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Early Outcome of Aortic Coarctation Repair in Patients with Age Below One Year

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Abstract

Background: A common ailment in children is coarctation of the aorta, a narrowing of the aorta most commonly occurring just distal to the origin of the left subclavian artery.

Aim and objectives: To follow up and analyze the early outcome of aortic coarctation repair in studied cases with ages below 1 year and the impact of the procedure on their life.

Patients and methods: This was a retrospective study conducted on forty studied cases with coarctation of the aorta that underwent repair operation and was followed up at Al-Hussien University Hospital and Atfal Misr Hospital.

Results: The mean ICU stay of the patients had been 6.68 (±5.13 SD) with range (2-20) days. The mean hospital stay of the studied subjects was 11.3 (±6.31 SD) with range (5-30) days. There were 3 (7.5%) who had heart failure and 1 (2.5%) who had sepsis; in our study, 1 (2.5%) died in the first 30 days of the operation. There were 5 (12.5%) who used anti-hypertensive treatment.

Conclusion: A few surgeons determine that extended end to end anastomosis (EEEA) repair is the safest option for individuals with Hypoplastic aortic arch (HAA). Additionally, In our experience, Aortic coarctation repair in studied cases with age below one year has favourable results and decreases the short and long term complications.

Keywords: Aortic coarctation repair; outcome; age below one year

1. Introduction

Children frequently suffer from coarctation of the Aorta (CoA), a constriction of the Aorta typically located just distal to the left subclavian artery's origin.¹

Coarctation of the Aorta represents 5%-8% of all congenital heart diseases; about three to four isolated types are present for every 10,000 live births, with males being affected more often than females.²

studied cases with untreated aortic coarctation can live to be thirty-five years old, twenty-five per cent can live to be forty-six years old, and less than twenty per cent can live to be fifty years old. Heart failure, cerebral haemorrhage, aortic dissection, or rupture account for around eighty per cent of untreated studied case deaths.³

Infant-studied cases with aortic coarctation can appear with severe acidosis, inadequate perfusion to the lower body, or congestive heart failure, depending on the extent of the

obstruction and related cardiac diseases. Once you have outgrown infancy, Most studied cases do not have any symptoms. They could exhibit symptoms including cold feet, leg cramps, headaches, nosebleeds, hypertension, and muscle weakness.⁴

Although the rate of prenatal diagnosis of coarctation of the Aorta has increased due to advancements in fetal echocardiography, this diagnosis is still difficult to make before birth.⁵

The surgical technique must remove the obstruction to maximise tissue growth potential, particularly in pediatric cases. To avoid late problems like restenosis at the anastomosis, manoeuvres, including massive dissections, anastomoses with the maximum area feasible, and thorough resections of ductal tissue are crucial. Typically, a left thoracotomy is done without CPB. End-to-end extended end-to-end anastomosis, which use the subclavian artery or an interposition graft, are usually the primary surgical procedure.⁶

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The aim of this research was to follow and analyze the early outcome of Aortic coarctation repair in studied cases with an age below 1 year and the impact of the procedure on their lives.

2. Patients and methods

This retrospective study was conducted on forty cases with coarctation of Aorta who underwent repair operations and were followed up at Al-Hussien University Hospital and Atfal Misr Hospital.

Inclusion criteria: Patients with coarctation of Aorta below one year of age and Patients with PDA

Exclusion criteria: Patients with coarctation of Aorta above one year, redo cases and patients with other cardiac anomalies.

Methods

Patients were subjected to the following:

Preoperatively

History taking: A detailed history was taken regarding age, gender, body weight, and clinical state according to the New York Heart Association classification.

Electrocardiogram (ECG): 12 leads ECG was done for assessment of cardiac rate, rhythm and ischemic changes

Radiological examination

Plain chest x-ray and Echocardiography: A full echocardiography study was done for all patients to assess EF, LVED, LVES, LA, right ventricle, pulmonary artery pressure, site of stenosis, pressure gradient at this site, and associated anomalies.

CT aortography: The key choice of imaging is to assess the site and extent of stenosis and the detailed anatomy of the Aorta and its branches.

Operative data: Clamp time, Type of repair and intraoperative monitoring

Postoperative evaluation

Early postoperative evaluation: ventilation time, ICU stay, hospital stay, Complications:(pneumothorax, hemothorax, chylothorax, chest infection, wound infection, Rrebound hypertension, arrhythmias, neurological complications and residual stenosis), CXR: Cardiac size, pneumothorax, hemothorax, lung collapse or consolidation and ECHO: Full echocardiography study was done for all patients for assessment of EF, LVED, LVES, LA if there was residual stenosis and pressure gradient at this site.

6 months follow up

All patients were clinically evaluated in the outpatient clinic regularly after the operation, and attention was given to the results regarding Body weight, hemodynamics, chest X-ray, and echocardiography during the first six months.

