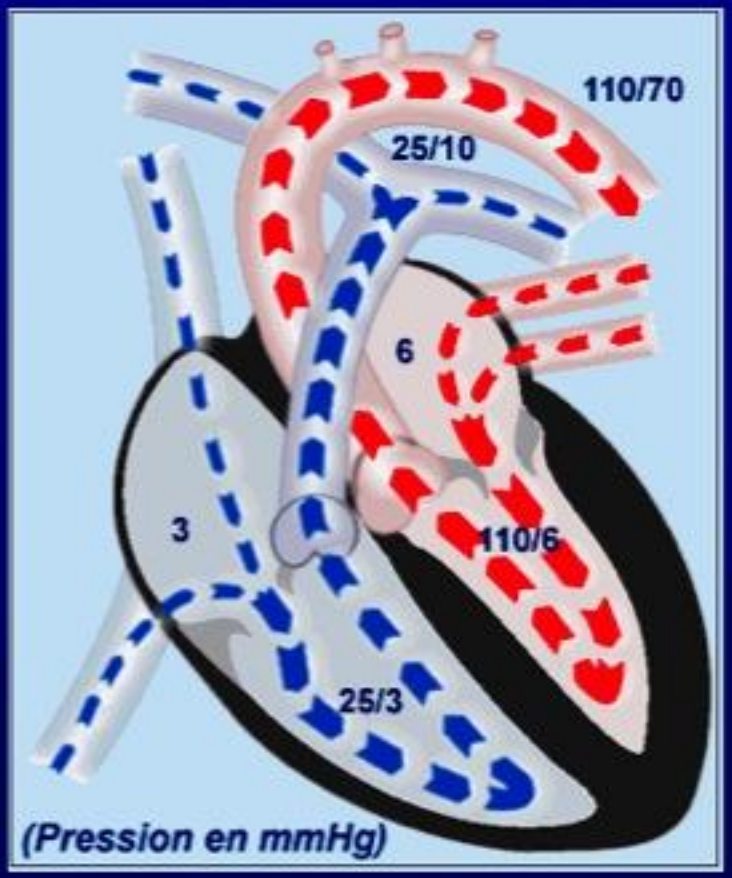
Children with Congenital Heart Disease

Pathophysiology
and
Treatment

10 th Spring Meeting, Cardiovascular Nursing
March 12 2010

Normal Heart: Pressures and Resistances



- Atrial pressures: R < L
- Ventricular pressures: R << L
- Pulm. art. pressure: R << L
- Pulmonary flow=systemic Flow
- Pulmonary resistance = 1/5 systemic resistance

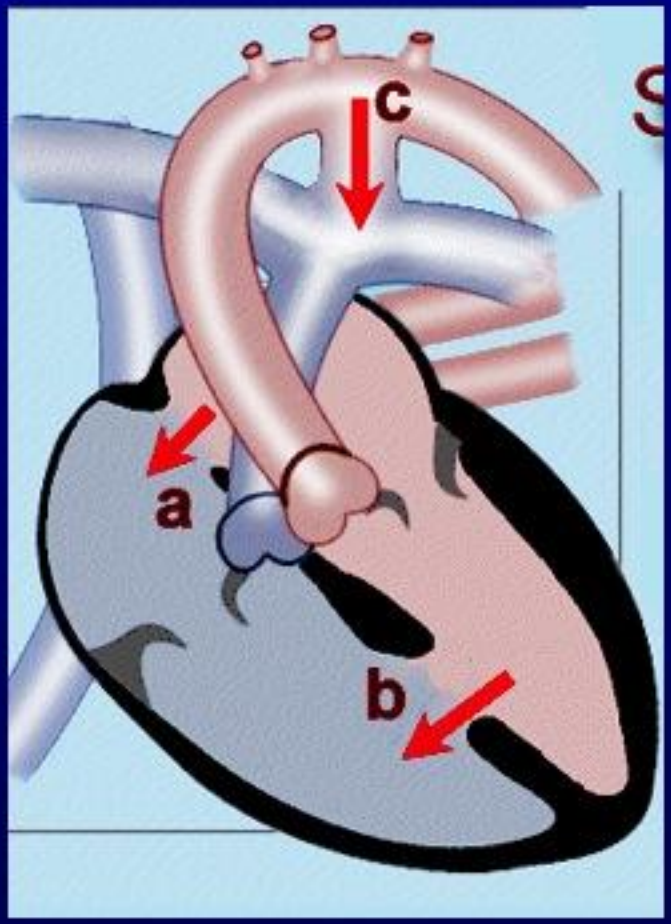
PATHOPHYSIOLOGY OF CONGENITAL HEART DISEASE

Pathophysiology	*Anatomic correlate*
• Left to right shunt →	Septal Defect
• Right to left shunt →	Septal Defect *plus* pulmonary stenosis *or* abnormal connection
• No shunt →	Valvular anomalies Stenosis

What is a Shunt ?

- A shunt is a passage of blood from left heart cavities (arterial blood) to right heart cavities(venous blood) or vice versa
- Arterialized (red) blood enters venous cavity: *Left to right shunt*
- Venous (blue) blood enters arterialized blood cavity: *Right to left shunt*

