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Primary bradycardia in children at Sohag university hospital: A single center experience

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ABSTRACT

Background: Heart rate monitoring is usually used in pediatric early warning scores; primary bradycardia may cause high morbidity and rarely sudden cardiac death.

Objective: Good assessment of primary bradycardia in children to allow proper management of critically ill child to prevent sudden death.

Patients and methods: The study was prepared in Pediatric Arrhythmia Clinic, Emergency room department and outpatient clinic from March 2020 to August 2021. Children aged from 1day to 14 years presenting with 1ry bradycardia were enrolled in our study. Pre-death bradycardia was excluded. Full medical history, physical examination, basic investigations, 12 leads ECG and echocardiography were done to all included patients in this study. Holter monitoring was done while indicated.

Results: 30 patients were included in the study. Heart rate ranged from 46 to 90 beat/minute with mean 67.44 bpm. 50 % of them had Syncopal attacks and another 50 % was diagnosed during routine examination. ASD detected in 20% of them, 20% had CHB; the remaining 60% were Idiopathic. Sinus bradycardia was present in 18 children, CHB was present in 6 patients while 1st and 2nd degree AV block were presenting in 6 children.

Conclusion: Primary bradycardia in children needs early, good assessment and well management to decrease the need of acute intervention and preventing sudden death.

Keywords: Pediatric, Bradycardia, primary bradycardia, syncopal attacks, ECG, Holter.
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Introduction:

Primary bradycardia is defined as a heart rate under the normal range for the child's age, level of activity and clinical condition. Primary bradycardia usually manifests as sinus bradycardia, junctional bradycardia or atrioventricular block [(1)].

Primary bradycardia results from congenital abnormalities or acquired injury to conduction system or the heart's pacemaker cells, less common causes include Myocarditis, cardiomyopathy and surgical injury. [(2)]

Bradycardia is less common in children than adults; infrequently it can cause high morbidity and rarely sudden cardiac death. The risk of death in untreated children with complete block of the AV node is 5 to 8 percent. [(3)]

Once 1ry bradycardia is diagnosed, it must be urgently and aggressively treated. Identification of the type of bradycardia present may help you detect its cause. The most common ECG findings include: Sinus bradycardia, 1st degree AV block,

2nd degree AV block (Mobitz I, Mobitz II) and 3rd degree AV block (CHB). Sinus bradycardia which means that the SA node is firing at a slow rate could be a normal response in a healthy child and might not be accompanied by symptoms. However, symptoms may be present when sinus bradycardia results from hypotension, hypoxia or acidosis. So the urgent assessment of the infant or child is critical. (4)

Patients and methods:

Using a prospective cohort observational study design, this study was conducted in Pediatric Arrhythmia Clinic, Emergency room department and outpatient clinic at Sohag university hospital in 18 months period from March 2020 to August 2021. Children aged from 1day to 14 years presenting with bradycardia and had given informed consent. Pre-death bradycardia was excluded.

Accurate evaluation was performed for all children in this study, which included: full medical history included Socio-demographic factors. Cardiac symptoms such as feeding problems, exercise intolerance, Syncope, medications and chronic maternal disease, physical examination included general condition, anthropometric measures, vital signs (Including Heart rate, blood pressure, respiratory rate and body temperature). Cardiac examination (including any recognized murmur, sings of heart failure). Basic investigations (FBC, serum electrolytes including total and ionized calcium level).12-lead electrocardiogram were done to all included children using (Fukuda Denshi CardiMax ECG device model FCP-7101). Interpretation of every ECG paper was done using specific centile tables for normal values of ECG waves and intervals compared to age. Echocardiography: All patients had 2-D and M-mode echocardiographic examinations in accordance with the American Society of Echocardiography standards. Holter monitoring using Mortara 2016 American made H3 while indicated.

Clinical and laboratory data was collected through Excel 2015 for Windows and will be analyzed using SPSS16.00 software.

Ethical considerations: Children were included after informed consent was obtained from their parents. The study was approved by the Scientific Ethics Committee of the Faculty of Medicine, Sohag University.

Results:

The study included 30 patients who had primary bradycardia. About 60% of them were boys. Age ranged from 1 day to 14 years with median 8.1 years

Table (1) Distribution of the studied children according to their demographic criteria:

	N=30	**%**
Gender: Girl Boys	 12 18	 40 60
Age (year): Median Min – Max	 8.1 years 1 day – 14 years	

Table (2) Distribution of the studied patients according to clinical presentation of primary bradycardia (n=30**):**

Clinical presentation	**Number**	**Percent**
Syncopal attack	15	50
Routine examination	15	50

Regarding presenting symptoms syncopal attacks were the main symptom in 50 % of cases, and the other 50 % were discovered during routine examination.

Table (3) ECG findings of studied children (n=30):

ECG findings	Number	Percent
Sinus bradycardia	18	60
1st , 2nd degree heart block	6	20
CHB	6	20

According to ECG results of studied children with primary bradycardia, 60 % of them had sinus bradycardia, 20 % had 1st and 2nd degree heart block and the remaining 20 % had CHB.

