

# Transcatheter treatment of VSD

*Surgical – interventional treatment of a patient  
with Eisenmenager Syndrome*

*“The whole is more than the sum of its parts”*

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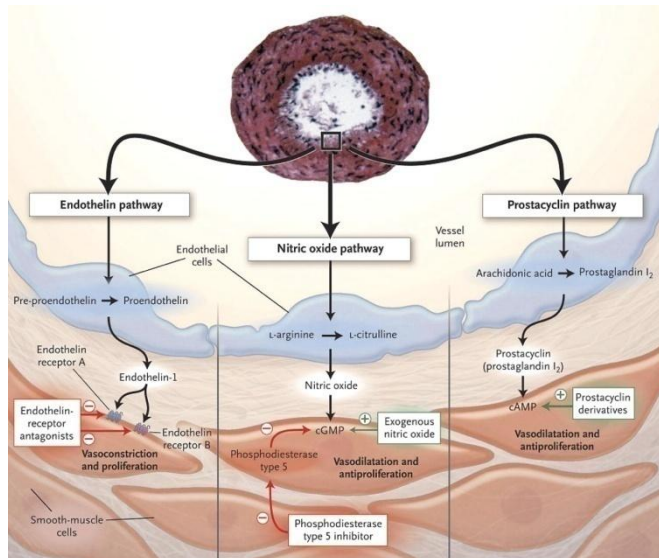
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# Key Stages in the Development of Eisenmenger Syndrome

## Definition:

- Pulmonary vascular obstructive disease that develops as a consequence of a large preexisting left-to-right shunt that pulmonary artery pressures approach systemic levels and the direction of the flow becomes bidirectional or right to left.



Left-to-right shunt



Increased pulmonary blood flow  
(shear stress/circumferential stretch)



Endothelial dysfunction and vascular remodeling  
Smooth muscle cell proliferation, increase in  
extracellular matrix, intravascular thrombosis



Increase in PVR



Inverted shunt: right-to-left



Cyanosis (Eisenmenger syndrome)

Beghetti, M. et al. J Am Coll Cardiol 2009;53:733-740



# Eisenmenger Syndrome

## Pathophysiology

Systemic-to-pulmonary circulation connection



Left-to-right shunting of blood



Increased pulmonary blood flow



Irreversible pulmonary vascular injury



Increased pulmonary vascular resistance



Right-to-left shunting of blood



Hypoxia and erythrocytosis

### Heath-Edwards Classifications

Circulation 1958;18:533-47

Grade I: Arteriolar medial hypertrophy

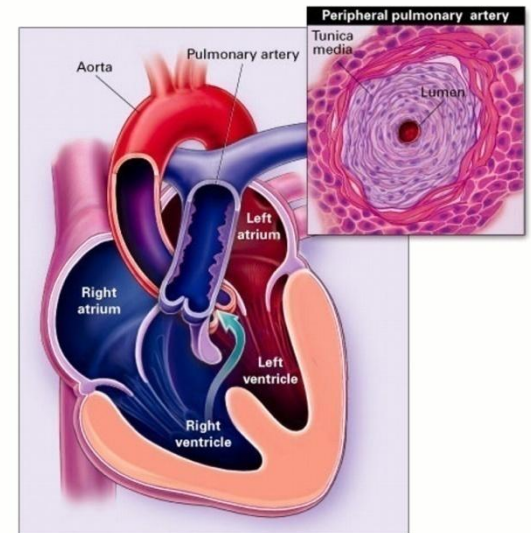
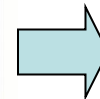
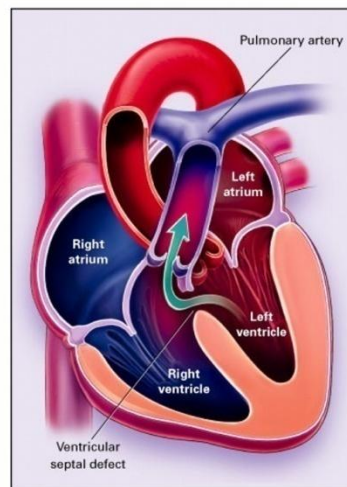
Grade II: Intimal proliferation

Grade III: Intimal fibrosis, occlusion

Grade IV: Plexiform lesions

Grade V: Hemosiderin-filled macrophage

Grade VI: Necrotizing arteritis



# Eisenmenger Syndrome

- **Precipitating congenital heart diseases**
  - **Ventricular septal defect**
  - **Atrial septal defect**
  - **Patent ductus arteriosus**
  - **Atrio-ventricular septal defect**
  - **Truncus arteriosus**
  - **Aortopulmonary window**
  - **Univentricular heart**
  - **D-transposition of the great vessels**
  - **Surgically created aorto-pulmonary connections**