Defects with Left to Right Shunts

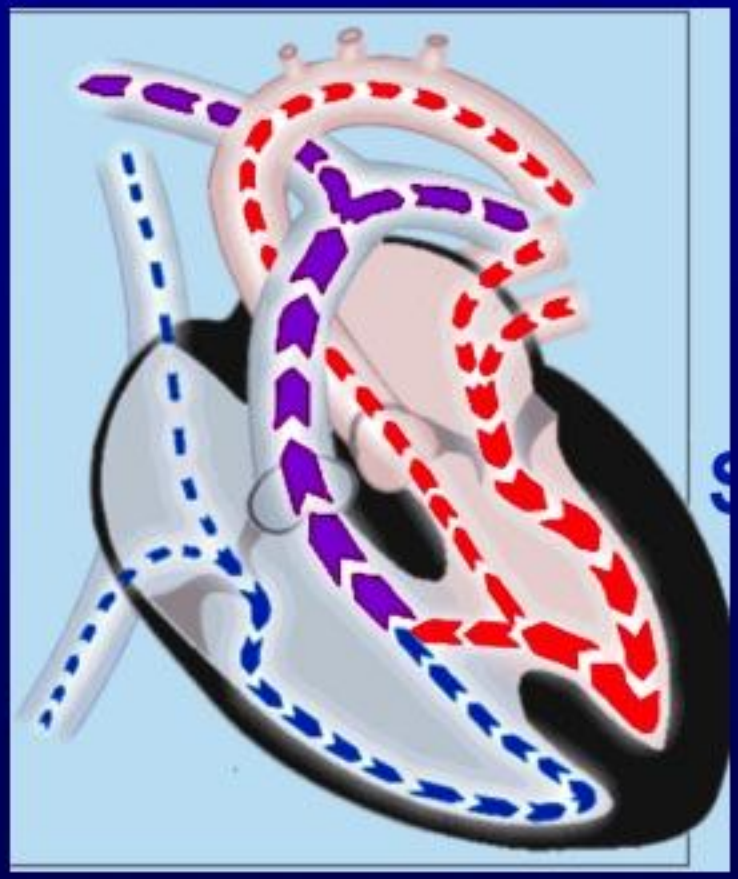


a) Atrial septal defect

b) Ventricular septal defect

c) Persistant Ductus arteriosus

Pathophysiology of left to right shunt Ventricular septal defect



- Pulmonay blood flow increased
- Systemic flow maintained

- Flow PA > flow Aorta

Left to right shunt:
Effect of increased pulmonary blood flow

ON LUNG

- Pulmonary congestion
- Decreased lung compliance
- Bronchial hypersecretion

↓

Bronchitis, pneumonia

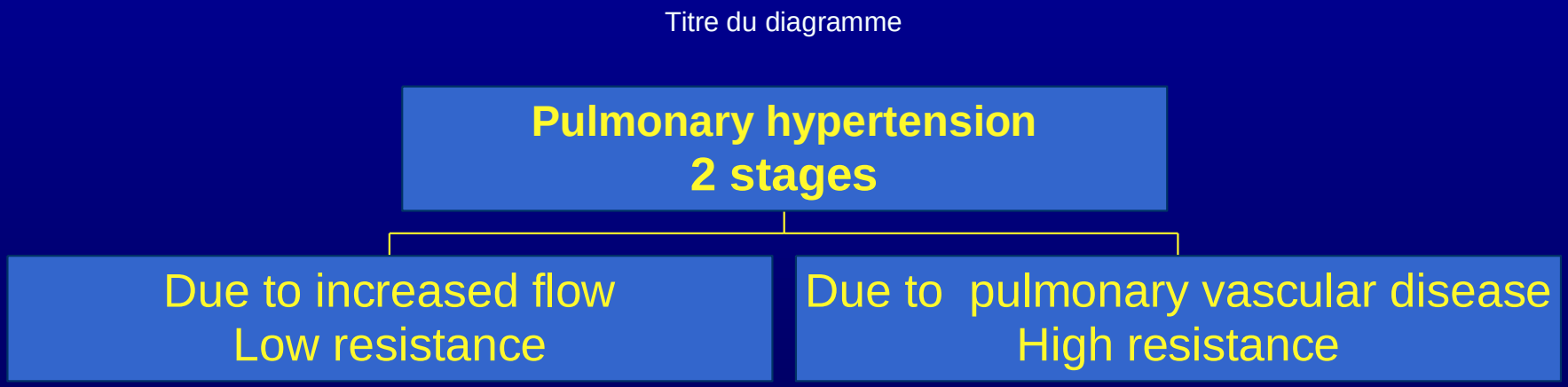
ON HEART

- Volume overload left atrium left ventricle
- Volume overload right ventricle

↓

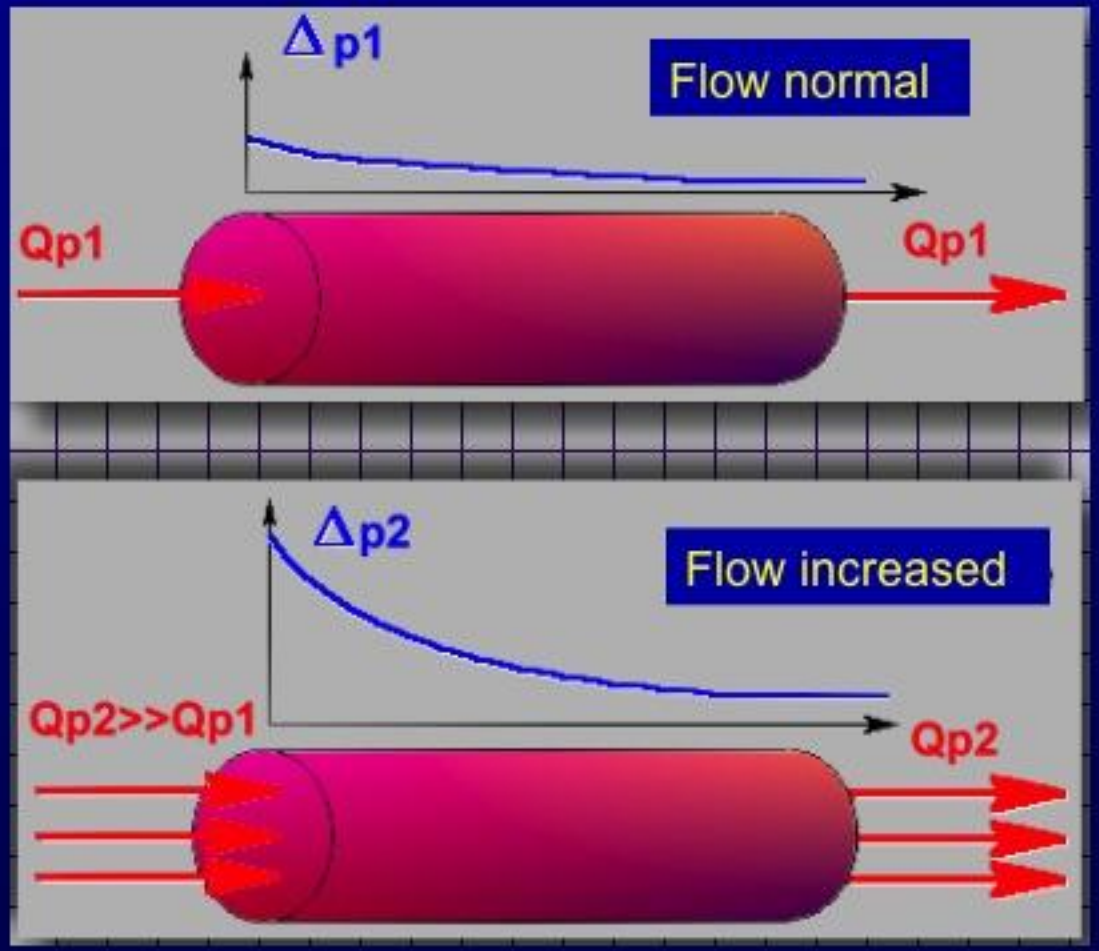
Heart failure

PULMONARY HYPERTENSION DUE TO LEFT TO RIGHT SHUNTS



Pulmonary hypertension in left-right shunt

Stage 1: Flow related.



