

LEFT-RIGHT SHUNT CONGENITAL CARDIOPATHY

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Abstract: Heart diseases with left to right shunting are the most frequent congenital heart diseases. All of them have in common the increase of pulmonary blood flow. Because of the abnormal communication between the heart cavities and vessels, the passage of the oxygenated blood from the systemic circulation into the pulmonary circulation increases. The evolution of congenital heart diseases is dominated by the irreversible alteration of the pulmonary blood vessels resulting in time, in fixed pulmonary hypertension. Medical discoveries, especially echocardiography combined with Doppler examination, and surgical progressions, that made possible corrective heart surgeries in younger ages, brought about better results in pediatric cardiology.

Keywords: congenital heart diseases, congenital cardiac shunts

Rezumat: Cardiopatiile responsabile de un shunt stânga-dreapta sunt cel mai frecvent cardiopatiile congenitale. Ele au toate în comun creșterea debitului sanguin pulmonar. Datorită prezenței comunicării anormale între cavități sau vase se antrenează pasajul sângelui oxigenat din marea circulație în mica circulație. Evoluția lor este dominată de riscul alterării ireversibile a vaselor circulației pulmonare, ducând spre hipertensiune arterială pulmonară fixă. Progresele medicale, grație ecocardiografiei cuplate cu examinarea Doppler și a progreselor chirurgicale, care au permis operarea copiilor la vârste tot mai mici prin cura completă, au adus foarte bune rezultate în cardiologia pediatrică.

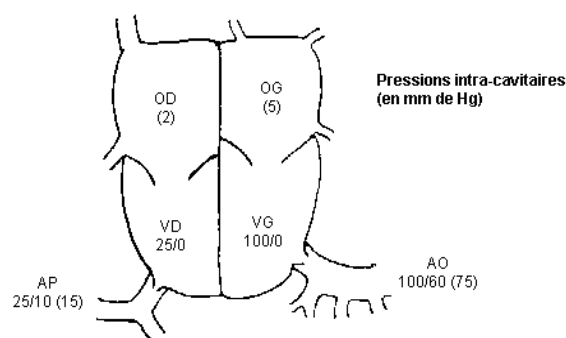
Cuvinte cheie: cardiopatii congenitale, cardiopatii cu shunt.

INTRODUCTION

A left to right shunt is a quantity of saturated blood that passes from left to right and overcharges the pulmonary blood flow. It is recognized by pulmonary and cardiologic clinical signs, pulmonary hypervascularity on radiography and echographic signs.

Physiopathology.

Picture no.1 Normal hemodynamics



The hemodynamic regime between the two types of circulations is brought about the following formula: $P = Dc \times R$ (resistant).

A left-right shunt consequences:

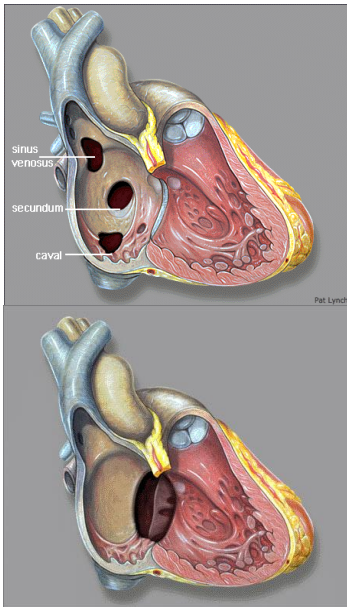
- Oxygen improvement of blood from the right cavities;
- Increase of the pulmonary flow ($DP > DS$), with the dilatation of the pulmonary artery that stimulates ventilatory disorders (dyspnoea, suprainfections) and hypervascularisation on radiography.
- Increased blood pressure in the pulmonary artery may lead to HTAP.
- Stature-ponderal retard and thoracic deformation (through sternum bowing).

INTERARTERIAL COMMUNICATION

Interarterial communications correspond to different types of dehiscences of the interarterial septum.

- Their frequency is of about 8%- 10% of the congenital cardiopathies.
- Four anatomic varieties of interarterial septum defects are described:

Picture no. 2. Interarterial communication



- ASD ostium secundum type is the most frequent atrial septal defect (70 %)
- ASD sinus venosus type, placed near the superior vena cava, represents 7% of the total number of ASD.
- ASD ostium primum type is a large dehiscence of the caudal part of the interauricular septum. (4%).
- ASD down placed near the inferior vena cava (18%).

Evolution

- Small central atrial septal defects (<5 mm) may close spontaneously until the age of 2 years old;
- Atrial septal defects are usually well tolerated until adult age;
- A fixed arterial hypertension may occur rapidly between 20 and 30 years old, exceptionally before the age of 15.
- Effort tolerance with cardiac insufficiency and rhythm disorders (flutter and auricular fibrillation) may occur around the age of 30-40 years old.

Treatment

Surgical closure

It is made in CEC (extracorporeal circulation) through median sternotomy or through right under-mammary, anterolateral thoracotomy during adolescence in girls. Risks are very low. Hospitalization is around 15-20 days.

