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Age, Gender, and Preoperative LVEF Influence on ICU Length of Stay After CABG

Rara Amourra, Budiana Rismawan, Muchammad Erias
Department of Anesthesiology and Intensive Care, Faculty of Medicine Universitas Padjadjaran/
Dr. Hasan Sadikin General Hospital Bandung, Indonesia

Abstract

Coronary artery bypass graft (CABG) surgery is a surgical therapy for coronary artery disease (CAD) patients who cannot be solely treated using pharmacological therapy. Patients undergoing CABG surgery require careful postoperative monitoring in the intensive care unit (ICU). This leads to the need for careful selection of patients due to the limited number of ICU beds available. A prolonged stay in ICU could delay surgery for other patients. This retrospective study analyzed how preoperative factors such as age, gender, and preoperative left ventricular ejection fraction (LVEF) may influence patient's length of stay (LOS) in the ICU. For this study, subjects were patients undergoing isolated CABG in Dr. Hasan Sadikin General Hospital Bandung, Indonesia, during the period of January 2019–December 2020 who were selected using the simple random sampling method. The subjects were categorized into <65 years old and ≥65 years old age groups; man and woman gender; preoperative LVEF of <40% and ≥40%; and prolonged ICU LOS (>96 hours) and non-prolonged ICU LOS (<96 hours). Deceased patients in the ICU were excluded. Results of the bivariate and multivariate analyses showed that age was the only factor (p-value of 0.017) that increased the risk of prolonged ICU LOS (OR of 3.34) after CABG surgery that was statistically significant. This study concluded that patient of old age (>65 years old) is at a higher risk of having prolonged ICU LOS after CABG; thus, a careful scheduling of patients for CABG surgery by age is important to prevent prolonged ICU LOS after CABG.

Keywords: Coronary artery bypass surgery, coronary artery disease, intensive care unit

Introduction

Coronary artery disease (CAD) has the highest mortality rate among cardiovascular diseases. The current management for CAD is pharmacological dan surgical intervention. Those who failed to be treated with solely pharmacological intervention were given options for surgical intervention or coronary artery bypass graft (CABG). The study also showed that five years-survival rates in patients exclusively treated with pharmacological intervention is 5% and increased to 82% in those receiving a surgical intervention. Nearly 500.000 patients undergo CABG every year in the United States. Similar trends were shown in Gatot Subroto Hospital Indonesia; approximately 1500 were diagnosed with CAD in 2017, and 50 were undergone CABG, the following year, the number of CABG patients increased to 67.[1–3]

The patient who had undergone CABG needs to be admitted to the ICU postoperatively for intensive monitoring due to various risks of complications. Unfortunately, these ICU beds are often in limited numbers. Length of stay in ICU after CABG may vary from 4–14 days, prolonged LOS (>96 hours) in ICU may become a problem which calls for careful patient selection and early recognition of risk factors in the preoperative period may avoid too many prolonged ICU LOS in one period which could result in CABG cancellation and higher cost of care. Prolonged ICU LOS also contributes to a higher mortality rate after CABG due to complications such as bleeding, prolonged ventilation, and low cardiac output syndrome (LCOS). These postoperative complications may occur under the influence of perioperative factors, which are divided into three stages: preoperative, intraoperative, and postoperative. Old age, gender, and

Corresponding Author:
Rara Amourra
Department of Anesthesiology and Intensive Care, Faculty of Medicine Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital Bandung, Indonesia
Email: rara.amourra@gmail.com

preoperative LVEF are among preoperative factors; cardiopulmonary bypass (CPB) time and intraoperative use of inotropic agents are among intraoperative factors; prolonged intubation, postoperative bleeding, and the use of intra-aortic balloon pump (IABP) are among postoperative factors. This study will solely focus on age, gender, and preoperative LVEF as the preoperative factors that can be identified during preoperative screening. Early detection of prolonged ICU risk might help in scheduling future patients to prevent too many long ICU cases in one period.[4–6]

Age, gender, and preoperative LVEF are easily identified in preoperative screening for patient CABG scheduling. Patient with old age is at risk due to changes in their anatomy and physiology, exposing this population to a higher risk of complications during intraoperative or postoperative, hence the prolonged ICU LOS. Women are also at risk of more extended ICU stay due to presenting symptoms and intervention at an older age and often have more severe symptoms than the male population. Low preoperative LVEF, which is also common in a patient undergoing CABG, these populations are also at higher risk of mortality and complication after CABG due to deprivation of cardiac function. Hopefully, this study could provide data on which preoperative factors may contribute to the risk of prolonged ICU LOS after CABG in Dr. Hasan Sadikin General Hospital Bandung during 2019–2020.

Methods

The study design is retrospective-analytic. The subject of this study is the medical records of isolated CABG patients who were admitted to ICU Dr. Hasan Sadikin General Hospital Bandung, Indonesia, from January 2019 to December 2020. The inclusion criteria of this study were patients undergoing isolated CABG aged 18 years above, and the exclusion criteria were incomplete medical record data and patients with heart valve disease or procedure involved; the dropout criteria were subjects who deceased during ICU care after CABG. After approval from the Health Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung, Indonesia, number LB.02.01/X.6.5/30/2022, all data on the subject was collected, including age, gender, preoperative LVEF, and ICU LOS after CABG. Subjects are picked using a simple random sampling method; 104 subject data were collected after exclusion and dropout. The data includes the age, gender, preoperative LVEF, and ICU LOS of each patient. Age is divided into two groups, <65 years old and ≥65 years old. Gender is divided into male and female, while preoperative LVEF is divided into <40% and ≥40%. Each independent variable was analyzed using bivariate analysis. The variable with a p-value <0.25 were analyzed further using the logistic regression method to find the most influential factor on ICU LOS. All these data will be displayed in a distributive and analytic table with statistical explanations accompanied by a discussion on the theoretical basis that has been found previously. Data processing and analysis were done using Windows's Statistical Product Service Solution (SPSS) version 25.0.

Results

Of 104 subjects involved in this study, the median age for subjects with <96 hours ICU LOS was 57, subject's ages ranged from 39–76 years old, while the median age for subjects with ≥96 hours ICU LOS was 61 with age ranged from 44–75 years old. Subjects that are admitted into ICU <96 hours are majority aged <65 years old (83.13%), and 16.86% were admitted ≥96 hours. In the≥65 age group, 54,14% were admitted <96 hours, and 42,86% were admitted ≥96 hours. Statistics show that age is statistically significant in influencing ICU LOS after CABG (p-value=0.017). Although more women have prolonged ICU LOS (42.86%) than males (18.88%), the gender variable did not show a significant influence statistically (p-value=0.077). Preoperative LVEF also did not show a significant influence statistically (p-value = 1.000). Both groups showed similar results. There is no significant difference in ICU LOS in subjects with preoperative LVEF <40% and ≥40%.

The final multivariate analysis model on three variables shows that the only factor influencing ICU LOS is Age because it has a p-value of 0.219. The P-value required for further analysis is <0.25. The p-value of age in the final model of multivariate analysis is 0.038, and it also shows that subjects with older age (≥65 years old) 3 times at higher risk of prolonged ICU LOS after CABG (OR 3.340).

Discussion

This study is aimed to see the influence of three preoperative factors that might influence ICU

Table 1 Bivariate Analysis of Preoperative Factors Influence on post-CABG ICU LOS

Variable	ICU LOS		P Value
	<96 hours	≥96 hours	
Age			0.017*
Median	57.00	61.00	
Range (min-max)	39,00–76,00	44,00–75,00	
<65 y.o	69 (83.13%)	14 (16.86%)	
≥65 y.o	12 (57.14%)	9 (42.86%)	
Genders			0.077
Male	73 (81.1%)	17 (18.88%)	
Female	8 (57.14%)	6 (42.86%)	
Preoperative LVEF			1.000
Median	60.00	55.00	
Range (min-max)	20.00–81.00	35.00–73.00	
<40%	13 (81.25%)	3 (18.75%)	
≥40%	68 (77.27%)	20 (22.73%)	

Note: Categorical data is presented with number/frequency and percentage, while numerical data is presented with mean, median, standard deviation, and range

LOS after CABG. Patients who have undergone CABG should be admitted to the ICU for close monitoring regarding complications after surgery. The period of ICU care after CABG usually ranged from 24 hours to ≤5 days. The previous study used 96 hours as the cut-off for prolonged ICU LOS because of the risk of complications such as ventilator-associated pneumonia (VAP). Hence, this study grouped the subject into two categories of ICU LOS, <96 hours and ≥96 hours.[5,6]

This study analyzed three preoperative factors to determine how much these factors can influence ICU LOS after CABG. Of the three factors in this study, age is the only factor influencing ICU LOS. The result showed that age is significant statistically (p-value=0,017) using bivariate analysis. Further analysis using logistic regression also showed that CABG patients with older age are at risk of prolonged ICU LOS (OR 3.34). Patient at an older age is known to have more comorbidities and often present with more severe symptom due to physiological and anatomical changes. The recovery period might be challenging in this population. Similar data were obtained in a previous study where CABG patients with older age are two times at higher risk of prolonged ICU LOS. Prolonged LOS varies around 20–30% longer than in younger patients. The previous study also found that the prolonged period can be up to 14 days. Anatomical and physiological changes in CABG patients with older age can affect the recovery phase, myocardial recovery can take longer, and it can also delay mechanical ventilation weaning and recovery in general. The reduced muscle mass and tone are the main reason for this delay. Decreased muscle tone, in general, would affect the recovery; myocardium in patients with old age will take longer to recover, resulting in the

Table 2 Multivariate Analysis on Preoperative Factors of Post CABG Subject in ICU

Variable	Coefficient B	p-value	OR	CI 95%	
				Lower	Upper
Age	1.046	0.219	2.845	0.537	15.066
Gender	0.420	0.589	1.522	0.331	6.994

Note: Multivariate analysis using biner logistic regression. The Independent variable included in the logistic regression must have a p-value <0.25

need for inotropic support, mechanical support such as IABP, and prolonged ventilation. Older patients are also more likely to have a longer period of respiratory muscle recovery. This could expose patients to ventilator-related infection, possibly increasing LOS and even higher mortality risk.[1,4,6–8]

The result of this study is that gender statistically does not influence prolonged ICU LOS (p-value=0.077), but the result shows that the percentage of females with prolonged ICU LOS is higher than males (42.86% and 18.88%). Though it cannot be said that gender is statistically significant in influencing ICU LOS, the percentage shows that there is more female patient in prolonged ICU care than male patient. In theory, gender is shown to influence CABG patients' ICU LOS but. Female patients are shown to have longer ICU LOS. This is due to the physiological protection of the estrogen hormone; females at a younger age are protected from CAD, so women often experience the symptom of CAD in older age, often with more comorbidities due to deteriorating physical and physiological status. This result may have been because other perioperative factors influencing the outcome of CABG in the ICU are not included in this study. Factors such as comorbidities, intraoperative intervention, and postoperative documented complications can contribute to patient recovery in general, thus may affecting ICU LOS.[9–11]

Patient with low preoperative LVEF is at higher risk of intraoperative and postoperative mortality. Low preoperative LVEF could lead to postoperative low cardiac output syndrome (LCOS). Patients with LCOS will require hemodynamic support such as inotropes or an intra-aortic balloon pump (IABP). Surgical intervention such as CABG may contribute to better myocardial preservation and recovery due to revascularization on the myocard than pharmacological therapy alone. Preoperative LVEF is also shown not to influence prolonged ICU LOS (p-value=1.000). A similar result is shown in the previous study; there is no significant difference in patients with isolated CABG with low preoperative LVEF and those who are not. Successful revascularization of the blood vessel and myocardium can elevate cardiac function significantly, leading to a successful recovery and higher survival rate. This condition may be different in a patient with valvular involvement where a patients is myocard function is worse and recovery may take longer, resulting in delayed ICU discharge.[12]

This study concludes that among all of the preoperative factors in this study, age is the only factor that influences and elevates the risk of prolonged ICU LOS after CABG. The limitation of this study is that many factors could influence the result of the CABG procedure in the perioperative period. However, these factors are not all included in this study. Another limitation of this study is the exclusion of deceased subjects during ICU care. The subject with these preoperative factors and prolonged ICU care is not included.

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Ajwa Date (*Phoenix dactylifera* L.) Extract to Prevent Alzheimer's Disease in Rat Model

Rizka Muthia Nuruddin,[1] Brian Wasita,[2] Adi Magna Patriadi Nuhriawangsa[3]
[1]Postgraduate Program of Nutrition Science, Universitas Sebelas Maret, Surakarta, Indonesia
[2]Department of Anatomical Pathology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia
[3]Animal Husbandry Study Program, Faculty of Agriculture, Universitas Sebelas Maret, Surakarta, Indonesia

Abstract

Alzheimer's disease (AD) is the most common disease of aging characterized by increased extracellular deposits of amyloid-β (Aβ) in the brain. Globally, the number of people affected by AD has increased from 35.6 million in 2010 to 46.8 million in 2015. Ajwa dates contain phenolic compounds that can protect against inflammation and oxidative stress in the brain. This study aimed to analyze the effect of the dose and duration of Ajwa date extract administration on IL-6 levels and SOD activity in rats induced with 400 μg/day homocysteine to trigger Alzheimer's Disease. This was a laboratory experimental study with a pretest-posttest group design conducted at the Laboratory of the Center for Food and Nutrition Studies (PSPG), Universitas Gadjah Mada, Yogyakarta, Indonesia from December 2020–January 2021. A total of 48 rats were divided into one control group, one untreated group, and 4 treatment groups that received different doses of Ajwa Date Extract (ADE) for 21 and 28 days in rats. The results showed that the administration of ADE (Ajwa date extract) for 21 and 28 days could reduce IL-6 levels but did not have the same effectiveness as donepezil. The administration of 800 mg/kg BW ADE for 28 days can increase SOD activities with the same effectiveness as donepezil. Ajwa date extract can be proven to have beneficial effects to prevent Alzheimer's disease and can be used to prevent decreased antioxidant and increased inflammation. Thus, further studies to explore the potential clinical use of the extract to manage Alzheimer's Disease may be beneficial.