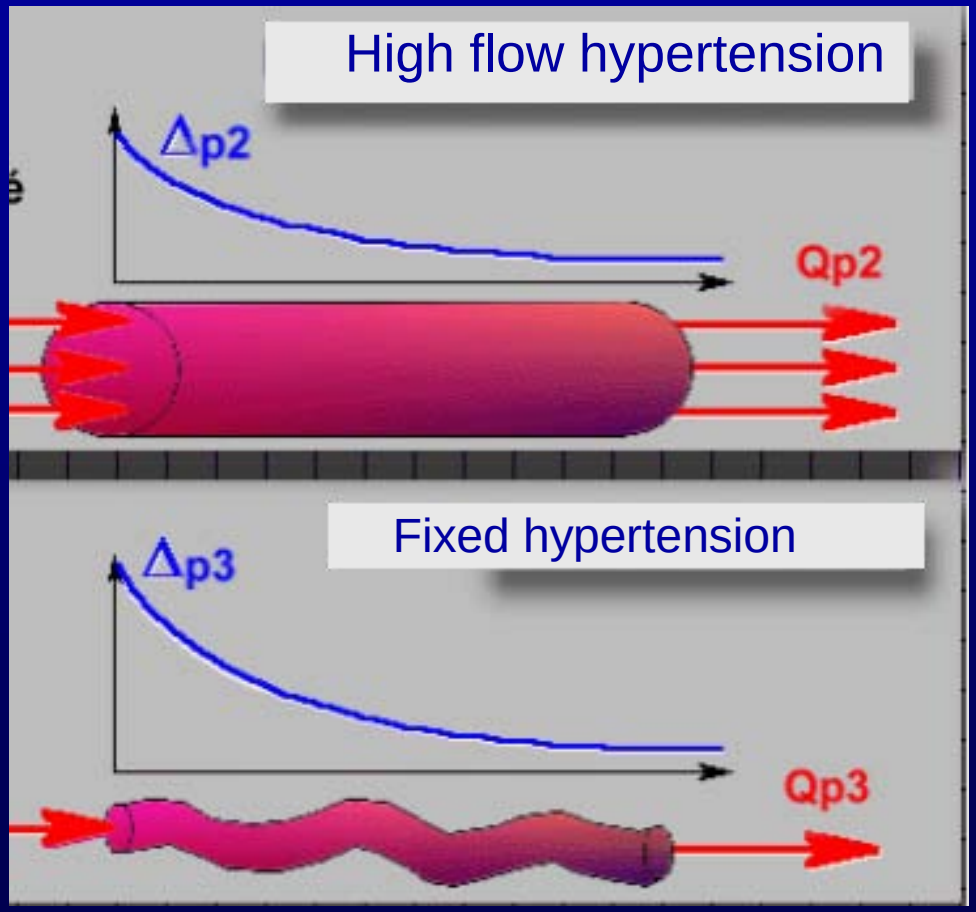
Normal flow:
Low pressure drop

Increased flow
Higher pressure drop

Pulmonary hypertension in left-right shunts
Stage 2: pulmonary vascular disease

- Small arteries thick and narrow
- Obstruction to blood flow

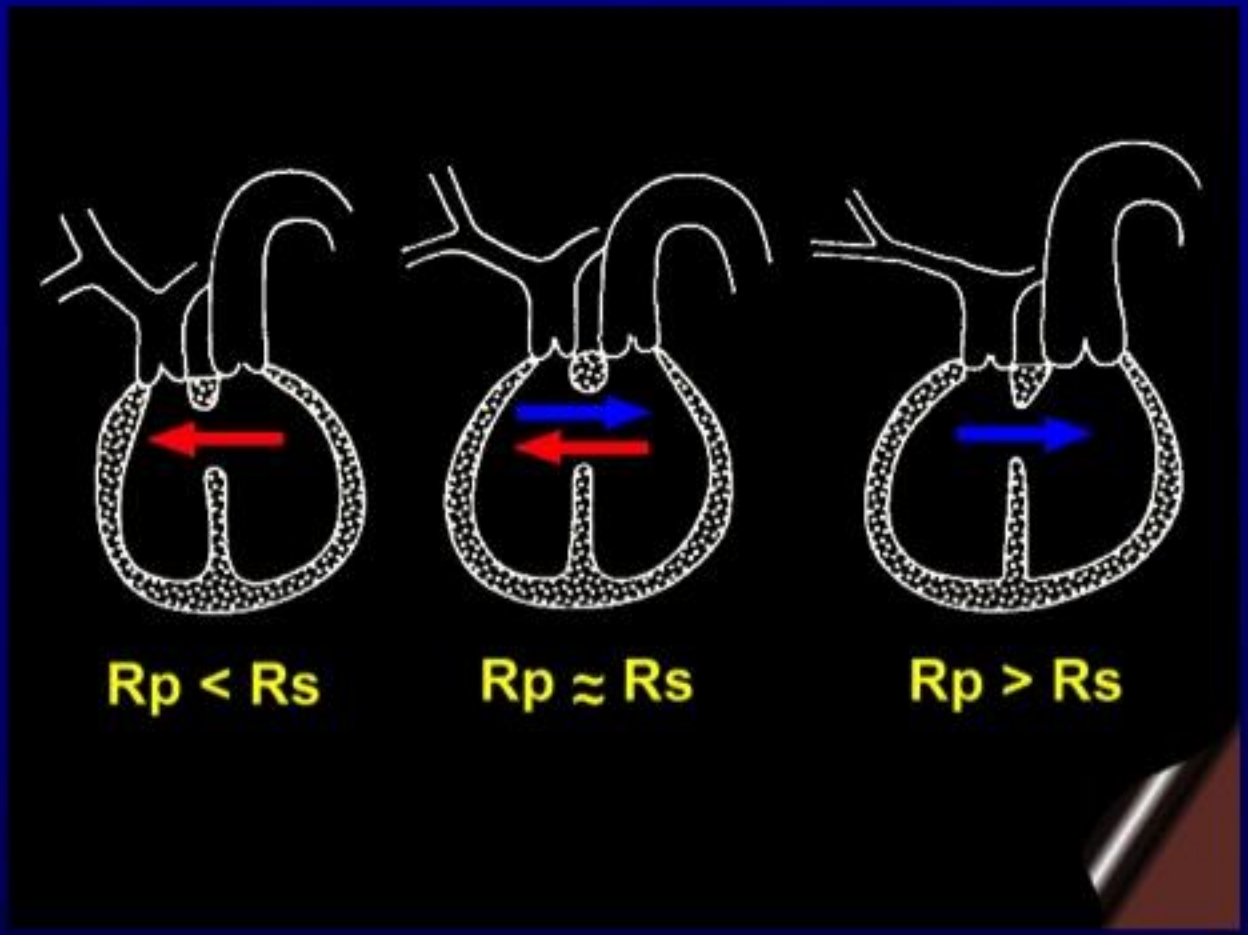
Pulmonary hypertension in left to right shunt
Stage 2: Pulmonary vascular disease



- Large vessel
- High flow
- High pressure
- Reversible

- Narrow vessel
- Low flow
- High pressure
- Irreversible

Ventricular septal defect with pulmonary hypertension Reversal of Shunt



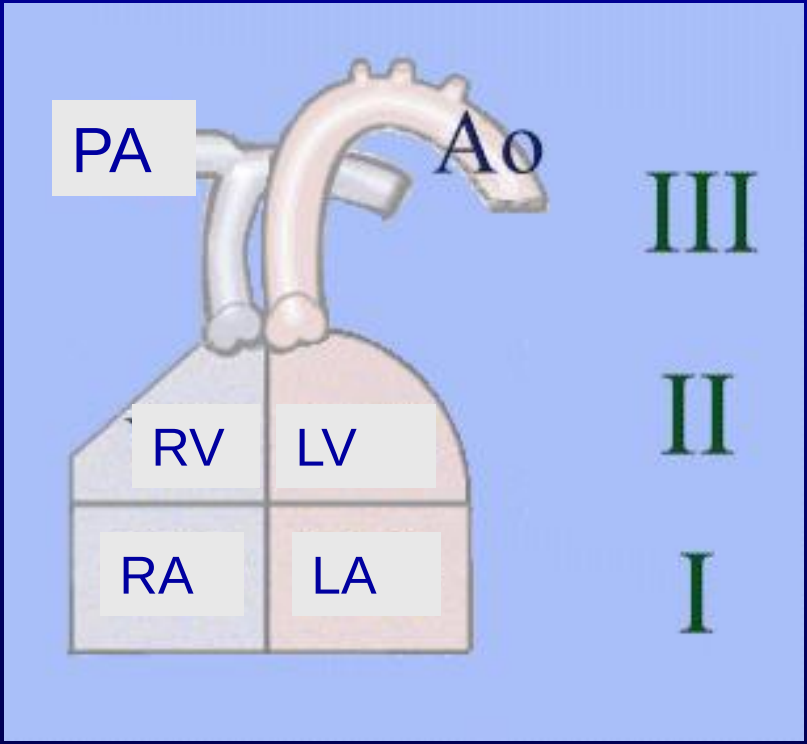
RIGHT TO LEFT SHUNT (Cyanotic Heart disease)

Results from one of the following anatomic abnormalities

- Abnormal connections
- *e.g. Transposition*

- Septal defect and pulmonary outflow obstruction
- *e.g.Fallots Tetralogy*

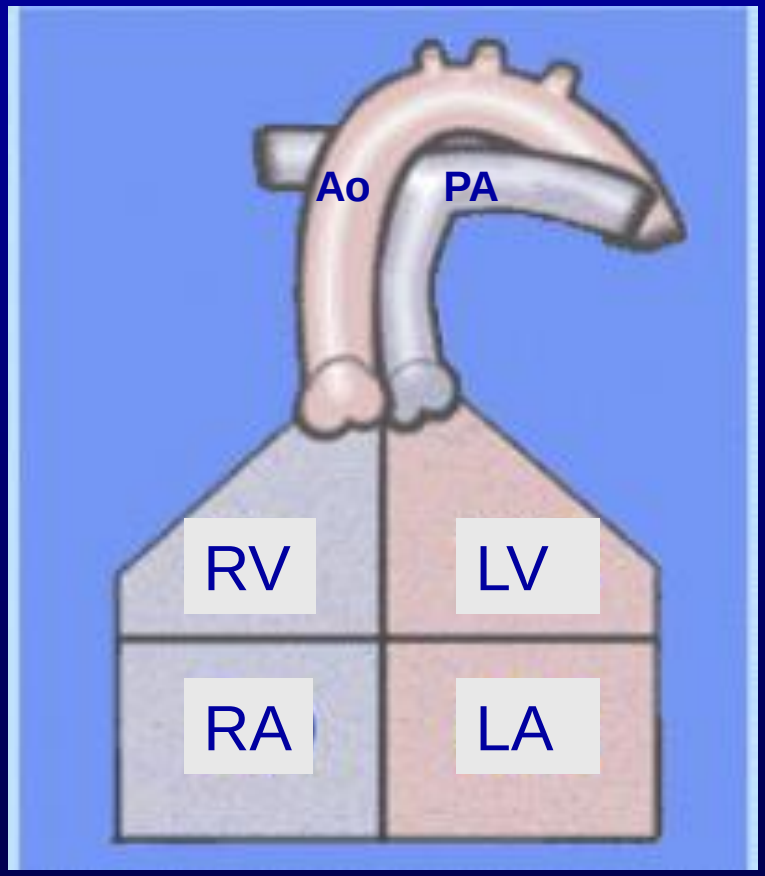
Atrio-ventricular and ventriculo-arterial Connections