Braunwald E. Heart Disease: A Textbook of Cardiovascular Medicine, P 1614 – 1616  
Ann Intern Med 1998; 128: 745-755



# Sy. Eisenmenger – case report

**40y.old male – Clinical manifestation**

**General cyanosis**

**Low cardiac output, congestive heart failure**

**Exertional dyspnea, fatigue, syncope, orthopnea,  
PND, peripheral edema**

**Neurologic symptoms: (hyperviscosity)**

**Headache, dizziness, Congestive heart failure**

**Others**

**Hemoptysis, arthralgia, incipient renal  
dysfunctions**

**Diagnostic procedures:**

**Electrocardiography**

**RAE, RVH, right axis deviation,  
arrhythmia**

**Chest X ray**

**Cardiomegaly, dilated pulmonary arteries,  
pulmonary artery calcification**



**Echocardiography parameters:**

**Secondary PAH (PA syst/med  
110/65)**

**MReg.+3, TReg +4, VSD, Pulm art.  
42mm**



# Eisenmenger Syndrome: corrective or palliative surgery

## Surgery : How to do?

07.12.2001

- Performed surgery: PA banding, Mitr. and tricuspid reconstruction.
- PA- 29mm, PA syst/med 68/43
- Pulmonary banding
  - *Arq Bras Cardiol. 1997 69(5): 369-72*
    - *Pulmonary banding in one patient with biopsy-proven irreversible pulmonary vascular changes led to regression of pulmonary vascular changes, which made surgical closure of the defects **possible**.*



# Sy. Eisenmenger – case report

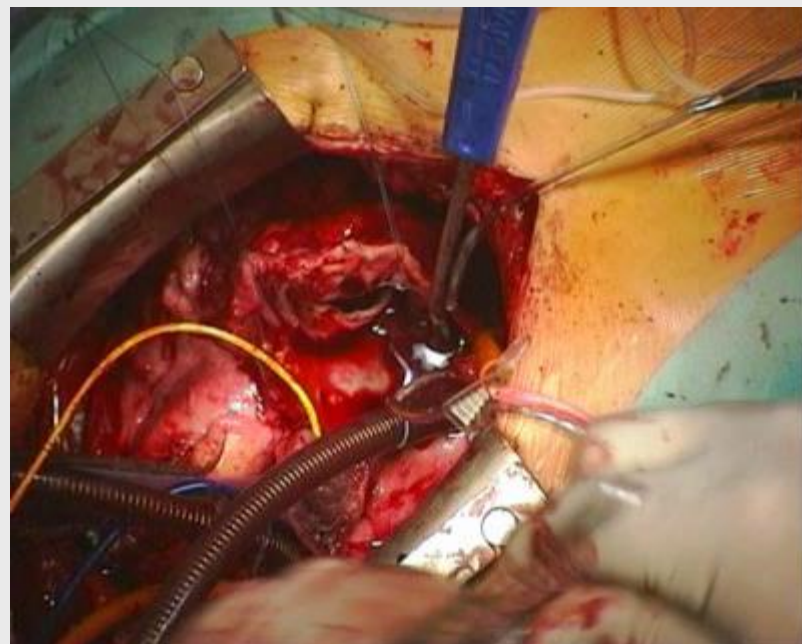


**05.11.2004 mitral reg.+4 due to prolaps of the valve and dilatation of the annuly, Tricuspid reg.+3**

**Preop.PA syst/med 110/60,LAP 30**

**Performed surgery: MVA, Tricusp. rec. and VSD closure with patch**

**Postop. PA syst/med 60/23**



# Sy. Eisenmenger – case report

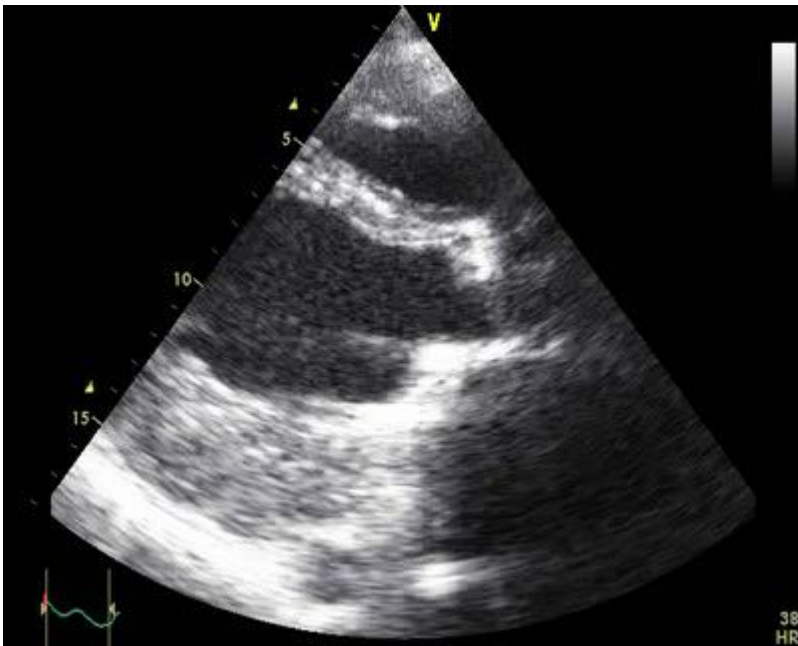
**03/2005      VSD rezidua (dominant left to right shunt)**