Endocavitary closure

It is made by closing the deficiency with obturating prosthesis, using the duct of the femoral vein. Nowadays, this method seems to be the most viable for closing the central septal defects, which are small-sized and well limited. Endocavitary closure avoids the unaesthetic scar, reduces the hospitalization period of time. Complications (perforation, prosthesis enlargement, embolism) are rare and the closure is total.

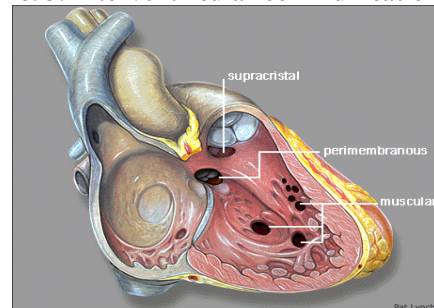
Indications:

- ASD large and badly clinically tolerated – surgical closure is required as soon as possible;
- ASD large ($VD/V_S > 1$) – surgical closure is recommended until the age of 5;
- ASD medium ($2/3 < VD/V_S < 1$) – in girls – yearly surveillance and closure though catheterization or thoracotomy after adolescence; in boys – surgical closure until the age of 5.
- ASD central small; catheterization is recommended.

Evolution after treatment:

The interarterial communications surgically closed during childhood should be considered healed. Surveillance supposes a cardiologic exam every three years until adolescence.

Picture no. 3. Interventricular communication



Interventricular communication is the defect of the interventricular septum. Interventricular septal defect may be isolated or within a complex cardiopathy. Interventricular communication is one of the most frequent congenital cardiopathies; in the first year of life, it represents 30% of the cardiac malformations.

Ventricular septal defects may be diagnosticated prenatally, as well. Specialized consultation should be given even from the first months of life.

- VSD small – well tolerated
- VSD large – presents respiratory sound between 1 and 18 months old through pneumonias with spastic component. Pulmonary resistances may become fixed between 6 and 9 months.

Irrespective of size, ventricular septal defects:

- Tend to close or to reduce size in the first year of life;
- Presents bacterial endocarditic risk;
- Presents risk of aortic insufficiency if VSD is high, under aorta;
- Risk to develop subpulmonary stenosis if it is perimembranous;
- Presents risk to develop a subaortic membrane if it is perimembranous;

Ventricular septal defects may occupy different places at the level of the interventricular septum:

- Perimembranous VSD is the most frequent; it is placed at the junction between tricuspid and aorta. It may be closed through an aneurysm made up of the accessory tricuspidian tissue.

ESSAYS

- Trabecular muscular VSD which may be multiple (more difficult to be closed surgically);
- Infundibular VSD is more rarely. It is placed subaortically and subpulmonarily and may stimulate the deformation of the aortic or pulmonary ring;
- Admission VSD placed in the posterior part of the interventricular septum, being in contact with the atrioventricular valve.

Evolution:

Interventricular communications tend to evolve towards size reduction or closure in the first year of life or during adolescence. It is necessary that certain risks should be foreseen:

- Until the age of 6–9 months, respiratory insufficiency could be observed;
- After the age of 9 – 12 months, pulmonary arteriolar resistances are fixed;
- Hypokinetic myocardiopathy rarely occurs after a number of months or years of diastolic overcharge of the left ventricle and it usually associates the mitral insufficiency through the dilation of the mitral valve ring.
- Bacterial endocarditis prophylaxis should be followed in all ages;
- Aorta insufficiency occurrence should be supervised in the case of infundibular VSD;
- It may develop an infundibular stenosis at the level of the right ventricle in the case of a primum membranous VSD;
- Progressively, a subaortic membrane may occur, starting from the level of the inferior border of a perimembranous VSD.

Catheterization

Catheterization is not indispensable; it becomes indispensable if the quality of the echographic image is not of quality or if there is doubt regarding the presence of a pulmonary hypertension. The cases of interventricular communication through multiple muscular defects require catheterization.

Treatment:

The only treatment in the case of ventricular septal defects is their closure. Closure may be spontaneous or surgical.

If the clinical health state allows, medical treatment may also be made until the surgical correction, or if, there is any counter indication of the surgical closure, cerclage of the pulmonary aorta may be proposed. (pulmonary banding).

Medical treatment:

The medical treatment is the treatment for a left to right shunt which is badly tolerated:

- *Digoxin*: 10 – 15 µg/kg/day p.o. in two doses in infants.
- *Furosemid*: 1-2 mg/kg/day p.o. in one or two doses with potassium chloride or in association with Spironolactone.

- *Conversion enzyme inhibitors*: 1- 4 mg/ kg/day in progressive doses (30-50 mg/m²/day) in two doses. (Captopril, Enalapril, Lisinopril)
- *Iron preparations* in order to prevent anemia in infants.
- *Transfusion* for anemia adjusting or for the increase of the haemoglobin towards the value of 14-15g%.
- *Respiratory kinesitherapy* in case of bronchial suprainfection.
- Diets with denser and richer meals regarding all food principles.
- Surgical correction should not be late “insisting” on medical treatment; respiratory distress, ventilation disorders or an important overweight hypothyroidism should not be waited.

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