Research Article

Glomerular and Tubular Renal Dysfunction in Infant and Children with Congenital Heart Disease

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Abstract
Introduction: Congenital heart disease (CHD) is among the most common birth defects and are the leading cause of birth defect-related deaths. **Aim of The Study:** The aim of this study is: To assess the glomerular and the tubular renal dysfunction in infants and children with congenital heart disease (CHD). **Subjects And Methods:** This prospective case study was conducted at Pediatric Cardiology Clinic of Pediatric Department, El- Minia University Hospital for Pediatrics during the period from June 2013 to April 2014. **Results:** This study included 60 child from outpatient clinic of "EL-Minia University Hospital for obstetric and pediatrics" during December 2013 to February 2015,The sixty child were classified in to three groups: **Discussion:** Congenital heart disease (CHD) defined as an anatomic malformation of the heart or great vessels which occurs during intrauterine development, irrespective of the age at presentation, Congenital heart defects classified into acyanotic and cyanotic depending upon whether the patients clinically exhibit cyanosis (Rao, 2015). **Recommendations:** We recommend the following: Routine periodical assessment for renal function in CHD patients. Large scale studies needed to obtain the possible explanation. Using of β2 microglobulin for an early diagnosis of tubular dysfunction in infants and children with CHD.
Keywords: Acute kidney injury, Anti Vascular Endothelial Growth Factor, Aortic stenosis

Introduction
Congenital heart disease (CHD) is among the most common birth defects and are the leading cause of birth defect-related deaths. CHD is a defect in the structure of the heart and great vessels which is present at birth. Many types of heart defects exist, most of which either obstruct blood flow in the heart or vessels near it, or cause blood to flow through the heart in an abnormal pattern; other defects affect the hearts rhythm (Lozano R et al., 2012).

Current epidemiological evidence suggests that chronic kidney disease (CKD) occurs in patients with congenital heart disease at a higher frequency than the general population and is detectable early in follow-up (i.e. during childhood). Best evidence suggests that approximately 30 to 50 % of adult patients with congenital heart disease have significantly impaired renal function. The risk of CKD is higher with cyanotic congenital heart disease but it is also present with non-cyanotic congenital heart disease. Although significant knowledge gaps exist, the sum of the data suggests that patients with congenital heart disease should be followed from an early age for the development of CKD (Morgan et al., 2015).

Among many short- and long-term consequences of congenital heart disease (CHD), renal disorders are quite common and the risk of developing renal impairments is particularly higher in patients with cyanotic heart diseases compared to non-cyanotic heart diseases (Amornchaicharoensuk et al., 2012). Furthermore, the incidence of renal abnormalities is directly associated with degree and duration of cyanosis. Impaired renal function in CHD may take place at either the glomeruli or tubules. To date, there are more numbers of studies reporting on the relationship of CHD and glomerular dysfunction compared to the studies reporting on tubular dysfunction (Amornchaicharoensuk et al., 2012).

Aim of the Study

The aim of this study is:

To assess the glomerular and the tubular renal dysfunction in infants and children with congenital heart disease (CHD).

Subjects and Methods

This prospective case study was conducted at Pediatric Cardiology Clinic of Pediatric Department, El- Minia University Hospital for Pediatrics during the period from June 2013 to April 2014.

This study included 40 infants and children with congenital heart disease and 20 apparent healthy infants and children. The laboratory investigations carried out in Clinical Pathology Department, EI-Minia Faculty of Medicine.

The included infants and children divided into the following groups:

Group I:

Include 18 children with congenital cyanotic heart disease (11 male, 7 female); the age of patients ranged from (4 to 9 years).

Group II:

Include 22 children with congenital acyanotic heart disease (15 male, 7 female); the age of patients ranged from (1.9 to 11 years).

Group III:

Include 20 apparent healthy children representing the control group (14 male, 6 female); the age of patients ranged from (2 to 11 years).

Inclusion criteria:

All infants and children with evidence of congenital heart disease.

Exclusion criteria:

Patients with other congenital diseases

Patients with diabetes mellitus.

Patients with urinary tract infection.

Patients with Chronic renal failure.

Patients with chronic chest disease.

Patients represented by signs of dehydration.

Patients with liver disease.

Patients with metabolic disease.

History of drugs such as: allopurinol, corticosteroids, vancomycin, penicillin and aminoglycosides.

Table : Comparison between glomerular and tubular renal function indictors in both acyanotic and control group

Variable	Groups		P. value (Sig.)
	Acyanotic group (n=22)	Control group (n=20)	
Urea (mg/dL):			
Range.	(14-37)	(12-28)	**<0.001***
Mean ± SD	26 ± 5.52	20.0 ± 4.76	
Createnine (mg/dL):			
Range.	(0.6-1)	(0.3-0.5)	**<0.001***
Mean ± SD	0.81 ± 0.11	0.35 ± 0.06	
eGFR(ml/min/1.73m2):			
Range.	(90-181.3)	(212.5-483.3)	**<0.001***
Mean ± SD	135.4 ± 23.8	334.3 ± 82.7	
A/C ratio:			
Range.	(5-24)	(5-18)	**<0.001***
Mean ± SD	16.7 ± 4.83	9.9 ± 3.72	
Urinary B_2microglobuline(µl/ml):			
Range.	(0.9-4.5)	(0.2-2.2)	**0.041***
Mean ± SD	3.21 ± 0.91	0.88 ± 0.58	

*** =Highly significant. eGFR (estimated glomerular filteration rate), A/C ratio(albumin/creatinine ratio)**

As shown in table (5) the acyanotic groups had significantly higher level of urea,creatinine,A/C ratio and B2-microglobulin(P. <0.001) and significantly lower eGFR in acyanotic groups compared with control group.

Discussion

Congenital heart disease (CHD) defined as an anatomic malformation of the heart or great vessels which occurs during intra-uterine development, irrespective of the age at presentation, Congenital heart defects classified into a cyanotic and cyanotic depending upon whether the patients clinically exhibit cyanosis (Rao, 2015).

Nephropathy is a well-known complication of congenital heart disease (CHD), and the risk of developing renal impairment is particularly high in patients with cyanotic CHD (Agras P. I. et al., 2005). Several studies have revealed that nephropathy is a prominent feature and a potential compli-cation of cyanotic CHD (Amoozgar H et al., 2014). Disorders of renal function in Cyanotic CHD take the form of abnormal glomerular and tubular function. Regarding glomerular dysfunction, decreased GFR and macro or micro albuminuria have been reported and the hallmarks of glomerular changes in cyanotic CHD are glomerulo-megaly, capillary dilatation, mesangial cell proliferation, and glomerulosclerosis (Morgan et al., 2015). The structural integrity and function of proximal tubules have also been studied, indicating tubular dysfunction and loss of its integrity in patients with CCHD (Agras P.I. et al., 2005).

β2-microglobulin serves as a useful biomarker to evaluate both glomerular and tubular function (Trof et al., 2006). Elevated level of serum β2-microglobulin indicates glomeruli malfunction while elevated urinary β2-microglobulin suggests tubular dysfunction (Bussolati et al., 2013), the latter is associated with proximal tubule injuries due to a variety of causes such as viral infection, ischemia, and toxicity from medications or heavy metals (Häring et al., 2011).

Recommendations

We recommend the following:

Routine periodical assessment for renal function in CHD patients.

Large scale studies needed to obtain the possible explanation.

Using of β2 microglobulin for an early diagnosis of tubular dysfunction in infants and children with CHD.

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