- ▶ **EDV(ml)      207      EF=35%**
- ▶ **ESV (ml)      165**
- ▶ **Normal position of the mitral mechanical valve.**
- ▶ **VSD between distal connection of the pericardial patch and muscular part of the interventricular septum.**
  
- ▶ **WHAT to do ???**
- ▶ **Third reoperation or interventional closure of the VSD with muscular device**

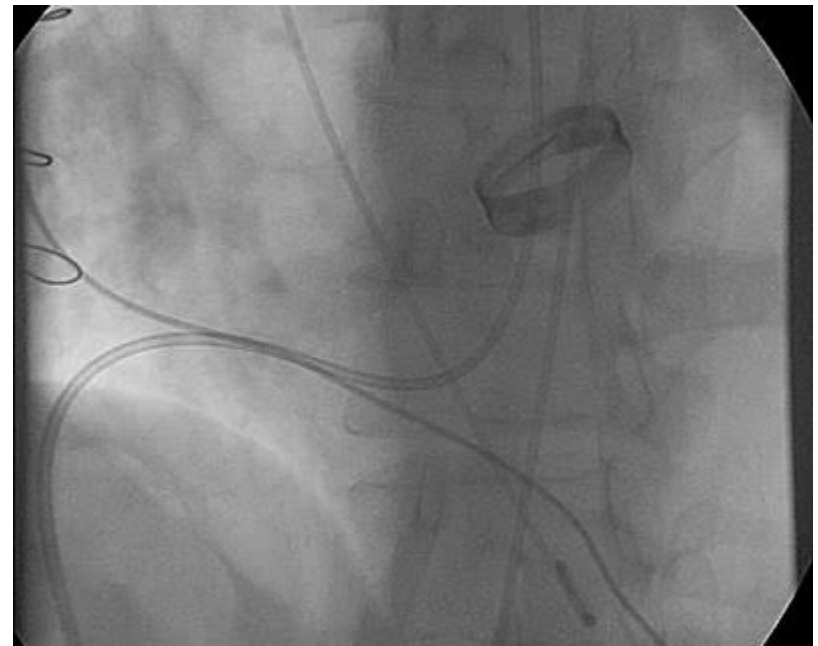




# Interventional closure of the VSD with muscular device



**Ultrasound view of the device closure**

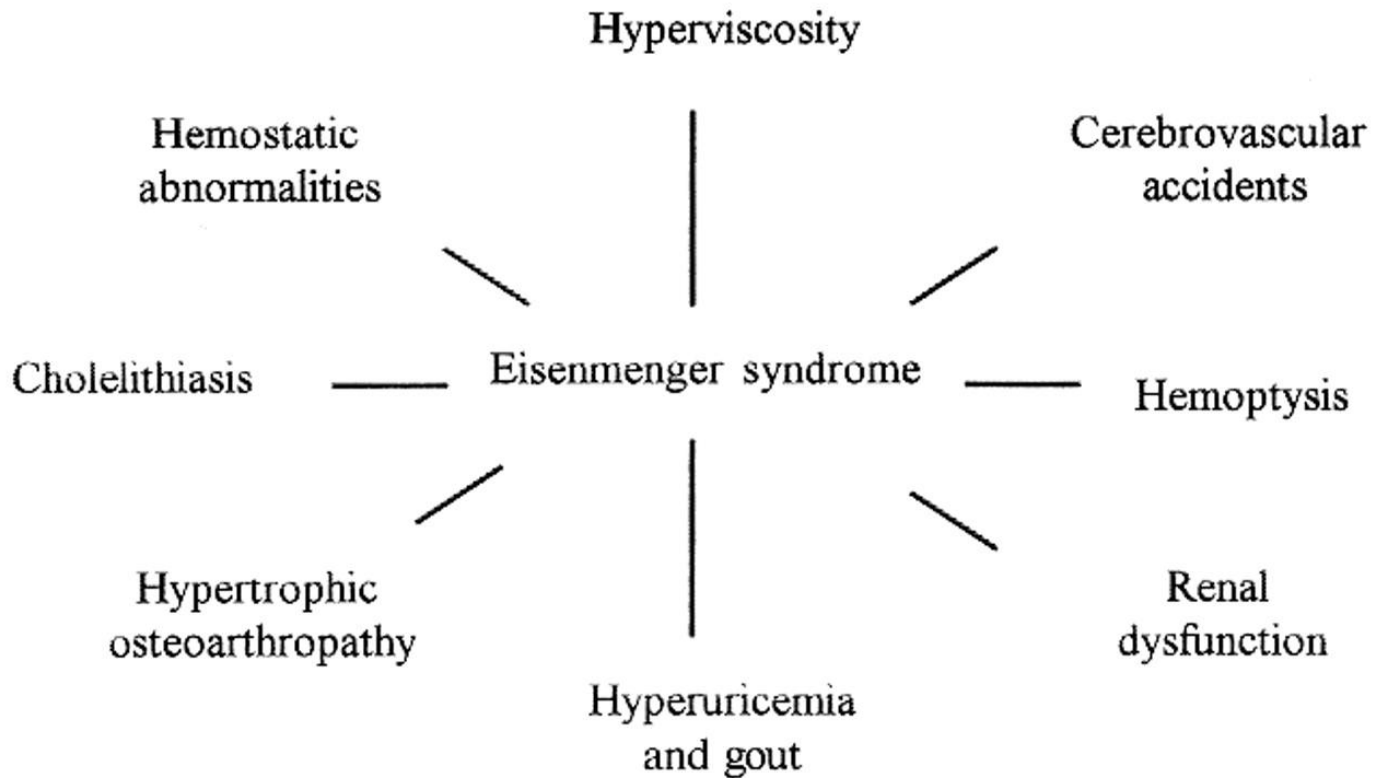


**Angio procedure of VSD closure**



# Eisenmenger Syndrome

## Possible complications



Ann Intern Med 1998; 128: 745-755

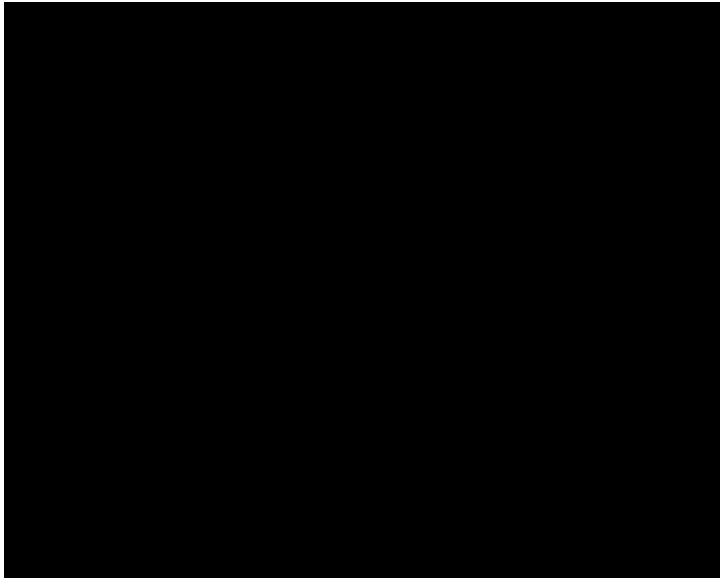


# In our case

- **Late complications-**
  - Total AV block (permanent pace maker – 12.11.2005)**
  - Stroke – 05/2009, without any residua**
- **Treated with:**
  - Ca channel blockers**
  - ACE inhibitors**  
( added first post op. day )
  - spironolacton ( first post op. day )**
  - diuretics**
- **After VSD closure normal blood gas analyses with pO<sub>2</sub> 64, and pCO<sub>2</sub> 38 ( without any oxygen supply)**
- **Late EF= 40%**
- **Follow up period 10 years**



# Last control 04.09.2011



# **Eisenmenger Syndrome**

## **Take Home Messages**

- **Eisenmenger syndrome is a pulmonary hypertensive disease caused by left-to-right congenital heart disease.**
- **The severity of pulmonary vascular resistance is an important prognostic factor.**
- **Corrective surgery may cause pulmonary crisis. It should be performed in selected patients.**
- **The principle of intervention is non-intervention.**
- **No medical interventions are proved effectively so far. It should be kept in investigation.**
- **For quality of life, complications must be managed.**
- **Pregnancy, non-cardiac surgery, travelling: be cautious!**
- **Transplantation is an effective choice of treatment**