Normal Connections:

Atrio-ventricular and Ventriculo-arterial concordance

Abnormal connection

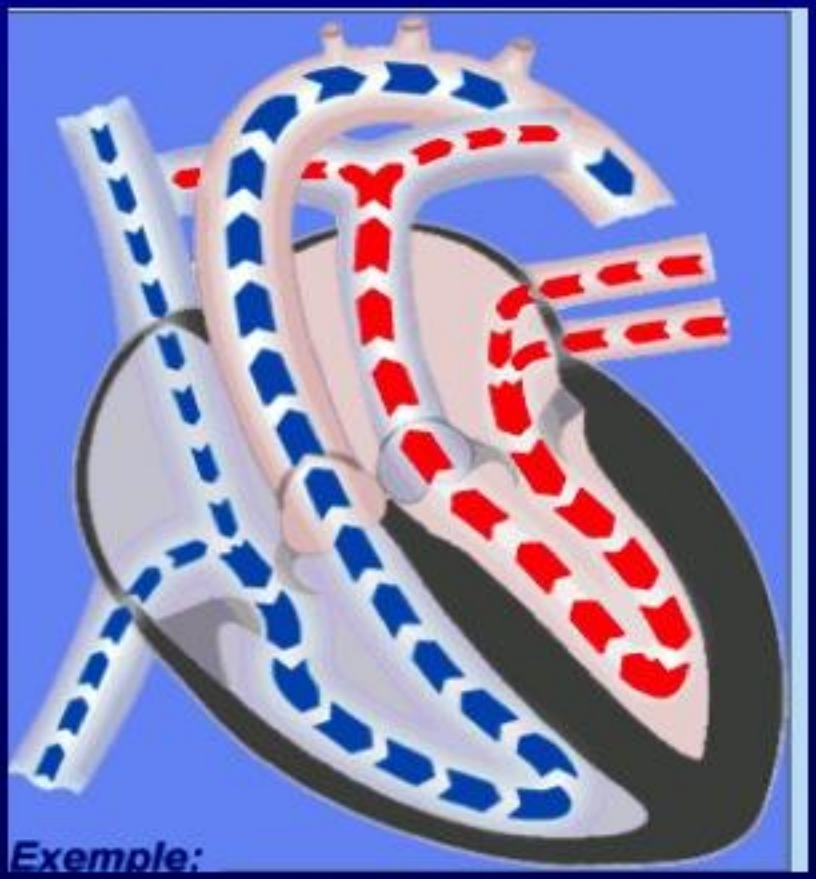


- Ventriculo-arterial discordance

- Aorta from RV
- Pulmonary a.from LV

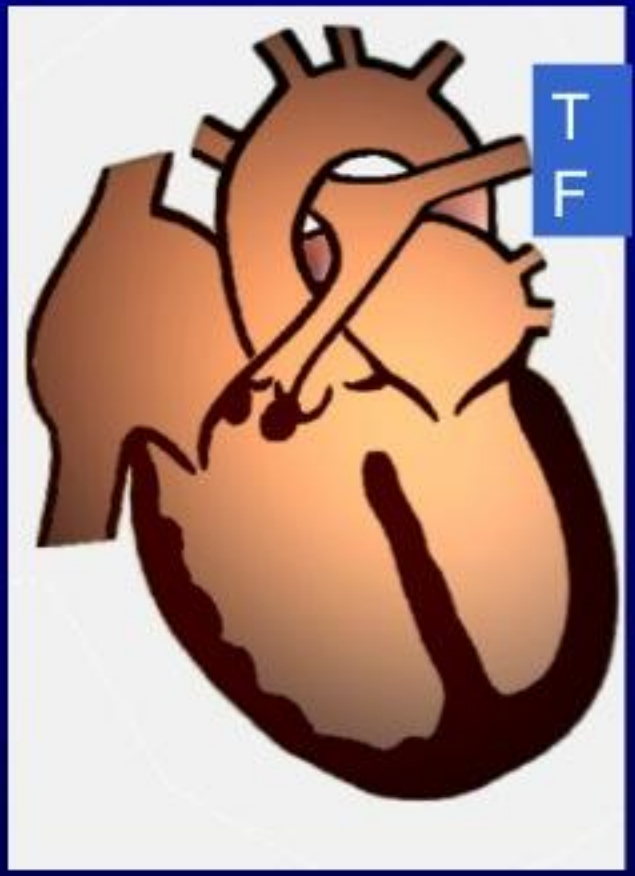
=Transposition of great arteries

TRANSPOSITION OF GREAT ARTERIES



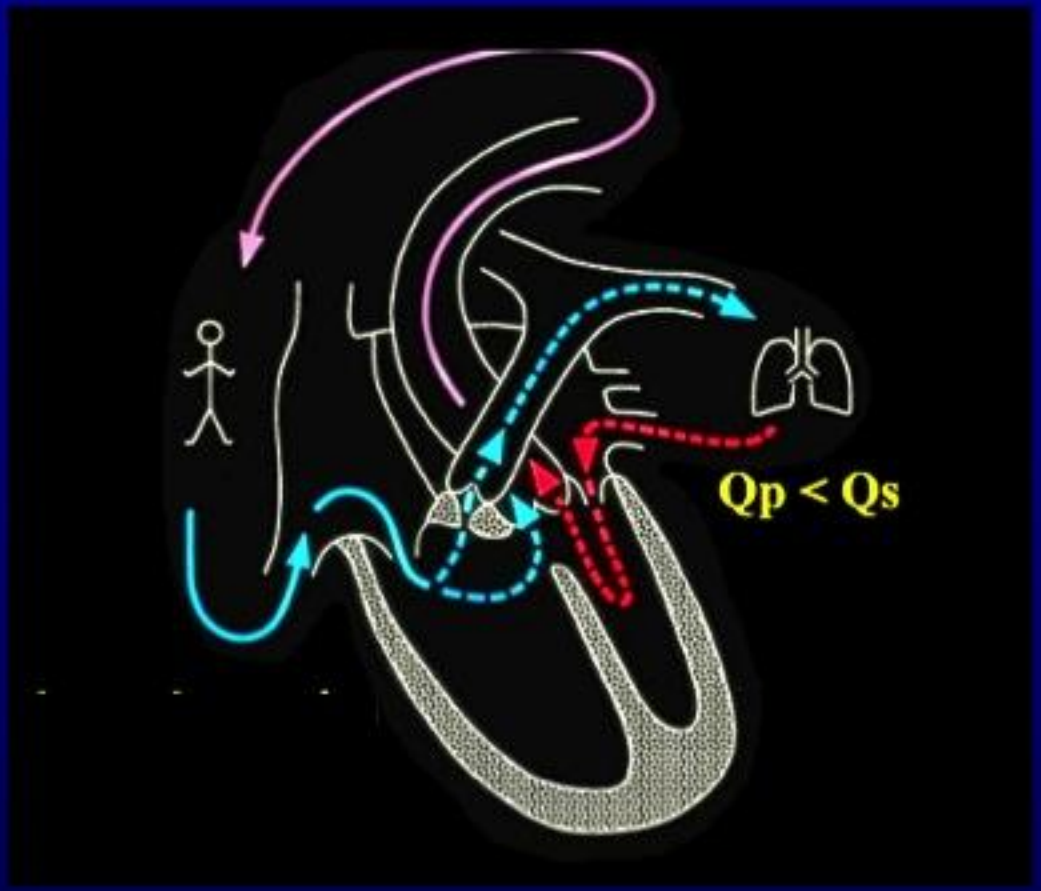
- Atrio-ventricular concordance
- Ventriculo-arterial discordance

