Echocardiography in congenital heart disease in children

Thesis

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The modern noninvasive imagistic methods make cardiology the most “technical” medical specialty, improving the possibilities of the cardiac anomalies diagnosis and treatment. Among these methods, echocardiography became the first line cardiovascular investigation in adults and children. This fact grew precision in the diagnosis of congenital cardiopathies, fact that I am personally convinced after 9 years of pediatric activity at the cardiology department, and that was the main reason that determined me to choose this subject as the theme of my thesis: “Echocardiography in congenital heart diseases in children”. The principal desiderate of the modern pediatric cardiology is the precocious positive diagnosis of congenital cardiopathy, if possible in the antenatal period, where echocardiography has a substantial importance in adequate postnatal therapy and saving a baby’s life. This is the desideratum towards the Romanian society also tends to proceed, implicitly the pediatric cardiology and pediatrics from our country. Life expectancy of patients with congenital heart defect (CHD) grows due to the success registered in the definitive repair treatment, but at the same time we assist to a significant increase of the CHD frequency in children in Romania, which impose increased efforts for a correct and precocious diagnosis and surgical treatment. In this sense, we tried to appraise the possibilities for diagnose of the congenital diseases in a pediatric cardiology department or in a pediatric hospital which benefit of a permanent connection with a pediatric cardiovascular surgical department. The aim of the thesis was, besides that of the positive diagnosis, the evolution of the patients with CHD from the moment of diagnosis up to the surgical treatment and, afterwards, to those recuperative. We studied the difficulties of the diagnosis and the factors which causes a delay in a positive diagnosis, the performances obtained with the echocardiographic examination comparative with other methods (chest X-ray, electrocardiogram, cardiac catheterization etc.), and each cases evolution, operated or not. We wanted also, to found which were the incidence of the principal cyanogens and without cyanogens CHD in children in our country, knowed that doesn’t exist a clear statistical in
this sense in Romania, so far. Chapter I of the thesis present the news from the literature concerning to the echocardiographic examination, utility of the echocardiography, the limits and the traps of the echocardiographic exam, basic notions of the ultrasounds, strategy and plans of examination, M mode, 2D and Doppler echocardiography, and some data concerning the new methods of echocardiographic exploration. In chapter II we presented the most important data concerning the incidence, etiology, clinical manifestations and treatment of CHD and in chapter III we presented the echocardiographic examination in principal cardiac congenital malformations in newborn, children and teenager.