Keywords: Ajwa date, alzheimer, rats

Introduction

Alzheimer's is a neurodegenerative disease characterized by increasing extracellular deposits of amyloid-β (Aβ) and protein TAU in the brain that causes memory loss.[1,2] The number of people with dementia, part of Alzheimer, worldwide has increased to 11.2 million from 2010 until 2015. This case is also expected to double every 20 years. Besides affecting the human brain's memory, Alzheimer's disease (AD) can also affect cognitive impairment, emotions, decision-making, behavioral problems, and poor taste and smell.[1,3]

The pathogenesis of AD is related to oxidative stress and inflammation, which causes nerve damage and nerve death by apoptosis or necrosis.[4,5] Inflammation causes high production of cytokines such as IL-1, IL-6, and TNF-α, it causes plaque formation and neuronal dysfunction in AD.[6] IL-6 cytokine expression was found in the early stages of amyloid-β (Aβ) plaque formation in the brain.[6] Research in animal models has proven that IL-6 regulates of central nervous system pathways for cognitive function.[7] Research conducted by Al-Yahya et al.[6] and Essa et al.[9] on rats proved that the IL-6 levels of Alzheimer's rats were higher than the control group.

High superoxide dismutase (SOD) activity shows antioxidants in healthy humans. The decreased SOD activity in the elderly is evidence that free radical levels are increasing; this is related to degenerative conditions such as AD.[17] High levels of oxidative stress are also influenced by high plasma malondialdehyde levels and age. The increasing age of a person is followed by increased production of free radicals.[18] Alzheimer's severity can be affected by decreased SOD activity in the body.[10]

Antioxidants are known to reduce the

Corresponding Author:
Rizka Muthia Nuruddin
Postgraduate Program of Nutrition Science, Universitas Sebelas Maret, Surakarta
Email: rizkamuthia@student.uns.ac.id

formation of oxidative stress and neuronal damage in AD.[5,11,12] Phenolic acid, an antioxidant, can protect cells from damage and has a preventive role against oxidative stress.[6,13] Dates have phenolic compounds that can protect against inflammation and oxidative stress in the brain.[6,13,14] The dates' phenolic acids, flavonoids, and antioxidants vary from various varieties.[2] Research on Ajwa dates proves that Ajwa dates are rich in phenolics and flavonoids, which affect cognition. Ajwa dates have the highest total phenolic content of the 12 types of dates studied at 22.11 mg/100 g.[13]

In experimental animal models, date fruits have been demonstrated to exhibit neuroprotective properties.[6,15,16] A study by Subash et al.[2] in Alzheimer's rats with date supplementation showed reduced oxidative stress and increased antioxidant enzymes. Another study by Essa et al.,[6] dates administration in Alzheimer's rats, can reduce inflammatory cytokines A 400 mg/kg dose is an effective dose in preventing memory and cognitive deficits in Alzheimer's rats. This study used data extract with a higher dose and shorter time than other studies. This study aimed to analyze the effect of the dose and duration of Ajwa date extract administration on IL-6 levels and SOD activity in Alzheimer's rats.

Methods

This study was an experimental laboratory method with a pretest-posttest group design. It was conducted at the Laboratory of Center for Food and Nutrition Studies (PSPG), Gadjah Mada University, Yogyakarta, from December 2020–January 2021. Sprague Dawley rats were used as experimental animals. The rats' model of Alzheimer's was prepared to refer to the study of Mahaman et al. using Homocysteine (Hcy) induction with modification.[11] Study by Rizma concluded that Hcy injection of 400 g/day for 14 days in Alzheimer's rats model showed pyramidal cell loss and amyloid bodies as a sign of Alzheimer's.[2,3] Determination of sample size using the Frederer formula with simple random sampling. Forty-eight rats, weighing approximately 150–200 grams, were randomly divided into six groups as follows; (1) normal, healthy untreated rats, (2) control, Hcy, (3) Hcy and administrated donepezil 1 mg/kgBW orally, (4) Hcy and ADE 200 mg/kgBW, (5) Hcy and ADE 400 mg/kgBW, (6) Hcy and ADE 800 mg/kgBW. DL-Homocysteine (Hcy) was injected respectively through vena caudalis with a dose of 400 µg/kgBW once a day. All treatments were given to two different groups for 21 days and 28 days. They maintained a 12:12 light: dark cycle and were given access to food and water ad libitum. The standard feed used is Comfeed AD II. The Health Research Ethics Committee of Medical Faculty approved the experimental protocol at Sebelas Maret University, number 172/UN27.06.6.1/KEPK/EC/2020. The rat model measured superoxide dismutase activity and IL-6 levels after 21 days and 28 days through blood sampling. The result was computed and analyzed with SPSS. Fresh Ajwa dates (P. dactylifera L.) were obtained from Al-Madina Al-Munawwarah, KSA. Extraction of P. dactylifera conducted in the Laboratory of Center for Food and Nutrition Studies (PSPG), Gadjah Mada University, Yogyakarta. Ajwa dates extract was prepared using the previously described protocol with slight modification.[13,15] The edible part of Ajwa dates was manually separated, then extracted by ethanol 70% (1:2 ratio, weight to volume) on a shaking homogenizer.[13,15] The edible part of Ajwa dates was manually separated, then extracted by ethanol 70% (1:2 ratio, weight to volume) on a shaking homogenizer. [13,15] The resultant extract was filtered using filter paper and evaporated under low pressure at 45°C using a rotary evaporator. Significant differences among the mean of the 21-day and 28-day groups were determined using Independent Sample T-Test. The significant difference between the mean of the extract date treatment groups was determined using the one-way ANOVA with the Post Hoc Tukey test. A level of $p<0.05$ was accepted as statistically significant. The data from the SOD and IL-6 levels were shown in mean ± standard deviation (SD).

Results

The study showed that the levels of IL-6 at 21 days and 28 days did not have a significant difference ($p>0.05$), namely 87.5±2.2 pg/mL at 21 days and 90.8±2.5 pg/mL at 28 days (Table 1). The ADE (Ajwa Date Extract) group with 21 days also did not significantly differ in IL-6 levels within 28 days of treatment. The lowest IL-6 level was in the normal group and the higher IL-6 level was in the control group. The levels of IL-6 in the ADE treatment group showed that the higher the dose, the lower the levels of IL-6 in both 21- and 28-day treatment.

There was a significant difference ($p<0.05$) in the mean levels of IL-6 between the treatment

Table 1 Effect of Ajwa Date Extract on IL-6 Level

Experimental Group	IL-6 (pg/mL)		p[a]
	21-days	28-days	
Normal	61.2±1.2[a]	66.9±3.5[ac]	p>0.05
Control	123.4±1.8[b]	134.5±4.3[b]	
Donepezil	68.3±2.3[c]	68.3±3.4[c]	
ADE 200mg/kgBW	103.3±2.8[d]	107.9±3.2[d]	
ADE 400mg/kgBW	90.6±4.2[e]	89.0±5.0[e]	
ADE 800mg/kgBW	78.0±2.2[f]	78.2±2.5[f]	
p[b]	p<0.05	p<0.05	

[a]: Independent sample t-test; [b]: One way ANOVA test

groups, both 21- and 28-days treatment. The ADE 200, 400, and 800 groups showed lower IL-6 levels than the control group, with a significant difference. It shows that Ajwa date extract can reduce IL-6 levels compared to IL-6 in Alzheimer's rats. ADE groups 200, 400, and 800 showed higher levels of IL-6 than the normal and donepezil group with a significant difference. This indicates that the levels of IL-6 in the Ajwa date extract group were high and could not be equivalent to the levels of IL-6 in normal rats and donepezil rats.

The study showed that SOD activity at 21 days and 28 days had no significant difference (p>0.05), namely 57.8±2.4% at 21 days and 56.3±2.8% at 28 days (Table 2). The group administration of ADE at 21 days also did not significantly differ in SOD activity for 28 days. The highest SOD activity was in the control group, and the lowest was Alzheimer's group. There was a significant difference in SOD activity in each treatment group (p<0.05), both at 21 days and 28 days (Table 2). The ADE group had significant differences between groups, and this shows that the different doses of ADE had different effects on SOD activity, and the higher the ADE dose could increase the SOD activity.

There was a significant difference (p<0.05) in the average SOD activity between groups at 21 days of treatment. The ADE 200 group showed a higher SOD activity than the control group, but this value did not show a significant difference from the ADE 200 SOD activity with the control group did not differ. This shows that the administration of Ajwa date extract at a dose of 200 mg/kgBW for 21 days still could not increase SOD activity compared to Alzheimer's rats. In contrast, the SOD 200 and 400 groups showed higher SOD activity than the control with a significant difference. The ADE 200, 400, and 800 groups showed lower SOD activity than normal and donepezil, with a significant difference.

There was a significant difference (p<0.05) in the average SOD activity between groups at 28 days of treatment. ADE groups 200, 400, and

Table 2 Effect of Ajwa Date Extract on SOD Activity

Experimental Group	SOD (%)		p[a]
	21-days	28-days	
Normal	87.1±3.3[a]	91.2±3.8[a]	p>0.05
Control	26.4±5.3[bd]	15.4±3.1[b]	
Donepezil	78.3±3.7[c]	76.1±3.7[cf]	
ADE 200mg/kgBW	30.8±3.8[d]	29.0±7.5[d]	
ADE 400mg/kgBW	53.3±4.0[e]	54.4±8.4[e]	
ADE 800mg/kgBW	70.5±2.7[f]	71.7±5.3[f]	
p[b]	p < 0.05	p < 0.05	

[a]: Independent sample t-test; [b]: One way ANOVA test

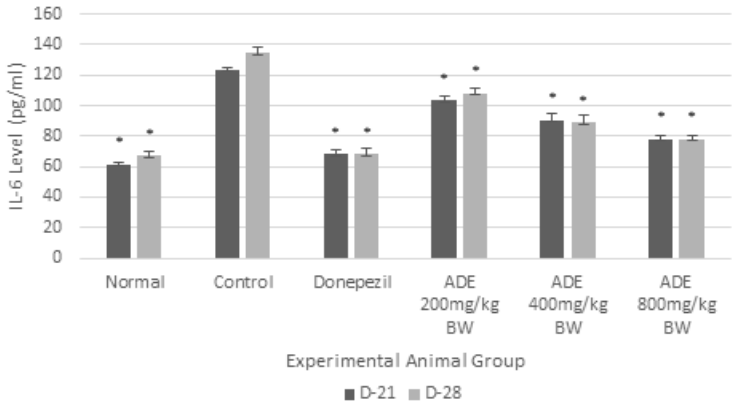

Figure 1 Effect of Ajwa Date Extract on IL-6 Level

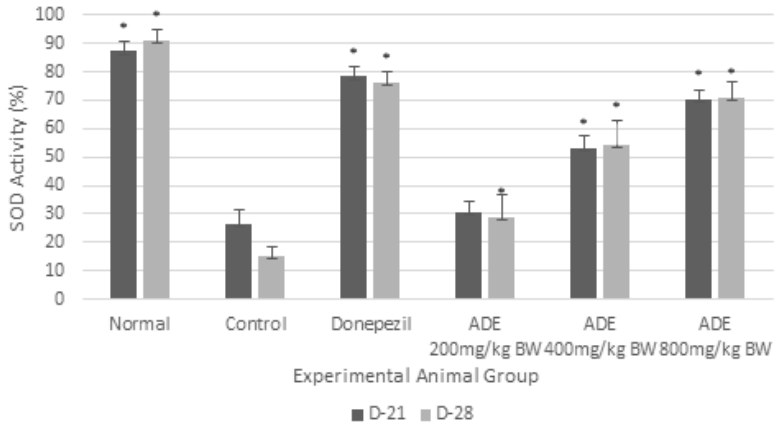

Figure 2 Effect of Ajwa Date Extract on SOD Activity

800 showed higher SOD activity than the control with a significant difference. The ADE 200, 400, and 800 groups showed lower SOD activity than normal with a significant difference. This shows an increase in SOD activity because the administration of Ajwa date extract for 28 days has not had the same effectiveness as healthy mice but has been able to increase beyond the SOD activity of Alzheimer's mice. The ADE 200, 400, and 800 groups showed lower SOD activity than donepezil, but the ADE 800 groups showed insignificant SOD activity. This shows that the administration of Ajwa date extracts at a dose of 800 mg/kgBW has the same effectiveness as the drug donepezil in increasing SOD activity for 28 days. The higher dose of Ajwa date extract, namely the ADE treatment, showed increased SOD activity at 21 and 28 days.

Discussion

Inflammation is one of the main factors contributing to aging and the development of age-related neurodegenerative diseases such as Alzheimer's.[2] According to Essa et al.[6] IL-6 cytokine expression was found in the early stages of amyloid-β (Aβ) plaque formation in the brain.Inflammation is formed due to the excessive production of cytokines such as IL-1, IL-6, and TNF-α, this causes plaque formation and neuronal dysfunction in AD.[6,8] The proinflammatory cytokine IL-6 is associated with important memory and learning cellular mechanisms. Research in animal models further proves that IL-6 regulates central nervous system pathways for cognitive function.[7]

Research showed that the higher the dose of

ADE, the lower levels of IL-6. This is in line with the study of Al-Yahya et al., who observed that giving dates for 21 days at a dose of 250 and 500 mg/kgBW can decrease the expression of pro-inflammatory cytokines (IL-6, IL-10, and tumor necrosis factor).[9] Further research by Essa et al. showed that supplementation with 4% date palm in transgenic mice significantly reduces the inflammatory cytokine IL-6 compared to control mice.[6]

The study's results in the 21-day group showed that the ADE group had significant differences from the donepezil group. This can be concluded that the ADE administration can reduce IL-6 levels to prevent AD but has not had the same effectiveness as donepezil. Dates have solid anti-inflammatory characteristics.[9,19] This mechanism is described by the presence of enzymatic modulation that releases signals from the antioxidant defense system in inflammatory situations.[19] Dates have active compounds that can inhibit the production of inflammatory hormones, such as prostaglandins and thromboxane.[9,19,20] Physiological changes in inflammatory defenses may involve the overproduction of several mediators such as reactive oxygen species (ROS), reactive nitrogen species (RNS), cyclooxygenase (COX), and cytokines, which are associated with the development of various disorders, including AD.

