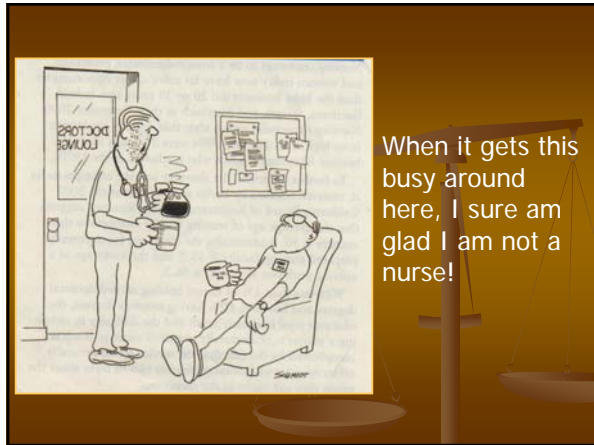
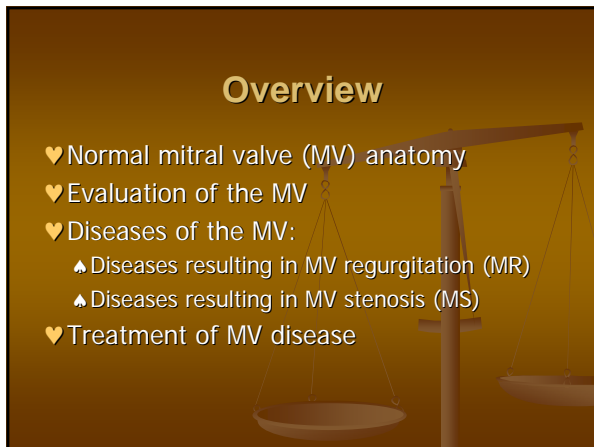


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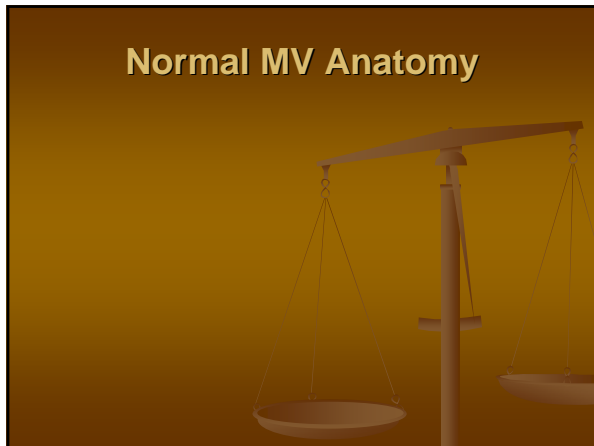


