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Research Article

Appropriate Empirical Antibiotic Treatment and Vital Sign Outcome among Pneumonia Patients in Universitas Gadjah Mada Academic Hospital, Indonesia

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Abstract

Pneumonia is defined as a common illness that remains to be the highest mortality rate in young children and the elderly-aged group in both of developed and developing countries. Pneumonia itself counted as the second out of the ten most common diseases from January to November 2018 inpatient care in the Universitas Gadjah Mada academic hospital. This study aimed to explore the appropriate of empirical antibiotics use based on Universitas Gadjah Mada Academic Hospital guideline of and to evaluate it's vital sign outcome. This study used cross sectional method with retrospective data collection through patients' medical report collected from January to June 2018 and driven descriptively. Specifically, the included patients in this study were hospitalized patients which diagnosed with pneumonia. Overall, there are total of 197 patients with Pneumonia or Bronchopneumonia diagnosed which particularly consisted of 98 children's patients and 97 adults. The highest prevalence of antibiotic treatment in academic hospital were using empirical antibiotic which is betalactam-penicilin antibiotic group for children patients and betalactam-cephalosporin antibiotic group for adult patients diagnosed with pneumonia. Moreover, the abnormality of patient's vital signs after the 48 until 72 hours duration of treatment were decrease remarkably. Regarding to the appropriate use of empirical antibiotic treatment which observed in children was reported low roughly around 0.071%, meanwhile in adults almost a half of observed patients were appropriated. Through this pioneer study the hospital's guideline on local pneumonia treatment should re-evaluate in order to improve the appropriate empirical usage of antibiotics.

Keywords: pneumonia, local hospital giudeline, appropriate empirical use of antibiotic, Universitas Gadjah Mada Academic Hospital.



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Introduction

The prevalence of pneumonia is higher in standardized older participants than in community occupants [4]. In Indonesia, pneumonia occurred in children under five years old around 447,431 case in 2017. While there were 1,155 case of pneumonia within the area of Yogyakarta reported in 2017 [5]. The highest cause of pneumonia is a bacterial infection. Antibiotic resistance is a main health problem throughout the world, including Indonesia [6]. Antibiotic resistance and sensitivity patterns change according to place and time [7]. Antibiotic sensitivity is essential to recognize the antibiotic

resistance. Controlling local antibiotic resistance is necessary to support the determination of empirical antibiotic therapy [8,9]. Pneumonia ordered being 2nd out of the 10 biggest diseases in the period January-November 2018 inpatient care for the teaching hospital in Yogyakarta, Indonesia. The importance of this study is to evaluate antibiotic management in pneumonia treatment by looking at patterns of the appropriateness empiric antibiotic use. The local guidelines use for pneumonia treatment at the teaching hospital. Antibiotic sensitivity applied to consideration of empirical antibiotic selection in initiating the establishment of Antibiotic Resistance Control Programs (PPRA) at RSA UGM.

Materials and Methods

These data were conduct with a cross sectional study and retrospective data collection by using patients’ medical records of patients diagnosed with Pneumonia at the Universitas Gadjah Mada Academic Hospital, Yogyakarta Indonesia. The study period spanned medical records from January to June 2018, and the data was collected from August to December 2018. Ethical approval for analysis of the hospital medical records was obtained from faculty of Medicine Ethics committee Universitas Gadjah Mada, Yogyakarta, Indonesia.

The sample size was count by (Lemeshow et al., 1990) with purposive sampling technique [10]. Statistical analyses were performed on the demographic and clinical variables. The result is presented as frequencies and percentages.

Result

Patients’ characteristics

In this study there are total 197 patients with Pneumonia or Bronchopneumonia diagnosed. Of these patients there were 98 children aged 0 to 17 years (the mean age were 13.5 ± 5.09 years), and 97 adults were in aged ≥ 18 years (the mean age were 66 ± 14.9 years). Most of the patients both children (57.1%) and adults (60.8%) were male with pneumonia diagnosed. The length of stay in hospital both of the patients were under 7 days. Children patients have had a pneumonia history of diseases (21.4%) before and about (19,6%) adults patients have had a hypertension (Table 1).