SOD activity is an intracellular antioxidant enzyme that is important in protecting cells against oxidative stress disorders. Antioxidants can reduce the formation of oxidative stress and neuronal damage in AD.[11,12,15] The severity of Alzheimer's can be affected by decreased SOD activity in the body.[10] Research showed that the higher the dose of ADE, the higher the SOD activity. This is in line with the Research of Pujari et al.,[15] which showed that the higher the dose of date extract is given, the more SOD activity significantly increases.It was found that ischemia caused a decrease in SOD activity, but the administration of date extract at doses of 100 and 300 mg/kgBW could significantly increase the SOD value.[15] Further on the research of Subash et al. showed a significant increase in SOD activity in the cortex and hippocampus of rats with 4% date supplementation compared to Alzheimer's transgenic mice.[2]

The results showed that in the 21-day treatment, the ADE group had significant differences from the donepezil group. It showed that the administration of Ajwa date extract could increase SOD activity as an Alzheimer's prevention effort but did not have the same effectiveness as donepezil in increasing SOD activity. In contrast to the 28 days treatment, it was found that the ADE group with a dose of 800 mg/kgBW did not significantly differ from the donepezil group. Administration of ADE at this dose has the same effectiveness as the drug donepezil in increasing SOD activity. This aligns with the Research of Alqarni et al., which showed that administering Ajwa date polyphenol extract could increase SOD activity in rats.[21] Ajwa dates can increase the antioxidant defense system. Furthermore, Research by Al-Yahya et al.[9] and Taleb et al.[19] showed that dates significantly increased the activity of SOD and catalase enzymes. Dates contain various vitamins with solid antioxidant potential (e.g., vitamins E, A, and C) capable of inhibiting other radicals in non-enzymatic reactions. Dates also contain several macro and micronutrients (e.g., zinc, manganese, selenium, and copper) that play a role in many biological functions in the body. [22]

This study has limitations; for instance, the dose and duration of ADE could not be equivalent to normal treatment or healthy rats. So that further Research is recommended to increase the dose and duration of date extract. The relationship of Alzheimer's with other varieties or the level of maturity of dates can also be discussed in further study.

Based on these experimental studies and the active ingredient profiles, it can be concluded that giving Ajwa dates extract to rats is associated with elevated antioxidant activity (SOD) and reduced inflammation levels (IL-6). Administration of ADE 400 and 800 mg/kg BW for 21 days and ADE 200 and 400 mg/kg BW for 28 days can increase SOD activity in Alzheimer's but does not have the same effectiveness as donepezil. Administration of ADE 800 mg/kg BW for 28 days can increase SOD activity and has the same effectiveness as donepezil. It could be worthwhile to explore the clinical potential of Ajwa dates extract at another stage of maturity in the managing of Alzheimer's Disease.

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Association of Lower Urinary Tract Symptoms and Benign Prostatic Enlargement in Patients with Hypertension

Dicky Stefanus, Safendra Siregar
Department of Urology, Faculty of Medicine, Universitas Padjadjaran/
Dr. Hasan Sadikin General Hospital Bandung, Indonesia

Abstract

Development of hyperplastic nodules in the transition zone of the prostate is the characteristic of Benign prostatic enlargement (BPE). Men with hypertension have a high risk of severe lower urinary tract syndrome (LUTS). This restrospective cohort analytic study investigated the association between LUTS and BPE in hypertension patients. Subjects were BPE patients with primary hypertension who visited the urology clinic of Dr. Hasan Sadikin General Hospital Bandung that were sampled consecutively from 2017 to 2020. Three hundred and twenty-four patients from the urology department participated in the study. These patients were categorized into mild LUTS (IPSS 1–7) (n=37, 11.4%), moderate LUTS (IPSS 8-19) (n=169, 52.2%), and severe LUTS (IPSS 20-35) (n=118, 36.4%). A positive correlation (r=0.761, p=0.000) and weak positive correlation (r=0.152, p=0.006) were found between systolic blood pressure and prostate volume and between LUTS and systolic blood pressure, respectively. In addition, there was also a weak positive correlation between diastolic blood pressure and prostate volume (r=0.065, p=0.245) and LUTS (r=0.015, p=0.784). Thus, there is an association between hypertension and prostate enlargement and the severity of lower urinary tract symptomsms.

Keywords: Benign prostate enlargement, hypertension, lower urinary tract symptoms

Introduction

The characteristic of benign prostatic enlargement (BPE) is the development of hyperplastic nodules in the transition zone of the prostate, which is also described as an enlargement of the whole prostate. BPE is a prevalent benign tumor among the middle-aged and elderly.[1] The prevalence of BPE at the age of 90 years ranges from 8 to 60%, increasing after the age of 40.[2] The exact incidence of BPE in Indonesia has not been studied; however, as an illustration, hospital prevalence from 1994 to 2013 was found to be 3,804 cases with an average patient age of 66.61 years at Dr. Cipto Mangunkusumo Hospital (RSCM). A similar average age of patients was obtained from the statistical results of Dr. Hasan Sadikin General Hospital Bandung, Bandung, which was 67.9 years old with a total of 718 cases from 2012–2016.[3]

Corresponding Author:
Dicky Stefanus
Department of Urology, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital Bandung, Indonesia
Email: drdickystefanus@gmail.com

Although BPE is not life-threatening, it could cause significant public health problems. The rapid growth of prostate tissue around the urethra will cause constriction or obstruction in the orifice of the urethra, which causes urinary tract-related symptoms, known as lower urinary tract symptoms (LUTS).[4] This condition is commonly found in the elderly and often worsens their quality of life. LUTS is often becoming the outcome of BPE.[5,6] LUTS is a likely diagnosed condition in the elderly population. In the United States, LUTS ranks as the fourth most common condition for elderly patients, after coronary artery disease (CAD), hyperlipidemia, and type 2 diabetes.[6]

Most treated LUTS patients (89% of patients in the UK and 79% in several other European countries) were admitted because of troubling symptoms.[7] Moreover, LUTS also has serious complications, including acute urinary retention, urinary tract infections, acute renal insufficiency, and even kidney failure, which is very dangerous for the patient's life.[8]

LUTS is associated with various risk factors, including age, obesity, metabolic syndrome, race, diet, and cardiovascular disease.[8] Hypertension or high blood pressure is a problem in developed

and developing countries, including Indonesia. Hypertension is when the systolic blood pressure is more than 140 mmHg and diastolic blood pressure is more than or equal to 90 mmHg. Hypertension is categorized into two types, primary/essential and secondary hypertension. The etiology of primary hypertension is still unknown, while the etiologies for secondary hypertension include kidney disease/disorders, endocrine, and heart diseases. Hypertension often causes no symptoms, while persistently high blood pressure for a long time could cause complications. Therefore, hypertension should be identified early by regularly checking blood pressure.[9]

Based on a study conducted by Hwang et al.,[9] men with hypertension have a high risk of having severe LUTS and explained that men with hypertension have a high IPSS score. The pathophysiology is an increase in sympathetic activity and alpha-1 adrenoreceptor activity. Hypertension causes vascular damage, resulting in resistance, then continued by prostate gland growth. This study aimed to investigate the association between LUTS and hypertension in BPE patients.

Methods

The population of this study was 324 patients from Urology Department in Dr. Hasan Sadikin General Hospital from January 2017 to December 2020. Patients were grouped into two categories based on their blood pressure: the hypertensive and non-hypertensive groups.

This was a retrospective cohort observational analytic study. The subjects were BPE patients in the urology clinic at Dr. Hasan Sadikin General Hospital Bandung who met the inclusion criteria and was not included in the exclusion criteria. The inclusion criteria were BPE patients at the urology clinic of Dr. Hasan Sadikin General Hospital Bandung who never consumed BPE alpha-blocker, 5-alpha-reductase inhibitor) and hypertension medication; and approved to be included in this study. The exclusion criteria included; diagnosed BPE patients who get routine control; urology patients diagnosed with secondary hypertension, alcohol dependence, hyperthyroidism, and liver disease; BPE-diagnosed urology patients, either new or control patients, who have already taken BPE drugs; patients with other conditions or diseases related to LUTS symptoms (urethral strictures, bladder stones, urinary tract infections, urinary tract cancer); and patients with severe cognitive impairment.

The study was written following STROBE. The research sample was taken by consecutive sampling. Data were taken from 2017 to 2020 and were analyzed using SPSS ver 26.0. Dr. Hasan Sadikin General Hospital Bandung Health Reseacrh Ethics Committee approved informed consent and ethical clearance with register number: LB.02.01/X.6.5/305/2020.

The normality test was carried out on numerical data with the Shapiro-Wilk test to assess whether the data were normally distributed or not. Based on the p-value, data including age, blood pressure, and body mass index were not normally distributed with a p-value <0.05. In this study, we obtained 32 (10%) patients with mild LUTS degrees (IPSS score 1–7), 170 (52.4%) patients with moderate LUTS degrees (8–19), and 122 (37.6%) patients with severe LUTS degrees. The correlation coefficients are interpreted between -1 to 0 and 0 to 1.

The International Prostate Symptom Score (IPSS) questionnaire comprises eight questions. Seven questions are about symptoms over the last month, and one question evaluates the quality of life. The seven questions of symptoms include frequency, urgency, intermittency, weak stream, incomplete emptying, nocturia, and straining. Each symptom is counted as 0 to 5, with a maximum of 35 points. To classify the severity, the total scores of each question were added. The severity includes mild - 0-7, moderate - 8-19, and severe - 20-35. The quality of life is evaluated from the eighth question, with a score of 0 to 6. Hypertension categories are explained in Table 1.

Results

This study obtained three hundred and twenty-four patients of the urology clinic. The median age was 67, with a median prostate volume of 48 ± (35–65) mL, as shown in Table 2.

Blood pressure is divided into systolic and diastolic pressures. A correlation test of blood pressure to prostate volume and IPSS was performed. The result showed a positive correlation (r=0.761, p=0.000) between systolic blood pressure and prostate volume, which was statistically significant. The IPSS also showed a weak positive correlation (r=0.152, p=0.006) with systolic blood pressure. This study found a weak positive correlation between diastolic

Table 1 Blood Pressure Classification

Blood pressure Classification	Systolic Blood Pressure mmHg	Diastolic Blood Pressure mmHg
Normal	<120	and <80
Prehypertension	120–139	or 80–89
Stage 1 hypertension	140–159	or 90–99
Stage 2 hypertension	≥160	or ≥100

Table 2 Mean Age, Prostate Volume, and International Prostate Symptom Score (IPSS)

Variable	n	p-value
Age (Median ± IQR)	67 ± (61–74)	p=0.027
Prostate volume	48 ± (35–65)	p=0.000
IPSS (n (%))		
Mild	32 (10%)	
Moderate	170 (52.4%)	
Severe	122 (37.6%)	

blood pressure with prostate volume (r=0.066, p=0.245) and IPSS (r=0.015, p=0.784), but both were not statistically significant. (Table 3). Patients were then grouped into 2 categories based on blood pressure: the hypertensive and non-hypertensive groups. Based on this grouping, it was found that the hypertension group was dominated by patients with moderate LUTS complaints, as much as 53%. In the group with mild LUTS complaints, only 10.2% of patients were classified as hypertension, while in the group with severe LUTS complaints, the number of hypertensive patients was 36.7%. As many as 27.3% of patients with severe LUTS were non-hypertensive patients (Table 4). Based on these findings, hypertension appears to play a role in the level of LUTS complaints (p=0.001).

The figure shows the distribution of systolic (blue) and diastolic (red) blood pressure data based on the total IPSS value (Figure 1). It appears that there is a positive relationship or correlation between the IPSS value with systolic and diastolic blood pressure, meaning that the increase in the total IPSS value causes an increase in the systolic and diastolic blood pressure values. The correlation of the total IPSS value obtained was weak with systolic blood pressure (r=0.152, p=0.006) and diastole (r=0.015, p=0.784) but

Table 3 Correlation of Blood Pressure with Prostate Volume And IPSS

Variable	Systolic blood pressure		Diastolic blood pressure	
	Spearman Correlation	P-value	Spearman Correlation	P-value
Prostate volume	0.761	0.000	0.065	0.245
Total IPSS	0.152	0.006	0.015	0.784

Table 4 Distribution of LUTS severity between Hypertensive and Non-Hypertensive Patients

	Hypertensive (n/%)	Non-hypertensive (n/%)
Mild LUTS	32 (10.2)	5 (45.5)
Moderate LUTS	166 (53)	3 (27.3)
Severe LUTS	115 (36.7)	3 (27.3)

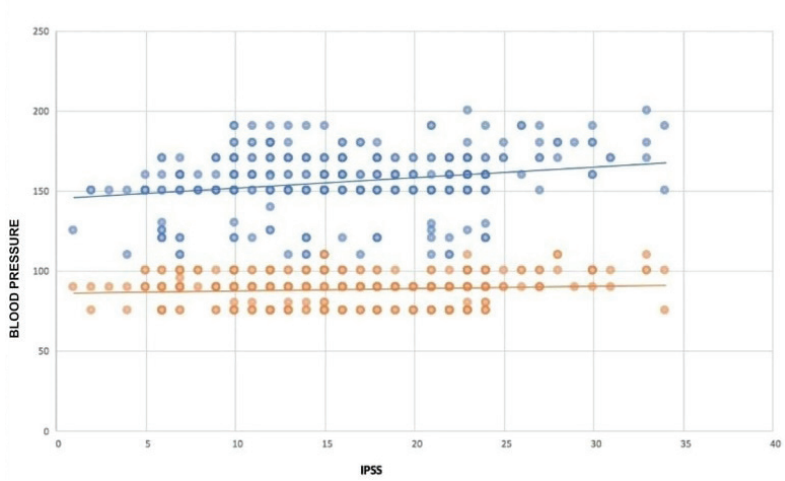

Figure Scatter Plot of Blood Pressure Correlation and IPSS

not statistically significant.

