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ORIGINAL ARTICLE

Relationship between Vital Signs and Asthma Attack Levels of Patients having Asthmatic Episodes

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ABSTRACT

Objective: To analysis the relationship of vital signs of patients experiencing acute asthmatic episodes presenting in the emergency room.

Methods: A cross-sectional study was conducted at the emergency department of provincial hospital, in Banjarmasin, Indonesia between July-August 2019. Subjects were studied during an acute asthmatic episode. The patient's vital signs, such as respiratory rate, temperature, blood pressure, and heart rate were continuously and in real time monitored using observation sheets kept by nurses providing emergency care.

Results: Of 220 patients with acute asthmatic attack, the mean age was 30.6 ± 9.7 years. There were 92 (41.8%) males and 128 (58.2%) females. According to the different levels of asthmatic episodes, majority 109 (49.5%) of patients had moderate level of asthmatic attack, while 66 (30.0%) patients had mild and 45 (20.5%) patients had severe asthmatic attack. Mean respiratory rate and heart rate significantly increased according to the levels of an asthma attack (mild to severe) (p-values < 0.001) respectively.

Conclusion: During an acute asthmatic episode, vital signs (such as heart rate and respiratory rate) alter abnormally, indicating the need for an immediate intervention. Appropriate asthma medications, as well as diligent vital sign monitoring by nursing staff, are essential for patients with altered vital signs.

Keywords: Asthma, Emergencies, Monitoring, Physiologic, Vital Signs.

INTRODUCTION

Asthma is a disease with a high incidence that, if left untreated, can have serious detrimental outcomes on health and overall well-being, especially in Indonesia. Patients who are having an asthma attack must treated quickly or it can result in death.[1-3] Asthma attacks are huge health burden for patients and a financial and human burden on public health services.[4,5] They are most common in patients with asthma, but they can appear as the first sign of needing medical attention. Although the severity of asthma is generally associated with more attacks, each asthma attack is associated with the same risk of attack. Asthma attacks are important predictors of the occurrence of asthmatic health conditions in the future.

Asthma management guidelines emphasize the importance of maintaining asthma control and reducing the risk of future attacks. Methods of managing asthma attacks have not changed much. Monitoring is one of the pillars of asthma patient management, enabling patients to properly assess their health and take appropriate action.[5-8] The main goal of asthma treatment is to use monitoring as a risk reduction strategy in severe asthma attacks. A risk assessment based on a history of asthma attacks and a list of clinical risk factors is currently recommended. However, many of these prognostic factors are either unchangeable or difficult to change, making it difficult to identify and measure the main risk factor before starting treatment. On the other hand, some risk factors can be modified, such as symptoms and lung function, so in this case monitoring of pulmonary function and other clinical signs is important when an asthma attack occurs.[4,5,8] This study aims to analysis the relationship of vital signs of patients experiencing acute asthmatic episodes when given treatment in the emergency room.

METHODS

A cross-sectional study was carried out at the emergency department of Ansari Saleh hospital, in Banjarmasin, Indonesia from July to August 2019.

Ethical committee of Health Research Ethics Committee, Politeknik Kesehatan Banjarmasin (HREC-PKB) had approved the study formally Moreover, signed informed consent had been taken from all the participants and the objective of the study had been explained to them. During the study period, patients with acute asthmatic episode presenting to the emergency department were randomly selected to be observed in this study. The sample size was calculated with a 5% margin of error using the assumption that severe asthma occurs in 15%.[9] The required minimum sample size was 195.9, which was increased to 220 after 12% of non-respondents were included.

In this study, the researcher used the following inclusion criteria: adult patients with age greater than 15 years, willingness to participate in the study by signing an informed consent, and respondents with asthmatic episode that did not require intensive care unit.

A detailed clinical examination and medical history was obtained. The socio-demographics of the patients along with clinical characteristics such as vital signs, systolic blood pressure, diastolic blood pressure, pulse rate, respiratory rate, and body temperature were noted.

