Infective endocarditis in children: profile in a 6 years experience from Dr.Mohammad Hoesin Hospital, Palembang, Indonesia

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Abstract. Infective endocarditis (IE) is an inflammation or infection in the endocardium. Cardiac abnormalities represent a predisposing for the development of IE. The aim of this study is to describe the profile of IE from Mohammad Hoesin Hospital. A retrospective study was conducted from January 2011 to December 2017. Forty six children were diagnosed with IE, 67.4% of patients with aged > 5 years old. The nutritional status was 69.6% wasting and 30.4% normal. Congenital Heart Disease (CHD) was the predominant underlying heart condition (60.9%), followed by Rheumatic Heart Disease (RHD) 37% and without cardiac abnormalities (2.1%). The infective agents were identified in 50% cases, and the most frequent causative agents were Staphylococcus aureus (21.7%), followed by Staphylococcus epidermidis (10.9%), Streptococcus viridans (6.5%), Enterococcus faecalis (4.3%), Streptococcus bovis (1%), Staphylococcus haemolyticus (1%). The following complications were common: heart failure (65.2 %), pneumonia (17.4%), anemia (4.3%), pericardial effusion (4.3%) respectively. The most empirical antibiotics were ampicillin and gentamicin (82.6%) and only 1 patient underwent surgery for IE. The overall death was 4.3%. The conclusion of this study is IE mostly occurs in CHD and the most organism is Staphylococcus aureus.

1. Introduction
Infective endocarditis is an inflammation or infection in the endocardium. Cardiac abnormalities represent a predisposing for the development of IE. The incidence of IE is 0.5 to 1 every 1000 hospitalized, not including postoperative IE events [1]. The incidence of IE in children with CHD about 16% and increase at more than 2 years of age [2,3]. Cardiac abnormalities are the most predisposing factor causing the occurrence of IE. In addition, the use of prosthetic devices and the use of drugs through intravenous access can also cause IE [1,4,5]. The incidence of IE in children without heart disease with the use of intravenous access approximately 8-10% [4].

In the past, the most microorganisms that cause IE is Streptococcus viridians, enterococcus and Staphylococcus aureus were responsible more than 90% of the cases. In recent years, this frequency has decreased until 50% to 60%, with a concomitant increase in cases caused by fungi and HACEK organism (Haemophilus, Actinobacillus, Cardiobacterium, Eikenella and Kinggelaspp) [1,6].

The location of vegetation found in areas with lower pressure on the side of the defect, around defects, or on the opposite side with defects in a condition which is endothelial damage caused by the turbulence of the defect [1,6,7]. The aim of this study is to describe the profile of IE from dr. Mohammad Hoesin Hospital.
2. Methods
This study is a retrospective study conducted from January 2011 to December 2017. Data were collected from medical records. The inclusion criteria were all patients diagnosed with infective endocarditis based on Duke criteria whose medical records were complete. The exclusion criteria were all patients diagnosed with infective endocarditis based on Duke criteria whose medical records were incomplete.

The diagnosis IE based on the modified Duke criteria. A diagnosis of definite of IE is made by pathological evidence and fulfillment of certain clinical criteria. Pathological evidence of IE includes a demonstration of microorganism by culture. Clinical diagnosis is based on clinical finding if there is found 2 major or 1 major and three minor. The major criteria were found to cause IE microorganisms Streptococcus viridans, Streptococcus bovis, HACEK group, Staphylococcus aureus and enterococcus and found vegetation based on echocardiographic examination. Minor criteria are: there are predisposing factors for cardiac abnormalities or the use of intravenous drug access, fever (temperature of more than 38°C), vascular phenomena, immunologic phenomena and microbiology found in addition to causes of IE based on major criteria of blood cultures [3] Body weight is measured using a standing digital scale and baby scales with the Secca® brand. Nutritional status based on standard anthropometric measurements of WHO (WHZ) weight for height Z score. All data is processed using SPSS version 20 software.