Discussion

Hwang et al.[9] determined that hypertension, diabetes, and dyslipidemia were categorized as risk factors for cardiovascular disease. From those factors, it is known that hypertension has a significant difference in IPSS, especially in obstructive symptoms, compared to the group without symptoms. Similar to this result, there is a positive relationship or correlation between the IPSS value and systolic and diastolic blood pressure, meaning that the increase in the total IPSS value causes an increase in the systolic and diastolic blood pressure values in this study. Many studies have investigated factors causing filling and urination symptoms, such as age, physical status, psychiatric factors, lifestyle, socioeconomic status, and metabolic factors. This result was also supported by the study conducted by Güven et al.,[10] which evaluated the relationship between hypertension and LUTS.

The role of hypertension in the pathogenesis of BPH is significant, mainly from the dynamic and static components. One study has shown that hypertension is associated with a high prevalence of lower urinary tract symptoms (LUTS).[9] In our study, there were 32 (10%) patients with mild LUTS (IPSS score 1-7), 170 (52.5%) patients with moderate LUTS degrees (8–19), and 122 (37.7%) patients with severe LUTS degrees. There are anthropometric risk factors for hypertension; higher odds of hypertension were found in patients who are overweight, obese, and with abdominal/central obesity. Risk factors, including gender, age, occupation, marital status, tobacco use, abdominal/central obesity, and BMI, were significantly associated with hypertension. Similar to the results of this study, Zeng et al.[11] conducted a study to determine the risk factors for BPH. The study found that African-American men with a history of hypertension were 1.76 times more likely to develop moderate to severe LUTS symptoms (OR=1.76 95% CI=1.26–2.45) and moderate to severe obstructive symptoms of LUTS (OR=1.76, 95% CI=1.20–2.58). Also, the subjects had twice the higher risk of having moderate to severe irritative symptoms of LUTS (OR=2.10.95 % CI=1.54–2.86). According to the National Health and Nutrition Examination Survey (NHANES III), it was stated that men with a history of hypertension had an increased risk factor for LUTS-related BPH than men without a history of hypertension (OR=1.76, 95% CI=1.20 –2.59).[10]

Results of this study found that the hypertension group was dominated by patients with moderate LUTS complaints, as much as 53%. In the group with mild LUTS complaints, only 10.2% of patients were classified as hypertension, while in the group with severe LUTS complaints, the number of hypertensive patients was 36.7%. As many as 27.3% of patients with severe LUTS were non-hypertensive patients. Based on these findings, it appears that hypertension plays a role in the level of LUTS complaints (p=0.001). This result is similar to a study conducted by Fujimura, et al[13]..,

which reported that men with hypertension did not have more severe LUTS compared to those without hypertension, but this study excluded patients with chronic and acute prostate and bladder diseases.[13] On the contrary, Hwang et al. [9] found that men with hypertension will get more severe symptoms of LUTS than those without hypertension. The study investigated the effect of hypertension on LUTS in BPH patients receiving α1-adrenoceptor antagonist therapy and calculated the relationship between blood pressure and the severity of LUTS. The effect of age on the relationship between LUTS and hypertension was also found. From this study, it was stated that hypertension and LUTS play a role in pathophysiological pathways and increase sympathetic activity and α1 adrenoceptor activity.[10]

This study showed a positive correlation (r=0.761, p=0.000) between systolic blood pressure and prostate volume, which was statistically significant. This result was supported by Guven et al.,[10] which explained a positive correlation between systolic pressure and storage problems in LUTS, with the problem of urgency as the most significant complaint. Diastolic blood pressure showed a weak, non-statistically significant positive correlation with prostate volume (r=0.065, p=0.245) and IPSS (r=0.015, p=0.784).

A study by Zeng et al. [13] showed a positive but insignificant association between hypertension and BPH. The study also revealed an insignificant association between hypertensive patients with BPH-related LUTS in the Chinese population. The differences and wide variations in LUTS definition, study population, survey methods, and data collection may cause this contradiction. Other cofactors, such as cardiovascular risk, also influenced the study results. This study found that men with hypertension experienced severe LUTS more often than men without hypertension. The limitation of this study is the small number of samples. Nevertheless, this study can be used as a preliminary study for a multicenter study or other comparative studies. Further studies are needed with a larger number of samples.

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CASE REPORT

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Case Report on Painful Patellar Crepitation Following a Knee Replacement with Preserved Patella

John Christian Parsaoran Butarbutar, Joshua Edward Hananto, Irvan
Department of Orthopedic and Traumatology, Faculty of Medicine Universitas Pelita Harapan, Siloam Hospitals Lippo Village, Tangerang, Indonesia

Abstract

Patellar clunk crepitation is a well-known complication following knee replacement surgery and is associated with posterior stabilized knee replacement surgery and surgical technique. Currently, patellar clunk or crepitation management following knee replacement surgery with preserved patella remains unclear. The purpose of this case report is to discuss whether patellar clunk or crepitation management should include debridement with patellar resurfacing or debridement alone. This case describes a patellar crepitation after knee replacement surgery with the preserved patella. The surgery went uneventfully using the standard medial parapatellar approach. However, the patient was still unsatisfied with the chronic left knee pain (>3 months) and crepitation that developed following the surgery, and the patient was diagnosed with patellar clunk and crepitation (PCC). A patellar resurfacing procedure was performed with a satisfactory clinical outcome. Replicating the original joint line level and placing the tibial component posteriorly play a pivotal role in preventing PCC. Debridement and patellar resurfacing procedures are recommended in this type of case to overcome the valgus knee alignment and the placement of the tibial component.

Keywords: Clunk, crepitation, debridement, knee arthroplasty, knee replacement, patellar resurfacing

Introduction

Knee replacement surgery is one of the most common treatments for advanced knee osteoarthritis, with more than 80% satisfaction.[1] Patellar clunk crepitation (PCC) is a well-known complication following knee replacement surgery and is associated with posterior stabilized knee replacement surgery and surgical technique.

PCC is caused by peripatellar fibrous tissue formation described by crepitation or catching sensation on the knee when moving, especially from flexion to extension.[2] However, it has various manifestations ranging from painless catching of the knee to anterior knee pain, caused by the locked knee when it moves from full flexion to extension.[3] The incidence of PCC was about 1.8% in total knee arthroplasty with fixed-bearing tibial tray.[3] Nodule or scar tissue formation under the tendon of the quadriceps or at the top/superior pole of the patella has been considered the cause of PCC.[4,5]

Corresponding Author:
John Christian Parsaoran Butarbutar
Department of Orthopedic and Traumatology, Faculty of Medicine Universitas Pelita Harapan, Siloam Hospitals Lippo Village, Tangerang, Indonesia.
Email: john.butarbutar@lecturer.uph.edu

Crepitation may result from fibrous nodule entrapment at the intercondylar area of the femoral component. This fibro-synovial proliferation and entrapment are caused by increased contact forces between the superior aspect of the intercondylar box and the quadriceps tendon. Increased contact forces are associated with the small patellar component, thin patellar composite, short patellar tendon, and increased femoral condylar posterior offset.[6]

Fibrosynovial cell adapts to physical trauma (increased contact forces) by increasing cell proliferation, thus increasing its' number (hyperplasia) to avoid degeneration or death.[7] These fibrous tissues, when examined microscopically, show distinguishable polypoid hypertrophy and hyperplasia with some alternating focusses of fibrosis and synovial hyperplasia. In addition, there are diffuse neovascularization and mild lymphocytic infiltration without extensive collections and germinal center. There is also frequent hyalinization of the collagen and foreign-body giant cells.[8]

There are several knee prostheses designs. These designs can be grouped as unconstrained and constrained based on the stabilizing ability. The unconstrained designs, such as posterior-

cruciate retaining (CR) and posterior-cruciate substituting (PS), do not contribute to medial-lateral stability since there is no engagement to the cutting box. The PS design requires PCL resection. It is used in patients with a more severe deformity, PCL tear, or any inflammatory arthritis that leads to PCL rupture. PS design is also preferred for fixed flexion contracture of more than 20 degrees since it is easier to achieve symmetric flexion and extension gaps when the PCL is resected.[9]

Some features of the PS design cause irritate the quadriceps tendon. First, the notch portion of the femur is extended more proximally compared to the CR design. Second, the PS design requires a large cutting box. These features may irritate the quadriceps tendon during knee extension and flexion, and therefore PCC more often develops in the knee with a PS implant.[10] The first generation of PS implant designs has a high transition zone/intercondylar box ratio (intercondylar box height vs. the anterior-posterior height of the femoral component). A high intercondylar box ratio results in earlier contacts of the distal quadriceps tendon to the anterior edge of the intercondylar box during flexion (compared with the designs with a lower ratio), thus causing quadriceps tendon irritation. The 2nd and 3rd generations of PS femoral components have been improved by lowering the intercondylar box ratio. Designs with a ratio <0.7 are associated with a lower incidence of patellar clunk.[6]

Previous studies showed that PCC was primarily diagnosed by clinical findings and occasionally via ultrasound and magnetic resonance imaging (MRI) imaging.[1] Sonographic confirmation of PCC can be made by visualizing the fibrous nodule and redemonstrating the clunk during knee movement. MRI may be utilized to assess PCC with a particular technique that shows a soft tissue lesion in the sagittal and axial view proximal to the patella.[11,12]

PCC can be treated with arthroscopic or open fibrous nodule excision. In addition, patellar maltracking/malposition should also be prevented to prevent further formation of the fibrous nodule and the development of anterior knee pain. Early in the knee replacement design, the patella is retained and results in high anterior knee pain incidences. After knee resurfacing is introduced, this complication is reduced, but other complications, such as patella fracture, avascular necrosis, and patella implant failure, appear. Later studies indicate that knee replacement with patella resurfacing improves long-term patient satisfaction and function, with reduced reoperation rate and crepitation after surgery and increased Knee Society Score and Function Score.[2] Nevertheless, patella resurfacing in knee replacement remains debatable, and many surgeons still preserve the patella, especially in the Asian population and female patients with a thin patella and lower Outerbridge score, as it may cause patellar fractures.[13–15]

There is no clear guideline for choosing debridement with patellar resurfacing or debridement alone (preserving the patella) to treat PCC. The purpose of this case report is to present a case of PCC that developed after a knee replacement and to discuss the options of only debridement with patellar resurfacing.

Case

A 63-year-old woman presented to an orthopedic clinic with a history of primary left knee replacement with preserved patella 12 months ago. Knee replacement surgery was performed due to painful, disabling left knee osteoarthritis. The surgery went uneventfully using the standard medial parapatellar approach. The prosthetic used was IRENE Diamond TKR PS (China), with a 10mm polyethylene tibial insert. No debridement and patellar denervation with electrocautery were done during the surgery. Physical exercises such as weight-bearing, knee muscle mobilization, and muscle-strengthening were started one day after the surgery.

Since five months after the surgery, she experienced chronic left knee pain, particularly on the anterior side of the knee. The patient characterized the pain as throbbing without any radiation to the lower extremity. The pain was worsened by walking and prolonged standing. She also reported crepitation in the left knee as the knee moves from flexion to extension. She denied any symptoms of fever, nausea, or vomiting. The patient routinely underwent physical therapy to alleviate the pain since she had had her knee replacement surgery. However, she was unsatisfied and was on crutches to aid walking. She consumes painkillers and rarely takes meloxicam, only when needed. The patient has type 2 diabetes mellitus with a well-controlled glucose level and hemoglobin A1c (HbA1c). She takes metformin daily for her type 2 diabetes.

The physical examination showed no deformity on the left knee and inflammation signs such as swelling, warmth, or redness. Mild

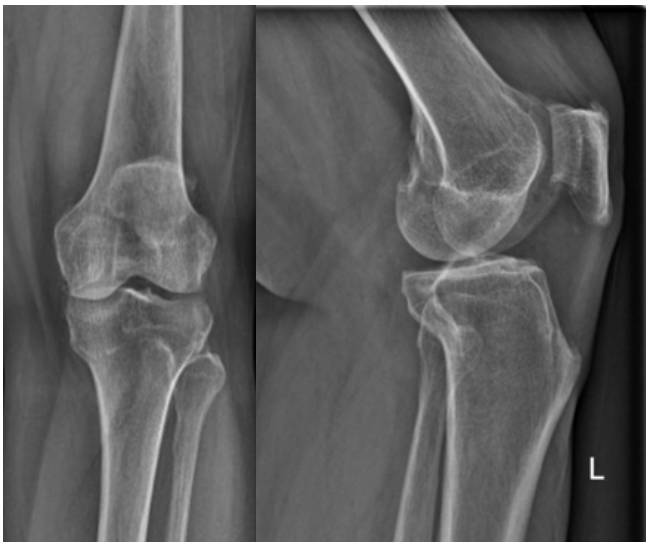

Figure 1 Knee Radiographs Examination Before Knee Replacement
(A) Erect Anteroposterior view; (B) Lateral view

left knee effusion and remarkable patellar grind pain were noted. The neurovascular examination was normal. The range of motion of the left knee was from 0° to 90° with pain. The laboratory test result was unremarkable. A knee radiograph was obtained (shown in Figure. 2A-C). CT-Scan was not performed due to financial problems.

Several radiographic measurements were carried out to assess implant malposition as the possible cause of PCC (Table). The joint line measurement using the lateral view method.

Since conservative management had been unable to rectify the patient's complaint, she underwent her second surgery 12 months after the first surgery. The surgeon performed a medial parapatellar approach to the left knee along with a subarachnoid block. Arthrotomy was performed, and the fibrous tissue was found on the superior pole of the patella. In addition, the patellar cartilage has shown Outterbridge 2 degeneration (Figure 3).

The fibrous tissue was excised completely.

