ISSN No:-2456-2165

Profile of Antibiotic Use in Pediatric Patients with Pneumonia at Dr. M. Djamil Hospital Padang, West Sumatra, Indonesia

Dian Ayu Juwita, Aliffia Maharani, Dita Permatasari*
Department of Pharmacology and Clinical Pharmacy
Faculty of Pharmacy, Universitas Andalas
Padang, West Sumatra, Indonesia
*Corresponding author

Abstract:- Pneumonia is an acute lung infection caused mainly by bacteria. The primary therapy given for pneumonia is antibiotics. Antibiotics are chemical compounds produced by a microbe that kill or inhibit the growth of other microbes. Studies in several countries have shown that more than 70% of patients were prescribed antibiotics and almost 90% received unnecessary antibiotic injections. The mortality rate and treatment failure will be higher if the prescription of antibiotics for patients is not following the established guidelines. This study aims to determine the antibiotic usage profile in pediatric pneumonia patients. The descriptive study with data collection through medical records of inpatient installation in 2020-2021, involving 30 patients retrospectively. The study showed that most pediatric pneumonia patients were males, with 21 patients (70%). The age range of most pediatric pneumonia patients was 13-60 months, with 16 patients (53.3%). The most common single antibiotic used in pediatric pneumonia patients at Dr. M. Djamil Hospital was ceftriaxone, with 13 patients (43.33%). In comparison, the most common combination antibiotic used was ampicillin and gentamicin with ten patients (33.34%).

Keywords:- *Antibiotics, Pneumonia, Pediatric, Pediatric Pneumonia*

I. INTRODUCTION

Pneumonia is an acute lung infection caused by viruses, bacteria, or fungi. *Streptococcus pneumoniae* is the most common cause of bacterial pneumonia in children, the *Respiratory syncytial virus* is one of the most common viruses that cause pneumonia, and *Pneumocystis jiroveci* is a common cause of fungal pneumonia [1]. This disease results in breathing difficulties for the patient as the alveoli in the lungs become filled with pus and fluid, making it difficult to absorb oxygen fully. If not treated quickly and appropriately, it can lead to the risk of death [2]. Therefore, according to WHO (2021), pneumonia is one of the leading causes of death from infection in children worldwide [1].

According to WHO data in 2019, pneumonia caused 740,180 deaths among children under five years old, accounting for 22% of all deaths in children aged 1 to 5 years old, earning it the title "the leading killer of children worldwide" [1]. The 2020 Indonesia health profile data showed that pneumonia in toddlers in Indonesia was 34.8%, with 4,972,553 visits to primary healthcare centers due to pneumonia [3]. Global estimates indicate that every hour, 71 children in Indonesia are infected with pneumonia [4]. In Padang City, West Sumatra in 2020, 702 cases (41.2%) of pneumonia were found and treated in toddlers [5].

Many factors can influence the high mortality rate of pneumonia in children under five in developing countries, both from the aspect of the individual child, the behavior of the parents (mother), and the environment. First, the following individual aspects can play a role, such as age, gender, and comorbidities. Next, on aspects of parental behavior such as not carrying out complete immunizations for children, not providing adequate breastfeeding, and children having poor nutritional status. Finally, environmental factors include high exposure to air pollution, overcrowding, poor air circulation, and exposure to cigarette smoke from the environment and family [6], [7]. The Ministry of Health of Indonesia (2011) stated that if antibiotic prescriptions for patients do not adhere to the established treatment guidelines, mortality and treatment failure rates will be higher [8]. In 2013, a study was conducted at Dr. M. Djamil Padang Hospital on antibiotic dosage regimens, revealing cases of incorrect dosages, frequency, and duration of administration, despite correct administration routes [9]. Similarly, a study in 2015 at Prof. Dr. W. Z. Johannes Kupang Regional Hospital on 41 patients also found cases of incorrect dosages (48.78%) and duration of administration (46.34%) [10].

It is crucial to ensure that drug dosage is appropriate and based on the patient's severity and condition. Overdosing may cause toxic effects, while inadequate dosages render the drugs ineffective. Inappropriate prescription of antibiotics leads to an escalation in antibiotic resistance [11]. Therefore, the researchers were motivated to conduct a study on the usage of antibiotics in pediatric patients with pneumonia.