The special part of thesis contained three chapters of our research. I entitled first chapter (chapter IV in our thesis): The epidemiological, clinical, imagistic and therapeutic study of the cases with congenital heart disease admitted in Pediatric Cardiology Department from Targu - Mures during the last 7 years. We studied 10436 patients admitted in Pediatric Cardiology Department from Targu- Mures during January 2000 - December 2006, aged between few hours of life and 18 years. As a methodology of work we used anamnensis, family and personal (physiological and pathological ) antecedents, signs and symptoms of a cardiac disease which include: fatigabilities, dyspnoea, cyanosis, squatting, miss of knowledge, the palpitations, present of a heart murmur, and the objective examination were axed in principal on the cardiovascular apparatus. For the diagnosis we used the electrocardiogram and chest X-ray, as a first step, and than the echocardiographic exam, a noninvasive examination capable to put an anatomic and functional diagnosis of the congenital heart malformation, and to exclude a CHD in children with a functional cardiac murmur. A deep level of investigation consist in the cardiac catheterization and angiographies performed only in a certain selected cases, reserved the scintigram and MRI just for some special cases. We estimated the benefit obtained from the diagnosis of CHD, insisting on the contribution of the echocardiographic examination for the type, severity of the cardiac malformation and adequate surgical treatment, as well as for the each case prognosis. The results of our investigations were presented in a number of tables, charts, echocardiographic images, and were statistically processing, using CHI square test, $p$ values less then 0,05 were considered statistically significant. In the chapter V we studied the contribution of the echocardiography in the diagnosis, medical and surgical treatment of the uncyanogenes congenital heart diseases and in the chapter VI we presented several considerations of the diagnosis and treatment concerning of the cyanogenes congenital heart diseases admitted in Pediatric Cardiology Department from Targu-Mures between 2000- 2006. The conclusions of our research are followings:
During 2000-2006 were admitted in Pediatric Cardiology Department from Targu Mures a number of 4207 children with congenital heart disease, boys and girls, aged between a few hours of life and 18 years, for diagnosis and medical or surgical treatment. The most frequently age group founded was that with age between 3 to 18 years (56% of cases), followed by that between 0 - 1 years (27%), and that between 1 to 3 years (17%). The clinical general examination with accent on the cardiovascular apparatus, especially the auscultation of the heart, remains a valuable examination in the diagnosis of the CHD in 80% of cases, permitting to send these children for supplementary investigations in an experienced pediatric cardiology department. The chest X-ray and electrocardiogram, together, are capable to change the suspicion of a CHD in 40-45% of cases, but the main investigatory method were and remains the echocardiography, with a sensibility about 99% of cases, comparable with informations obtained from the foreign literature. The uncyanogenes CHD are the most frequently cardiac malformations, registering a proportion of 85,88% and those cyanogenes represented the second category of cardiac malformations, registering a proportion of 14,12% from all cases with CHD hospitalized in the Pediatric Cardiology Department from Tg. Mures during 2000 - 2006. Thus, were admitted 3613 cases with uncyanogenes CHD and 594 cases with cyanogenes CHD, boys and girls. The number of cases increased in the latest years of our study, thus the number of the cases with uncyanogenes CHD increased from 264-365 cases on year in the first part of the study to 709-814 cases on years in the last part of the study, and those with cyanogenes CHD increased from 47-78 cases on year to 136-161 cases on year in the last part of our study. Studying the type and the number of the cases with uncyanogenes CHD we found the presence of a four most frequently uncyanogenes malformations: atrial septal defect, ventricular septal defect, patent ductus arteriosus and atrioventricular defect, and six cyanogenes malformations: tetralogy of Fallot, transposition of the great arteries, truncus arteriosus, double-outlet right ventricle, tricuspid atresia and univentricular heart. The most frequently uncyanogene CHD met for us in this study were: atrial septal defect, present in a proportion of 21,65% of all CHD with a statistical significant difference (p < 0,05) from the literature data (reported at 6 – 10%) where the principal CHD is the ventricular septal defect (20%) found by us in a proportion of 14,66% of all CHD. There are not significant differences between our data and foreign data regarding the atrioventricular defect, the pulmonary stenosis, aortic stenosis and mitral insufficiency, but in the coarctation of the aorta our data (1,35%) are significantly different from those reported in the literature (6-8%), p = 0.01. The most often cyanogene cardiac malformation met in our study is the tetralogy of Fallot, we found identically date in
Romania with those from the special foreign literature regarding the all cyanogenes CHD. A number of 482 cases with uncyanogenes CHD (13.23% from all cases with uncyanogenes CHD), as well as 190 cases with cyanogenes CHD (31.94% from all cases with cyanogenes CHD) were surgical treated, the majority of the selected cases for surgery were diagnosed only with echocardiography. The catheterism and angiocardiography were performed only in a few cases with severe pulmonary high blood pressures, for a correct appreciation of the pressures in the pulmonary artery, pulmonary resistances, the anatomy of peripheric pulmonary branches and coronary circulation, but in the last years these procedures were used mostly for the interventional treatment. We observed a gradually increased of the operated cases, result of an increased incidence of the congenital heart diseases in Romania and a better addressability of the patients to the medical services of the Pediatric Cardiology Department, part of the Institute of Cardiovascular Disease and Transplantation from Tg.Mures, as well as for the permanent improving of the medical team performance (surgeons and pediatric cardiologists), and also secondary to the increased interest in approaching the complex cases, especially in the emergency neonatal pathology. We found a reduce level of mortality in uncyanogenes CHD (0.35%), comparable with data from other countries. Even if we registered a number of 44 deaths from cyanogenes CHD (7.40%), and 4.71% (from total cyanogenes CHD) postoperative deaths, we consider these results encouraging according to the complexity of malformations, little age of the patients and the precarious clinical status of the majority of these patients, which were late diagnosed in territory and, frequently, sent and transported in an inappropriate conditions. For the improvement of the CHD management in Romania, it is necessary to increase the number of operated cases and decrease the cases without medical solutions, through a permanent information of the physicians and patients’ family about the severity of the CHD in children. The results of our study impose echocardiography as an indispensable method for the diagnosis of the CHD, before and after surgical treatment, and also for those cases who doesn’t required surgery. In conclusion, echocardiography performed with high performances equipments, using the newest ultrasounds techniques, done by specialized physicians, represent the principal method of investigation for the diagnose in CHD, permitting the cardiac examination in the preoperative and postoperative periode and also for follow-up in children with congenital heart diseases to avoiding the lethal complications.