As for the severity of an asthmatic episode, study participants were classified into three categories, namely mild, moderate and severe. This classification was based on the frequency of the occurrence of symptoms of asthma.[9]

Data entry and analysis were done using a Statistical Package for Social Sciences (SPSS) version 20.0. Mean ± SD were computed for quantitative variables like, age (years), respiration rate (/minute), body temperature (°C), systolic blood pressure (mmhg), diastolic blood pressure (mmhg), and heart rate (/minute) while frequency and percentages were computed for categorical variables. Inferential statistics were explored using Chi-square test and One-way ANOVA to compare asthmatic episodes with demographic and clinical characteristics of the patients. The p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Of 220 asthma attack patients, the mean age was 30.6 ± 9.7 years. There were 92 (41.8%) males and 128 (58.2%) females. Most of the patients reported abnormal respiration rate 166 (75.4%), normal body temperature in 189 (85.9%), normal blood pressure 159 (72.3%) and normal heart rate 111 (50.5%).

The asthmatic episodes showed that the majority of the patients reported a moderate level of episode 109 (49.5%), while 66 (30.0%) reported mild and 45 (20.5%) reported severe asthmatic episode. The mean respiratory rate during asthmatic episode was 23.1 ± 7.86 breaths/minute, body temperature was 36.8 ± 0.43 °C, systolic blood pressure was 113.8 ± 21.3 mmhg, diastolic blood pressure was 81.4 ± 11.5 mmhg, and heart rate was 103.5 ± 24.7 beats/minute. (Table 1)

Moderate level of asthmatic attack was found more prevalent in patients aged >30 as compared to patients aged ≤ 30 i.e., 62 (56.9%) vs. 47 (42.3%). Similarly, the average asthmatic attack was found greater in female patients as compared to male patients i.e., 80 (62.5%) vs. 29 (31.5%). Furthermore, these two variables, age, and gender were found to be significantly associated with asthmatic episodes (p-values < 0.001) respectively. (Table 2)

Table 3 represents changes in the vital signs of patients when experiencing asthma attacks. Mean respiration and heart rate significantly increased among different levels of an asthma attack (mild to severe) (p-values < 0.001) respectively. While performing multiple comparisons, it was found that mean respiration and heart rate also differ significantly among all three group comparisons (p-value <0.001). The rest of the variables reported in table 3, did not show any significant mean difference among asthmatic episodes (p-values> 0.05).

DISCUSSION

In the current study, most patients have an increased pulse rate (tachycardia). This shows that compensation occurs to balance the supply of oxygen to organs and body tissues against hypoxaemic conditions and prevent hypoxia. This is in accordance with various studies that show that there is a relationship between body temperature and acute asthma attacks where during an asthma attack the body experiences inflammation, especially in the upper respiratory tract which is characterized by an increase in body temperature. This of course will also further worsen the patient's condition and the patient will be increasingly anxious and tired of dealing with this condition.[10-12]

The findings of current study revealed that the majority of respondents experienced abnormal respiratory rate correlating with the severity of an asthmatic episodes. Respiratory rate is an important factor in respiratory dysfunction in patients with bronchial asthma, which correlates with the pathophysiological changes occurring during asthmatic episode.[13,14] Variations in respiratory rate can also indicate laryngeal dysfunction. In severe asthma, laryngeal dysfunction impairs respiration and phonation. This necessitates detection

Table 1: Patients' vital signs during asthma attack (n=220)

Vital Signs	Mean ± SD	Minimum - Maximum
Respiratory Rate (breaths/minute)	23.1 ± 7.86	14 – 39
Body Temperature (°C)	36.8 ± 0.43	35 – 38
Systolic Blood Pressure (mmHg)	113.8 ± 21.3	80 – 160
Diastolic Blood Pressure (mmHg)	81.4 ± 11.5	60 – 120
Heart Rate (beats/minute)	103.5 ± 24.7	65 - 190

Table 2: Comparison of asthmatic episodes with demographic characteristics of the patients (n=220)