ISSN No:-2456-2165

II. RESEARCH METHOD

A. Research Design and Data Collection

The research was conducted using a retrospective descriptive method using medical record data of pediatric pneumonia patients in the Dr. M. Djamil Padang Hospital pediatric ward from 2020-2021. The inclusion criteria are pediatric patients under five years of age with pneumonia who received antibiotic treatment without coexisting diseases. Death cases were not included in the study criteria. The medical record number, patient name, gender, age, weight/height, drug name, dosage, administration interval, and duration of use are recorded and transferred to a prepared data collection sheet.

B. Data Analysis

Data were analyzed descriptively. The results were only presented in frequency and percentages for each antibiotic, such as dosage, administration frequency, and use duration.

C. Ethical Approval

This study obtained ethical approval from the Health Research Ethics Committee Dr. M. Djamil Padang Hospital, West Sumatra, Indonesia (No. LB.02.02/5.7/103/2022).

III. RESULTS AND DISCUSSION

The findings from the study conducted at Dr. M. Djamil Padang Hospital showed that most pediatric pneumonia cases were in male patients, comprising 21 out of 30 cases (70%), as stated in Table 1. This result aligned with previous research that found a more significant proportion of pneumonia cases in male children than in females [12], [13]. The 2020 Indonesian Health Profile also reported a higher prevalence of pediatric pneumonia in males in the West Sumatra Province, with 2,448 cases in toddlers compared to 2,023 cases in females [3]. It should be noted that male children have smaller respiratory tracts than females, which could contribute to a higher incidence of respiratory illnesses in males [14]. Furthermore, Kaparang (2014) highlighted that males' and females' biological immune defense mechanisms are distinct. Male lungs have greater airflow resistance and lower airflow conductance, resulting in slower air circulation in the respiratory cavity and increased susceptibility to pathogenic infections [15].

The study showed that most pediatric pneumonia cases fall within the age range of 13-60 months, with 16 patients (53.3%) affected. Age is a significant risk factor that is closely linked to the occurrence of pediatric pneumonia. The risk is higher for children under two years of age due to their underdeveloped immune system and less efficient respiratory system, which makes them more susceptible to bacterial or viral infections [16]. These findings were consistent with Saffrina's study (2016), which revealed that children under 24 months of age are more prone to contracting pneumonia than older age groups [17]. Additionally, Hartati (2011) found that children under 24 months of age are 3.24 times more likely to develop pneumonia than those over 24 months of age, with an OR = 3.24; 95% Cl (1.58 < OR < 6.64) [18].

Table 1. Demographic characteristics of patients (n=30)

Demographic characteristics	Frequency (%)
Gender	
Male	21 (70)
Female	9 (30)
Age (months)	
0– 1	4 (13.4)
2 – 12	10 (33.3)
13 – 60	16 (53.3)

Based on Table 2, in Dr. M. Djamil Hospital, ceftriaxone was the most widely used monotherapy for treating pediatric pneumonia, with 13 patients (39.4%). This finding was in line with a study by Putri (2020), which reported that ceftriaxone was the most frequently used single therapy, with 27 patients (32.14%) [19]. Ceftriaxone belongs to the third generation of cephalosporin antibiotics, the second line of treatment for pediatric pneumonia [20]. It effectively against gram-positive and gram-negative bacteria, such as *Enterobacteriaceae*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Pseudomonas aeruginosa*. This antibiotic was also rapidly absorbed and widely distributed in tissues and body fluids following parenteral administration to animals. As such, ceftriaxone was highly effective in treating various bacterial infections [21].

The recommended primary treatment by WHO for pediatric pneumonia was the combination therapy of ampicillin and gentamicin, commonly used for the condition. A total of 10 patients (33.34%) received this treatment in our study. In a randomized controlled trial conducted by WHO, children aged 2-59 months were given either chloramphenicol or ampicillin and gentamicin for ten days, with 479 children in each group. The results showed that the ampicillin and gentamicin combination had a lower clinical failure rate than chloramphenicol [20]. Tambun's study in 2019 also found that the ampicillin and gentamicin combination was the most commonly used treatment, with 28 patients (21.2%) [22]. This combination works synergistically by inhibiting cell wall synthesis and facilitating aminoglycoside diffusion, leading to increased antibiotic activity. Single gentamicin administration is less effective due to poor penetration into lung tissue.