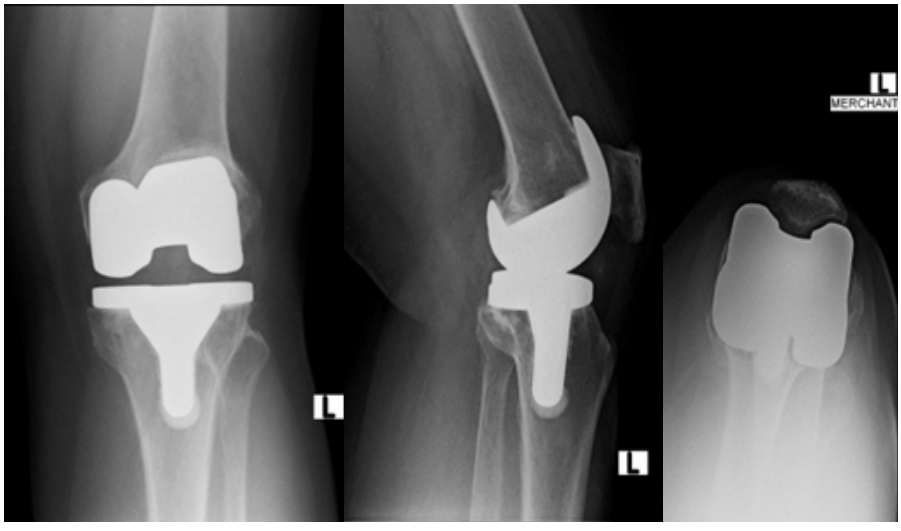

Figure 2 Knee Radiographs Examination Before the Patellar Resurfacing Procedure.
(A) Erect Anteroposterior view; (B) Lateral view; (C) Merchant view

Table Radiographic Measurements Between Preoperative Knee Replacement and Postoperative Knee Replacement Without Patellar Resurfacing Procedure

Radiographic Measurements	Preoperative Knee Replacement without Patellar Resurfacing	Postoperative Knee Replacement without Patellar Resurfacing
Blackburne-Peel Ratio	1.13	0.94
Patellar Tendon Length (mm)	53.54	52.86
Femoral Component Flex (°)	N/A**	1.74
Posterior Tibial Slope (°)	N/A**	1.45
Joint line (mm)	34.14	36.32
Tibiofemoral Angle (°)	0.80	6.70 (Valgus)
Patellar Tilt (°)	None	4.32

N/A** = not available

Thereafter, patellar resurfacing was performed with a 38 mm diameter implant. The patellar tracking was assessed using the 'no touch' technique and did not show patellar mal-tracking. The range of motion was full intraoperatively. Post-operative radiograph examination was obtained following the patellar resurfacing procedure (shown in Figure 4A-B). Early full weight-bearing and muscle-strengthening exercises were started after the surgery.

Before the resurfacing procedure, the Knee score was 21, and the functional score was 48. One month after the resurfacing procedure, while the patient was still in progress on the physiotherapy program, the patient still felt the pain from the incision; however, the patient already noticed no more crepitation. A six-month follow-up showed that the patient reported significant improvement in pain relief with a Knee Score of 75 and a Functional score of 65 (Knee Society Score). The patient still uses an assistive cane to walk, with minimal limping. On physical examination, neither patellar grind nor crepitation was noted, and the left knee range of motion showed improvement (0-120°). The participant consented to submit this case report, including all data and images. Despite having two procedures, the resurfacing procedure significantly relieves the pain, and the patient is satisfied with the outcome.

Discussion

Anterior knee pain after a total knee replacement may be caused by patellofemoral maltracking,

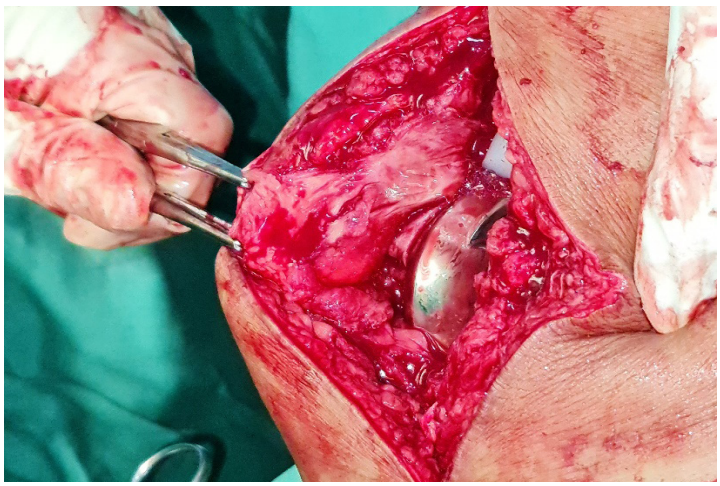

Figure 3 Fibrous Tissue on the Superior Pole of the Patella

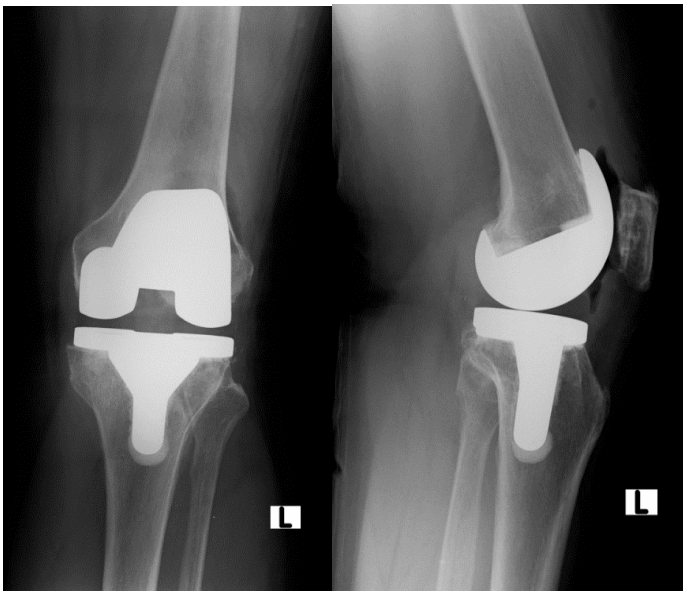

Figure 4 Knee Radiographs Examination Following Patellar Resurfacing Procedure
(A) Erect Anteroposterior view; (B) Lateral view

patella baja, offset errors of the femoral component, rotational error of the femoral or tibial component, tibiofemoral instability, patellar fracture, patellar clunk, and synovial hyperplasia.[12] Clunk or crepitation is determined by the shape of the fibrous tissue or nodule. In patellofemoral crepitation (without clunk), fibro-synovial hyperplasia still occurred. Still, a discrete fibrous nodule does not develop, and the clinical manifestation is only anterior knee pain with a grinding sensation when the knee is loaded at 30-60 degrees.[16,17] The patient was diagnosed clinically with PCC due to anterior knee pain, crepitation as the knee extends, positive patellar grind test, and exclusion of prosthetic joint infection.

Before the resurfacing procedure, an X-ray radiograph was taken. The radiographic implant measurements showed no malposition and tolerable joint elevation. A patellate tilt of 4.32 degrees was present but patella lateralization, tilting of the patella, or a lateral osteophyte was not found from merchant view, no patellar fracture was found, the Blackburne peel ratio was 0.94 (no patella baja), Radiographic implant measurements showed tibial component laid precisely at the anterior border of the tibia, valgus alignment was noted and considered as a factor that worsens patella tracking that might be a contributor to the recurrence of PCC. The rotational error of the femoral/tibial component (which may contribute to the development of PCC by altering patellar tracking) cannot be excluded pre-operatively because we cannot attain a CT scan due to financial problems. Nevertheless, there are no intraoperative findings of any malrotation of the femoral/tibial component.

There are several risk factors and preventive measures to avoid the development of PCC. There are several design features intended to avoid PCC. Extending the trochlear groove more posteriorly and distally, and lowering the intercondylar box ratio can minimize contact between the superior part of the patella and the intercondylar box.[6] Tibial tray placement at the neutral or posterior position also minimalizes the risk of various patellar complications. During knee flexion, the patella will contact the trochlear groove. The stresses caused by the contact between the patella and trochlear groove will also intensify and shift superiorly as the flexion progresses. It is recommended to avoid contact between un-resurfaced bone with the femoral component by placing the patellar component at the patella's most superior part but not surpassing the patella's prominent border, as it may cause quadriceps tendon irritation and PCC. Exciting excess bone tissue uncovered by the patellar component at the superior pole also prevents the development of crepitus and

clunk. Choosing thicker patellar components, performing debridement of the fibro synovial tissue, and avoiding over-resection of the patella may also help to prevent PCC development.[7] The author suggests that maintaining joint line level, TFA neutral alignment, patellar tracking & positioning, and proper placement of the femoral & tibial component (not placing the tibial component overly anterior) may prevent the development of PCC.

Treatment of PCC depends on the patient's tolerance to the symptoms. If the only symptom is mild crepitus and unrecognizable by the patient, then no surgical treatment is needed. Physiotherapy with exercises to stretch the quadriceps and hamstrings also have good outcomes.[18] If PCC causes disabilities or disturbances in daily activities, open or arthroscopic removal of suprapatellar tissue is the main procedure to treat PCC.[19] Several studies[4,5] have shown the satisfactory result of arthroscopic debridement procedure to manage PCC. Most of the time arthroscopic fibrous nodule debridement is sufficient in typical PCC. However, if there are other peripatellar soft tissue impingements, the result is less predictable. Open debridement allows a more extensive intra-articular synovial debridement and adequate excision, including any excessive synovial tissue that may proliferate and cause PCC on the posterior aspect of the quadriceps tendon that should also be excised. Open debridement also allows patellar button revision and additional procedures when needed. Nevertheless, it has a higher risk of co-infection and extensor apparatus disruption.[20]

Open debridement was performed to explore, address, and excise the nodule that caused PCC. In this case, open debridement was preferred because the procedure was performed along with the patellar resurfacing procedure.[21] In a primary total knee replacement, patella resurfacing is not always done unlike the distal end of the femur and the proximal end of the tibia which are routinely replaced. The thickness of the patella, which is usually thinner in the Asian population, especially in females, is one of the considerations that influence the decision to resurface or not.[22] In this case, the consideration of the patellar resurfacing procedure was to improve tracking (to compensate for postoperative valgus alignment).

Patella malposition and maltracking are potential causes of PCC. Patella malposition such as post-operative Patella Baja can be caused by excessive distal femoral cut and inferior placement of the patellar component. Patella baja can be prevented by placing the patellar component as superior as possible and by avoiding excessive distal femoral resection that raises the joint line. In this case, the Blackburne peel ratio was 0.94 (no patella baja). Patella mal tracking can be attributed to inadequate soft-tissue balance or tibial/femoral component malrotation.[23] The patellofemoral contact force and lateral retinacular tension can be reduced by medialization of the patellar component.[23] Internally rotated femoral component (relative to the trans epicondylar line) or internally rotated tibial component (relative to the tibial tubercle) will cause the patella to track laterally with a higher risk for dislocation. In addition, medial translation of both the femoral and tibial components should also be prevented because it will result in lateralization of the tibial tubercle and a lateral force vector force on the patella.

Patellar tilt is one of the morphological features that is associated with patella maltracking. A study showed that the incidence of PCS increases by 1.27 for every degree increase in patellar tilt.[24] During surgery, to make sure that the patella tracks centrally without lateral tilt or subluxation, the knee's full range of motion should be tested during implant trialing and before capsular closure. The "no thumb" technique is used to assess tracking (without the surgeon having to manually reduce the patella, the medial border of the patella should make contact with the medial femoral condyle through the knee range of motion). The etiology should be identified for any patellar tilt or instability. The most likely etiologies are the imbalance of extensor mechanism soft tissues, component malposition, or anatomic abnormalities. For extensor mechanism imbalance, a lateral retinacular release can improve tracking. It significantly reduces the contact force of the patella femoral. Many patients with lateral mal-tracking have tight lateral retinacular structures, causing increased pressure at the patella-femoral joint and stress at the metallic implant-articular cartilage junction, thus causing the fibrous nodule to form at the bone-implant interface.[25]–Other methods are also available such as advancement of the vastus medialis muscle or medial retinacular via imbrication. A medial tibial tubercle transfer can be performed for severe valgus deformities. If maltracking does not resolved, revision and repositioning of the components can be done to improve rotation and tracking.

Patella resurfacing is a method that removes

the under surface of the patella and inserts a plastic surface in its place. Resurfacing the patella will aid the optimization of patella tracking by allowing the positioning of the patellar button (proximal dan medial positioning) and optimizing the thickness of the construct, to achieve better fit over the femoral flange, creating less contact with the proximal edge of the femoral box. Indications that support patellar resurfacing are valgus knee deformity, rheumatic disease, patellofemoral arthritis, and maltracking.[23]

When resurfacing was not performed, an alternative method called phalloplasty can be done to reduce the rate of PCC by reshaping and improving the congruence of the patella with the different prosthetic trochleae geometries to optimize tracking. The patellar articular cartilage is removed to reduce the patellar thickness to get the best match possible with the femoral trochlea, the facets are reshaped (mimicking a normal anatomical shape with a 130° angle between the facets). Osteophyte removal and smoothening of the fibrillated cartilage are also done. Peripheral denervation is usually also performed by electrocautery. In contrast, the traditional treatment only removes marginal osteophytes on the patellar surface.[25] A systematic review studied the role of patelloplasty in total knee arthroplasty and conclude that in terms of preoperative functional outcomes and the rate of anterior knee pain, patelloplasty is superior to traditional treatment but inferior to patella resurfacing. However, patelloplasty has fewer complications than patella resurfacing such as component failure, instability, fracture, and tendon rupture.[25,26] A study conducted by Liu et al.[27] compared patella resurfacing with a procedure similar to patelloplasty called patella reshaping (whereas only the lateral patellar facet is resected to match the trochlea) the Knee Society Pain Score, Knee Society Function Score improved in both groups with no statistically significant differences between the two. The authors prefer patellar because it preserves bone stock and is still convertible to patellar resurfacing if the anterior knee pain continues.