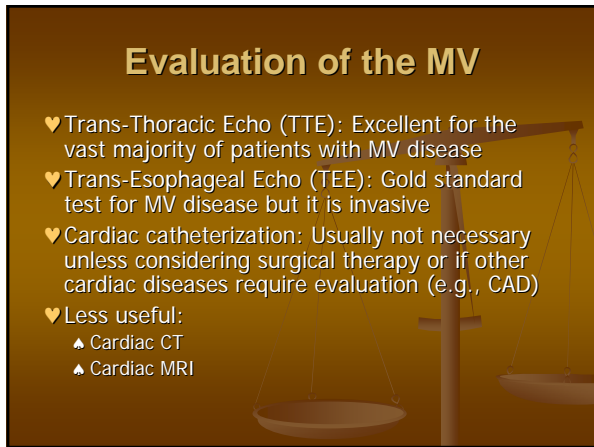


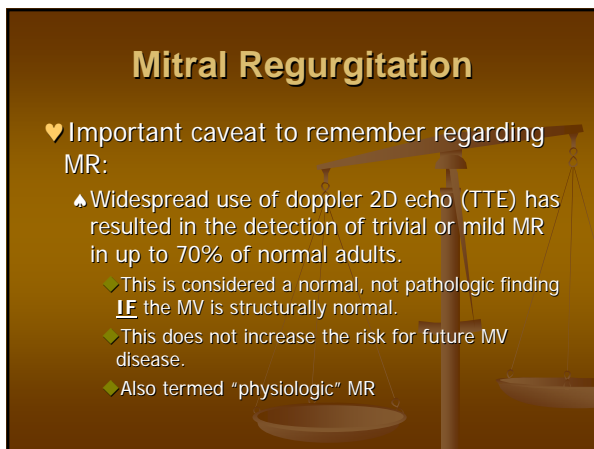


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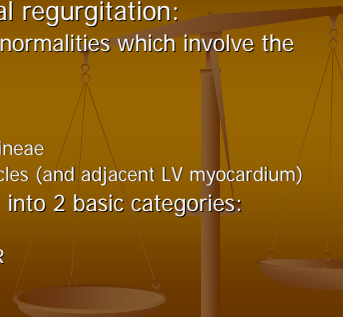
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Mitral Regurgitation

♥ Causes of mitral regurgitation:

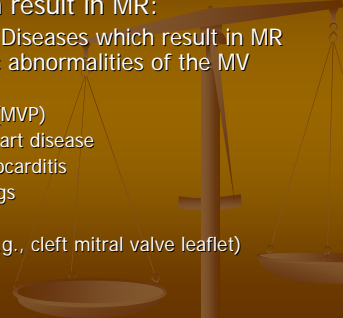
- ♣ Result from abnormalities which involve the MV apparatus:
 - ✔ Leaflets
 - ✔ Annulus
 - ✔ Chordae tendineae
 - ✔ Papillary muscles (and adjacent LV myocardium)
- ♣ Can be divided into 2 basic categories:
 - ✔ Primary MR
 - ✔ Secondary MR



Mitral Regurgitation

♥ Diseases which result in MR:

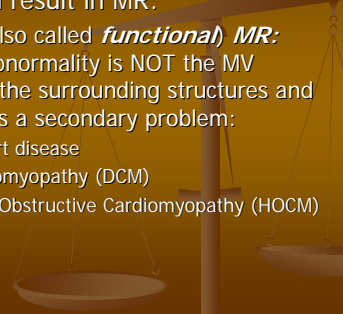
- ♣ **Primary MR:** Diseases which result in MR due to intrinsic abnormalities of the MV apparatus:
 - ✔ MV Prolapse (MVP)
 - ✔ Rheumatic heart disease
 - ✔ Infective endocarditis
 - ✔ Anorectic drugs
 - ✔ Trauma
 - ✔ Congenital (e.g., cleft mitral valve leaflet)



Mitral Regurgitation

♥ Diseases which result in MR:

- ♣ **Secondary** (also called **functional MR**):
The primary abnormality is NOT the MV apparatus but the surrounding structures and MR develops as a secondary problem:
 - ✔ Ischemic heart disease
 - ✔ Dilated Cardiomyopathy (DCM)
 - ✔ Hypertrophic Obstructive Cardiomyopathy (HOCM)



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MV Prolapse (MVP)

- ♥ Definition: systolic motion of one or both MV leaflets across the plane of the MV annulus into the left atrium (LA)
- ♥ 2 basic types of MVP:
 - ♣ Classic: true abnormality of the MV leaflets and/or chordae tendineae (MV apparatus).
 - ♣ Non-classic: an echocardiographic finding which is a variant of normal MV anatomy and NOT a true disease or condition
 - ◆ Unfortunately, many patients carry this diagnosis

MV Prolapse (MVP)

- ♥ Diagnosis of MVP in patients has been made based on:
 - ♣ Symptoms
 - ♣ Physical exam findings
 - ♣ 2D Echocardiography (gold standard)