The study discovered that 10% (3 patients) used a combination treatment of ampicillin-sulbactam and gentamicin (Table 2), selected due to reported resistance to beta-lactam antibiotics. Sulbactam, similar in structure to penicillin, has a modified side chain that allows for irreversible inhibition with beta-lactamases and prevents antibiotic breakdown. At the same time, gentamicin is added to expand the antimicrobial spectrum for severe infections and counteract resistant bacteria [23].

Two patients (6.67%) were treated with ampicillin and ceftriaxone (Table 2). In several countries, ceftriaxone and ampicillin were the recommended first-line antibiotics for CAP. Although they are effective against the same range of microorganisms, except for anaerobic bacteria, the primary pathogens in aspiration pneumonia, previous research has shown no significant difference between ceftriaxone and ampicillin in treating pneumonia [24]

One patient (3.33%) received treatment with ampicillin and chloramphenicol. Farida's study in 2017 found that the combination therapy of ampicillin and chloramphenicol had the highest usage rate (27.27%). Chloramphenicol is a bacteriostatic antibiotic that inhibits the replication of some gram-positive and gram-negative bacteria and is bactericidal against *Streptococcus pneumoniae* and *Haemophilus influenzae*. However, in vitro, studies have demonstrated that combining these two antibiotics can result in pharmacodynamic drug interactions. Chloramphenicol's inhibitory effect can antagonize the effectiveness of ampicillin, which works best when bacteria are growing and dividing, but chloramphenicol inhibits protein synthesis, limiting the activity of ampicillin [25]

The antibiotic chloramphenicol has been reported to cause severe and fatal cases of blood dyscrasia (abnormalities in blood cells), such as aplastic anemia, hypoplastic anemia, thrombocytopenia, and granulocytopenia. There have been reports of aplastic anemia associated with chloramphenicol that later resulted in leukemia. Blood dyscrasias have occurred after short-term and prolonged use of this antibiotic; therefore, chloramphenicol should not be used [26]

Meropenem was used by one patient (3.33%) in this study. This finding aligns with a previous study by Farida (2017) which reported that meropenem is used as a therapy in the Regional Referral Hospital of Surakarta. Meropenem has a broad in vitro spectrum of activity against gram-positive and gram-negative pathogens. Several studies have shown that meropenem results in more significant improvement in adult and pediatric patients with serious bacterial infections compared to a combination of ceftazidime and amikacin or tobramycin for nosocomial pneumonia patients [27].

Table 2. Antibiotic Treatment Profile in Pediatric Pneumonia Patients (n=30)

Antibiotic Treatment Types	Frequency (%)
Ampicillin + gentamicin	10 (33.34)
Ampicillin-sulbactam + gentamicin	3 (10)
Ampicillin + chloramphenicol	1 (3.33)
Ampicillin + ceftriaxone	2 (6.67)
Ceftriaxone	13 (43.33)
Meropenem	1 (3.33)

IV. CONCLUSION

The antibiotic use profile in pediatric pneumonia patients at Dr. M. Djamil Padang showed that ceftriaxone was most widely used as monotherapy. A combination of antibiotics using ampicillin and gentamicin is dominant in therapy. In addition, in this study, there were more male patients than women, with the highest number in the 13-60 months age group.

ACKNOWLEDGMENT

The authors would like to thank those who contributed significantly to this research.