PCC is a rare complication following knee replacement surgery and is associated with using posterior stabilized TKR prosthesis. The author suggests that PCC treatment should include patella resurfacing to improve the patellar tracking when there is an alteration in joint line level, joint malalignment, or prosthesis malposition after the primary knee replacement. A further comparative study is needed to assess the clinical outcome between the debridement only and debridement with patellar resurfacing combined for PCC treatment following a knee replacement surgery with the preserved patella.

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Correlation Analysis of Lactic Acid Level as A Predictor of Severity of Patients with Acute Appendicitis

Reno Rudiman, Tommy Ruchimat, Cytra Givanni Rossy
Department of Surgery, Faculty of Medicine Universitas Padjadjaran/
Dr. Hasan Sadikin General Hospital Bandung, Indonesia

Abstract

Perforated appendicitis is a leading cause of morbidity and mortality in all appendicitis cases, both for adults and children. Delay in preoperative diagnosis is the main reason for perforation. In previous studies, it was revealed that diagnostic modalities such as radiological examination and the current scoring system have not been able to predict the onset of perforated appendicitis. Serological biomarkers of lactic acid are associated with intestinal obstruction and ischemia. The increase in the serological value of lactic acid in perforated appendicitis compared to acute one was shown to increase significantly by 0.25 mmol/L ($p<0.05$) according to a previous study. This study aimed to determine the correlation between lactic acid level and the severity of appendicitis in patients visiting Dr. Hasan Sadikin General Hospital. This was a cross-sectional prospective analytic observational study on adult patients diagnosed with appendicitis who were admitted to the emergency room of Dr. Hasan Sadikin General Hospital from January 1, 2021 to June 1, 2021. Data analysis was performed using bivariate analysis and correlation tests of difference. This study involved 54 subjects with a mean lactic acid level of 2,5093 mmol/L (0.9 mmol/L - 11.8 mmol/L). In the complicated appendicitis group, 20 subjects (37%) was found to experience an increase in lactic acid (OR 1.07; 95% CI: -0.03-0.22; p=0.14). The correlation analysis showed the direction of negative correlation. Thus, it is concluded that there is no significant correlation between lactic acid level and the severity of appendicitis in patients with appendicitis.

Keywords: Correlation, lactic acid, perforated appendicitis

Introduction

Acute appendicitis is a frequent case that is often found in the field of digestive surgery. Research revealed the incidence of perforated appendicitis in adults ranges from 4–19%. The risk of perforation is very high in the first 24 hours and increases to 6% in the next 36 hours from the beginning of symptoms. Based on this research, surgery is recommended in the first 36 hours of symptoms to prevent complications from appendicitis. Delay in diagnosis is the main cause of these complications. An accurate examination that can predict the risk of perforated appendicitis is currently still not found.[1,2]

A complete history taking and good physical examination in cases of appendicitis are believed to have the same accuracy as other investigation modalities in establishing the diagnosis. However, in different cases of complicated appendicitis that cannot be distinguished with certainty from non-complicated appendicitis at the time of the initial examination at the hospital, causing a delay in diagnosis. This problem increases morbidity and mortality due to the risk of perforated appendicitis.[3]

Several previous studies tried to establish the diagnosis of appendicitis with radiological examinations: CT scan, USG, and scoring systems such as the Alvarado score, pediatric appendicitis score (PAS), and appendicitis inflammatory response (AIR). These supporting modalities have proven to be very useful in predicting acute appendicitis in patients with complaints of right lower abdominal pain but are still unable to predict the risk of perforated appendicitis. [4,5,6]

Serological biomarker of lactic acid value is associated with the presence of intestinal obstruction and ischemia based on the pathophysiology of appendicitis so that it can facilitate early detection of the risk of perforated appendicitis. Previous studies in patients with perforated appendicitis found higher plasma

Corresponding Author:
Reno Rudiman
Department of Surgery, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital Bandung, Indonesia
Email: renorudiman@yahoo.com

levels of lactic acid than in patients with acute nonperforated appendicitis (96% sensitivity; 87% specificity).[7] Research in Indonesia on lactic acid biomarkers as a risk predictor of perforated appendicitis is rare and currently has not been done in Bandung. The researcher intends to find out the correlation between lactic acid values as a predictor of perforated appendicitis in adult patients who had been previously diagnosed with acute appendicitis in Dr. Hasan Sadikin General Hospital Bandung, Indonesia. This research is expected to be able to provide benefits for clinicians to conduct an early intervention in cases of appendicitis at risk of perforation with appropriate and efficient investigations.

Methods

The study was conducted on subjects who met the inclusion criteria, adult patients (>18 years), diagnosed with appendicitis which was established through history taking, physical examination, Alvarado and Tzanakis scoring, underwent emergency surgery, and did not meet the exclusion criteria. The research was conducted at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia in the period from January 1st, 2021 to June 1st, 2021. The research was carried out after obtaining Ethical Approval No: LB.02.01//X.6.5/343/2021 from the Health Research Ethic Committee of Dr. Hasan Sadikin General Hospital Bandung.

This study is a prospective analytic observational study with a cross-sectional design. The independent variable is the value of blood lactic acid and the dependent variable is perforated appendicitis. The sample size is determined by the two-proportion hypothesis formula with each proportion totaling a minimum of 66 samples. The sampling method is consecutive sampling.

Data processing through the steps of editing, coding, data entry, and cleaning. Analysis of the characteristics data was analyzed descriptively. The bivariate analysis uses simple logistic regression bivariate analysis. The risk probability in the bivariate analysis is shown as crude odds ratio (OR) with a 95% confidence interval (CI). The p-value is considered significant if $p<0.05$. The OR value is considered a risk factor if the OR ≥1.00. The analysis between numerical variables and categorical variables uses the independent T-test if the data is normally distributed and the Mann-Whitney test if the data is not normally distributed. The normality test of the data used the Kolmogorov-Smirnov test. The candidate variables that will be included in the multivariate analysis are variables that have a P-value <0.25. The multivariate analysis uses multiple logistic regression with a determinant model. Statistical analysis was processed with SPSS version 21.0 for Windows.

Results

This study involved 54 subjects in two groups, consisting of the acute appendicitis group (the study group) and the complicated appendicitis group (the control group) by monitoring the increase in lactic acid in these patient groups (Table 1). Regarding the characteristics of the subjects, It was found that the subjects suffering from appendicitis were more women than men with a ratio of 1.25:1 with a mean value of age was 40.16 years old (18–81). In the characteristic description based on the severity of the disease, it was found that 94.4% perforated appendicitis and 5.6% acute appendicitis (Table 1). Based on the increase in lactic acid, it was found that 37% (20 subjects) had an average value of lactic acid at 2.5093 mmol/L (0.9–11.8).

Based on the Simple Regression Logistic test, there was an increase in lactic acid levels in subjects with acute appendicitis and perforated appendicitis with p-value>0.05 (p=0.14; OR:1.07; 95%CI: -0.03–0.22) so that there was no significant difference between lactic acid levels in patients with acute appendicitis and

Table 1 Characteristics of The Subjects

Variables	n=54
Age	
Mean±Std	40.16±15.5
Range (min-max)	18.00-71.00
Sex	
Male	24 (44.4%)
Female	30 (53.6%)
Severity	
Complicated appendicitis	51 (94.4%)
Acute appendicitis	3 (5.6%)
Level of lactic acid	
Increase	20 (37%)
Normal	34 (63%)

Table 2 Simple Regression Analysis for Variables of Perforated Appendicitis Predictors

Variables	Perforated Appendicitis		Acute Appendicitis		OR	CI 95%		P-Value
	n	%	n	%		Min	max	
Sex								
Male	24	47	0	0				
Female	27	53	3	100	-0.11	-0.23	0.02	0.09
Onset of symptoms								
<24 hours	0	0	3	100	9.86	1.99	3.01	0.00
>24 hours	51	100	0	0				
Lactic acid								
Increase	20	39	0	0	1.07	-0.03	0.22	0.14
Normal	31	61	3	100				

perforation. The results were the same for the gender variable with p-value >0.05 (p=0.09; OR: -0.11; 95%CI: -0.23 -0.02). Appendix obstruction based on symptom onset with a time limit of 24 hours showed a significance value of p<0.05 (p=0.00; OR: 9.86; 95% CI: 1.99 -3.01) so it can be concluded that there was a significant difference between lactic acid levels in patients with obstruction less than 24 hours and more than 24 hours (Table 2). In the correlation analysis of the value of lactic acid and the severity of appendicitis, the Pearson Correlation value was 0.186, which means the correlation is very weak (Table 3).

Discussion

In this study, univariate and bivariate analysis was carried out on the characteristics of the research subjects. In this study, there was no significant difference between gender in acute and perforated appendicitis patients. This is following the results of a study in Turkey involving 576 appendicitis patients which showed that the group of perforated appendicitis was dominated by the male sex, but there was no significant difference between men and women in the statistical test of both groups.[7]

Table 3 Pearson Correlation Between Lactic Acid and Severity of Appendicitis

		KAL_X	KUB_Y
KAL_X	Pearson Correlation	1	**.186**
	Sig. (2-tailed)		.178
	N	54	54
KUB_Y	Pearson Correlation	**.186**	1
	Sig. (2-tailed)	.178	
	N	54	54

In the bivariate analysis between increased levels of lactic acid in patients with acute appendicitis and perforation, the p-value> 0.05 (p=0.14; OR:1.07; 95%CI: -0.03-0.22) It means that were no significant results between the increase in the value of lactic acid with the severity of appendicitis. These results were strengthened by the correlation analysis of lactic acid values and the severity of appendicitis, the Pearson Correlation value was 0.186, which means the correlation was very weak. This was probably because patients with high lactic acid levels and unstable hemodynamics parameters who were admitted to an emergency department in Dr. Hasan Sadikin General Hospital had already received intensive fluid intravenous therapy earlier based on sepsis bundle protocols and were proved by intraoperative findings where the complications of appendicitis do not occur. This assumption is following studies conducted by previous studies that patients who received intravenous fluid therapy more than 30 minutes since the diagnosis of sepsis was made had a higher mean lactic acid level (3 mmol/L) than patients who received intravenous fluids 30 minutes after the diagnosis of sepsis was made (2.6 mmol/L). The result was that patients who received intravenous fluids before 30 minutes had a 12% shorter length of stay compared to patients who received intravenous fluids after 30 minutes (HR 1.14; 95% CI, 1.02-1.27).[4,8,9]

This study has several limitations that might have an influence on the results of this study which showed a negative correlation between lactic acid levels and the incidence of perforated appendicitis. This study had a sample size that

was less than the minimum number of samples because the study was conducted in a type A general hospital (main referral hospital) where cases of acute appendicitis were rare. The research was only conducted in one hospital, so the amount of research data was still limited. Most of the patient's lactic acid data were not taken every day so the researcher must adjust the clinical data with the lactic acid data on the day when the patients were admitted to the hospital.

This study concluded that there was no significant correlation between lactic acid levels and the severity of appendicitis in Dr. Hasan Sadikin General Hospital Bandung. This study could be used as a clinician's/surgeon's consideration to choose the laboratory parameters for supporting the diagnosis of the severity of appendicitis. Surgeons are expected not to rely solely on the lactic acid parameter because it could be proven that it did not correlate with the severity of appendicitis based on this study. Further research is needed by involving a larger number of subjects in a multicenter and using multivariable parameters which will be tested for statistical quality as a predictor of severity in appendicitis patients.

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Effect of High Fat and Cholesterol Diet on Total Blood Cholesterol Levels in Pregnant Wistar Rats

Desmawati,[1] Annisa Yuda Mahdiyah,[2] Husnil Kadri[3]
[1]Department of Nutritional Science, Faculty of Medicine Universitas Andalas, Padang, Indonesia
[2]Department of Medical Education, Faculty of Medicine Universitas Andalas, Padang, Indonesia
[3]Department of Biochemistry, Faculty of Medicine Universitas Andalas, Padang, Indonesia

Abstract

Hypercholesterolemia during pregnancy is a physiological condition resulting from increased insulin resistance, lipoprotein synthesis, and lipolysis in adipose tissue, which mobilizes lipids as an energetic substrate for fetal growth. Consumption of foods high in fat and cholesterol may lead to an increase in total blood cholesterol levels during pregnancy due to saturated fat and cholesterol contents that will increases the synthesis of lipoproteins in the blood. The objectives of this study were to determine the effects of high fat and cholesterol diet on the total blood cholesterol levels in pregnant Wistar rats. This study was a true experimental research using a randomized post-test-only control group design conducted from November 2020 to October 2021 on fourteen female Wistar rats that were divided into control and intervention groups. Cow brain was provided as the high fat and cholesterol diet and after the rats gave birth, blood was drawn from the heart. The total blood serum cholesterol levels were assessed using Micro Lab 300 with the CHOD-PAP method and the data were analyzed using an independent t-test. This study showed that the mean total blood cholesterol levels for the control and treatment groups were 80.43±18.512 mg/dL and 142.57±24.786 mg/dL, respectively, which reflected a significant differences in the mean total blood cholesterol level between the control and treatment groups (p-value <0.01). In conclusion, a high fat and cholesterol diet affects the total blood cholesterol level in pregnant Wistar rats..