MVP Syndrome

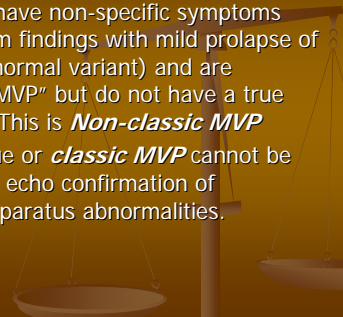
- ♥ Diagnosis of MVP syndrome is based on:
 - ♣ Symptoms (non-specific):
 - ◆ Atypical (non-anginal) chest pain
 - ◆ Palpitations
 - ◆ Dyspnea (shortness of breath [SOB])
 - ◆ Exercise intolerance
 - ◆ Dizziness or syncope
 - ◆ Anxiety or panic attacks
 - ♣ Physical exam findings (usually subtle):
 - ◆ Mid-systolic clicks
 - ◆ MR murmur

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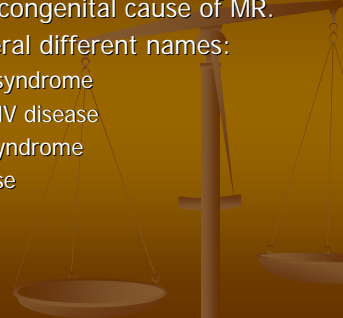
MVP

- ♥ Several patients have non-specific symptoms and physical exam findings with mild prolapse of the MV leaflets (normal variant) and are diagnosed with "MVP" but do not have a true disease process. This is **Non-classic MVP**
- ♥ A diagnosis of true or **classic MVP** cannot be made without 2D echo confirmation of pathologic MV apparatus abnormalities.



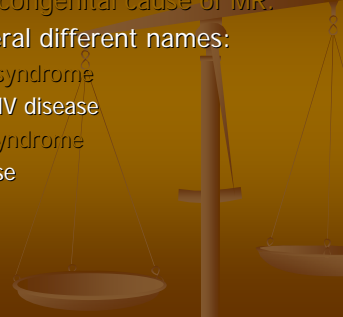
Classic MVP

- ♥ Most common congenital cause of MR.
- ♥ Known by several different names:
 - ♣ Click/murmur syndrome
 - ♣ Myxomatous MV disease
 - ♣ Floppy valve syndrome
 - ♣ Barlow's disease



Classic MVP

- ♥ Most common congenital cause of MR.
- ♥ Known by several different names:
 - ♣ Click/murmur syndrome
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 - ♣ Barlow's disease



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Classic MVP

♥ Pathology:

- ▲ Myxomatous degeneration of the MV leaflets and/or chordae tendineae resulting in:
 - ▶ Leaflet thickening and redundancy:
 - ▲ Anterior, posterior, or both leaflets can be involved (most common is P2: middle scallop of the posterior leaflet)
 - ▶ Thinning, stretching, and occasionally rupture of the chordae tendineae
 - ▶ Occasionally, dilatation of the MV annulus

♥ Caveat: the amount of MR does not always correlate to the degree of myxomatous degeneration.

Classic MVP

♥ Classification:

- ▲ Primary MVP: Idiopathic myxomatous degeneration of the MV apparatus without evidence of any systemic connective tissue disorder. Can occur as a result of:
 - ▶ A spontaneous mutation
 - ▶ Familial MVP:
 - ▲ Autosomal dominant condition with incomplete penetrance
 - ▲ Prevalence in first degree relatives ranges from 30-50%

Classic MVP

♥ Classification:

- ▲ Secondary MVP: Myxomatous degeneration of the MV apparatus with evidence of a systemic connective tissue disorder:
 - ▶ Marfan's syndrome
 - ▶ Ehlers-Danlos syndrome
 - ▶ Adult polycystic kidney disease
 - ▶ Osteogenesis imperfecta
 - ▶ Pseudoxanthoma elasticum
 - ▶ Similar condition is seen in some patients with bicuspid aortic valve (BAV) disease

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Classic MVP

♥ Classification:

- ♣ Functional MVP: Prolapse of a structurally normal MV apparatus:
 - ✓ Papillary muscle dysfunction due to ischemic heart disease
 - ✓ Dilated MV annulus due to dilated cardiomyopathy (DCM)
 - ✓ LV cavity size which is too small for the MV apparatus:
 - ♣ Hypertrophic Cardiomyopathy (HCM)
 - ♣ Dehydration or decreased blood volume

Classic MVP

♥ Prognosis and complications:

- ♣ In general, classic MVP has a benign clinical course and good prognosis.
- ♣ However, can be associated with serious complications:
 - ✓ MR and congestive heart failure
 - ✓ Infective endocarditis
 - ✓ Arrhythmias (PACs, PVCs, AFib, SVT, or VT [rare])
 - ✓ Embolic events (e.g., CVA, TIA, etc.)
 - ✓ Sudden Cardiac Death (SCD) ??? True incidence is probably very low except in patients with ischemic heart disease.

Classic MVP

♥ Prognosis and complications:

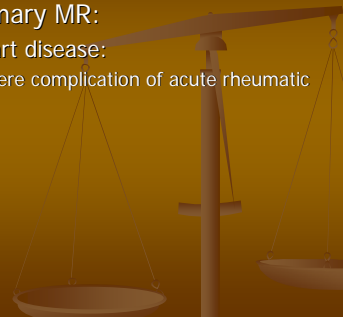
- ♣ Risk for complications can vary depending upon:
 - ✓ Etiology of MVP (e.g., ischemic heart disease → ↑ risk)
 - ✓ Severity of MR (↑ MR → ↑ risk)
 - ✓ Degree of LV systolic dysfunction (↓ LVEF → ↑ risk)

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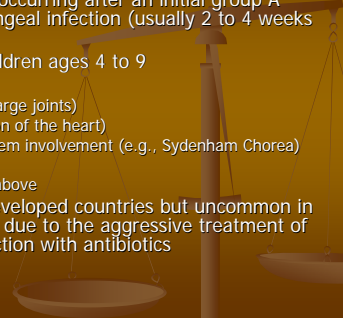
Mitral Regurgitation

- ♥ Etiology of primary MR:
 - ♣ Rheumatic heart disease:
 - The most severe complication of acute rheumatic fever (ARF)



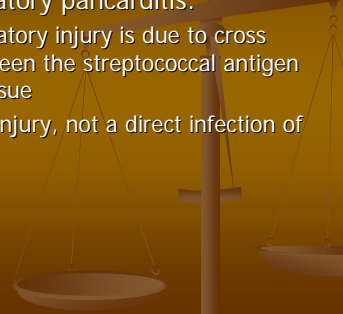
Acute Rheumatic Fever (ARF)

- ♥ Acute febrile illness occurring after an initial group A streptococcal pharyngeal infection (usually 2 to 4 weeks later).
- ♥ Most common in children ages 4 to 9
- ♥ Can manifest as:
 - ♣ Migratory arthritis (large joints)
 - ♣ Carditis (inflammation of the heart)
 - ♣ Central nervous system involvement (e.g., Sydenham Chorea)
 - ♣ Rash
 - ♣ Combination of the above
- ♥ Common in underdeveloped countries but uncommon in developed countries due to the aggressive treatment of the initial strep infection with antibiotics



Acute Rheumatic Fever (ARF)

- ♥ Acute inflammatory pancarditis:
 - ♣ Acute inflammatory injury is due to cross reactivity between the streptococcal antigen and cardiac tissue
 - ♣ Auto-immune injury, not a direct infection of the heart



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Acute Rheumatic Fever (ARF)

- ♥ Acute inflammatory pancarditis:
 - ♣ Pericardium: pericarditis
 - ♣ Epicardium
 - ♣ Myocardium: LV systolic dysfunction and congestive heart failure (CHF)
 - ♣ Endocardium
 - ♣ Valves:
 - ◆ Usually involves the MV and AV
 - ◆ Regurgitation is usually the acute abnormality
 - ◆ Stenosis of the MV and AV is rare at this stage and is more common as a late finding