Right to left shunt= cyanotic heart disease
TETRALOGY OF FALLOT



- Ventricular septal defect
- Pulmonary stenosis (infundibular)
- Overriding Aorta

Right to left shunt in Tetralogy of Fallot



- Obstruction to RV outflow
- RV pressure=LV pressure
- Venous blood crosses VSD to enter Aorta

Right to left shunt: Clinical aspects

- Cyanosis: Skin and mucosa
- Finger clubbing

Cyanotic Heart Disease: Hematological Consequences

- Increase in number of red blood cells = hyperviscosity
- Coagulation abnormalities

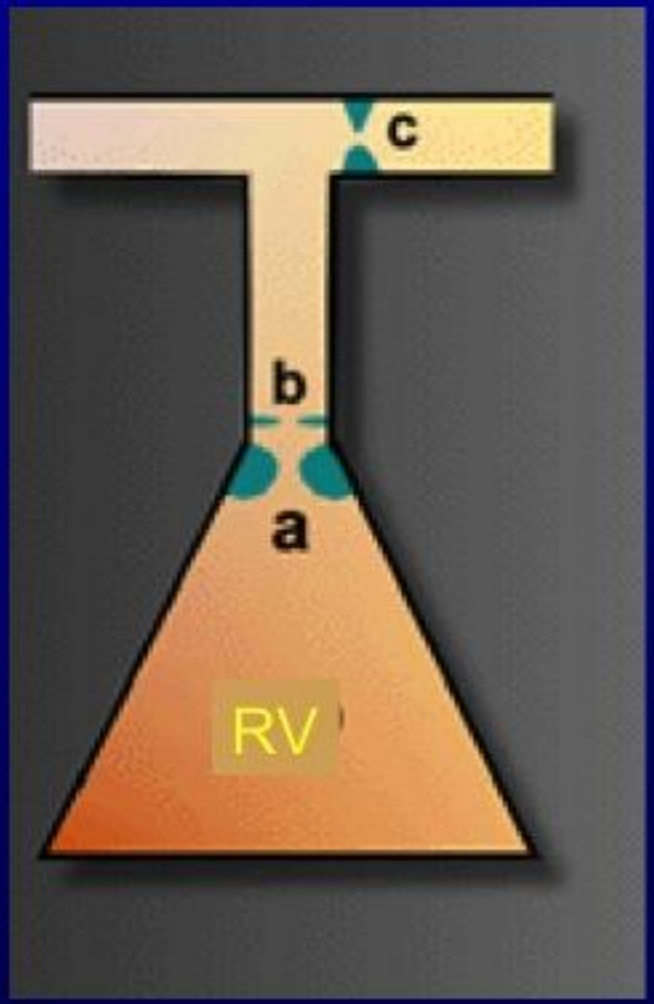
Cyanotic Heart Disease: Neurological Complications

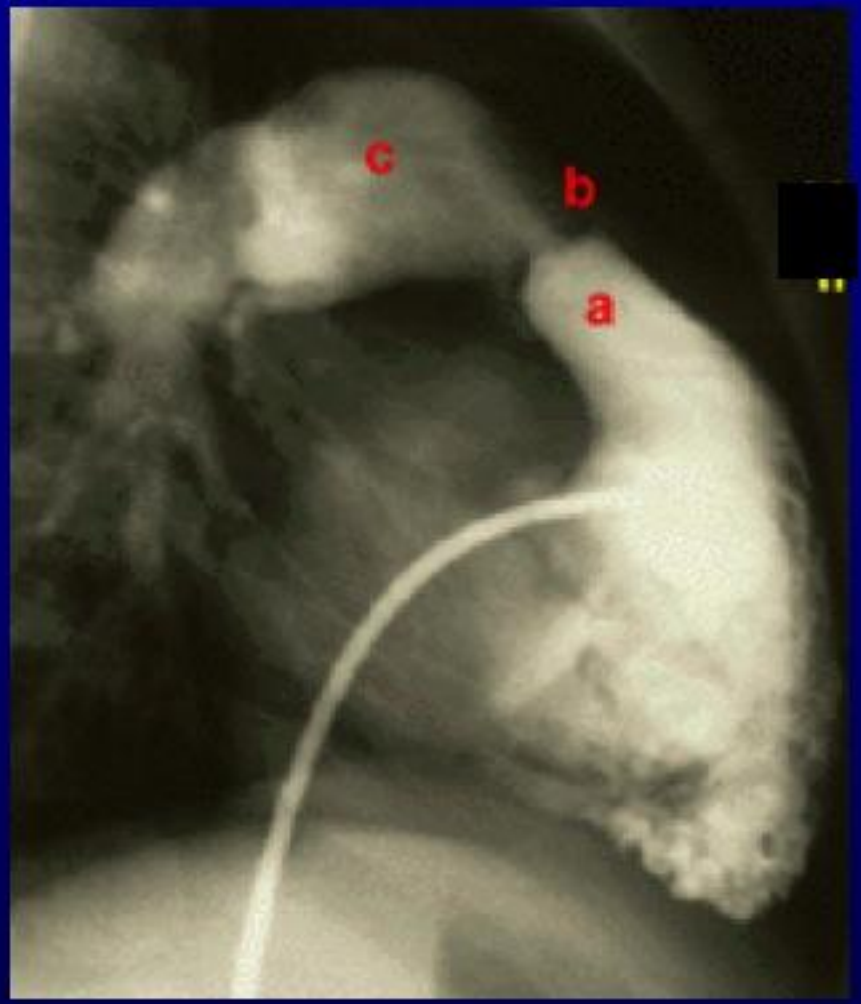
- Cerebrovascular accidents (Stroke)
- Brain abcess

Due to :Hyperviscosity
No Lung filter !