3. Results
There were 56 data of patients diagnosed with IE, who were taken as study subjects 46 data. Table 1 shows the characteristic of the study population. In table 1, it can be seen that the average age of the subject was 99.57 months old and 67.4% patients with aged ≥5 years old. The most nutritional status was wasting as many as 26 patients (56.5%), predisposing factors for the most heart defects were VSD as many as 18 (39.1%) and RHD were 17 (37%). The highest number of vegetation occurred in the estuary of VSD and mitral valve respectively 13 patients (28.3%).

| Characteristics                  | Frequency (n = 46) |
|----------------------------------|-------------------|
| Gender, n (%)                    |                   |
| Male                             | 23 (50%)          |
| Female                           | 23 (50%)          |
| Age, month, mean, SD (range)     | 99.57, 65.88 (2-306) |
| Weight, kg, mean, SD (range)     | 18.98, 10 (3-40)  |
| Nutritional Status (WHZ), n (%)  |                   |
| Severely wasting                 | 6 (13%)           |
| Wasting                          | 26 (56.5%)        |
| Normal                           | 14 (30.4%)        |
| Cardiac abnormalities, n (%)     |                   |
| RHD                              | 17 (37%)          |
| PDA                              | 6 (13%)           |
| VSD                              | 18 (39.1%)        |
| ASD                              | 1 (2.2%)          |
| Pulmonary atresia                | 1 (2.2%)          |
| TGA                              | 1 (2.2%)          |
| Aortic Stenosis                  | 1 (2.2%)          |
| Without Heart Disorders          | 1 (2.2%)          |
| Location of vegetation           |                   |
| Pulmonary valve                  | 8 (17.4%)         |
| Aortic valve                     | 4 (8.7%)          |
| Tricuspid valve                  | 5 (10.9%)         |
| Mitral valve                     | 13 (28.3%)        |
| Near the VSD                     | 13 (28.3%)        |
| Near the PDA                     | 2 (4.3%)          |
| Near the ASD                     | 1 (2.2%)          |

In table 2, most of the patients return control as many as 43 (93.5%) who respond to antibiotic treatment and only 1 patient underwent surgery for IE. The pattern of bacteria that causes IE from the results of blood culture and the type of antibiotics used can be seen in table 3. In table 3, the infective agents were identified in 50% of cases, and the most frequent causative agents were Staphylococcus aureus (21.7%), followed by Staphylococcus epidermidis (10.9%), Streptococcus viridans (6.5%),
Enterococcus faecalis (4.3%), Streptococcus bovis (1%), Staphylococcus haemolyticus (1%). The most empirical antibiotics were 38 ampicillin and gentamicin combinations (82.6%). The overall death was 2 patients. The cause IE in the first patient was streptococcus viridans and the second patient was staphylococcus aureus.

Table 2. Complication and outcome.

| Characteristics       | Frequency (n = 46) |
|-----------------------|--------------------|
| Complication          |                    |
| Heart Failure         | 30 (65.2%)         |
| Pneumonia             | 8 (17.4%)          |
| Anemia                | 2 (4.3%)           |
| Pericardial effusion  | 2 (4.3%)           |
| Without complication  | 4 (8.7%)           |
| Outcome               |                    |
| Recovered             | 43 (93.5%)         |
| Died                  | 2 (4.3%)           |
| Operation             | 1 (2.2%)           |

Table 3. Patterns of bacteria causing IE and antibiotic.

