

UNIVERSITY OF MEDICINE, PHARMACY, SCIENCE AND TECHNOLOGY
"GEORGE EMIL PALADE" FROM TÎRGU MUREȘ

SCHOOL OF DOCTORAL STUDIES

PHD THESIS SUMMARY

INNOVATIVE RESEARCH INTO COARCTATION OF THE AORTA IN CHILDREN

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INTRODUCTION:

Coarctation of the aorta (CoA) is a congenital malformation characterised by a narrowing of the aortic lumen, usually between the origin of the left subclavian artery and the junction with the ductus arteriosus. It accounts for approximately 4-8% of congenital heart defects and is more common in males. CoA is often associated with bicuspid aortic valve, which occurs in 50-85% of cases and contributes to aortopathies and long-term cardiovascular complications.

The narrowing of the aorta may be accompanied by histological and structural changes that favour the development of hypertension, early atherosclerosis and myocardial infarction, even after surgical correction. Prenatal diagnosis of CoA is difficult, especially in the third trimester of pregnancy, despite advances in echocardiography. Parameters such as CSAi and I/D index have proved useful in making the diagnosis. Management of CoA includes surgical or interventional correction. The surgical technique of choice in neonates is end-to-end anastomosis, whereas balloon angioplasty or stent implantation is preferred in older children and adults. Early treatment has reduced the mortality associated with this condition, but patients remain at increased long-term cardiovascular risk.

OBJECTIVE:

The current study was based on the hypothesis that CoA is frequently associated with bicuspid aortic valve. This association is of particular importance because bicuspid aortic valve is associated with an aortopathy most commonly characterised by progressive dilatation of the aortic root, thus increasing the risk of complications secondary to both bicuspid aortic valve and CoAo in these patients. With advances in multimodality imaging, rapid advances in the interventional treatment of this pathology, and the accumulation of data on the mid- and long-term postoperative outcomes of these patients, important advances have been made in the diagnosis and therapeutic management of these cases. There is now a growing body of evidence describing CoA as a generalised arteriopathy. This describes an increased risk of myocardial infarction due to hypertension and/or atherosclerosis, which tends to develop prematurely even after surgical correction of the defect. The increased cardiovascular risk in this group of patients is described as being due to hypertension and atherosclerosis even if they were not present in the preoperative period. These patients therefore require lifelong cardiological monitoring.

In this context, correlations were made between anthropometric, biological and echocardiographic data in patients who underwent surgical treatment for CoAo and in those in our registry diagnosed with bicuspid aortic valve.

GENERAL METHODOLOGY:

The studies described in this paper were of two types: retrospective and prospective. The respective groups comprised 102 and 123 patients, evaluated at the Paediatric Cardiology III Clinic of the Emergency Institute for Cardiovascular Diseases and Transplantation in Targu Mures.

The first study included 102 patients diagnosed with CoA who underwent surgical treatment between January 2018 and 7 October 2024, aged between 0 and 17 years.

The second study was conducted between 10 January 2023 and 10 January 2024. The study population comprised patients aged between 6 and 17 years who had been diagnosed with bicuspid aortic valve disease at the Cardiology Clinic III. The study population also included a control group of healthy children.

The inclusion criteria for the two studies were: age 0-18 years, patients diagnosed with CoA and undergoing

surgical/interventional treatment of CoA, patients with bicuspid aortic disease and periodically re-evaluated, healthy children.

The study was approved by the Ethics Committee of the University of Medicine, Pharmacy, Science and Technology "George Emil Palade", Țirgu Mureș (No. 3359, 07.10.2024). All procedures in the study were performed in accordance with the ethical standards of the Declaration of Helsinki, and the analysis protocol was approved by the Ethics Committee of the Emergency Institute for Cardiovascular Diseases and Transplantation, Țirgu Mureș (No. 7563/11.09.2024).

RESULTS:

STUDY 1- COARCTATION OF THE AORTA AND BICUSPID AORTIC VALVE IN CHILDREN

The study included 102 patients diagnosed with CoA, 68.3% of whom had bicuspid aortic valve. The analysis showed that:

- Patients with CoA and bicuspid aortic valve have significant haemodynamic and structural differences compared to those with isolated CoA.
- The echocardiographic parameters CSAi <1.5 and I/D <0.64 correlated with the severity of CoA.
- Common postoperative complications include aortic recoarctation and secondary hypertension.

STUDY 2 - THE CONTRIBUTION OF NEW IMAGING TECHNIQUES IN THE QUANTIFICATION OF LEFT VENTRICULAR FUNCTION IN PAEDIATRIC PATIENTS WITH BICUSPID AORTIC VALVE AND COARCTATION OF THE AORTA

Speckle-tracking assessment revealed subclinical left ventricular dysfunction in patients with CoA and bicuspid aortic valve, with reduced global longitudinal strain (GLS) values compared to the control group. This parameter may identify early myocardial dysfunction and help optimise long-term therapeutic management of these patients.

GENERAL CONCLUSIONS

Despite adequate treatment, patients with CoA remain at risk of cardiovascular complications, including recoarctation, hypertension and aortic regurgitation. Detailed echocardiographic screening and long-term monitoring are essential to reduce morbidity and mortality in this group of patients.

ORIGINALITY OF THE THESIS:

This study stands out because it clarifies some key points that have been unclear in medical practice regarding the use of different echocardiographic indices with increased specificity and sensitivity in paediatric patients with CoA. Also, a greater distance between the left common carotid artery and the subclavian artery can be considered an indirect sign of coarctation regardless of the age of the patients. Contemporary medicine is grounded in the utilisation of minimally invasive diagnostic methodologies, which minimise the exposure of patients to the adverse effects associated with more invasive procedures during the diagnostic process. Thus the value of the thesis is increased by the fact that we were able to emphasise the importance of echocardiographically

determined indices in establishing the diagnosis of aortic coarctation. Moreover, the originality of this work lies in the comparison of patients groups from several perspectives: the presence or absence of bicuspid aortic valve, their age and echocardiographic parameters.

The present study has utilised the speckle tracking technique to evaluate the contractile function of the left ventricle, thereby highlighting subclinical contractile dysfunction in patients who have undergone surgical treatment for this pathology, with ejection fraction considered normal prior to treatment. There is also a need for further long-term studies in this group of patients to determine whether reduced values of longitudinal and segmental strain can serve as a marker to identify patients with subclinical heart failure in the absence of complications secondary to aortic coarctation.