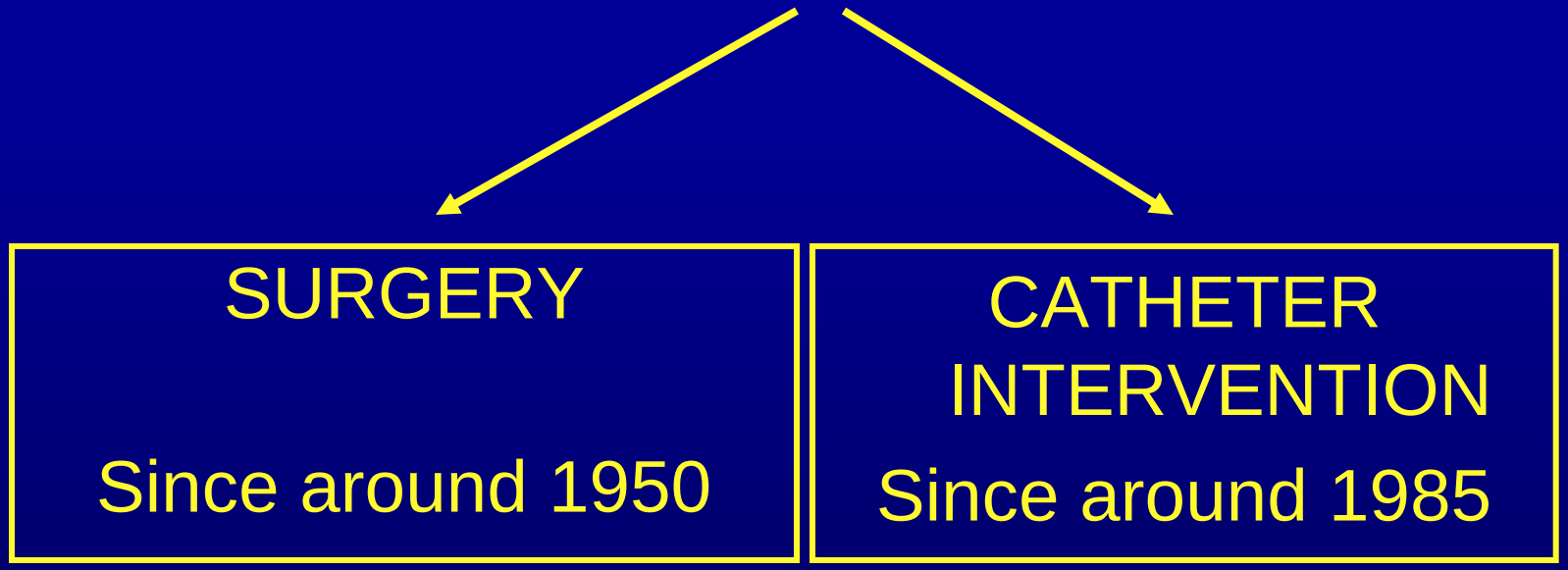
Congenital heart disease without Shunt

example: Simple Pulmonary valve stenosis

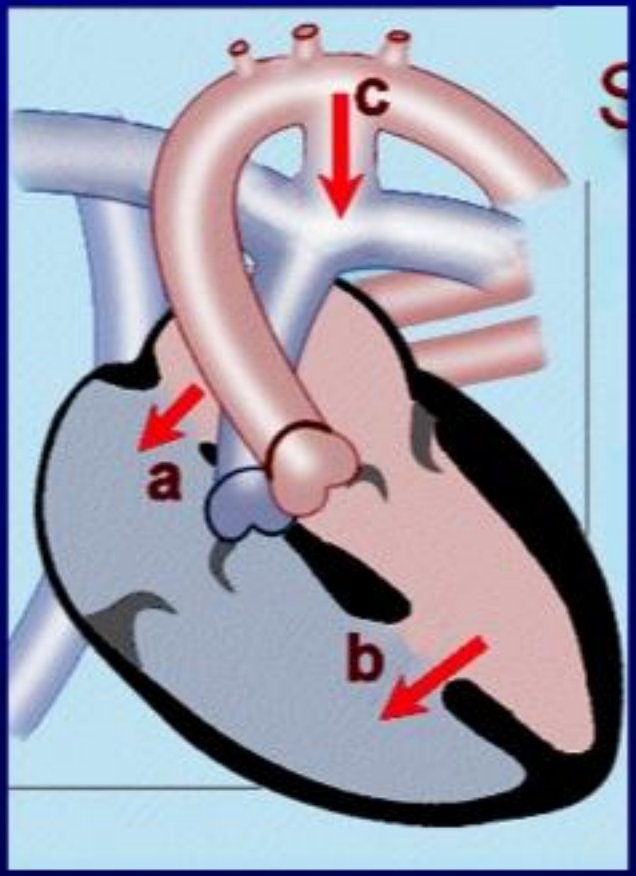




TREATMENT OF CONGENITAL HEART DEFECTS

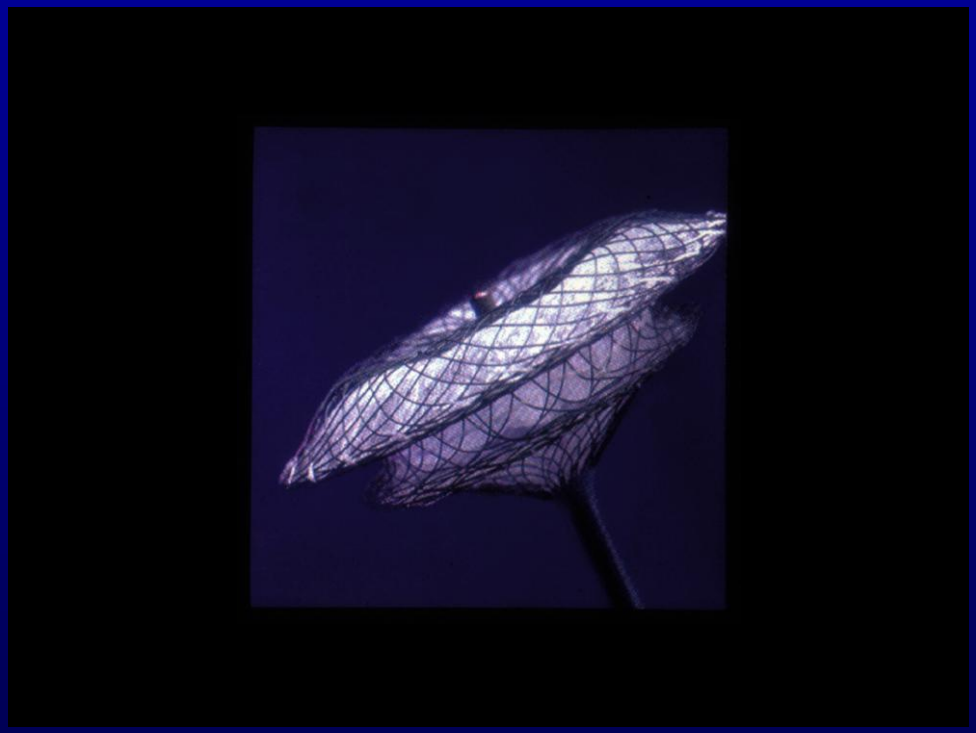


TREATMENT OF LEFT TO RIGHT SHUNTS



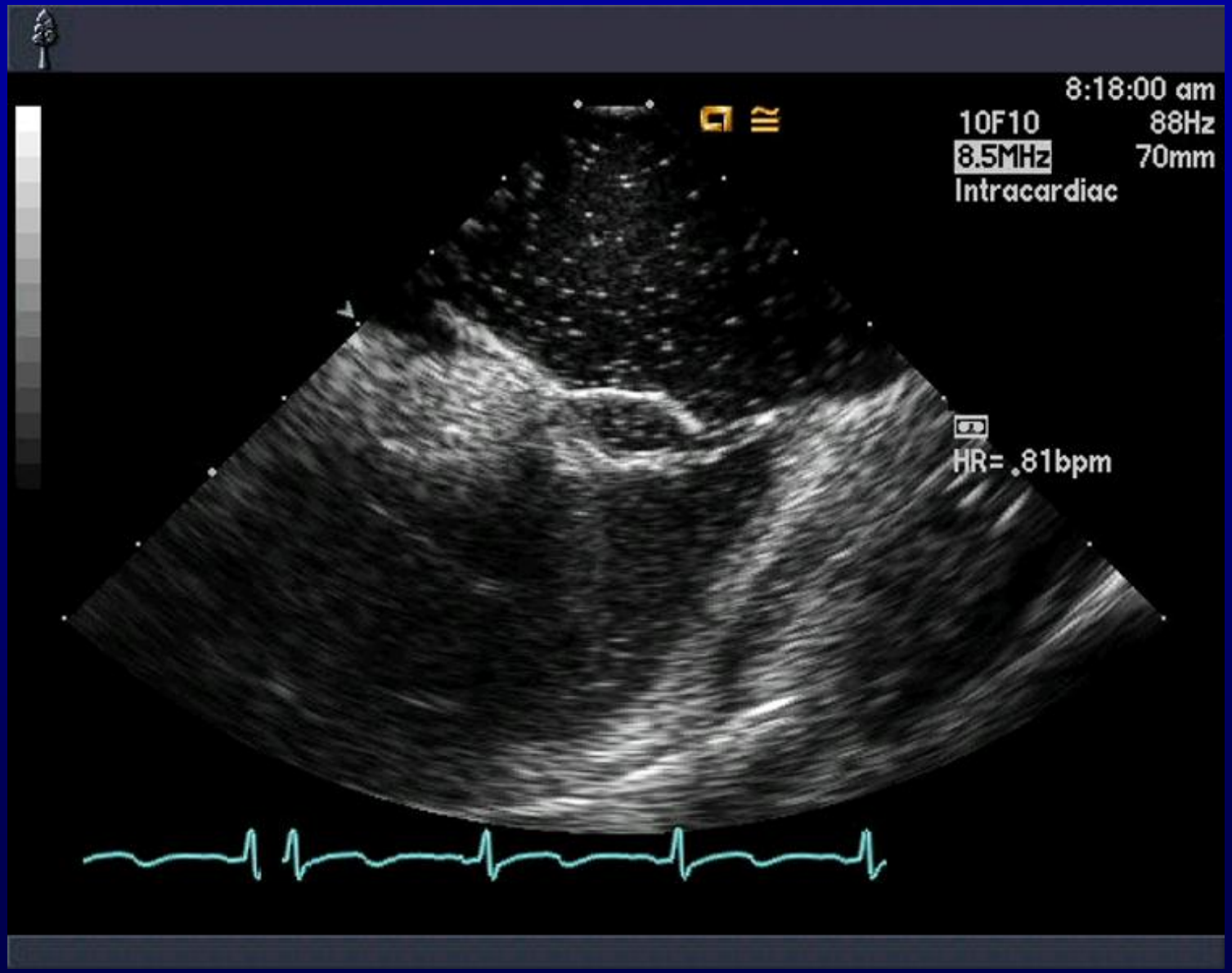
- Ductus : mostly catheter intervention
- Atrial septal defect : Catheter > surgery
- Ventricular septal defect: surgery > catheter

