Results After Surgical Correction of Coarctation of the Aorta in Adults

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KEYWORDS
Aortic coarctation, Surgical repair, Retrospective study, Hypertension.

ABSTRACT
Aim: This retrospective study aimed to determine the impact of coarctation surgical repair on arterial blood pressure in adults over 18 years of age. Materials and methods: This retrospective study included 17 patients with aortic coarctation in QSUT, Cardiac Surgery Service, from January 2007 to March 2024. Results: 22 patients with coarctation of the aorta included in this study were mostly male12(70%) versus 5 (30%) females. All patients had preoperative hypertension. Main systolic blood pressure was 160 ± 28mm Hg (range, 120 to 220 mm Hg). All patients had preoperative CT Angiography (the mean gradient across the coarctation was 62 ± 27 mm Hg). After surgical repair, the mean gradient was 24 ±4.3 mmHg. The operative technique was an extra-anatomic bypass for 22 patients. Of the 22 patients with preoperative hypertension, 5 were normotensive (systolic blood pressure ≤ 140 mm Hg, diastolic blood pressure ≤ 90 mm Hg) with no medication. 4 patients were receiving medication: 1 required single-drug therapy, and 3 patients required two drugs. There were no repeat operations. No patient had evidence of a cerebrovascular accident. There were no hospital deaths and no late morbidity. Conclusions: Surgical repair of coarctation in adults has proved to be an effective procedure and significantly reduces arterial hypertension. However, long-term surveillance is mandatory and should include exercise testing to identify patients with potential hypertension. Echocardiography is the most patient's friendly method to evaluate CoA.

1. Introduction

The heart, a vital organ situated in the middle mediastinum behind the sternum, serves as the central hub for blood circulation. Its conical shape, with the apex directed downwards and to the left, houses four chambers that play crucial roles in managing the body's oxygen supply. Among various congenital heart conditions, coarctation of the aorta (CoA) emerges as a significant defect, characterized by a narrowing of the aorta, the primary vessel responsible for delivering oxygen-rich blood throughout the body [1].

CoA accounts for approximately 6-8% of congenital heart disease cases, with a prevalence rate of 409 cases per million live births [2]. It ranks as the sixth most common congenital heart anomaly, with an incidence of about 1 in 2,500 births, predominantly affecting males [3]. Notably, about 64% of cases manifest soon after birth, while others may not present until later in life, often revealing symptoms like hypertension and heart failure. Early diagnosis is critical; prenatal detection of CoA can lead to improved outcomes, including higher survival rates and better preoperative conditions. The underlying etiology of CoA remains largely speculative, with theories ranging from hemodynamic influences during fetal development to the abnormal contraction of ductal tissue after birth. Several maternal risk factors, including alcohol and drug use, as well as infections during pregnancy, have been associated with increased risk for congenital heart defects, including CoA.

Clinically, the manifestations of CoA can vary significantly. In neonates, signs such as poor feeding, shock, and heart failure are common, while older children and adults may experience persistent hypertension, headaches, and claudication. Physical examination often reveals characteristic findings, such as differences in blood pressure between the upper and lower extremities, as well as distinct heart sounds. In Albania hypertension has been shown to increase the past decade [4].

Diagnosing CoA involves simple yet effective techniques such as blood pressure measurements and pulse evaluation. Advances in prenatal imaging, particularly 3D and 4D modalities, hold promise for early detection. Even mother weight have been shown a risk factors for birth congenital defect [5]. Once diagnosed, treatment approaches may include pharmacological management to alleviate heart failure symptoms and surgical intervention to correct the aortic narrowing. Understanding coarctation of the aorta is crucial for healthcare professionals, as early recognition and appropriate management can significantly improve patient outcomes and reduce long-term complications associated with this congenital defect.

Once diagnosed, the treatment of CoA may vary depending on the age of the patient and the severity of the condition. Early interventions often include pharmacological management for heart failure and stabilization,

while late interventions may focus on surgical correction and the management of hypertension. This section outlines diagnostic techniques, nursing considerations, and treatment strategies vital for addressing CoA effectively.

2. Objectives

This retrospective study aimed to determine the impact of coarctation surgical repair on arterial blood pressure in adults over 18 years of age.

Specific objectives:

- Collection of epidemiological data such as sex, age group
- Overview of the main symptoms with which the patients presented
- Data on associated abnormalities, type and corresponding frequencies
- Presentation of intraoperative data including the type of surgical technique
- Determination of hospital mortality

3. Methods

In this retrospective study, 22 patients with coarctation of the aorta admitted to the Cardiac Surgery service at QSUT were included, in the period January 2007-March 2024. The data were obtained from the files near the Statistics service at QSUT as well as from the operative sheets in the Cardiac Surgery ward. Patients are predominantly male (70%) versus female (30%). All patients underwent surgical intervention for the correction of CoA.