		Asthmatic Episodes			p-value
	Total	Mild (n=66)	Moderate (n=109)	Severe (n=45)	
Age					
≤ 30	111	61 (55.0)	47 (42.3)	3 (2.7)	<0.001*
> 30	109	5 (4.6)	62 (56.9)	42 (38.5)	
Gender					
Man	92	61 (66.3)	29 (31.5)	2 (2.2)	<0.001*
Woman	128	5 (3.9)	80 (62.5)	43 (33.6)	

Chi-Square test applied, *p-value < 0.05

Table 3: Mean comparison of asthmatic episodes with vital signs of patients (n=220)

	Asthmatic Episodes			p-value
	Mild Mean ± SD (n=66)	Moderate Mean ± SD (n=109)	Severe Mean ± SD (n=45)	
Respiratory Rate (breaths/minute)	16.9 ± 4.5 [a]	22.9 ± 5.7 [a,b]	32.8 ± 6.5 [a,b,c]	<0.001*
Body Temperature (°C)	36.8 ± 0.43	36.8 ± 0.44	36.9 ± 0.39	0.433
Systolic Blood Pressure (mmHg)	114.2 ± 22.5	114.5 ± 20.6	111.6 ± 21.7	0.728
Diastolic Blood Pressure (mmHg)	82.1 ± 12.8	81.1 ± 11.0	81.1 ± 10.9	0.845
Heart Rate(beats/minute)	85.4 ± 12.9 [a]	104.2 ± 22.5 [a,b]	128.6 ± 20.3 [a,b,c]	< 0.001*

The superscripts show the pair-wise significance. The different alphabets show statistical significance
One-way-ANOVA test applied, *p-value < 0.05

and treatment in order to reduce the impact on asthma symptoms.[15] Problems with the immune system related to IL-5 and IL-5Rα t so that patients can be given Anti-IL-5 and anti-IL-5Rα t to treat asthma attacks.[16]

Even breathing frequency monitoring in asthmatics is now more sophisticated and more specific using current technological advances such as using in vitro biomimetics, machine learning algorithms, and spiroarteriocardiorhythmography.[14,17]

The findings of the current study showed the patient's body temperature in relation to the severity of an asthmatic episode. Numerous studies have reported that body temperature is an important clinical sign that correlates with the severity of an asthma attack.[12,14,18] A higher risk of re-admission and severity were linked to high temperatures. Repeated reception revealed agreater sensitivity to high summer temperatures. During this period, the high temperature was associated with an increased risk of re-entry.[19] Environmental temperature can also have implications for the temperature of patients who are experiencing asthma attacks and diurnal temperature (DTR) indicates that high DTR is associated with increased susceptibility of childhood asthma. The effect of DTR is higher in boys and preschoolers. Days with high DTR and low mean temperature require extra attention.[12] The use of exhaled breath temperature (EBT) can be used by a nurse to assess that an asthma attack patient is experiencing inflammation of the respiratory tract which will exacerbate the decrease in oxygen intake and will usually occur due to uncontrolled asthma.[14]

Asthma can be caused by a variety of factors as it has different etiologies. Environmental factors continue to be common triggers for asthma, especially in children,

and such environmental exposures can be more difficult to avoid than behavioral triggers. Therefore, when considering recurrent asthma cases, there may be an increased contribution of environmental factors compared to the initial symptoms.[18,19]

Increased blood pressure in asthmatics in this study may be caused by age and gender factors. Older people tend to have higher systolic blood pressure or upper pressure, this is due to the thickening of the blood vessel walls, in addition to getting stiffer. Gender is another factor that influences blood pressure. Women are more likely than men to suffer from hypertension. In this study, 27.5% of women had hypertension, compared to 5.8% of men. Women over the age of 45 are at an increased risk of developing high blood pressure (hypertension). Women who have not reached menopause are protected by the hormone estrogen, which plays a role in increasing high density lipoprotein (HDL) levels. Low HDL cholesterol levels and high low density lipoprotein (LDL) cholesterol levels both contribute to atherosclerosis and high blood pressure.[20]

