

# Patterns of infective endocarditic in children in a Sudanese referral hospital

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## Abstract:

**Background:** Infective endocarditis (IE) is an important cause of morbidity and mortality in children with heart disease. In Sudan, cardiac services are improving , however, data about IE is scarce. This study aims to evaluate the clinical and echocardiographic (echo) patterns of children admitted to cardiology ward with IE.

**Methods:** A cross sectional descriptive observational study was conducted in Jafar Ibn Ouf (JIO) Children’s Hospital- Khartoum-Sudan. There were retrospective (January 2013- November 2018) and prospective (December 2018-November 2019) parts where clinical and echo data were collected. IE was diagnosed according to the Dukes Criteria. Standard echo/Doppler studies were done by pediatric cardiologist.

## Results:

The prevalence of IE was 51 per 1000 cardiology ward admissions. The mean age at diagnosis was 9.2 years with male: female ratio of 1.3:1. The most common underlying cardiac lesion was congenital heart disease (CHD) in 74.3% followed by rheumatic heart disease (RHD) in 25.7% of patients. Prior cardiac interventions (surgery and catheterization) were reported in 15.7 %. The most common presenting symptoms were fever (98.6%), followed with arthralgia (21.4%) and neurological manifestations (11.4%). Prior use of antibiotics was detected in 68.6% of patients. Only 25.7% had positive blood culture results, and the most common isolated organism was Staph species in (44.5%). Echo features include vegetations in 74.3%, most commonly seen on mitral and tricuspid valves (14.3% each). Mortality was 10% mainly due to heart failure and neurological complications.

**Conclusion:** IE is an important cause of morbidity and mortality in children. The most common underlying lesions are CHD, with a significant proportion of the cases who had preceding cardiac interventions. Low yield of blood culture and increased rate of prior antibiotics were found. The rates of RHD and mortality decreased in comparison with previous studies.

**Keywords:** Infective Endocarditis; children; Sudan

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## **Introduction**

Infective endocarditis (IE) is an infection of the endocardium and/or heart valves with the formation of a thrombus and secondary damage of the involved tissue leading to significant morbidity and mortality. The incidence of IE in children ranges between 0.05–0.12 cases/1000.(1) Incidence has been progressively increasing in recent years due to progress in neonatal and cardiovascular interventions leading to more use of invasive procedure and central catheters. (2). In addition, there is a significant increase in IE associated with congenital heart disease (CHD) because of the major advances in cardiac interventions with consequent improved survival of these patients.(3)

In Sudan , there had been major advances in pediatric cardiology, cardiac surgery as well as neonatal care which might potentially lead to changes in epidemiology of IE.(4) Data about IE in Sudan is scarce and this study is done to evaluate the patterns of the disease in Sudanese children.

## **Materials and Methods**

A cross sectional descriptive observational study was conducted in Jafaar Ibn Ouf (JIO) Children's Hospital, Pediatric Cardiology Unit. All children (0-18 years) admitted with IE in the study period were included. The study has 2 parts: a retrospective part from January 2013- November 2018 and a prospective part from December 2018-November 2019.

Complete history and physical examination were done, results of laboratory investigations and details of echocardiography (echo) were reviewed. Hospital morbidity and mortality was recorded. Diagnosis of IE was based on the modified Dukes Criteria (5). All patients with suspected or confirmed IE were included. Echo was done by pediatric cardiologist using standard segmental approach. Functional assessment of heart

valves was performed according to the protocol of the American College of Cardiology (6)

Ethical Considerations: the study protocol was approved by the Ethics Committee of the Sudan Medical Specialization Board. Approval was obtained from JIO Hospital administration. An informed written consent was obtained from the guardians of all prospective patients, no consent was necessary for the retrospective part.

### **Results:**

During the study period 1,351 patients were admitted to the cardiology ward, out of these 70 were diagnosed as IE giving an incidence of 51.8/1000. The mean age was  $9.2 \pm 4.5$  years and male: female ratio of 1.3:1.