Keywords: Cholesterol diet, high fat diet, hypercholesterolemia, pregnancy, total blood cholesterol

Introduction

Dyslipidemia is a lipid metabolism disorder in the form of an increase or decrease in the level of lipid fraction in plasma. Total cholesterol is one of the parameters that become the main focus in diagnosing dyslipidemia. Hypercholesterolemia is one of the classifications of dyslipidemia. An increase in total serum cholesterol exceeds 200 mg/dL after nine to twelve hours of fasting without increasing other lipid fractions.[1] Based on the Global Health Observatory (GHO) from WHO data, dyslipidemia caused 2.6 million deaths in the world in 2008, with a prevalence of 37% for men and 40% for women. Based on Basic Health Research 2013, in Indonesia, 35.9% of the Indonesian population aged 15 years and over had hypercholesterolemia conditions, with prevalence based on sex found in men at 30% and in women it was higher, namely 39.6%.2 Women are more at risk for various reasons, including hormonal factors, pregnancy, and menopause.[3]

Gestational hyperlipidemia or hypercholesterolemia is a physiological condition resulting from hormonal increases, insulin resistance, lipoprotein synthesis, and lipolysis in adipose tissue, which mobilizes lipids as energetic substrates for fetal growth.[4,5] Excess cholesterol in pregnancy needs to be considered as a risk factor for pregnancy and fetal development. Gestational hyperlipidemia is associated with metabolic morbidities such as obesity and gestational diabetes mellitus, and several studies have shown an association with post-term, preeclampsia, and preterm birth. [4,6]

Based on research conducted by Siringoringo et al.[7] on pregnant women in Padang, the average total cholesterol in the third trimester reached 247.56 mg/dL in a normal pregnancy. Although several studies have shown that cholesterol levels increase substantially during

Corresponding Author:
Desmawati
Department of Nutritional Science, Faculty of Medicine Universitas Andalas, Padang, Indonesia
Email: desmawati@med.unand.ac.id

the last two trimesters of pregnancy, the optimal serum cholesterol levels have not yet been determined.[8] According to research conducted by Retnakaran et al.,[9] there was an increase in total cholesterol up to 289.58 mg/dL at the end of the second trimester of pregnancy and three months after birth, a decrease to around 220 mg/dL.

Adequate food intake from the beginning of pregnancy is necessary to support the fetus's physical health and mental development.[10] Unbalanced maternal diet with high-fat content can impact maternal condition and fetal growth due to disturbances in the transportation of placental nutrients.[11] In pregnant women, consuming a high-fat diet can affect offspring with changes in energy balance, cardiovascular dysfunction, neuroinflammation, and an increased risk of metabolic syndrome, including hypercholesterolemia.[12,13] According to research from the Brazilian Diabetes Society Congress in 2015, it was found that as many as 48.4% of pregnant women had inadequate food consumption patterns due to high consumption of fat and cholesterol, and also low consumption of vegetables and dairy products during pregnancy.[14] This aligns with research by Narasiang et al. on 181 pregnant women. The average daily fat consumption during pregnancy was 118.63 grams/day, whereas the maximum fat consumption during pregnancy was 67.3 grams/day.[15]

According to Cerf et al.,[11] giving pregnant rats a high-fat diet can increase plasma cholesterol on the 20th day of gestation by about 10% (90 mg/dL) compared with the control diet group. The treatment group was given a high-fat diet with 40% fat, 14% protein, and 46% carbohydrates. While the control group with a composition of 10% fat, 15% protein, and 75% carbohydrates (80 mg/dL). Based on a study conducted by Li et al.,[13] pregnant rats fed a high-fat diet with a composition of 58% fat, there was an increase in body weight, lipid profile, and blood glucose on the 19th day of gestation. In the group that was given a high-fat diet, the average total cholesterol level increased up to 96 mg/dL, while in the control diet group, the average total cholesterol level was 63 mg/dL.

In this study, we will give different doses of a high-fat diet. A high-fat diet was given as mashed beef brain at 3 mL/head/day during pregnancy until delivery. This study aimed to determine the effect of a high-fat and cholesterol diet on total blood cholesterol levels in pregnant Wistar rats.

Methods

This research is experimental research with a post-test-only research control group design. The research was conducted at the Faculty of Medicine, Andalas University's animal house, for the maintenance and treatment of experimental animals, and at the biochemistry laboratory of the Faculty of Medicine, Andalas University, to examine blood samples from November 2020 to October 2021.

The population in this study was the Rattus novergicus Wistar albino strain. The sample was the entire population that met the inclusion and exclusion criteria. Inclusion criteria: healthy female albino Wistar strain rats aged 3–4 months and an average body weight of 200–250 grams, pregnant, and active.

The sampling technique used simple random sampling that met the inclusion and exclusion criteria. The sample size was determined based on WHO criteria, where the minimum number of samples in each experimental research group was five rats. To prevent the existence of exclusion and dropout criteria, the researchers took a total of seven mice in each group. This study consisted of 2 sample groups: one control group without a high-fat and cholesterol diet and 1 group with a high-fat and cholesterol diet, so 14 rats were needed.

Experimental animals were placed in several places according to the number of treatment groups. After acclimatization, the animals were tried to be mated. Mating in mice takes place within 4–5 days. The presence of a vaginal plug or copulatory plug after fusion indicates that copulation has occurred and this day is defined as the first day of pregnancy. The weight of the pregnant experimental animals was recorded, and the treatment started from the first day of the pregnant experimental animals.

A group of female mice (control group, n=7) was randomly selected and placed as a control group, which was fed a standard diet ad libitum during the experiment. Standard food consists of 5% fat, 16% protein, 8% crude fiber, 10% ash content, and 12% moisture content. Another group of rats (treated group, n=7) was given a standard diet supplemented with 2 ml/head/day of bovine brains (high-fat diet (HFD)). The beef brains given have been steamed beforehand and blended with a 1:1 ratio of adding water. Cattle brain is given using a gastric tube once a day and standard food is given ad libitum. The treatment was carried out from the first day the

Table 1 Results of Total Blood Cholesterol Levels' Measurement

No	Control Group mg/dL	Treatment Group mg/dL
1.	75.9	158.2
2.	79.5	137.7
3.	65.4	115.4
4.	106.2	179.9
5.	71.7	162.5
6.	105.2	116.9
7.	59.1	127.4
Mean	80.43	142.57
Standard Deviation	18.512	24.786

rats were pregnant for 21 days.

Blood sampling was carried out after the mice gave birth (the first day after birth) so that the treatment could be given in total for 21 days. Blood sampling was carried out after all rats fasted for 10-12 hours before blood collection. The mice were anesthetized beforehand to make taking samples through the heart easier using a 1cc syringe. Total cholesterol was determined enzymatically using the cholesterol oxidase-peroxidase aminoantipyrine phenol (CHOD-PAP) method.

Data analysis was performed using univariate and bivariate. Univariate analysis was performed to determine the mean total cholesterol level of the sample group. Bivariate analysis was performed to statistically determine the difference in the mean of the two sample groups. The data obtained were first tested for normality using the Shapiro-Wilk test and homogeneity test using the Levene Statistics test. If p> 0.05, then the data is usually distributed and homogeneous. Then an independent t-test was conducted with a significance value of 99% (p≤0.01). If p 0.01, then the calculation results are statistically significant. The Health Ethics Committee has approved this research of the Faculty of Medicine, Andalas University, with the ethical number 354/UN.16.2/KEP-FK/2021.

Results

The results of measuring total cholesterol levels from blood serum samples of female Wistar rats from both groups can be seen in Table 1. It shows that the mean total cholesterol level of pregnant Wistar rats in the control group is 80.43±18,512 mg/dL, and the mean total cholesterol level of pregnant Wistar rats in the treatment group is 142.57±24,786 mg/dL.

Data analysis was carried out using the independent sample T-Test based on the data obtained. Independent sample T-Test requires several rules: the data is normally distributed, the variance between groups of homogeneous data, the two groups of independent data, and the associated variables are numerical (with only two groups).

The normality test results conducted with the Shapiro-Wilk test showed that the data were normally distributed with a significance value of the control and treatment groups of 0.221 and 0.500, respectively (p>0.05). Furthermore, a homogeneity test was carried out with the Levene test, which showed that the data was homogeneous with a significance of 0.264 (p>0.05).

An Independent T-Test was conducted to determine the difference in the mean of two

Table 2 Differences in Cholesterol Levels in the Control Group with the Treatment Group

Group	Cholesterol Level		p
	Mean	SD	
Control	80.43	18.512	0.001
Treatment	142.57	24.786	

independent data groups. The data obtained were tested with a 99% confidence interval and a significance level of 0.01 (p=0.01). The test results showed a significant difference between the total blood cholesterol levels of the treatment group and the control group (p<0.01). The results of the data analysis are presented in Table 2.

Table 2 shows that the mean total blood cholesterol level of female Wistar rats in the treatment group was higher than in the control group. According to the results of statistical analysis, it was found that there were significant differences between the two groups.

Discussion

Based on the results of the average total cholesterol levels of pregnant Wistar rats in table 1, it was found that the average total cholesterol level in the control group was in the normal range of 80.43 mg/dL. This result is in line with research conducted by Cerf and Herrera. The total cholesterol levels of pregnant rats fed standard diets were in the normal range of 80 mg/dL.11 According to research by Xie et al., there was an increase in total cholesterol levels in pregnant rats to 81.05 mg/dL compared to 77.30 mg/dL before pregnancy.[16]

There is an increase in total cholesterol levels physiologically during pregnancy. However, not all pregnant women experience hypercholesterolemia. There is a relative increase in cholesterol, especially in the second and third trimesters of pregnancy. Hypercholesterolemia in pregnancy is mostly experienced by women who have familial hypercholesterolemia.[17] Familial hypercholesterolemia is an autosomal dominant inherited disorder of lipid metabolism. Mutations in the LDL receptor gene cause HF. During pregnancy, women with familial hypercholesterolemia show relative changes in plasma lipid levels similar to those in healthy women. However, the absolute increase is higher in familial hypercholesterolemia.[18]

A significant effect was found in the treatment group's average increase in total cholesterol levels compared to the control group. The treatment group was given standard feed plus high-fat and cholesterol foods using beef brains with a total fat content of 63% and cholesterol of 3100 mg per 100 grams of material. In the treatment group, the average total cholesterol level was 142.57 mg/dL, and five out of seven rats had hypercholesterolemia.

This result is in line with research conducted by Cerf and Herrera. There was an increase in the average total cholesterol level of pregnant rats fed a high-fat diet and cholesterol with a total fat content of 40% compared to the control group up to 90 mg/dL. However, it did not reach a hypercholesterolemic condition.[11] Based on research conducted by Li et al.,[13] pregnant rats fed a high-fat diet with a composition of 58% fat experienced an increase in the average total cholesterol level of up to 96 mg/dL, compared with the control diet group with only 63 mg/dL.A study by Xie et al.[16] also showed a significant increase in total cholesterol levels of pregnant rats given a high-cholesterol diet of 117.05 mg/dL compared to the control group of 77.30 mg/dL.

Dietary factors and pregnancy factors influenced the treatment group's total cholesterol levels. Beef brains contain high levels of saturated fat and cholesterol, which affect fat metabolism in the body. The content of saturated fatty acids can lead to the overexpression of ACAT 2 in catalyzing the formation of cholesterol esters released into the bloodstream with ApoB in the form of VLDL, increasing VLDL levels.[19]

Cholesterol content causes high intracellular cholesterol levels in the liver. Increased liver intracellular cholesterol levels result in increased VLDL production. Both of these mechanisms can increase LDL levels in the blood. The high level of intracellular cholesterol in the liver causes the liver to stop the mechanism of returning LDL, which transports cholesterol esters in the blood so that LDL levels increase, leading to an increase in total cholesterol levels.[20]

The mechanism of this increase in cholesterol is also influenced by lipid metabolism in pregnancy, where there is an increase in lipogenesis in the early two-thirds of the phase and the process of lipolysis in the late third of pregnancy.[12] In the early two-thirds of pregnancy, an increase in insulin production and sensitivity is caused by an increase in maternal hormones, especially estrogen, and progesterone, which triggers pancreatic cell hyperplasia.[21] These changes affect maternal hyperphagia and increase the performance of lipoprotein lipase, resulting in increased fat synthesis and hypertrophy of adipocytes. It can be seen from the increased body weight of the mice weighed from the beginning of pregnancy to the end.

In weighing the rats' body weight twice a week, there was an increase in body weight every time it was weighed. It is in line with research conducted by Mathias et al.[22] that there was an

increase in body weight in pregnant rats, where the body weight of rats fed a high-fat diet was higher than that of pregnant rats in the control group.

In the final third of pregnancy, there is a decrease in insulin sensitivity due to a spike in local and placental hormones such as estrogen, progesterone, leptin, cortisol, human placental lactogen (HPL), and placental growth hormone. Those trigger lipolysis of triglycerides in adipocytes and decrease LDL receptors. This mechanism stimulates cells to use energy intake other than glucose, such as free fatty acids, to increase the supply of nutrients to the fetus.[23]

The increase in adipose cells from the first and second trimesters also leads to increased secretion of tumor necrosis factor (TNF-α) and leptin in the local circulation, which triggers mechanisms of insulin resistance. TNF-α interferes with insulin performance by inhibiting insulin receptor signaling, namely tyrosine kinase, resulting in the failure of phosphorylation of insulin receptor substrates (IRS) on tyrosine. Reduced IRS phosphorylation causes failure of phosphatidylinositol (PI) 3-kinase activation, so insulin fails to distribute it to the glucose transporter (GLUT4) that contains vesicles. PI 3-kinase is thought to play a role in the activity of vesicle fusion with the cell surface, resulting in glucose uptake from the cell surface to the intracellular. The decrease in PI 3-kinase activity causes the vesicles in GLUT4 not to fuse with the cell surface, so glucose cannot enter the cell.[24]

Insulin resistance results in decreased lipoprotein lipase performance resulting in a decrease in chylomicron catabolism, thereby increasing triglyceride synthesis in the liver. This increase in triglycerides can increase VLDL in the blood, so hypertriglyceridemia occurs. In addition, triglycerides are closely related to the formation of sdLDL, which can increase total cholesterol levels in the blood. The decrease in LDL receptors due to insulin resistance also affects the increase in total blood cholesterol due to a decreased *clearance* in the blood.[25]

The components studied were only total blood cholesterol levels and did not measure other lipid components such as HDL, LDL, and triglycerides. They could not see the effect of a diet high in fat and cholesterol on these lipid components. In addition, the dosage in this study was only one variant, as much as three cc/day, so it could not see variations in the increase in total cholesterol levels in pregnant rats.