3. Results

Regarding age of the studied cases there was range from 4 months to 12 months with mean of 7.2 months, there were 9 (22.5%) females and 31 (77.5%) males. Also, the mean weight of the patients had been 5.03 (± 1.66 SD) with range (2.5-7.8) kg, The mean height was 67.28 (± 8.11 SD) with range (50-80) cm. (Table 1).

Table 1. Distribution of the patients according to demographic data.

SUBJECTS (N = 40)		
AGE		
RANGE	(4 mon to 12 mon)	
MEAN \pm SD	7.2 \pm 2.5	
SEX	No.	%
FEMALE	9	22.5
MALE	31	77.5
WEIGHT		
RANGE	2.5 – 7.8	
MEAN \pm SD	5.03 \pm 1.66	
HEIGHT		
RANGE	50 – 80	
MEAN \pm SD	67.28 \pm 8.11	

Table 2. Distribution of the studied cases according to clinical data

SUBJECTS (N = 40)		
NYHA CLASS	No.	%
I	37	92.5
II	3	7.5
HYPERTENSION	15	37.5
HEART FAILURE	3	7.5
FAILURE TO THRIVE	3	7.5

Among our studied cases 37 cases (92.5%) were with NYHA class 1, and 3 cases with NYHA class II, 15(37.5%) patients were suffering of hypertension,

3 (7.5%) patients were with heart failure and 3 (7.5%) patients were with failure to thrive

Table 3. Distribution of the studied cases according to Echo data:

ECHO DATA		
EF	Range : (40% to 70%) Mean \pm SD : 58.8 \pm 6.8	
PG	Range : (40 to 70 mmHg) Mean \pm SD : 53.3 \pm 9	
VARIANT	NO.	%
HYPO PLASTIC AORTIC ARCH	10	25
BICUSPID AORTIC VALVE	5	12.5
PATIENTS WITH PDA	19	47.5

According to pre-operative Echo data the studied cases EF range was from 40% to 70% with mean of 58.8 % , while PG range was from 40 mmHg to 70 mmHg with mean of 53 mmHg . There were 10 (25%) with hypo plastic aortic arch, 5 (12.5%) with bicuspid aortic valve, and 19 (47.5%) with PDA

Table 4. Distribution of the studied cases according to Operative data

SUBJECTS (N = 40)		
OPERATIVE APPROACH	No.	%
LATERAL THORACOTOMY	40	100.0
TYPE OF REPAIR	No.	%

EEEEA	40	100
CLAMP TIME		
RANGE	20 - 35	
MEAN ± SD	26.88 ± 4.76	

All the cases underwent extended end to end anastomosis (EEEEA) through Lateral thoracotomy and the mean clamp time was 26.88 (±4.76 SD) with range (20-35) minutes.

Table 5. Distribution of the studied cases according to ICU stay

SUBJECTS (N = 40)	
ICU STAY	
RANGE	2 - 20
MEAN ± SD	6.68 ± 5.13

The mean ICU stay of the studied cases was 6.68 (±5.13 SD) with range (2-20) days .

Table 6. Distribution of the studied cases according to hospital stay

SUBJECTS (N = 40)	
HOSPITAL STAY	
RANGE	5 - 30
MEAN ± SD	11.3 ± 6.31

The mean hospital stay of the studied subjects was 11.3 (±6.31 SD) with range (5-30) days .

Table 7. Distribution of the studied cases according to postoperative complications

SUBJECTS (N = 40)		
COMPLICATIONS	No.	%
REBOUND	5	12.5
HYPERTENSION		
PNEUMOTHORAX	0	0.0
HEART FAILURE	3	7.5
CHYLOTHORAX	0	0.0
INFECTIONS/SEPSIS	1	2.5
WOUND INFECTION	0	0.0
POST COARCTATION SYNDROME	0	0.0
BLEEDING	0	0.0

Among the studied cases there were 3 (7.5%) who had heart failure, 1 (2.5%) of them had sepsis while 5 (12.5%) developed rebound hypertension

Table 8. Distribution of the studied cases according to early post-operative ECHO data

SUBJECTS (N = 40)	
PRESSURE GRADIENT	
RANGE	10-15
MEAN ± SD	11 ± 1.7
EJECTION FRACTION	
RANGE	50-70
MEAN ± SD	60.8 ± 6.2

Follow up Echo shows improvement of mean EF to 60.8% with range of 50 to 70 %, while the mean PG decreased to 11 mmHg with range of 10 to 15 mmHg

Table 9. Distribution of the studied cases according to clinical state after 6 months follow up

SUBJECTS (N = 39)		
NYHA CLASS	No.	%
I	38	97.4
II	1	2.6
HYPERTENSION	.3	7.6
HEART FAILURE	0	0.00
FAILURE TO THRIVE	0	0.00

6 months follow up study of our cases shows only 1 (2.6%) patient still suffering of class 11 dyspnea according to NYHA classification, while 3 (7.6%) patients are still in need for antihypertensive drugs.