The most common presenting symptoms was fever among (98.6%), followed by arthralgia (21.4%) and neurological manifestations (11.4%), the most common of which were weakness in (62.5%). Brain imaging showed infarction in 50% of patients, brain hematoma and brain abscess each in 12% of patients. The study did not report any prior dental procedures. About two thirds (68.6%) used prior antibiotics. The most common signs were tachycardia (90%), clubbing (35.7%), splenomegaly (28.6%) and heart failure (22.9%). The final diagnosis was possible IE in (30%) and definite IE in (70%)

The most common cardiac diagnosis was CHD in 52 patients (74.3%), most common defects were VSD (36%) and complex CHD (17%). Rheumatic heart disease (RHD) was found in 18 patients (25.7%). Vegetations were found in (74.3%) of patients The most common sites were the mitral valve and tricuspid valve (Figure 1). Two of patients with tricuspid vegetations needed cardiac surgery due to severe tricuspid regurgitation. Other echo findings include aortic root abscess (Figure 2) and leaflet perforation as shown in table1,

There was history of cardiac interventions in 11 patients as shown in table 2. Blood culture was positive in (25.7%) of patients. The most common isolated organism was Staphylococcal species (44.5%) as shown in table 3.

There were 7 deaths due to IE during the study period (case fatality of 10%). All cases who died presented with heart failure, and one third of them had neurological complications. IE was responsible for (4.2%) of reported deaths in cardiology ward during the study period.

## **Discussion**

The pediatric cardiology ward in JIO hospital receives cardiac admission from all over the country thus the incidence of IE is relatively high when compared with general pediatric wards such as in Ethiopia and Burkina Faso where IE incidence was 17 per 1000 and in Pakistan where the incidence was 32 per 1000. (7,8,9).

In the current study, RHD frequency is significantly lower than a similar study conducted in JIO hospital from 2006-2010. (10). RHD as the underlying cause of IE decreased from 40% to 25% in the current study. This sharp decline in RHD is simultaneous with the introduction of RHD control program in Sudan in 2012 and may reflect a true decrease in incidence of RHD (11). In contrast, RHD remained the most common cardiac disease predisposing to IE in Ethiopia, and Pakistan, (7,9)

In accordance with other studies, there was no history of preceding dental or other surgical procedures which emphasizes the recommendations of the American Heart Association that antibiotics need not be prescribed before dental procedures. Rather, patients should be educated about keeping good oral hygiene. It has been documented that the rate of IE did not change after adopting these recommendations (12) The most common predisposing heart lesions were CHD, most commonly VSD which led to increased rate of vegetations on tricuspid valve leading to severe regurgitation. This highlights the importance of educating patients with CHD about dental hygiene as well as the early symptoms of IE as the complications of IE can be extremely difficult to manage particularly on tricuspid valve.

This study reported a significant number of patients who had cardiac interventions. Compared to the study conducted in 2006- 2010, the frequency of patients who had cardiac interventions has doubled and this reflects the improving rates of cardiac interventions in Sudan. (13) On the other hand, these findings should alert cardiologists and surgeons to insist on universal precautions of infection control. In addition, patients who underwent interventions need to be alerted to refer early to cardiac centers if they experience post procedure fever.

Only about a quarter of the study participants had a positive blood culture, although the result is much better than the study done in 2010 (10% of patients had positive cultures)

(10). The current yield is considered low when compared with results from other countries such as Burkina Faso (56%) and Pakistan (47%) (8,9). In developed countries such as Canada, culture-negative IE has been described in only 5% to 10% of cases, meaning that over 90% of cases of IE have a positive blood culture which reflects efficient microbiological services. (14) This low yield of blood culture needs to be thoroughly investigated in order to identify possible causes as the treatment of patients with IE in the absence of reliable microbiological diagnosis can be challenging. A potentially manageable cause is the common use of antibiotics before taking samples for blood culture which was found in many patients in the current study. Primary and secondary care practitioners need to be alerted to always take blood culture samples before starting antibiotics in order to avoid false negative blood culture results.

The pattern of isolated organisms in this study were similar to other studies from Ethiopia and Burkina Faso (7,8). Other studies revealed that *Strep viridians* is the most common organism and likely to cause more community acquired IE while staph causes more of post procedure IE (9,14). The results of blood culture in the current study could represent a true higher prevalence of staph due to high frequency of cardiac interventions, however, this could also indicate a high rate of contamination of the blood culture sample which needs a sterile method of collection.

The overall mortality with IE in this study was (10%), this rate is significantly lower than that reported in 2010 which was 20%. (10) This decrease in mortality rate is probably related earlier diagnosis which we believe is due to significantly improved availability of echo. The number of echo machines and echo clinics had tripled in the current era, in addition, increased number of specialized personnel became available and probably contributed to improved medical care.(13)

The mortality rate is relatively high in developing countries due to multiple factors including late presentation, limited facilities for surgical and intensive care management. Patients who need cardiac interventions during active IE are considered to have a high surgical risk, therefore have smaller chance for immediate surgery which is needed in server valve lesions.

