Assessment of Serum Electrolytes in Congenital Heart Disease pre and post Cardiac Catheterization

Thesis

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By

Engy Shehata Zakaria Abdelrahim

M.B.B.Ch

Under supervision of

Prof. DR. Mohammed Ali Hegazi

Professor of Pediatrics

Faculty of Medicine

Cairo University

Prof. DR. Mohammad Shehata Abdullah

Professor of clinical & Chemical Pathology.

Faculty of Medicine

Cairo University

Dr. Rania Mohamed Helmy Osman El-Kaffas

Lecturer of Pediatrics

Faculty of Medicine

Cairo University

Faculty of Medicine

Cairo University

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Abstract

Assessment of Serum Electrolytes in Congenital Heart Disease Before and After Cardiac Catheterization

Background: Cardiac catheterization plays an important role in diagnosis and treatment of cases of congenital heart disease. Electrolytes are essential micronutrients that have important, physiological and metabolic roles in human being and cardiac functions.

Objective: This study aims to evaluate the effect of cardiac catheterization either diagnostic or therapeutic on serum levels of selected electrolytes (sodium, potassium, calcium, magnesium and phosphorus) in cases of congenital heart disease.

Methodology: This study enrolled upon 75 patients with congenital heart disease (cyanotic and acyanotic) aged from one day to 16 years. All patients were subjected to full clinical history, examination and specific cardiac investigations (echocardiography, ECG and chest x-ray), as well as detection of serum levels of sodium, potassium, calcium, magnesium and phosphorus before and after cardiac catheterization.

Results: The results of the present study revealed that, all serum electrolytes' levels decreased after cardiac catheterization. However, this decrease had no statistical significance except that of serum phosphorous.

Regarding serum phosphorous, it was found that, there was a statistically significant decrease in the mean value of serum phosphorus level post-catheterization compared to pre-catheterization one in the studied group (p value = 0.010). Moreover, the current study revealed that, there is a highly significant statistical positive correlation between fluoroscopic time and DAP, with p value < 0.000.

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However, correlations between age, sex, type of heart disease (cyanotic or acyanotic) and type of cardiac catheterization (diagnostic or therapeutic), and these electrolytes before and after cardiac catheterization were insignificant (p value > 0.05).

Conclusion: Cardiac catheterization associated with decrease in all serum electrolytes' levels, especially serum phosphorous. This change in serum phosphorus level may play an important role in post-operative complications that might happen after cardiac catheterization. There were no significant correlations between age, sex, type of congenital heart disease, catheterization type, duration of fluoroscopic time, or DAP and serum electrolytes.

Key words: CHD, Cardiac catheterization and serum electrolytes.

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Abbreviations

ABC: Automatic Brightness Control

AEC: Automatic Exposure Control

ADH: Anti Diuretic Hormone.

ATP: Adenosine Tri Phosphate.

ASD: Atrial Septal Defect.

BAV: Bicuspid Aortic Valve.

CATCH: cardiac, abnormal facies, thymic hypoplasia, cleft palate, hypocalcaemia.

CHD: Congenital Heart Disease.

CKD: Chronic Renal Failure.

Ca^{2+}: Calcium.

CaR: Calcium Receptors.

Cl^-: Chloride.

CM: Contrast Medium.

Co-A: Coarctation of the Aorta.

DAP: Dose Area Product.

ECF: Extra Cellular Fluid.

ECG: Electro Cardio Gram.

eGFR: Estimated Glomerular Filtration Rate.

GFR: Glomerular Filtration Rate.

Gy: Gray (1 Gy = 100 rad).

Abbreviations

$Gycm^2$: $Gy*cm^2$

$Hco_{3:}$ Bicarbonate.

INR: International Normalized Ratio

ICF: Intra Cellular Fluid.

LV: Left Ventricle.

Mg: Magnesium.

mSV: milliSieVert

Na: Sodium.

NaCl: Sodium Chloride.

NSAIDS: Non-Steroidal Anti-Inflammatory Drugs.

K: Potassium.

P: Phosphorous.

PA: Pulmonary Artery.

PDA: Patent Ductus Arteriosus.

PS: Pulmonary Stenosis.

PTH: Para Thyroid Hormone.

PTHR: Para Thyroid Hormone Receptor.

PVR: Pumonary vascular resistanc

Rad: Radiation-absorbed dose

Rem: Roentgen equivalent in man

RTA: Renal Tubular Acidosis.

SD: Standard Deviation.

Abbreviations

SV: SieVert

SVR: systemic vascular resistanc

TAL: Thick Ascending limb.

TBW: Total Body Water.

TOF: Tetrology of Fallot.

TOGV: Transposition of Great Vessels.

VDR: Vitamin D Receptor

VSD: Ventricular Septal Defect.

RV: Right ventricle.

RVH: Right Ventricular Hypertrophy.

VPS: Valvular Pulmonic Stenosis.

Introduction

Congenital heart diseases (CHD) consist of defects of the cardiac architecture which interfere with the venous drainage, septation of the cardiac segments and their sequences and regular function of the valve apparatuses. In normal heart, segments are disposed in such a way to allow deoxygenated venous blood to go to the lungs through the pulmonary artery and the oxygenated venous blood to go to the systemic organs through the aorta without mixing. Small and great circulations are in sequence, with no communication to each other **(Thiene and Frescura, 2010)**.

Congenital heart disease (CHD) accounts for nearly one-third of all major congenital anomalies. Reported total CHD birth prevalence increased substantially over time, from 0.6 per 1,000 live births in 1930 to 1934 to 9.1 per 1,000 live births after 1995. Over the last 15 years, stabilization occurred, corresponding to 1.35 million newborns with CHD every year. Significant geographical differences were found **(Van der Linde et al., 2011)**.

The incidence of CHD in different studies varies from about 4/1,000 to 50/1,000 live births. The incidence of severe CHD that will require expert cardiologic care is quite stable at about 2.5 to 3/1,000 live births. The moderately severe forms of CHD probably account for another 3 per 1,000 live births. The majority of minor forms of CHD do not need specialized cardiologic care, and indeed many of these, such as the tiny VSD or ASD and the small PDA, may either close spontaneously or never cause medical problems **(Hoffman and Kaplan, 2002)**.

We divided cardiac anomalies in: CHD with increased pulmonary blood flow (septal defects without pulmonary obstruction and with left-to-right shunt); CHD with decreased pulmonary flow (septal defects with pulmonary obstruction and with right-to-left shunt); CHD with obstruction to blood progression and no septal defects (no shunt); CHD so severe as to be incompatible with postnatal blood circulation; and CHD silent until adult age **(Thiene and Frescura, 2010)**.