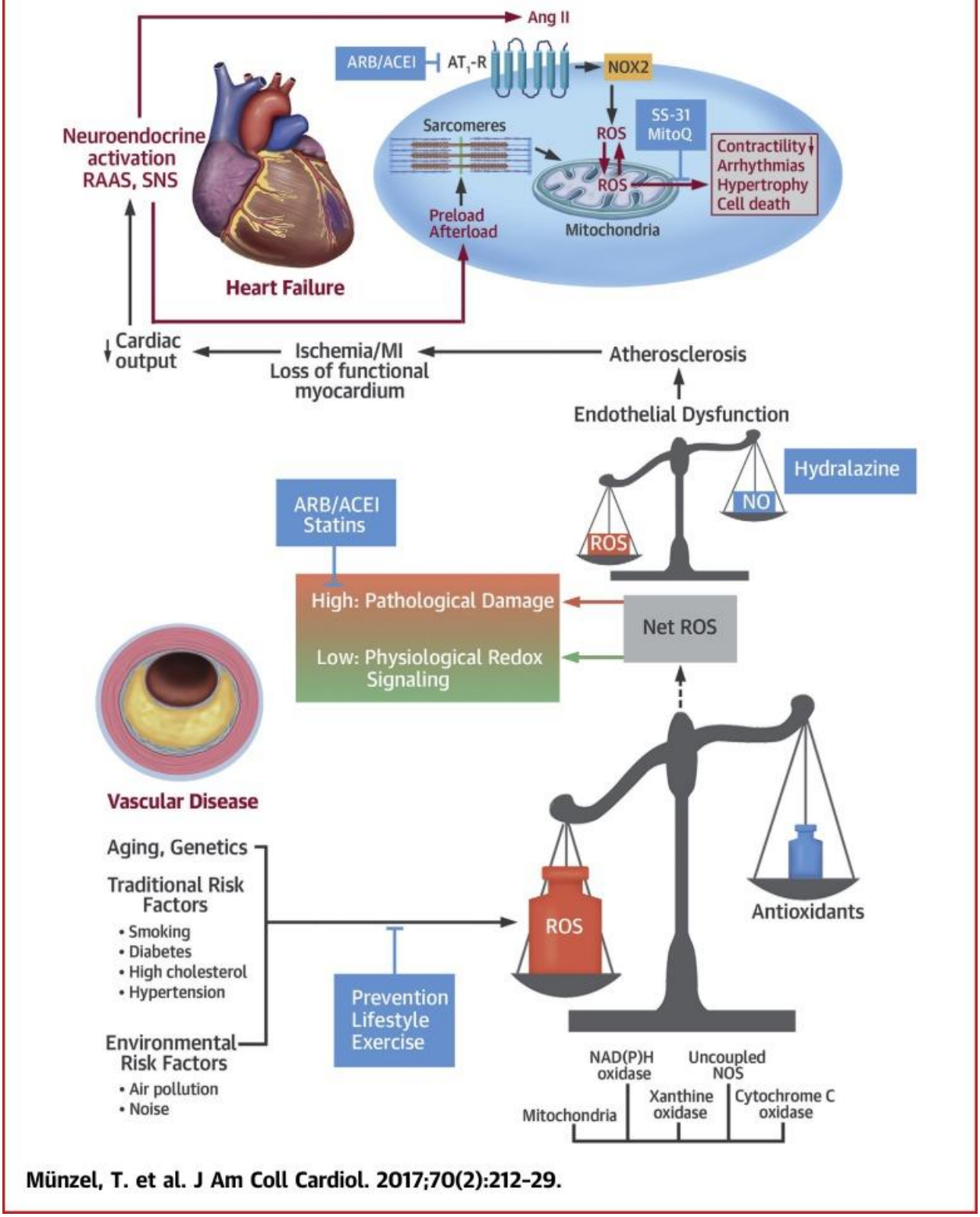
On the other hand, there are several antioxidants grouped as enzymatic and non enzymatic antioxidants.

Various ROS and corresponding neutralizing antioxidants

- Hydroxyl radical-it is neutralized by antioxidants such as vitamin c, glutathione, Flavanoids, lipoic acid.
- Superoxide radical – vitamin C glutathione, falvonoids, SOD neutralizes the superoxide.
- Hydrogen peroxide – Vitamin C, glutathione, beta carotene, vitamin E, CoQ10, flavonoids, lipoic acid are the neutarlizing agents for hydrogen peroxide.

Lipid peroxides - it is neutralized by the antioxidants like beta carotene, vitamin E, flavanoids, glutathione peroxidise.

CENTRAL ILLUSTRATION: Mechanisms, Sources, and Implications of Oxidative Stress in Cardiovascular Disease and Heart Failure



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CONCLUSIONS

Inspite of immense advancement in cardiovascular research, CAD leftovers one of the most frequent causes of morbidity and mortality worldwide. On the other hand, significant inter-collaborative efforts stuck between researches, clinicians and added related professionals contain led to multi-faceted and novel strategies to be developed to treat CAD and its connected conditions. Early evidence being available on some of this novel management, the consequences are promising and hold the potential to turn into alternative to existing treatment options in the future. Ever since, we are in the era of the evidence –based medicine, so further clinical trials and long term follow up studies are mandatory. Mean while antioxidants plays a vital role in prevention of coronary artery disease.

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