TREATMENT OF LEFT TO RIGHT SHUNTS

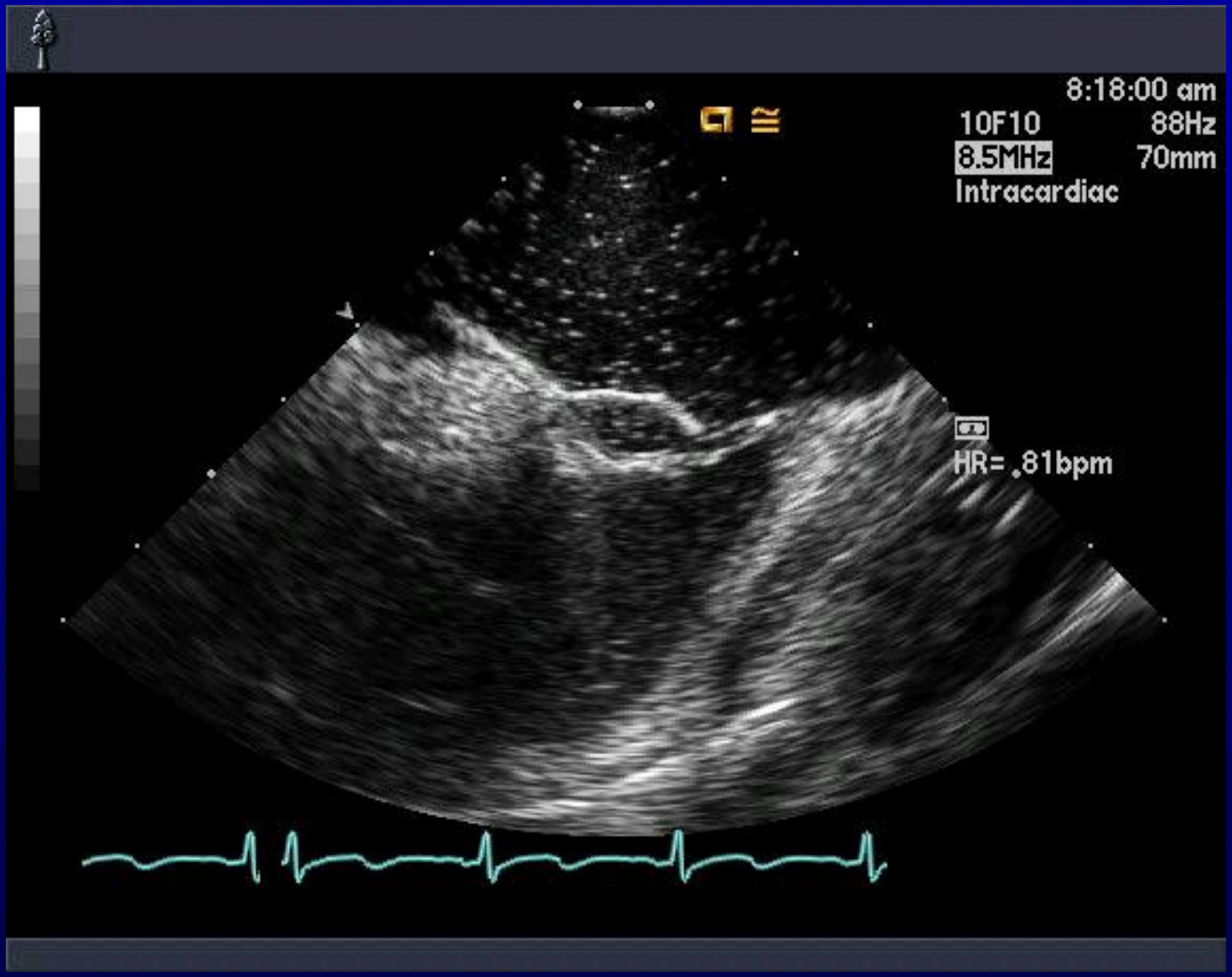


ASD closure with
Amplatzer device

Closure of atrial septal defect



Closure of atrial septal defect

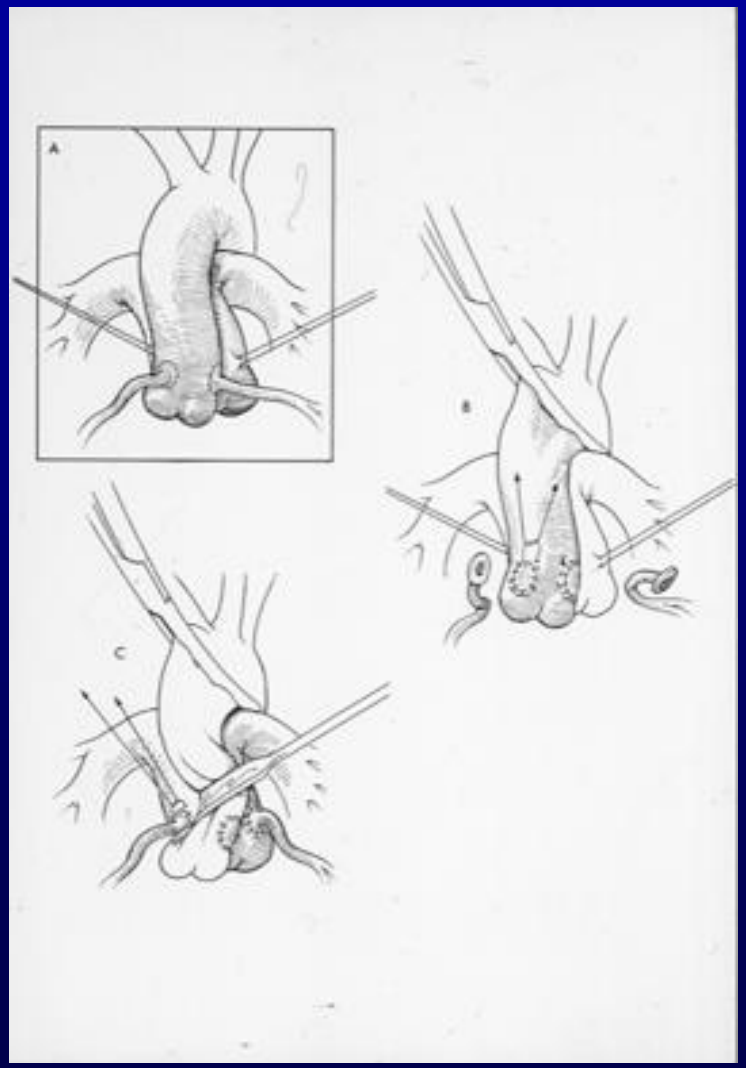


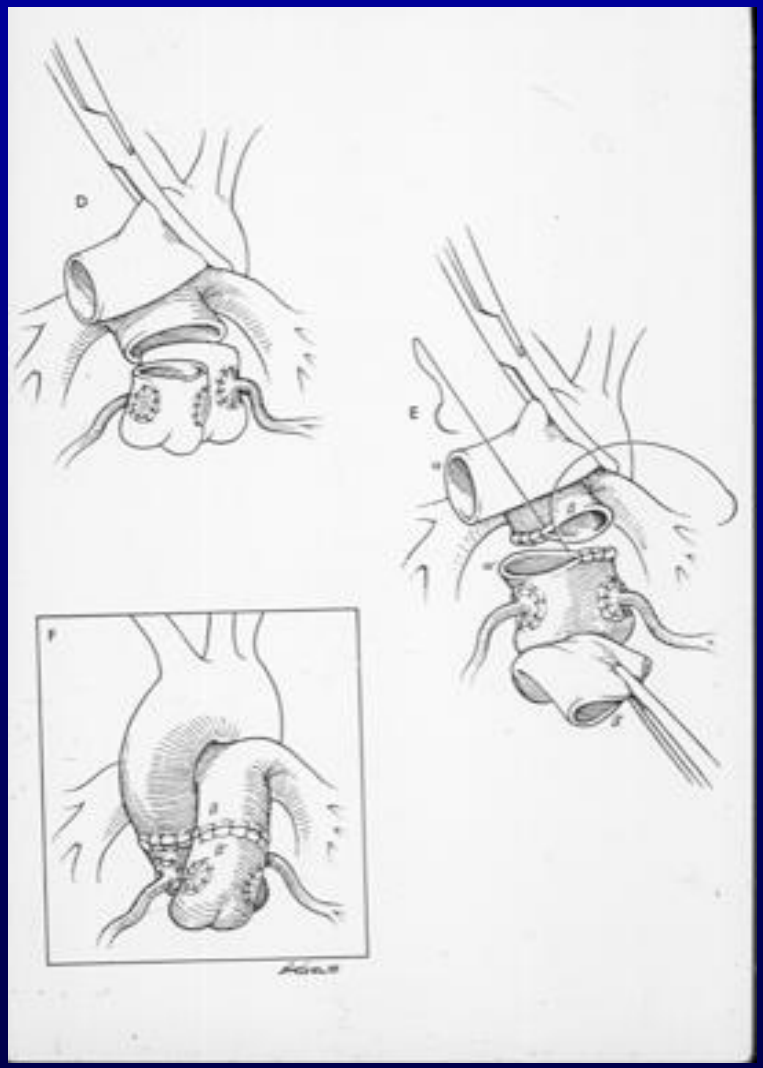
TREATMENT OF RIGHT TO LEFT SHUNTS

ESSENTIALLY SURGERY !

- FALLOT: COMPLETE REPAIR
- TRANSPOSITION: ARTERIAL SWITCH

TRANSPOSITION: Arterial SWITCH operation





Treatment of pulmonary valve stenosis
Balloon valvuloplasty