Rheumatic Heart Disease

- ♥ Most severe late complication of ARF
- ♥ Usually occurs 10 to 20 years after the initial episode of ARF with carditis
- ♥ In patients who develop carditis with ARF, up to 50% can have valvular heart disease later in life.
- ♥ Most common valve involved is the MV:
 - ♣ Mitral stenosis (MS) is most common
 - ♣ MR is less common

Mitral Regurgitation

- ♥ Etiology of primary MR:
 - ♣ Infective Endocarditis:
 - ♣ Infection of a cardiac structure due to seeding
 - Usually a bacterial infection from a remote site.

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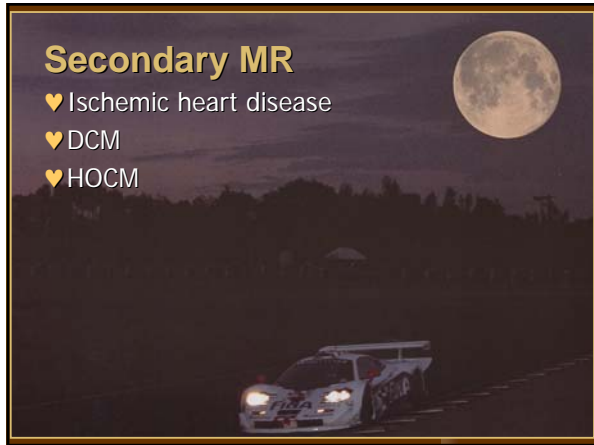
Mitral Regurgitation

♥ Etiology of primary MR:

- ▲ Anorectic drugs (used for weight loss by suppressing appetite):
 - ▶ True incidence of drug induced valvulopathy is unknown. Data is relatively weak.
 - ▶ Pathologic features are similar to patients with Carcinoid heart disease (plaque like encasement of the leaflets with leaflet thickening) felt to be due to increased Serotonin release.
 - ▶ Specific drugs:
 - ▲ Fenfluramine (Pondimin)
 - ▲ Dexfenfluramine (Redux)
 - ▲ Phentermine (Adipex, Fastin, Ionamin): No reports of valvulopathy when used alone.
 - ▲ Combination therapy: Fenfluramine and Phentermine (Fen/Phen). Highest incidence of valvulopathy.

Secondary MR

- ♥ Ischemic heart disease
- ♥ DCM
- ♥ HOCM



Mitral Regurgitation

♥ Ischemic heart disease resulting in secondary (functional) MR:

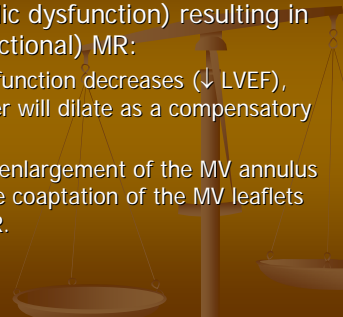
- ▲ This results from a myocardial infarction involving the lateral wall of the LV.
- ▲ Posteromedial papillary muscle dysfunction or infarction.
- ▲ Retraction or rupture of posteromedial papillary muscle
- ▲ Retraction of the posterior MV leaflet or flail leaflet resulting in MR

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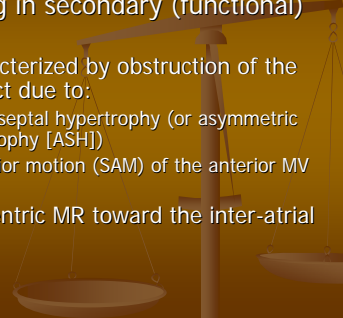
Mitral Regurgitation

- ♥ DCM (LV systolic dysfunction) resulting in secondary (functional) MR:
 - ♣ As LV systolic function decreases (\downarrow LVEF), the LV chamber will dilate as a compensatory mechanism.
 - ♣ This results in enlargement of the MV annulus and incomplete coaptation of the MV leaflets and central MR.