Table 1. Patients’ Characteristics

Characteriscics	Age	
	Age <18 (n=98)	Age ≥ 18 (n=97)
Male, n (%)	56 (57.1)	59 (60.8)
Female, n (%)	42 (42.9)	38 (39.2)
Age (in years), mean (SD)	13.5 ± 5.09	66 ± 14.9
Pneumonia Type		
Pneumonia	79 (80.6)	54 (55.7)
Bronchopneumonia	19 (19.4)	43 (44.3)
Length of Stay (days)		
<7	69 (70.4)	69 (71.1)
≥7	29 (29.6)	28 (28.9)
History of Disease, n(%)		
None	61 (62.6)	38 (39.2)
Pneumonia	21 (21.4)	5 (5.2)
Hypertension	0 (0)	19 (19.6)
Asthma	0 (0)	8 (8.2)
Diabetes Mellitus	0 (0)	5 (5.2)
CKD	0 (0)	5 (5.2)
URI	5 (5.1)	0 (0)
Etc	11 (11.2)	17 (7.5)

Clinical manifestations

Clinical manifestations in this study is focusing on the vital sign of patient. The vital sign (heart rate, temperature, respiratory rate and oxygen saturation) was recorded from the patient admission to hospital and 48-72 hours after admission. Presentation of abnormal vital signs on admission were from most to less frequent in children: heart rate (20,4%),fever (48%), respiratory rate (28.6%), and oxygen saturation (17.3%), adults: heart rate (49.5%), fever (22,4%), respiratory rate (73.2%), and oxygen saturation (56,7%) (Table 2).

Table 2. Patients vital sign (clinical manifestation on admission and 48-72 hours after empirical antibiotic treatment)

Vital Sign	First Admit to Hospital		42-72 Hours Antibiotic Treatment	
	Age <18 (n=98)	Age ≥ 18 (n=97)	Age <18 (n=98)	Age ≥ 18 (n=97)
Heart Rate, n				

(%)				
Normal	78 (79.6)	49 (50.5)	81 (82.7)	76 (78.4)
Abnormal	20 (20.4)	48 (49.5)	17 (17.3)	21 (21.6)
Temperature, n (%)				
Normal	51 (52)	70 (72.2)	76 (77.6)	90 (92.8)
Abnormal	47 (48)	27 (27.8)	22 (22.4)	7 (7.2)
Respiratory Rate, n (%)				
Normal	70 (71.4)	26 (26.8)	79 (80.6)	75 (77.3)
Abnormal	28 (28.6)	71 (73.2)	19 (19.4)	22 (22.7)
SpO2, n (%)				
Normal	81 (82.7)	42 (43.3)	85 (86.7)	78 (80.4)
Abnormal	17 (17.3)	55 (56.7)	13 (13.3)	19 (19.6)

Empirical antibiotic treatment

Empirical Antibiotic treatment that used was record with many variations such as intravenous, oral route, single or combination.

Table 3. Empirical antibiotic treatment in patients with pneumonia

Characteristic	Age<18	Age ≥18
Betalactam (cephalosporin)	67	92
Betalactam (carbapenem)	0	17
Betalactam (penicillin)	104	6
Macrolide	22	50
Aminoglycoside	58	1
Fluoroquinolone	0	14

Clinical outcome after 48-72 hours antibiotic treatment

Evaluation of patients clinical outcome was assessed after 48-72 hours of empirical antibiotic use. The patients clinical outcome improves if they meet 4 clinical outcome criteria (heart rate, body temperature, respiration rate and SpO2) and the patients clinical outcome not improved if

they did not meet the 4 clinical outcome criteria. The results showed clinical outcomes of adult patients after 48-72 hours of empirical antibiotic use provided improved clinical outcomes in 51 patients (52,58%) and clinical outcomes not improve in 46 patients (47,42%) (Table 4).

Table 4. Appropriate usage of empirical Antibiotics Related to Patients' Treatment Outcome

Clinic Outcome	Age			
	Age <18 (n=98)		Age ≥ 18 (n=97)	
	Appropriate	Inappropriate	Appropriate	Inappropriate
Improve	7	69	24	27
Not Improve	0	22	18	28

Appropriate Empirical Antibiotics

The appropriate use of empirical antibiotics based on local academic hospital guidelines. Evaluation of antibiotic use is based on empirical antibiotic selection, route, frequency and duration. Regarding to the appropriate use of antibiotic treatment there were 42 adult patients with pneumonia were appropriated (Table 4).

Discussion

To our knowledge, this is a first cross-sectional study on adherence of empirical antibiotic use towards guidelines among pneumonia patients in Yogyakarta Province, Indonesia. Currently the appropriate use of antibiotic is one of the focus in healthcare to minimize the resistance cases. The appropriate use of antibiotic can be control by the adherence of health workers to follow the local guidelines therapy and evaluate every clinical outcome of the patient. The aim of this study was to explore the adherence, appropriate use of empirical antibiotics based on local hospital guidelines (Universitas Gadjah Mada Academic Hospital), and to evaluate it's clinical outcome. Half of the patients both children (57.1%) and adults (60.8%) were male. Mostly reported a significantly higher incidence of hospital admissions with pneumonia in male (p<0.05), compared to female [11]. Male had a higher incidence of pneumonia than female, possibly because of differences in intrinsic immune or inflammatory responses or differences in lung structure of function [12]. Patients with a previous history of pneumonia were at a higher risk of CAP, especially those whose initial episode occurred more than 2 years previously [13]. To our findings, clinical characteristic of the patients with history of pneumonia accounted (21.4% children and 5.2% adult) of 195 cases. This case was similar to study in China and from Ozdmenir et al, there were (12.4%) of childhood pneumonia cases in China and (10.4%) case from 595 hospitalized children had histories of recurrent pneumonia [14]. A lifelong history of pneumonia and prior hospitalizations for CAP are also well-known risk factors