Study variables that were obtained from clinical chart data included:

Questionnaire:

1. Gender

- Man
- Female

2. Distribution by age group (18-58 years)

- 18-20
- 21-30
- 31-50
- 51-60

1. Associated anomalies

2. Main complaints

3. Values of TA

- in bed
- exit

4. Type of surgical intervention

5. Days of stay

- Hospital
- Reanimation
- Post-operative

6. Max I CoA gradient

- In bed
- On the way out

4. Results

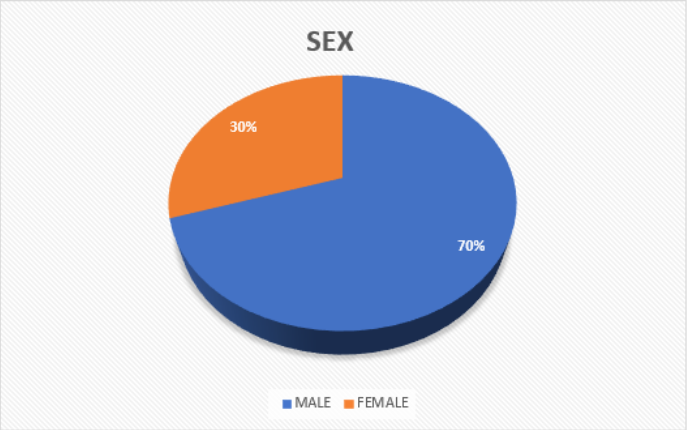
The results of our study are as below:

Table 1. Distribution of patients by sex.

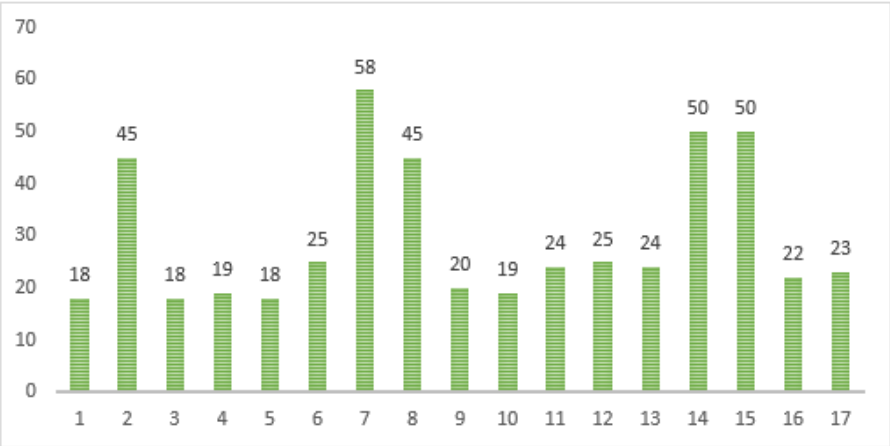
Sex	Nr. Of case
Female	7
Male	15
Total	22

The table presented above shows a predominance of the male sex in relation to females. The ratio of the number of male/female patients is 2.4.

The graph below shows the percentage representation by gender, and men account for 70% of cases, while women account for 30%.