An increased heart rate in an asthma attack may be due to the degree of asthma attack experienced. The more severe the degree of attack, the higher the heart rate. It was noted that of the 70 respondents studied, there were 19 people (27%) who were diagnosed with severe asthma attacks and 30 people (43%) who had moderate asthma attacks. So the number of respondents who were diagnosed with mild asthma attacks total to 21 people (30%). That means most respondents have moderate and severe asthma attacks. The heart rate at the time of an asthmatic attack was >120 beats/minute. This is because the body is not able to get enough oxygen. As a result, the heart will start pumping faster to get the oxygen the body needs. This results in a rapid heart rate.[1,21,22]

An increase in heart rate generally indicates worsening asthma. Increased heart rate correlates closely associated with increased severity of asthma; it is incorrect to assume that tachycardia is caused by the use of 2 adrenergic bronchodilators. It is safe for people with acute asthma, and the heart rate usually drops as a result of the high doses of 2-adrenergic bronchodilators given. In asthma attacks, the peak expiratory flow (PEF) value is usually 33-50%, respiratory rate 25 x/minute and heart rate 110 /minute, and the inability to complete sentences in one breath, it is a sign of a severe asthma attack.[20,23]

The presence of abnormal changes in vital signs indicates a pathological condition that must be treated by doctors and nurses immediately because changes to a bad abnormal direction indicate an asthma attack is getting worse and can lead to death. Quality nursing care from nurses and correct and appropriate asthma drug therapy will overcome this problem. Close observation of changes in vital signs by nurses and doctors is absolutely necessary continuously until the asthma attack condition is gone and the patient's condition is stable. This study has few limitations that can be improved in future researches. Firstly, a larger sample size from various hospitals could give us more representative sample, and secondly, to have better insight for correlation between vital signs and severity of asthmatic episodes could be gained by studying pulmonary function tests.

CONCLUSION

The vital signs of a patient who has an acute asthma attack in the emergency room may change to an abnormal direction. The change in the direction that continues to worsen indicates that the patient's asthma condition is getting worse. Close observation and proper management from doctors and nurses are very important in overcoming the worsening condition of asthma patients.

ETHICAL APPROVAL: The research was approved by Banjarmasin Health Polytechnic Research Ethics Committee.

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REFERENCES

1. Kotwani A, Chhabra SK. Effect of patient education and standard treatment guidelines on asthma control: an intervention trial. WHO South East Asia J Public Health 2012; 1:42-51. doi:10.4103/2224-3151.206913.
2. American Lung Association. Asthma Risk Factors American Lung Association [Internet]. 2018. Available from: https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-symptoms-causes-risk-factors/asthma-risk-factors.html.

