Reconstruction of right ventricular outflow tract in congenital heart surgery

In Romania, congenital heart disease plays an important role among congenital pathologies in children. It has multiple causes, such as poor diet, use of teratogenic agents, toxic substances and radiation during pregnancy, lack of information about risks factors that can affect the mother, and an inadequate technical support for detecting congenital heart disease in utero or in immediately postnatal period.

Congenital heart diseases involving right ventricular outflow tract have an incidence of 27% among all cardiac congenital diseases, so I proposed to study the incidence of this malformation in our setting, to study the risk factors and the etiology, to determine appropriate protocol for investigations and to study the best suited surgical techniques for each case in part.

In this retrospective clinical study, we included all patients (226 cases) with right ventricular outflow tract obstruction, operated in between 2005-2010 in the Institute of Cardiovascular Diseases and Transplantation Tg-Mures, Department of Pediatric Cardiovascular Surgery. We analyzed the incidence of these malformations, the usefulness of different methods of investigation/ screening, sex and age of patients in whom surgical intervention were performed, different surgical interventions and the results of different surgical correction, postoperative complications and mortality. The mean age of patients enrolled in this study was 3.3 ± 4.5 years.

In 64 children palliative interventions were performed, consisting in peripheral (44) or central (20) systemic-pulmonary shunts, representing 28.3% of all surgical interventions made on right ventricle outflow tract. Most shunts (62%) were performed in the first 1-12 months of life, in 24 cases for pulmonary valve atresia, in 37 cases for valvular or subvalvular stenosis in tetralogy of Fallot, in one patient with severe hypoplasia of the main pulmonary artery and branches and in 3 cases for severe pulmonary valve stenosis. Complications were: postoperative hemorrhage, renal dysfunction, thrombosis and chilotorax. In patients with systemic-pulmonary shunts, the short term mortality was 4.54%.

In 162 patients corrective interventions were performed in cardiopulmonary bypass. The mean cardiopulmonary bypass time was 134 ± 35 minutes, myocardial ischemia 88 ± 28 minutes. In pulmonary stenosis, when only valvuloplasty had to be done, the surgical intervention was made in cardiopulmonary bypass with beating heart.

In 136 cases right ventricular outflow tract enlargement was made, infundibular muscle resection was performed as single intervention in 19 patients and associated with ventricular septal defect closure or pulmonary valvuloplasty in 117 cases. The right ventricular outflow enlargement was made with heterologous pericardium and pulmonary valvuloplasty in 61 cases and in 75 patients patches from heterologous
pericardium and PTFE were used. In 5 patients valve replacement was necessary, in 16 cases pulmonary valve preservation was possible. In our setting heterologous pericardium conduits made in our laboratories were implanted as well as bovine jugular vein conduits (Contegra) or Dacron conduits with tissue valve (Hancock).

In 121 (85%) out of the 142 children who underwent right ventriculotomy or right ventricle outflow tract resection presented at 24-72 hours postoperatively low cardiac output syndrome due to decreased right ventricular compliance and low filling capacity, ventricular edema. All patients required inotropic support (dopamine, dobutamine, milrinone or adrenaline), in 26% of cases higher doses were necessary. Tricuspid valvuloplasty was performed in 46 cases.

The most common complications encountered after corrective interventions were postoperative hemorrhage (11 children), systemic infections (3 cases), atrioventricular block (4 patients), residual ventricular septal defect (11 children), residual right ventricular outflow tract obstruction (26 children), moderate pulmonary insufficiency (18 patients), right ventricular dysfunction or heart failure (11 children).

In conclusion we can say that the incidence of the congenital cardiac pathology which includes stenosis of the right ventricular outflow tract is about one third of all congenital heart diseases.

The age at which surgery is indicated in these patients is becoming smaller as the resolution of early surgery may influence the further development of the child.

Enlargement techniques of right ventricular outflow tract include palliative techniques, intermediate or definitive techniques, use of biological or synthetic materials in order to minimize risk and to ensure correction as close to physiological values as possible.

The most frequent surgical interventions studied were those for correction of tetralogy of Fallot, muscle resection, right ventricular outflow tract enlargement by different methods and techniques, followed by palliative interventions and tricuspid valvuloplasty. In patients with tetralogy of Fallot, total correction was performed generally after the age of 6 months, under this age we preferred palliative surgery (systemic-pulmonary shunt).

According to our experience, the optimal time for primary definitive correction is at age between 6 and 12 months. Postoperative morbidity and mortality found in our setting is comparable to those reported in the literature, the most common postoperative complications were pulmonary regurgitation, postoperative bleeding, residual outflow tract stenosis, arrhythmias, postoperative infections and right ventricle dysfunction / failure.