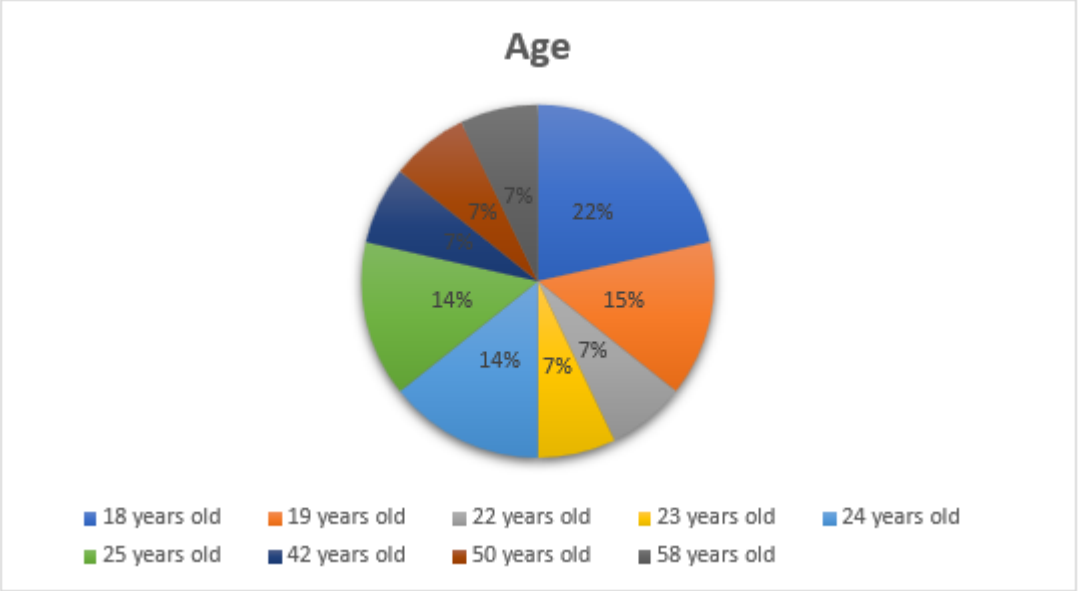


Graphic 1. Percentage distribution by sex.



Graphic 2. Age of patients.

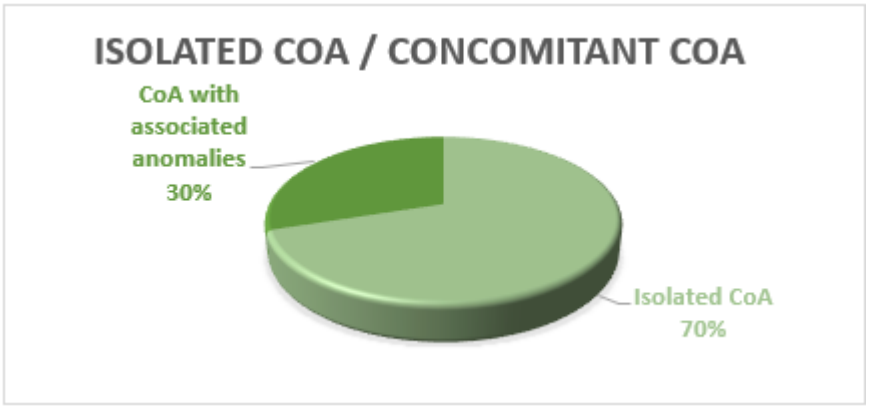
Based on the collected data, the distribution was made according to age groups. The age that prevails among adults is eighteen years old and the average age of adult patients is 27 ± 13 years old. These data are presented below by means of graphs where the age is expressed in percentage as well as age groups according to the number of patients.



Graphic 3. Age in years of patients expressed as a percentage.

Table 2. Number of patients depending on their age

Age	Nr of patient
18-2 y	7
21-30 y	8
31-50 y	5
51-60 y	2

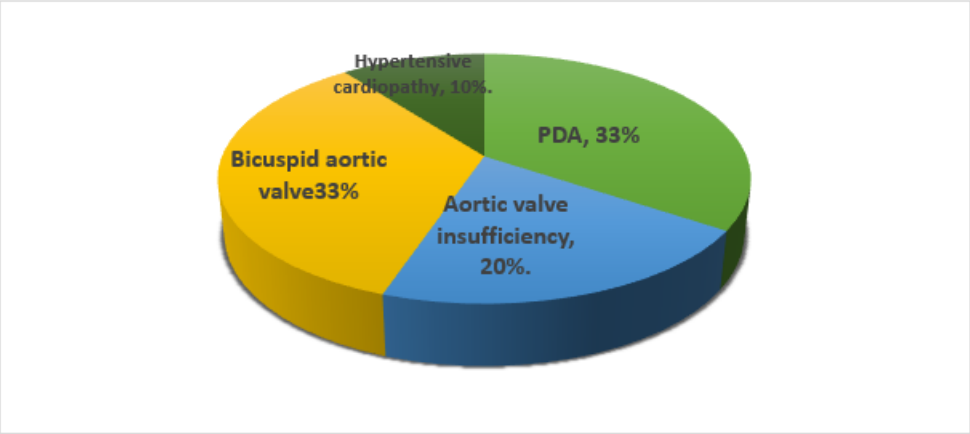


Graphic 4. Distribution of the number of cases with isolated and concomitant CoA expressed in percentage.

From the collected data we noticed that most of the adults exactly 70% of them or expressed in number n=12 had isolated CoA while 30% or n=5 had CoA associated with other abnormalities such as bicuspid aortic valve, ductus arteriosus persistent/Ductus Botalli, aortic valve insufficiency as well as hypertensive cardiopathy.

Table 4. Frequency of associated anomalies.