REFERENCES

[1]. WHO, “Pneumonia,” *www.who.int*, 2021. https://www.who.int/news-room/fact-sheets/detail/pneumonia.
[2]. Cahyati. dkk, “The Overview of Toddler Pneumonia Patient Trend in Semarang City in 2012 - 2018" Tren Pneumonia Balita di Kota Semarang Tahun 2012-2018, *Higeia J. Public Heal.*, vol. 3, no. 3, p. 408, 2019.
[3]. KEMENKES RI, *Profil Kesehatan Indonesia 2020*. 2021.
[4]. UNICEF, “One Child Dies of Pneumonia Every 39 Seconds, Agencies Warn" Lembaga Kesehatan dan Anak Memeringatkan Satu Anak Meninggal Akibat Pneumonia Setiap 39 Detik, 2019. https://www.unicef.org/indonesia/id/press-releases/lembaga-kesehatan-dan-anak-memeringatkan-satu-anak-meninggal-akibat-pneumonia-setiap.
[5]. Dinas Kesehatan Kota Padang, “Profile of Health 2020" Profil Kesehatan 2020, 2021.
[6]. O. Monita, F. F. Yani, and Y. Lestari, “Profile Of Community-Acquired Pneumonia (CAP) In Pediatric Ward Of Dr. M. Djamil Hospital Padang West Sumatera" Profil Pasien Pneumonia Komunitas di Bagian Anak RSUP DR. M. Djamil Padang Sumatera Barat,” *J. Kesehat. Andalas*, vol. 4, no. 1, pp. 218–226, 2015, doi: 10.25077/jka.v4i1.225.
[7]. I. Leonardus and L. D. Anggraeni, “Factors That Associated With The Incidence Of Pneumonia In Children Under-Five Years Old At The Lewoleba Hospital” Faktor – Faktor Yang Berhubungan Dengan Kejadian Pneumonia Pada Balita Di RSUD Lewoleba, *J. Keperawatan Glob.*, vol. 4, no. 1, pp. 12–24, 2019, doi: 10.37341/jkg.v4i1.62.
[8]. Kementrian Kesehatan Republik Indonesia, “Guidelines for Pharmaceutical Treatment for Antibiotic Therapy, Ministry of Health of the Republic of Indonesia" Pedoman Pelayanan Kefarmasian Untuk Terapi Antibiotika Kementrian Kesehatan Republik Indonesia, 2011.
[9]. D. A. Juwita, H. Arifin, and N. Yulianti, “A Retrospective Descriptive Study On Antibiotic Dosage Regimen In Pediatric Pneumonia Patients At Dr. M. Djamil Hospital Padang” Kajian Deskriptif Retrospektif Regimen Dosis Antibiotik Pasien Pneumonia Anak di RSUP Dr. M. Djamil Padang. *Sains Farm. dan Klin.*, vol. 3, no. May, pp. 128–133, 2017.
[10]. Y. Anwar and M. E. B. B. Horang, “Evaluation Of Antibiotic Use at Childrens Medical People Pneumonia in Hospital Inpatient Installation Prof. Dr. W. Z. Johannes Kupang Period January - June 2015" Evaluasi Penggunaan Antibiotika Pada Pengobatan Penderita Pneumonia Anak Di Instalasi Rawat Inap RSUD Prof. Dr. W. Z. Johannes Kupang Periode Januari – Juni 2015, *Pharm. J. Farm. Indones.*, vol. 13, no. 02, pp. 252–260, 2016.
[11]. Nuryati, "Pharmacology" *Farmakologi*. Jakarta: Kementerian Kesehatan Republik Indonesia, 2017.

[12]. M. A. Mardani RA, Pradigdo SF, "The Risk Factors Of Pneumonia In Children Aged 12-48 Months In Puskesmas Gombong II In 2017" Faktor Risiko Kejadian Pneumonia Pada Anak Usia 12-48 Bulan (Studi Di Wilayah Kerja Puskesmas Gombong II Kabupaten Kebumen Tahun 2017), *J. Kesehat. Masy.*, vol. 6, no. 1, pp. 581–590, 2018.

[13]. M. Jannah, A. Abdullah, M. Hidayat, and Q. Asrar, "Analysis of Risk Factors that Associated with Pneumonia under Five Years Old Babies in Working Area UPTD Banda Raya Health Center Banda Aceh City in 2019" Analisis Faktor Risiko Yang Berhubungan Dengan Kejadian Pneumonia Balita Di Wilayah Kerja UPTD Puskesmas Banda Raya Kota Banda Aceh Tahun 2019, *Jukema (Jurnal Kesehat. Masy. Aceh)*, vol. 6, no. 1, pp. 20–28, 2020, doi: 10.37598/jukema.v6i1.797.

[14]. M. Sunyataningkamto *et al.*, "The role of indoor air pollution and other factors in the incidence of pneumonia in under-five children," *Paediatr. Indones.*, vol. 44, no. 1, pp. 25–29, 2004.

[15]. P. Kaparang and H. Tjitrosantoso, "Evaluate The Rational Utilizing Of Antibiotics In The Treatment Of Pediatric Pneumonia In Hospitalized Installation Of RSUP Prof. Dr. R. D. Kandou Manado Period January-December" Evaluasi Kerasionalan Penggunaan Antibiotika Pada Pengobatan Pneumonia Anak Di Instalasi Rawat Inap Rsup Prof. Dr. R. D. Kandou Manado Periode Januari-Desember 2013," *Ilm. Farm.*, vol. 3, no. 3, pp. 247–254, 2014.