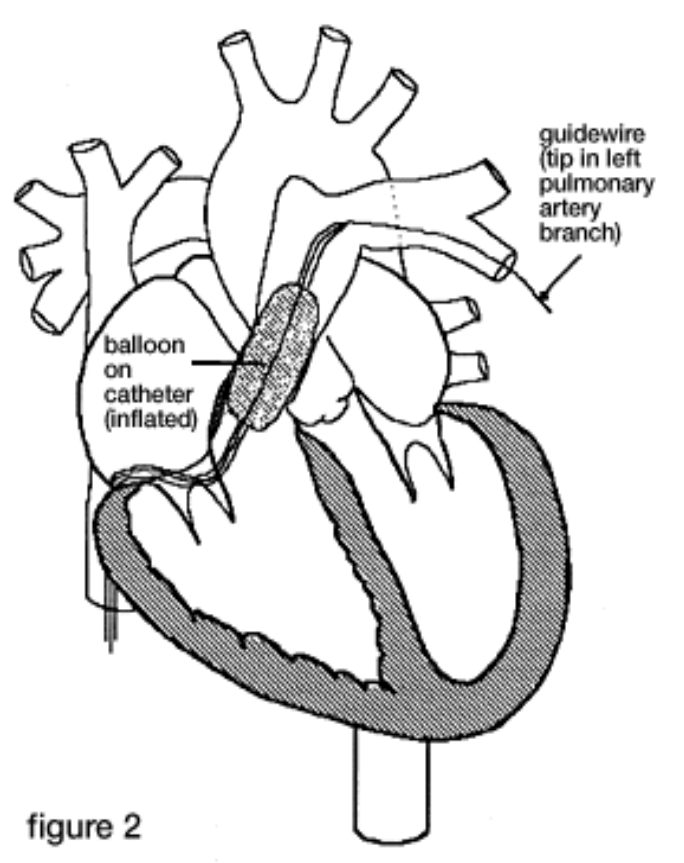
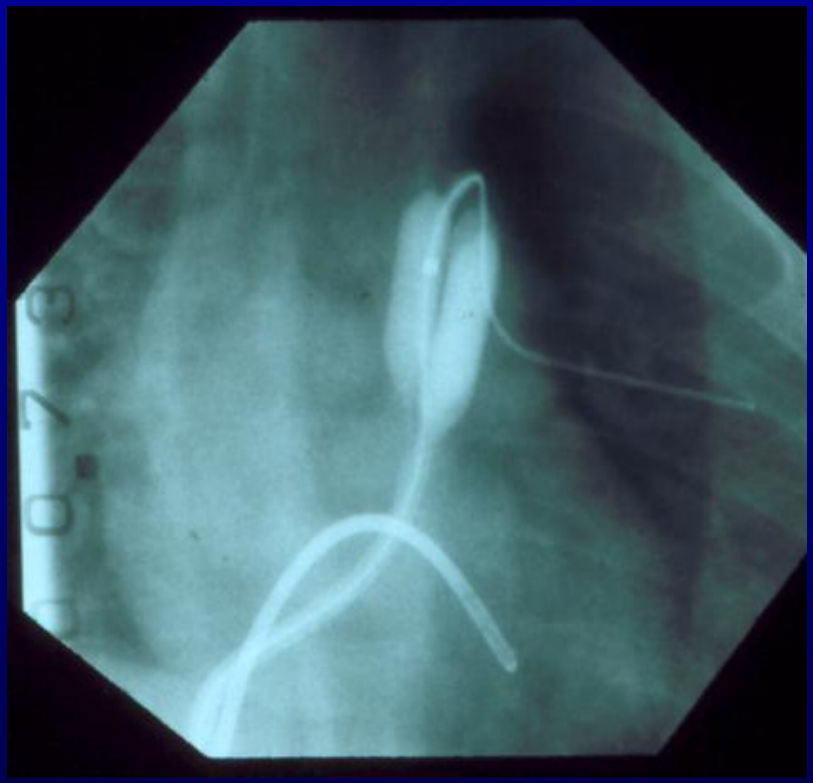


figure 2



CONCLUSIONS 1

- Pathophysiology remains a useful approach to the understanding and classification of Congenital Heart Defects
- It helps to understand the resulting symptoms and possible complications

CONCLUSIONS 2

- A majority of congenital heart defects can be corrected with surgery,which has been steadily improving over the last 60 years
- Over the last 25 years, catheter interventions have replaced some surgical procedures