Table (4) Echocardiographic findings in patients confirmed to have primary bradycardia using Holter monitoring (n=30)

Echocardiographic findings	Holter ECG findings	Account
Normal Echo findings	Sinus bradycardia	18
ASD Patch closure	1st , 2nd degree heart block	6
Impaired systolic function	Congenital CHB	3
Complete AV canal defect	CHB	3

Echocardiography was performed for all 30 patients with primary bradycardia. Normal echo findings were confirmed in 18 patients (60%). ASD patch closure was the finding in 6 patients with 1st and 2nd degree heart block (20%), 3 children (10%) who had congenital CHB due to maternal SLE were confirmed to have impaired systolic function, and the last 3 patients (10%) who had CHB were associated with Complete AV canal defect .

DISCUSSION:

Primary bradycardia is defined as a heart rate under the normal range for the child's age, level of activity and clinical condition. Primary bradycardia usually manifests as sinus bradycardia, junctional bradycardia or atrioventricular block [(1)].

Regarding causes in this study, 30 patients had primary bradycardia. Syncopal attacks were the presenting symptom in 15 patients (50%) 0f cases and other 15 patients (50%) were discovered during routine examination.

The most common cause of primary bradycardia in this study was Idiopathic, followed by post ASD patch closure and less common cause was maternal SLE.

Another study by Adkisson et al., 2015 who studied 153 children found such result as primary bradycardia was presenting in 25 children (16.3%) during routine examination while syncopal attacks were presenting in 31 patients (20.3%) [(8)].

In this study using ECG findings were 60 % had sinus bradycardia, 20 % had CHB, and 20% had 1st and 2nd degree heart block.

In a study done by **Choi et al., 2021** who studied 271 children in whom 81.8% of them had sinus bradycardia, 8.5% had CHB, 7 % had post operated bradycardia, 3.7 % had long QTC, 2.2% had ECG changes of prolonged PR interval and 0.7 % had 1st and 2nd degree heart block[(12)].

More or less different to our study **Hafeez et al., 2020** showed that ECG findings of children with bradycardia in their study was 75.4% of them had sinus bradycardia, 22.3% had CHB, 11.3 % had post-operative bradycardia , 6.8 % had long QTC , 2.4% had 1st and 2nd degree heart block and 1.2% had ECG changes of prolonged PR interval. [(9)]

As Holter monitoring has an essential role in the evaluation of primary bradycardia [(6)]. In this study **Holter monitoring** was used in all 30 patients. Sinus bradycardia was confirmed in 18 patients (60). 1st and 2nd degree heart block were present in 6 patients (20%). Complete heart block was confirmed in 6 patients (20%).

Another study in our university done by **Feby S. et al., 2019** studied the role of 24 hours Holter ECG in monitoring pediatric patients with arrhythmia which done in 80 patients. 54 patients

of them had abnormal Holter ECG findings, the most common finding was sinus bradycardia in 9 patients, followed by 1st and 2nd degree heart block were in 7 patients, less common findings were CHB, Low voltage QRS complex and Prolonged PR interval in 1 patient for each. (10)

Comparable to us **Hegazy et al., 2007** in KSA studied the role of Holter in monitoring children with arrhythmia, palpitations (19.8%), syncope (17.8%), evaluation of antiarrhythmic drugs (6.8%), and complete heart block (2.4%) were the detected causes for using Holter ECG, and enrolled that Holter has an important role in evaluation of high risk patients as postoperative and cardiomyopathy, while in children with palpitations, syncope and chest pain Holter monitoring has a low yield (11).

In our study **echocardiography** was performed for all 30 patients, 18 (60%) of them were with normal echocardiography, 6 (20%) had 1ry bradyc-ardia with post ASD patch closure, 3 patients (10%) had impaired systolic function and last 3 patients (10%) had complete AV canal defect.

More or less similar to our study **Choi et al., 2021** whom made echocardiography for 169 children in whom 62 patients (36.7) were with no echocardiographic abnormalities while 107(63.3) were with abnormal findings. The most common findings were ASD in 51 patients (30.2%), then Post ASD patch closure in 18 patients (10.7%) (12)

Another study done by **Adkisson et al., 2015** whom made echocardiography for 153 children in whom 102 patients were with no echocardiographic abnormalities while 51 were with abnormal findings. The most common findings were ASD in 18 patients (11.8%), Post subcutaneous Trans cath-eter device closure of ASD in 8 patients (5.2%).(8)

Pacemaker insertion in AV block is mainly based on average heart rates, determined by Holter monitoring which gives accurate data about the range of ventricular rates attained by the junctional escape rhythm in complete AV block.(6)

Patients with CHD and 1st, 2nd degree or complete AV block or post-operative sinus node dysfunctions (SND) have a high risk of sudden cardiac arrest. One year of mortality in patients with complete post-surgical AV block who didn't receive permanent pacemaker implantation has been reported ranging from 28 to 100% in many studies 30 years ago.(7)

In our study Pacemaker insertion were done for 3 children (10%) who had congenital CHB due to maternal SLE and were confirmed to have impaired systolic function, While Calcium and vitamin D supplementation with proper, regular follow up were introduced to the remaining children and resulting in well improvement.

Conclusion & Recommendations:

Primary bradycardia in children requires early assessment and management to decrease their need for acute intervention and to prevent sudden death.

Routine examination, Holter ECG and bedside echocardiography may be helpful in early diagnosis, monitoring and evaluation of primary bradycardia in pediatrics.

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