[16]. D. E. Puspitasari and F. Syahrul, "The Risk Factors of Pneumonia Disesase at Babies Under Five Years Old Based on Measles Imune Status and Breast Freeding Exclusive Status" Faktor Risiko Pneumonia Pada Balita Berdasarkan Status Imunisasi Campak Dan Status ASI Eksklusif, *J. Berk. Epidemiol.*, vol. 3, no. 1, pp. 69–81, 2015.

[17]. L. M. Saffrina and R. Indawati, "Risk Factor For Pneumonia Based On Exclusive Breastfeeding And Nutrition Status Of Children In Benowo District Surabaya" Faktor Risiko Pneumonia Berdasarkan Asi Eksklusif Dan Status Gizi Balita Di Kecamatan Benowo Surabaya, *J. Ilm. Kesehat. Media Husada*, vol. 5, no. 2, pp. 143–156, 2016, doi: 10.33475/jikmh.v5i2.174.

[18]. S. Hartati, "Analysis of Risk Factors Associated with The Incidence of Pneumonia Among Children Under Five in Pasar Rebo Hospital Jakarta" Analisis Faktor Risiko Yang Berhubungan Dengan Kejadian Pneumonia Pada Anak Balita Di RSUD Pasar Rebo Jakarta, Universitas Indonesia, 2011.

[19]. C. A. Putri, "Description of the Use of Antibiotics for Pediatric Patients in Pneumonia Cases at Regional Hospitals in Sleman Regency Yogyakarta" Gambaran Penggunaan Antibiotik Bagi Pasien Anak Pada Kasus Pneumonia di Rumah Sakit Wilayah Kabupaten Sleman Yogyakarta," Universitas Sanata Dharma Yogyakarta, 2020.

[20]. World Health Organization, *Revised WHO Classification and Treatment of Childhood Pneumonia at Health Facilities: Evidence Summaries*. 2014.

[21]. J. J. Maradiya, H. V. Goriya, S. K. Bhavsar, U. D. Patel, and A. M. Thaker, "Pharmacokinetics of ceftriaxone in calves," *Vet. Arh.*, vol. 80, no. 1, pp. 1–9, 2010.

[22]. S. H. Tambun, I. Puspitasari, and I. S. Laksanawati, "Clinical Outcome Evaluation of Antibiotics Therapy in Community Acquired Pneumonia Inpatient Children" Evaluasi Luaran Klinis Terapi Antibiotik pada Pasien Community Acquired Pneumonia Anak Rawat Inap, *J. Manaj. Dan Pelayanan Farm. (Journal Manag. Pharm. Pract.*, vol. 9, no. 3, p. 213, 2019, doi: 10.22146/jmpf.47915.

[23]. L. Koernia Wahidah, N. Tri Wahyuni, and D. Maharani Putri, "Evaluation Of Pneumonia Antibiotic Using Atc/Ddd Method For Pediatric Patients In Installation Of Hospital. Dr. A. Dadi Tjokrodipo Bandar Lampung In 2019" Evaluasi Penggunaan Antibiotik Pneumonia Dengan Metode Atc/Ddd Pada Pasien Pediatri Di Instalasi Rawat Inap Rsud. Dr. a. Dadi Tjokrodipo Bandar Lampung Tahun 2019, *JFL J. Farm. Lampung*, vol. 9, no. 2, pp. 99–108, 2021, doi: 10.37090/jfl.v9i2.338.

[24]. N. Hamao *et al.*, "Comparison of ceftriaxone plus macrolide and ampicillin / sulbactam plus macrolide in treatment for patients with community- acquired pneumonia without risk factors for aspiration : an open-label , quasi- randomized , controlled trial," pp. 1–11, 2020.

[25]. Y. Farida, A. Trisna, and D. Nur, "Study of Antibiotic Use on Pneumonia Patient in Surakarta Referral Hospital," *JPSCR J. Pharm. Sci. Clin. Res.*, vol. 2, no. 01, p. 44, 2017, doi: 10.20961/jpscr.v2i01.5240.

[26]. Drugs.com, "chloramphenicol Side Effect," 2021. https://www.drugs.com/sfx/chloramphenicol-side-effects.html.

[27]. C. M. Baldwin, K. A. Lyseng-Williamson, and S. J. Keam, "Meropenem: A review of its use in the treatment of serious bacterial infections," *Drugs*, vol. 68, no. 6, pp. 803–838, 2008, doi: 10.2165/00003495-200868060-00006.