for CAP for all age groups [15]. The length of stay in hospital both of the patients were under 7 days. The treatment of community acquired pneumonia should be treated for a minimum of 5 days [16]. We found that adults patients have more comorbid/previous history of disease than children. The previous history disease of hypertension, asthma, diabetes mellitus, chronic kidney disease had increased the risk of pneumonia-related admission. Recent studies have recognized that chronic respiratory disease and heart failure as a risk factors for CAP in adults admitted to the hospital [15]. Asthma and diabetes increase the risk and report a significant association between diabetes and the risk of CAP [15].

Empirical antibiotic treatment in patients with pneumonia

The classes of antibiotics used in children (age < 18 years) during hospitalization include beta lactams (penicillin, cephalosporins), polypeptides (macrolides), and aminoglycosides which can be seen in table 3. In this study, empirical antibiotics use in pneumonia patients according to the guidelines at Academic Hospital are amoxicillin for children aged <5 years and the macrolide group for children aged ≥5 years. These criteria are the same as guidelines from the IDAI and the British Thoracic Society (BTS) which recommend amoxicillin as the first-line (IDAI). In this study the appropriate use of empirical antibiotic that we found was Cefotaxim as single antibiotic therapy 8 (8.2%) and ampicilin 5 (5.2%) children patients with pneumonia. Hospitalized patients with Pneumonia cause by *S.aureus* is generally given initial therapy a single antibiotic of the beta-lactam penicillin class or first-generation cephalosporins [17]. The use of cefotaxime as a single therapy was in accordance with the guidelines for treating children pneumonia at RSA UGM, IDAI, and the British Thoracic Society (BTS). [18,19,20]. Empirical antibiotics for pneumonia in adults patient (age ≥ 18 years) according to the guidelines for the management of adult pneumonia therapy at Academic Hospital for non-ICU inpatients are 2nd or 3rd generation cephalosporin antibiotic or beta lactam and betalactamase inhibitors combined with macrolides or fluoroquinolones alone. Antibiotics for ICU inpatients are 3rd generation cephalosporin antibiotics with antipseudomonas activity or beta lactam and betalactamase inhibitors combined with macrolides or fluoroquinolones [18]. These guidelines are in accordance with the guidelines for treating adult pneumonia at RSA UGM, PDPI (Pedoman Dokter Paru Indonesia), and the Infectious Disease Society of America (IDSA)/ American Thoracic Society (ATS). [16,18,21].

The results showed that beta lactam antibiotics (cephalosporins, carbapenems, and penicillins) were the most widely used, there were 115 cases. Combination antibiotic therapy ceftriaxone and azithromycin were used in 30 patients (30.9%). The combination of beta lactam and macrolide antibiotics can increase patient outcome due to 3 factors. The factors were boarder spectrum of

antibiotic action, the workings of beta lactams and macrolides, the immunomodulatory abilities of macrolides [22]. The use of combination ceftriaxone and macrolide can reduce the mortality rate by 2.76% [23].

Appropriate empirical antibiotic use and Clinical Outcome

The results of our study show that only 7 (0,071%) children patients are using appropriate empirical antibiotic use amoxisilin according with improved clinical outcomes. There were 42 adult patients with pneumonia who received appropriate empirical antibiotics resulted improved clinical outcomes in 24 patients and not improve in 18 patients. Patients who received appropriate empirical antibiotics with not improved clinical outcomes maybe due to comorbid/previous history of disease that can worsen pneumonia. In 55 adult patients with pneumonia who received inappropriate empirical antibiotics resulted improved clinical outcomes in 27 patients and not improve in 28 patients. This may cause by the effectiveness of empirical antibiotics in combination therapy.

The abnormality of patient's vital signs (heart rate, temperature, respiratory rate and oxygen) after 48 until 72 hours duration of treatment were decrease remarkably. Presentation of abnormal vital signs after 48 until 72 hours duration of treatment were from most to less frequent in children: heart rate (17.3%), fever (22.4%), respiratory rate (19.4%), and oxygen saturation (13.3%), adults: heart rate (19.6%), fever (7.2%), respiratory rate (22.7%), and oxygen saturation (21.6%) (Table 2).

Conclusion

The appropriate use of empirical antibiotic treatment which observed in children was reported low roughly meanwhile in adults almost a half of observed patients were appropriated. Through this pioneer study the academic hospital's guideline on local pneumonia treatment should re-evaluate in order to improve the appropriate empirical usage of antibiotics.

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