Mitral Regurgitation

- ♥ HOCM resulting in secondary (functional) MR:
 - ♣ HOCM is characterized by obstruction of the LV outflow tract due to:
 - ✓ Abnormal LV septal hypertrophy (or asymmetric septal hypertrophy [ASH])
 - ✓ Systolic anterior motion (SAM) of the anterior MV leaflet
 - ♣ Results in eccentric MR toward the inter-atrial septum



MR

- ♥ Treatment of MR:
 - ♥ Acute
 - ♥ Chronic



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Mitral Stenosis

♥ Etiology of MS:

- ▲ Rheumatic heart disease:
 - ▶ Most common cause of MS (> 75-90% depending upon the literature)
 - ▶ Occurs late (several years) after development of ARF. Patients in developed countries usually present in their 40's and 50's
 - ▶ Many patients (30-50%) do not report a prior history of ARF

Mitral Stenosis

♥ Other etiologies of MS:

- ▲ Severe mitral annular calcification (Ca⁺⁺), especially in the presence of end-stage renal disease
- ▲ Infective endocarditis (MS occurs late as a result of scarring, Ca⁺⁺, and fibrosis of the MV)
- ▲ Prosthetic valve dysfunction due to pannus formation, leaflet Ca⁺⁺, or thrombus formation. Can be rapid in onset.
- ▲ Other very rare disorders (< 1% of cases):
 - ▶ Congenital MS, carcinoid heart disease, systemic lupus erythematosus, endomyocardial fibrosis, rheumatoid arthritis

Rheumatic MS

♥ Pathophysiology:

- ▲ Initial injury is formation of tiny nodules along the coapting portions of the leaflets
- ▲ With disease progression (over years [decades]):
 - ▶ Fusion of the leaflet commissures (causes "hockey stick" appearance to leaflets on echo)
 - ▶ Thickening, fusion, and shortening of the chordae tendineae
 - ▶ Thickening, fibrosis, and Ca⁺⁺ of the leaflet cusps.

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Rheumatic MS

♥ Pathophysiology:

- ▲ Net effect of this damage to the MV is a stenotic MV with a symmetric, central oval shaped orifice (fish mouth) and classic "doming" of the leaflets in diastole due to fusion of the leaflet tips at the commissures.
- ▲ Decrease in MV orifice area
- ▲ The degree of leaflet thickening and Ca⁺⁺ and chordal involvement is variable.
- ▲ Progression of severity of the valve disease over several years is due to the stress of turbulent flow across a diseased valve, not due to recurrent episodes of ARF.

Rheumatic MS

♥ Pathophysiology:

- ▲ Cardiac hemodynamic consequences of MS:
 - ◆ Pressure gradient across MV between LA and LV resulting in ↑ LA pressure → ↑ pulmonary venous, capillary, and arterial pressures → pulmonary edema (congestive heart failure [CHF]) and ↑ pulmonary vascular resistance (PVR).
 - ◆ In isolated MS, LV size and systolic and diastolic pressures are normal with mild MS. However, with progression of MS, all LV parameters above will ↓ resulting in ↓ cardiac output (CO)

Rheumatic MS

♥ Severity of MS by MV area:

- ▲ 4 – 6 cm² : normal
- ▲ 1.5 – 2.0: mild MS
- ▲ 1.0 – 1.5: moderate MS
- ▲ < 1.0 cm²: severe MS
- ▲ Exertional dyspnea begins when MVA < 2.5 cm²
- ▲ Resting dyspnea begins when MVA < 1.5 cm²

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Rheumatic MS

♥ Symptoms:

- ▲ With mild MS, many patients are asymptomatic
- ▲ Development of symptoms from episode of ARF was average of 16 years
- ▲ Progression from mild to severe symptoms was average of 7 – 10 years
- ▲ Are exacerbated by:
 - ◆ Tachycardia
 - ◆ ↑ Blood volume
 - ◆ ↑ Cardiac output
 - ◆ Examples: Exercising, pregnancy, AFib