| Profile                 | Frequency (n = 46) |
|-------------------------|--------------------|
| Blood culture results   |                    |
| Streptococcus viridans  | 3 (6.5%)           |
| Streptococcus bovis     | 1 (2.2%)           |
| Staphylococcus aureus   | 10 (21.7%)         |
| Staphylococcus epidermidis | 5 (10.9%)     |
| Staphylococcus haemolyticus | 1 (2.2%)     |
| Staphylococcus saprophyticus | 1 (2.2%)     |
| Enterococcus faecalis   | 2 (4.3%)           |
| Sterile                 | 23 (50%)           |
| Antibiotic              |                    |
| Ampicillin and Gentamicin | 38 (82.6%) |
| Ampicillin and Ceftriakson | 4 (8.7%) |
| Ampicillin and Vancomycin | 1 (2.2%)   |
| Meropenem and gentamicin | 1 (2.2%)   |
| Meropenem               | 2 (4.3%)           |

4. Discussions

In this study, there were no gender differences in the occurrence of IE, each of which was 50%. Forty six children were diagnosed with IE, 67.4% of patients with aged >5 years old. Similarly with the study by Dinela Rushani et al, IE more frequency in more than 6 year old children [5]. The nutritional status was 56.5% wasting.

The predisposing factor for the most cardiac abnormalities in this study was VSD as many as 18 (39.1%). This is almost the same as the research conducted by Niwa K et al in Japan, that the highest incidence of IE in VSD is 37.5% [8]. Likewise, a study was conducted by Alshammary A et al, the highest IE incidence is at 70% VSD [9]. Whereas the study was conducted by Dinela Rushani et al in Canada, the highest incidence of IE occurred in cyanotic CHD about 34% [5]. The highest number of vegetation occurs in near the VSD and mitral valve respectively 13 patients (28.3%). This is according with the theory, that the common location of vegetation is in areas with lower pressure on the side of the defect, or around the defect [3]. In this study, IE mostly occurs in VSD and RHD, so that the most vegetation location is near to the VSD and mitral valve.

In this study there was 1 person who experienced IE without a predisposing factor for previous heart abnormalities, but because of the use of drugs through intravenous access. The results of blood culture in these patients are Staphylococcus aureus bacteria. In the previous study, Staphylococcus aureus is the most germs cause IE to the use of drugs through intravenous access. This is almost the same as the research conducted by Alshammary A et al, where there were 2 cases of IE in children without cardiac failure, but caused by the use of CVC access, with the location of vegetation found in the aortic and mitral valves, with blood cultures found Staphylococcus aureus [9].

In this study, almost the majority of patients had been recovery about 43 (93.5%) who responded to antibiotic treatment. The most common causes of IE microorganisms were Staphylococcus aureus, Staphylococcus epidermidis and Streptococcus viridans. This is different from the study was
conducted by Niwa K et al in Japan, the highest number of IE causing microorganisms is streptococcus sp. (49.8%), followed by 31.8% staphylococcus viridans and 5% staphylococcus epidermis [8].

The most widely used empirical antibiotics are 38 ampicillin and gentamicin combinations (82.6%). In accordance with the guidelines in therapy infective endocarditis of the European Society of Cardiology, that the first line empiric therapy for IE is a combination of ampicillin and gentamicin or a combination of ampicillin and ceftriaxone [6]. In the study was conducted by Niwa K et al in Japan, the use of a combination of empirical ampicillin and gentamicin antibiotics is only 21% [8].

There are some limitations in this study, including retrospective data retrieval, so that some data needed to find a relationship between the incidence of IE and the incidence of dental caries is not available. In addition, no data on prophylactic antibiotic use was available before invasive procedures to reduce risk factors for IE in patients with congenital heart disease and rheumatic heart disease. In this study also did not assess the duration of the occurrence of fever. The results of sterile blood cultures in this study are likely due to antibiotics pre-treatment. Further research is needed that is cohort prospectively to find a relationship between oral hygiene and the incidence of dental caries with IE.

5. Conclusions
Infective endocarditis is more common in the heart disease of congenital cyanotic ventricular septal defects. The location of the most vegetation is located at the near of the VSD and mitral valve. Most of the blood culture in this study is sterile. The most common germ pattern in this study is Staphylococcus aureus. The most widely used empirical antibiotic is a combination of ampicillin and gentamicin.

6. References
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