In conclusion, we found that IE is an important cause of morbidity and mortality in Sudanese children. The frequency of RHD as well as the mortality rates are less than

those in 2010. The rate of positive blood culture is low which could indicate limitations of microbiology services and the need to alert physicians to send blood culture samples before starting antibiotics.

**Study Limitations:** The sample is relatively small and there are missing data in retrospective patients.

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**Table (1) Echocardiography Findings in 70 Patients with IE**

<b>Echocardiography findings</b>		<b>Frequency</b>	<b>Percent</b>
RHD		18	25.7
CHD		52	74.2
	VSD	19	36
	Complex CHD *	9	17
	TOF	6	11
	Aortic Valve disease	6	11
	PDA	4	8
	Tricuspid valve dysplasia with ASD	1	2
	PS	1	2
	TGA +VSD	1	2
	COA +Bicuspid aortic valve	1	2
	COA with VSD	1	2
	VSD/ASD	1	2
	ASD /PDA	1	2
	VSD/AR	1	2
Vegetations		52	74.3
	Mitral valve	10	19
	Tricuspid valve	10	19
	Aortic valve	9	17
	Multiple valve	8	15
	Pulmonary valve	7	13
	Not specified	8	15
Others			
	Aortic root abscess	1	1.4
	Valve leaflet perforation	2	2.9

**Table 2**  
**Cardiac Interventions in 11 Patients with IE**

Cardiac Intervention	No (%)
TOF repair	3 (27)
Cardiac catheterization**	2 (18)
Of the following diagnoses: CCTGA repair PDA ligation Blalock Tausig shunt Mitral valve repair COA repair One patient from each diagnosis	1 (9)
Total	11

**Abbreviations:** CHD: Congenital heart disease, RHD: Rheumatic heart disease, VSD: Ventricular septal defect, TOF: Tetralogy of Fallot, PDA: Patent ductus arteriosus. PS: Pulmonary stenosis, ASD: Atrial septal defect, TGA: Transposition of great arteries, COA: Coarctation of the aorta, AR: Aortic regurgitation. CCTGA: Congenitally corrected transposition of great arteries,

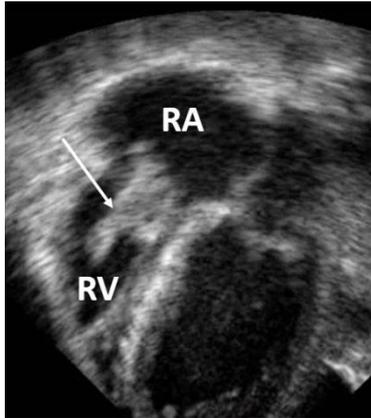
\* **Complex CHD:** Double outlet right ventricle (2), Functionally single ventricle (5), Corrected transposition of great arteries (2).

\*\* One case had diagnostic cardiac catheterization for TOF and the other had balloon atrial septostomy for TGA.

**Table 3 Blood Culture Results (n = 70)**

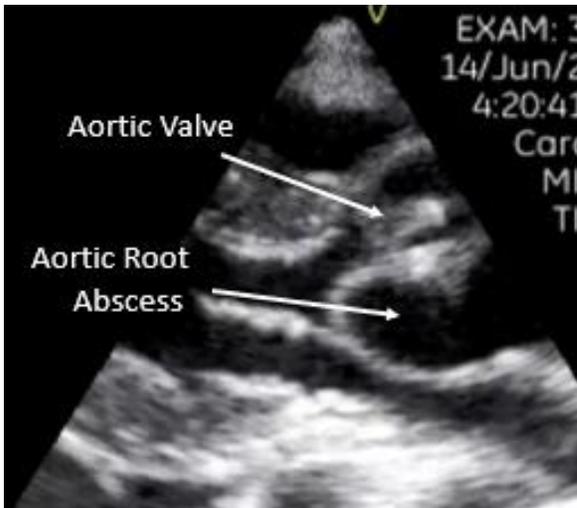
Investigation results		Frequency	Percent
Blood culture	Positive	18	25.7
	Negative	52	58.6
	Unknown	11	15.7
Isolated Organisms (n = 18)	Staphylococcus aureus	5	27.8
	Streptococcus species	5	27.8
	Staphylococcus species	3	16.7
	Pseudomonas	2	11.1
	Streptococcus viridans	2	11.1
	Klebsiella	1	5.6

**Figures:**



**Figure 1**

Four chamber view showing a large vegetation on the tricuspid valve (arrow)  
RA: Right atrium, RV: Right ventricle



**Figure 2**

Parasternal long axis view showing thick aortic valve with a large aortic root abscess