3. Global Asthma Network. The Global Asthma Report. Vol 5. Auckland, New Zealand 2018.
4. Couillard S, Steyerberg E, Beasley R, Pavord I. Blood eosinophils, fractional exhaled nitric oxide and the risk of asthma attacks in randomised controlled trials: protocol for a systemic review and control arm patient-level meta-analysis for clinical prediction modelling. BMJ Open 2022; 12:e058215. doi:10.1136/bmjopen-2021-058215
5. Fletcher M, van Der Molen T, Lenney W, Boucot I, Aggarwal B, Pizzichini E. Primary Care Management of Asthma Exacerbations or Attacks: Impact of the COVID-19 Pandemic. Adv Ther [Internet] 2022; 39:1457–73. doi:org/10.1007/s12325-022-02056-x
6. Couillard S, Laugerud A, Jabeen M, Ramakrishnan S, Melhorn J, Hinks T, et al. Derivation of a prototype asthma attack risk scale centred on blood eosinophils and exhaled nitric oxide. Thorax 2022; 77:199-202. doi:10.1136/thoraxjnl-2021-217325
7. Couillard S, Do WIH, Beasley R, Hinks TS, Pavord ID. Predicting the benefits of type-2 targeted anti-inflammatory treatment with the prototype Oxford Asthma Attack Risk Scale (ORACLE). ERJ Open Res 2021; 8:00570-2021. doi:10.1183/23120541.00570-2021
8. Zolotareva O, Saik OV, Konigs C, Bragina EY, Goncharova IA, Freidin MB, et al. Comorbidity of asthma and hypertension may be mediated by shared genetic dysregulation and drug side effects. Sci Rep 2019; 9:16302. doi:10.1038/s41598-019-52762-w
9. Padem N, Saltoun C. Classification of asthma. Allergy Asthma Proc 2019; 40:385-8. doi:10.2500/aap.2019.40.4253
10. Kwok WC, Tam AR, Ho JC, Lam DC, Tam TC, Chan KP, et al. Asthma, from mild to severe, is an independent prognostic factor for mild to severe Coronavirus disease 2019 (COVID-19). Clin Respir J 2022; 16:293-300. doi:10.1111/crj.13480
11. Salih MR, Abd AY, Fawzi AH. Awareness of asthma and its management in primary school teachers in Baghdad, Iraq. F1000Res 2022; 11:367. doi:10.12688/f1000research.73495.2
12. Wei Q, Zhong L, Gao J, Yi W, Pan R, Gao J, et al. Diurnal temperature range and childhood asthma in Hefei, China: Does temperature modify the association? Sci Total Environ 2020; 724:138206. doi:10.1016/j.scitotenv.2020.138206
13. Karpov VY, Medvedev IN, Romanova A V, Usov SS, Kozyakov R V. Functional disorders in the respiratory system in adolescents with bronchial asthma. Indian J Public Health Res Dev 2019; 10:1904–9.
14. Sol IS, Kim YH, Kim SY, Choi SH, Kim HR, Kim KW, et al. Exhaled breath temperature as a tool for monitoring asthma control after an attack in children. Pediatric Pulmonol 2019; 54:230–6.
15. Vertigan A E, Kapela SL, Gibson PG. Laryngeal Dysfunction in Severe Asthma: A Cross-Sectional Observational Study. J Allergy Clin Immunol Pract 2021; 9:897-905. doi:10.1016/j.jaip.2020.09.034
16. Holguin F, Cardet JC, Chung KF, Diver S, Ferreira DS, Fitzpatrick A, et al. Management of severe asthma: A European Respiratory Society/American Thoracic Society guideline. Eur Respir J [Internet] 2020; 55: 1900588. doi:org/10.1183/13993003.00588-2019
17. Romanchuck O, Bazhora Y. Regulatory peculiar features of uncontrolled bronchial asthma. J Edu Health Sport 2018; 8:330–46.
18. Xu Z, Crooks JL, Davies JM, Khan AF, Hu W, Tong S. The association between ambient temperature and childhood asthma: a systematic review. Int J Biometeorol 2018; 62: 471–81.
19. Lam HC, Hajat S, Chan EY, Goggins WB. Different sensitivities to ambient temperature between first- and re-admission childhood asthma cases in Hong Kong – A time series study. Environ Res 2019; 170:487–92.
20. Svendsen CD, Kuiper K, Ostridge K, Larsen TH, Nielsen R, Hodneland V, et al. Factors associated with coronary heart disease in COPD patients and controls. PLoS One 2022; 17:1–18. doi:org/10.1371/journal.pone.0265682
21. Lorensia A, Yulia R, Wahyuningtyas IS. Hubungan Persepsi Penyakit (Illness Perception) dengan Kontrol Gejala Asma pada Pasien Rawat Jalan. Media Pharm Indones 2017; 1:92.
22. Sari Ni PW. Asma: Hubungan Antara Faktor Risiko, Perilaku Pencegahan Dan Tingkat Pengendalian Penyakit. J Ners LENTERA 2013; 1:30–41.
23. Losappio L, Heffler E, Carpentiere R, Fornero M, Cannito CD, Guerrera F, et al. Characteristics of patients admitted to emergency department for asthma attack: A real-LIFE study. BMC Pulm Med 2019; 19:1–6.