Associated anomaly	Nr. Of cases
Pda	3
Aortic valve bicuspid	3
Hypertensive cardiopathy	1
Aortic valve insufficiency	2



Graphic 5. Associated anomalies expressed in percentage.

The majority of adult patients presented to the Cardio surgery service as the only main symptom had arterial hypertension. The average preoperative blood pressure was 160/90mmHg. Other patient complaints were headache, dizziness (n= 13), dyspnea on minimal effort (n=6), back pain (n=10), palpitations (n=5), epistaxis (n=7), syncope (n= 3), fatigue and physical weakness for a long time (n=14). We also had a category of patients who did not refer complaints (n=3).

Patients' complaints can be grouped depending on the physio pathological mechanism. Thus, we have symptoms related to arterial hypertension (dizziness, headache, epistaxis, dyspnea on exertion, fatigue and body weakness) symptoms related to hypoperfusion of the lower extremities (intermittent claudication, cooling of the sides, fatigue in small efforts) as well as symptoms related to cerebral damage.

5. Discussion

Coarctation of the aorta is generally diagnosed at an early age, specifically in neonates and infants [6]. Echocardiographic examination is the gold standard for establishing the diagnosis in children, while CT-scan in adults [7]. Seventeen adults participated in the study, among them 12 (70%) were men and 5 (30%) were women. The ratio of the number of male/female patients is 2.4. These data coincide with the epidemiology in the world where, like most left obstructive lesions, coarctation of the aorta is more frequent in men.

The predominant age group was eighteen years old, while the average age of the patients in the study was 27 years old. The main concomitant abnormalities in adults are PDA, aortic valve bixupia, aortic valve insufficiency and hypertensive cardiopathy. The most important symptoms in adults belonged to hypertension, including headache, epistaxis, body weakness, dyspnea on exertion. It is very important to have control over symptoms as these can cost economic problems to patients and in public health [8].

All patients had hypertension before surgery. The average blood pressure was 160/90 mmHg, 4 patients were taking at least one medication for hypertension (lercanil, nifedipine, hydrochlorothiazide, amlodipine, losartan, bisocor) at the time of surgery. Sometimes they have uses corticosteroids, these medicines have been seen to be used in different diagnoses according to their effects [9]. The arterial pressure values at the exit were normalized with a mean of 110/60 mmHg. All patients had prior CT scan (mean gradient along the coarctation was 64±5mm Hg). After the intervention, the mean gradient of CoA was 24 ±4.3 mmHg. Seventeen adults underwent surgical repair of coarctation between 2007 and 2021. The operative technique chosen was extraanatomic bypass between the sinister subclavian artery and the descending aorta and proximal anastomosis with allograft tube no. 16 for 10 patients, proximal anastomosis with allograft tube no. 8 for 1, proximal anastomosis with allograft tube no. 18 for 1 patient, proximal anastomosis with allograft tube number 10 for 3 patients and proximal anastomosis with allograft tube no. 14 for 1 patient.

Post-operative complications were present in 30% of cases. Complications included sero-hemorrhagic pleural effusions, soft tissue edema in the sinister thoracic region as well as arterial hypertension. There was no case of re-intervention as well as no evidence of cerebrovascular damage. Hospital mortality in adults was 0%. Other studies have shown low mortality rate [10], [11].

Coarctation of the aorta is a congenital cardiac pathology, which has been corrected for years in the Cardio surgery service, at QSUT with very good surgical results. Various techniques are used to correct coarctation of

the aorta. These techniques are: End-to-end resection and anastomosis; Aortoplasty with synthetic patch; Aortoplasty with subclavian flap; Extraanatomic bypass between a. subclavian syn. and descending aorta.

Meanwhile, in teenagers and adults, the surgical technique most used by the Cardiosurgery team, QSUT, is the extraanatomical bypass between a. subclavian syn. and descending aorta. In other countries, percutaneous endovascular treatment such as balloon angioplasty and stenting is generally applied to adolescents and adults. In Albania, this includes high economic value, as other studies have reported [12], but also even the frequency of post-intervention infection can influence in post-operative results. Different studies in Albania have reported the importance of infections [13].

The diagnosis is mainly established by angiocardiography, without the need for additional examinations. CT-scan is performed in adults. The choice of surgical technique is made judging by: the anatomy and localization of the coarctation; age of the patient; the presence of other cardiac lesions; other anatomical determinants (expressed collaterals or calcification of the aorta)

Patients generally leave the room in good hemodynamic conditions and without intraoperative complications. This will improve patients' satisfaction as this is very important for health service, other studies have done surveys about Albanian service and patient satisfaction [14] [15].

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