Rheumatic MS

♥ Symptoms:

- ▲ Dyspnea
- ▲ Palpitations (usually due to atrial fibrillation [AFib])
- ▲ Hemoptysis
- ▲ Thromboembolic events

Rheumatic MS

♥ Complications of MS:

- ▲ AFib
- ▲ Pulmonary HTN (usually reversible)
- ▲ Thromboembolic events
- ▲ Endocarditis
- ▲ Right heart failure with functional TR
- ▲ Hemoptysis
- ▲ Pulmonary hemorrhage

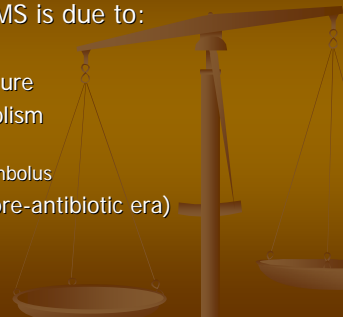
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Rheumatic MS

♥ Mortality with MS is due to:

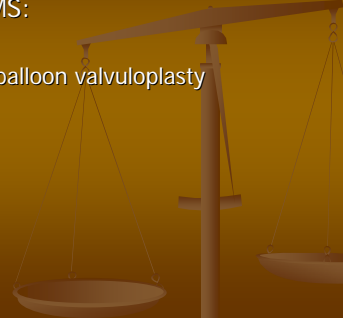
- ♣ CHF
- ♣ Right heart failure
- ♣ Systemic embolism
 - ♣ CVA
 - ♣ Pulmonary Embolus
- ♣ Endocarditis (pre-antibiotic era)



Rheumatic MS

♥ Treatment of MS:

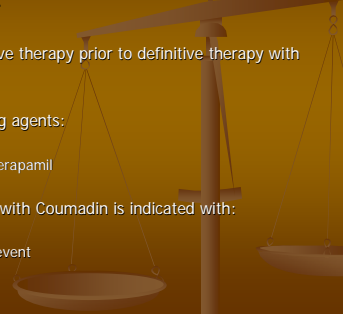
- ♣ Medical
- ♣ Percutaneous balloon valvuloplasty
- ♣ Surgical



Rheumatic MS

♥ Treatment of MS:

- ♣ Medical:
 - ♣ Used as adjunctive therapy prior to definitive therapy with PBMV or surgery
 - ♣ Diuretics
 - ♣ AV nodal blocking agents:
 - ♣ Beta-blockers
 - ♣ Diltiazem or Verapamil
 - ♣ Digoxin
 - ♣ Anti-coagulation with Coumadin is indicated with:
 - ♣ AFib
 - ♣ Prior embolic event



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Rheumatic MS

♥ Treatment of MS:

- ▲ Percutaneous mitral balloon valvuloplasty (PMBV):
 - ✔ Timing of PMBV or surgery is crucial:
 - ▲ Too early: Risk of the procedure with little or no short or long term benefit
 - ▲ Too late: Risk of irreversible pulmonary HTN
 - ✔ Main indication for PMBV:
 - ▲ Moderate – severe MS (MV area < 1.5 cm²)
 - ▲ Symptoms

Rheumatic MS

♥ Treatment of MS:

- ▲ Surgery: based on the 2006 ACC/AHA guidelines, surgery is only indicated if:
 - ✔ Patient is not a candidate for PMBV (unfavorable valve morphology)
 - ✔ LA thrombus
 - ✔ MV leaflets are non-pliable and heavily Ca++
 - ✔ Moderate (3+) to severe (4+) MR

Rheumatic MS

♥ Treatment of MS:

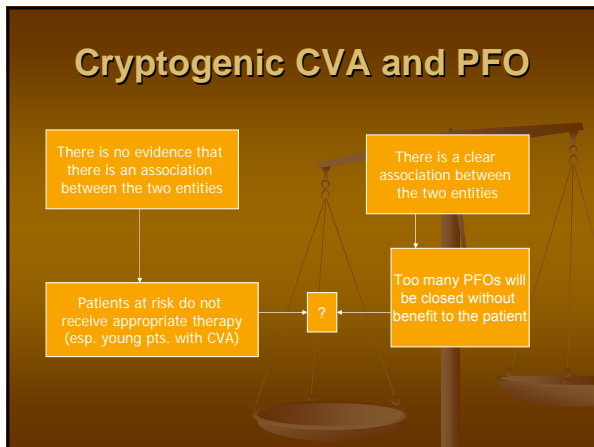
- ▲ Surgery:
 - ✔ Open commissurotomy
 - ✔ Closed commissurotomy
 - ✔ MV repair (usually with an annuloplasty ring)
 - ✔ MV replacement

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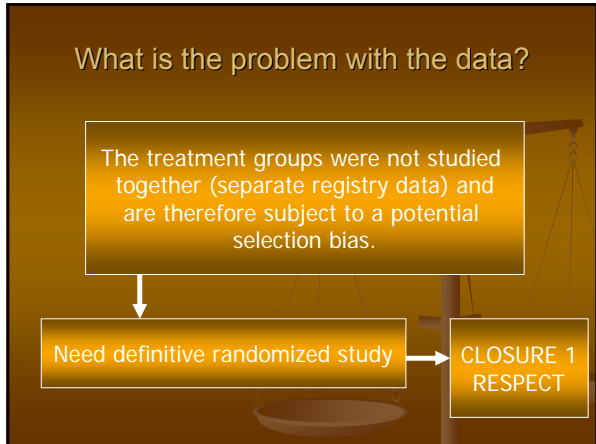
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What is the problem with the data?

The treatment groups were not studied together (separate registry data) and are therefore subject to a potential selection bias.

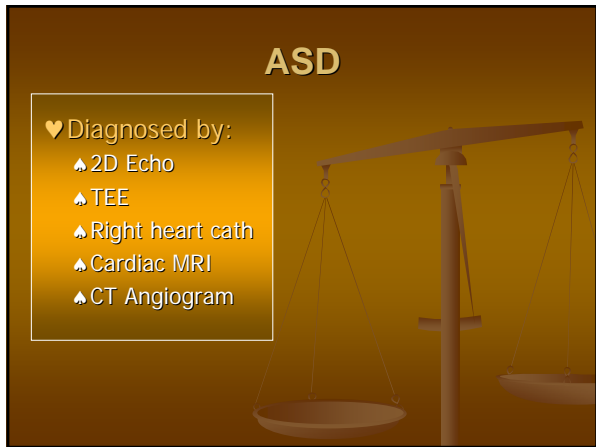
Need definitive randomized study → CLOSURE 1 RESPECT




ASD

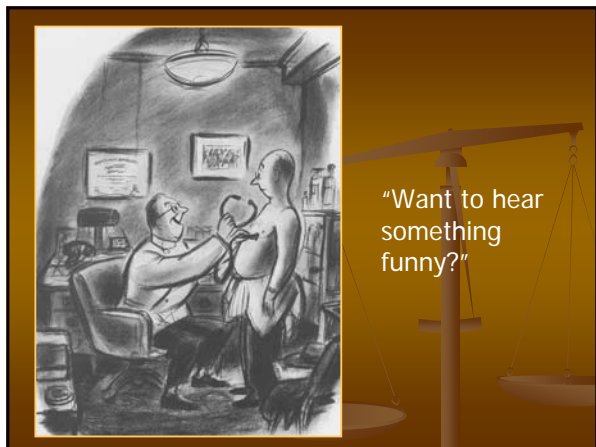
♥ Diagnosed by:

- ♣ 2D Echo
- ♣ TEE
- ♣ Right heart cath
- ♣ Cardiac MRI
- ♣ CT Angiogram





"Want to hear something funny?"



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