Table 10. Distribution of the studied cases according to ECHO data after 6 months follow up

SUBJECTS (N = 39)	
PRESSURE GRADIENT	
RANGE	5-10
MEAN ± SD	5.7 ± 1.3
EJECTION FRACTION	
RANGE	50-70
MEAN ± SD	63.4 ± 4.8

Follow up Echo shows improvement of mean EF to 60.8% with range of 50 to 70 %, while the mean PG decreased to 5.7 mmHg with range of 5 to 10 mmHg

4. Discussion

Coarctation of the aorta represents 5%-8% of all congenital heart diseases; around three to four isolated types are present for every 10,000 live births, with males being affected more often than females.⁷

The main results of our study were as follows:

In our current study, according to the age of the studied cases, there was a range from 4 months to 12 months with a mean of 7.2 months; there were 9 (22.5%) females and 31 (77.5%) males. Also, the mean weight of the patients had been 5.03 (±1.66 SD) with a range (of 2.5-7.8) kg; the mean height was 67.28 (±8.11 SD) with a range (50-80) cm.

Zhao et al.'s study cohort comprised fifty-one cases (thirty men and twenty-one women), with an incidence of twenty-five per cent (13/51). The mean age was 5.33 months (interquartile range: 2.00-15.00 months), and the median weight was 5.60 kg (interquartile range: 4.20-10.00 kg).⁸

In our current study, according to the NYHA class, 37 (97.4%) I and 3 (7.4%) II cases were among the studied cases.

Barreto et al. found that Half of the studied cases with CoA surgical correction had cardiac symptoms, hypertension, and no palpable pulse in the lower extremities at the time of diagnosis. Most of the studied cases had a systolic heart murmur with posterior radiation. According to NYHA class, among the studied cases, there were 24 (40%) I and, 14 (23.2%) II, and III 12 (20%).⁹

In this work, we found that among the studied cases, 10 (25%) had hypoplastic aortic arch, 5 (12.5%) had bicuspid aortic valve, and 19 (47.5%) had PDA. The EF ranged from 40% to 70%, and the mean PG was 53 mmHg.

Minotti et al. included 218 consecutive neonates (M/F: 129/89), with a median age at surgery of 11 days (IQR 7-17 days). CoAo was isolated in 133 (61.0%); 102 (46.8%) had Hypoplastic aortic arch.¹⁰

In this work, according to the type of repair among the studied cases, all the cases underwent extended end to end anastomosis (EEEE) through Lateral thoracotomy, and the mean clamp time was 26.88 (± 4.76 SD) with a range (of 20-35) minutes.

Many studied cases (178, 81.6 per cent) had EEEA. In 202 studied cases, a left lateral thoracotomy was performed (92.7 per cent). Of the studied cases, sixty-one underwent associated procedures (27.9 per cent). Eight studied cases needed intervention before CoAo repair (six underwent balloon dilation, two underwent pulmonary artery banding, 2 underwent atrioseptostomy).¹⁰

In our current study, the mean ICU stay of the patients was 6.68 (± 5.13 SD) with range (2-20) days. The mean hospital stay of the studied subjects was 11.3 (± 6.31 SD) with range (5-30) days.

Ungerleider et al. found mean hospital stay was 7 days.¹¹

The 72 studied cases were grouped into 3 age groups: Group A consisted of thirty-four studied cases (\leq thirty days), group B included twenty-four studied cases (thirty-one days to 1 year), and Group C included fourteen studied cases (\geq one year to eighteen years). Group A, which included neonates, had longer mean periods spent in the intensive care unit on mechanical ventilation. Mechanical ventilation took about 6 days; the intensive care unit took around fourteen.¹²

Among our studied cases, we found that the early postoperative mean was PG 11, while it was 15 at Al-Dairy, A. (2023).

In this work, we found among the studied cases, there were 3 (7.5%) who had heart failure, 1 (2.5%) who had sepsis,

Murakami et al. found that 15.3 percent of infections had been presumed or laboratory-confirmed to be bacterial sepsis, primarily in group A (20.6 percent).¹²

In our current study, Among the studied cases, there was 1 (2.5%) who died in the first 30 days of the operation.

Minotti et al. found no early reoperations. 30day mortality had been 2.3percent (five studied cases, three of whom with complex CoAo, after repair on CPB).¹⁰

Padalino et al. found that 4.4 per cent of patients underwent an aortic arch reintervention during a very long-term follow-up. Furthermore, during a median follow-up of 10.2 years, the occurrences of late arterial hypertension and late death are both extremely low. As stated in other reports,¹³

Out of 196 survivors (89.9 per cent), eighteen (9.2 per cent) underwent aortic arch re-interventions. However, only four studied

cases (1.8 per cent) required a surgical reoperation (three in complex CoAo); balloon angioplasty proved viable for the remaining studied cases. Among the survivors, eighteen (9.2 per cent) had been receiving anti-hypertensive medication, 183 (93.4 per cent) had been in NYHA class I.¹⁰

4. Conclusion

A few surgeons have determined that extended end to end anastomosis (EEEE) repair is the safest option for studied cases with HAA. Additionally, in our experience, Aortic coarctation repair in patients below one-year-old has favourable outcomes and decreases short-term and long-term complications.

Disclosure

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