The cow brain consists of 63% fat, 33% protein, and 4% carbohydrates (per 100 grams). In 1 gram of beef brain, there are 31 mg of cholesterol and 0.1 gram of fat. The maximum cholesterol requirement in humans is 300 mg/day, and the fat requirement in pregnant women is 67.3 grams/day. If converted to mice, 5.4 mg/day of cholesterol and 1.2 grams/day of fat is needed. The fat content in 1 gram of beef brain does not meet the maximum fat requirement, while it has exceeded the cholesterol requirement. Therefore, the researchers gave a dose of 3 ml/day of the beef brain, which was based on previous studies, where giving cow brain at that dose could increase total cholesterol levels by up to 70% in two weeks. [26]

In this study conclude a significant difference in the mean total blood cholesterol levels of pregnant Wistar rats between the group given a standard diet and the group given a high-fat and cholesterol diet during pregnancy. This study emphasizes that consuming a diet high in fat and cholesterol can increase cholesterol levels higher than physiological ones during pregnancy. Further research is needed regarding the measurement of others lipid fractions of each rat before and after pregnancy.

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Hospital Management Information System Implementation Assessment Using HOT-FIT Model in Langsa General Hospital Aceh, Indonesia

Sri Wahyuni Nasution,[1] Chairunnisa[2] Chrismis Novalinda Ginting[3]
[1]Department of Tropical Medicine, Faculty of Medicine University of Prima Indonesia, Medan, Indonesia
[2]Department of Public Health, Faculty of Medicine University of Prima Indonesia, Medan, Indonesia

Abstract

In providing the best health care to the community, hospitals as health care facilities utilize technologies that are influenced by developments and advances in medical sciences and technologies. One of such technologies is the information management technology. Since the quality of information processing is an essential factor for succesful medical care of patients, Regulation of the Minister of Health of the Republic of Indonesia Number 82 of 2013 requires all hospitals to implement a hospital information management system (HIMS). To assess the successful implementation of HIMS, various models and frameworks have been developed, including the HOT-FIT model. This study aimed to analyze the implementation of the hospital management information system at Langsa General Hospital, Aceh, Indonesia, using the HOT-FIT model which applied the SEM-PLS method. This quantitative study was performed in approximately three months using the HOT-FIT (company, technology-FIT human,) framework that includes nine variables of system quality, information quality, service quality, organization structure, facility situations, support from leadership, system usage, user satisfaction, and net benefits. Data analysis was performed using the SEM-PLS analysis in SmartPLS application (V.3.2.9). Results showed that human, organization, and technology supports were factors that influence the successful implementation of HIMS. To conclude, the HOT-FIT model can be used to identify the factors that influence the successful implementation of HIMS to inform the HIMS improvement in the hospital that will eventually improve the hospital's quality system, information, service quality, and user satisfaction.

Keywords: HOT-FIT, hospital, SIMRS

Introduction

A computerized system called the Hospital Management Information System (SIMRS) is known to run data quickly and accurately, creating a variety of relevant information available to managers at all levels of the hospital.[1,2] The implementation, management, and development of SIMRS must be able to improve and support the health service process in hospitals, which includes: speed, integration accuracy, service improvement, efficiency improvement, and ease of reporting in operational implementation.[3] In general, the purpose and advantage of SIMRS are to provide accurate and timely information for decision-making at all management levels in hospital planning, implementation, monitoring, control, and evaluation.[4,5]

SIMRS is needed in supporting health services and is essential in producing information that hospital managers use for decision-making. Therefore, it is crucial to pay attention to and further study the success of implementing SIMRS.

In assessing the success of SIMRS, various methods can be used, one of which is the HOT-FIT method. One of the theoretical frameworks used to judge the effectiveness of medical information systems is the HOT-FIT technique.[1] The HOT-FIT approach targets the adequacy of relationships between the core components of information systems: humans, organizations, technology, and the three parts. The human who evaluates based on an information system (system use) is associated with those who apply the information system, who accepts or rejects the training, experience, knowledge, expectations, and attitudes. Organizations evaluate organizational structure and environmental systems regarding organizing, administration, system control, top management support, and financing. Technology that evaluates system quality, information quality, and service quality[6]

Corresponding Author:
Sri Wahyuni Nasution
Department of Tropical Medicine, Faculty of Medicine
University of Prima Indonesia
Email: sriwahyuni_nst88@yahoo.com

Langsa General Hospital Aceh is a type B hospital in Langsa City, Aceh, established in 1915. Langsa General Hospital has a vision of the Langsa City General Hospital becoming the leading hospital in the eastern region of Aceh. The information technology management unit in Langsa General Hospital has a vision of making technology fast, accurate, and accurate complete information as a supporting facility for hospital health services. Langsa General Hospital Acehl already has a SIMRS application developed by a third party (SIMRS developer). It was assisted by a foreign NGO (GTZ-Health) in 2006 and managed directly by the Langsa General Hospital IT team. The SIMRS application has been used in hospital operations.

Based on information from the IT unit, the Langsa General Hospital SIMRS is still valid in the administration section. The SIMRS of Langsa General Hospital is in the Independent Online Website Development stage by the IT Unit of Langsa General Hospital Aceh. The reason for developing SIMRS Mandiri is that the old version of SIMRS still has a lot of bugs and errors. Also, the implementation of SIMRS at Langsa Hospital has never been evaluated, so in this study, it is necessary to evaluate the implementation of SIMRS at Langsa Hospital.

SIMRS evaluation at Langsa General Hospital Aceh should be performed when evaluating, measuring, improving, or completing a hospital management information system to find potential problems facing users and organizations. The results of this study may shed light on the successful implementation of SIMRS at Langsa General Hospital Aceh.

This study analyzed the fruitfulness of implementing a hospital management information system at Langsa General Hospital Aceh.

Methods

This type of research is quantitative research by method descriptive research that is finding a deeper picture of the utilization of management information systems Hospital (SIMRS) at Langsa General Hospital. Research subjects where the number overall research subjects were 70 respondents from several units' services and objects to be researched/evaluated by researchers in this research. Data collection using data collection techniques In-depth interviews (in-depth interviews), namely conducting in-depth interviews with 70 respondents at the Langsa General Hospital Aceh. The research was conducted at Langsa Hospital in January-April 2022. In this research, the technique of sampling used researcher is purposive sampling, and the research subjects became a sample of 70 respondents from several service units and objects to be researched/evaluated by researchers. The sample was selected using inclusion criteria, where the sample was SIMRS users at Langsa General Hospital Aceh. The respondent criteria data: age (20–50) years; gender (male and female); education (senior high school, diploma, bachelor degree); working period (1–3 or more) years.

This study uses the HOT-FIT method. HOT-FIT is a theoretical framework used to evaluate or assess an information system's success in health services. This assessment approach describes the whole information system's components.[1,7] A semi-structured questionnaire was adapted from a questionnaire by Abda'u and Winnarno, which was developed in the Indonesian version, and the results were then translated into English. The questionnaire consists of 41 indicators divided into nine variables; top support management, user satisfaction, facility condition, information quality, service quality, system quality, net benefit, system use, and organization structure. This study scored each item with a Likert scale (1 to 5). The research analysis of data used SEM-PLS modeling. PLS can describe variables that are not directly measured (latent variables) and are calculated using indicators. PLS is used because the data is not hypothetical, does not have to be regularly distributed, nor is the number of samples required. PLS is also used in information system research to study technology adoption.[8]

Two sub-models make up the SEM-PLS analysis: a model of measurement or an outer model and a structural model. The model of measurement or usually called the outer model is used to evaluate each indicator's reliability and validity. In comparison, the reliability test was carried out with two events: Crobanch's Alpha and Composite Reliability. The structural or inner model determines if there is an impact between the variables/correlations between the components measured using the PLS's t-test. The R-Square Model value, which depicts the degree of interaction between model variables, can be used to gauge the inner model. The estimation of the path coefficient, which comes after that, is in the following stage. This is the estimated value for the path connection in the structural model acquired by the bootstrapping technique (significance level 5 percent).[9]

Table 1 Convergent Validity

Variable	Indicator	Loading Factor	Description
Top management support	DP1	0.860	Valid
	DP2	0.845	Valid
	DP3	0.850	Valid
Facility condition	KF1	0.795	Valid
	KF2	0.847	Valid
	KF3	0.902	Valid
Information quality	KI1	0.773	Valid
	KI2	0.884	Valid
	KI3	0.862	Valid
	KI4	0.798	Valid
	KI5	0.781	Valid
Service quality	KL1	0.905	Valid
	KL2	0.832	Valid
	KL3	0.881	Valid
User satisfaction	KP1	0.759	Valid
	KP2	0.865	Valid
	KP3	0.848	Valid
	KP4	0.807	Valid
	KP5	0.818	Valid
	KP6	0.830	Valid
System quality	KS1	0.797	Valid
	KS2	0.840	Valid
	KS3	0.793	Valid
	KS4	0.820	Valid
	KS5	0.820	Valid
Net benefit	MK1	0.810	Valid
	MK2	0.847	Valid
	MK3	0.811	Valid
	MK4	0.836	Valid
	MK5	0.830	Valid
	MK6	0.854	Valid
System use	PS1	0.759	Valid
	PS2	0.773	Valid
	PS3	0.852	Valid
	PS4	0.831	Valid
	PS5	0.789	Valid
Organization structure	SO1	0.810	Valid
	SO2	0.826	Valid
	SO3	0.874	Valid
	SO4	0.847	Valid
	SO5	0.833	Valid

Table 2 Discriminant Validity (√AVE)

Variable	√AVE	Description
Top support management	0.726	Valid
User satisfaction	0.676	Valid
Facility condition	0.721	Valid
Information quality	0.674	Valid
Service quality	0.763	Valid
System quality	0.663	Valid
Net benefit	0.691	Valid
System use	0.643	Valid
Organization structure	0.703	Valid

AVE=average variance extracted

The study received approval from the University of Prima Indonesia's Health Research Ethics Committee with the number 012/KEPK/UNPRI/XII/2021.

Results

Validity of convergent, validity of discriminant, and reliability were three indicators used to assess the evaluation of the measurement model. The convergence validity is done by examining the standardized load factor. It represents the magnitude of the correlation between each indicator and its components by looking at the load factor value. The indicator is valid if the indicator load factor is positive and more significant than 0.5. A high load factor indicator indicates that the indicator is the strongest (dominant) variable that measures the variable. Table 1 shows the load factor values.

The validity of the discriminant is performed by testing if the value of √AVE is more than 0.5. This study conclude that the variables have excellent discriminative validity. The √AVE value for each variable is in Table 2.

Cronbach alpha and Composite reliability values are used in PLS to measure reliability. If Cronbach's alpha is indicated to be above 0.6 and the Composite reliability value is above 0.7, the data is considered reliable. Table 3 contains Cronbach's alpha and composite reliability values.

Structural model analysis or the inner model is carried out to see the relationship between the research model's construct, significance value, and R-square.

Table 4 indicates that the value of adjusted R-Square from the User Satisfaction variable of 0.898; it shows that the variables of information quality, service quality, system quality, and organization structure can explain 89.8 percent of the User Satisfaction variable, while the remaining 10.2 percent can be described by

Table 3 Reliability

Variable	Composite	Cronbach Alpha	Description
Top support management	0.888	0.811	Reliable
User satisfaction	0.926	0.904	Reliable
Facility condition	0.885	0.805	Reliable
Information quality	0.912	0.878	Reliable
Service quality	0.906	0.844	Reliable
System quality	0.908	0.873	Reliable
Net benefit	0.931	0.911	Reliable
System use	0.900	0.860	Reliable
Organization structure	0.922	0.894	Reliable

Table 4 Quality of FIT Test

Variable	R-Square	R-Square Adjusted
User satisfaction	0.903	0.898
Net benefit	0.760	0.753
System use	0.847	0.841

other variables not examined in this study. The net benefit variable's adjusted r-square value is 0.753, indicating that 75.3 percent of the net benefit variable can be accounted for by the facility condition and user satisfaction variable, and the remaining 24.7 percent by variables not examined in this study. The system uses the variable's adjusted r-square value is 0.841, which shows that 84.1 percent of the variance can be accounted for by the support of top management, the quality of a system, and also user satisfaction, and the remaining 15.9 percent is becoming able to get accounted for by variables not examined in this study. The system uses the variable's adjusted r-square value is 0.841, which shows that 84.1 percent of the variance can be accounted for by the support of top management, the quality of a system, and also user satisfaction, and the remaining 15.9 percent is becoming able to get accounted for by variables not examined in this study.

The methodology applied to test the hypothesis directly is if the p-value <0.05 (level of significance =5%) states that there reveals such a significant effect of exogenous variables on the endogenous variables.[10]

The figure of research hypotheses and Table 5 above can explain the results of hypothesis testing in this study: (1) the p-value of 0.035 and a t-statistical effect on system use of 2.111, the top management support variable is significant. These findings show that top management's support positively, significantly, and directly influences system use. (2) User satisfaction variable showed a t-statistic influence towards the net benefit of 6.425 with a p-value of 0.000. These findings suggest that user satisfaction also directly, positively, and considerably influences the net benefit. (3) User Satisfaction variable has a t-statistic influence on the system use of 2,416 with p-values of 0.016. These results indicate that user satisfaction gives such a positive and also significant influence on the use of the system

Figure Research Hypotheses

Table 5 Results of Hypotheses Testing

Variable	Sample Original (O)	Mean (M)	Deviation Standard (STDEV)	T-Statistic	P-Value
DP → PS	0.199	0.196	0.094	2.111	0.035
KP → NB	0.644	0.630	0.100	6.425	0.000
KP → PS	0.414	0.398	0.171	2.416	0.016
KF → NB	0.279	0.273	0.095	2.940	0.003
KI → KP	0.269	0.270	0.086	3.109	0.002
KL → KP	0.169	0.169	0.070	2.420	0.016
KS → KP	0.358	0.372	0.109	3.288	0.001
KS → PS	0.343	0.351	0.164	2.090	0.037
SO → KP	0.220	0.207	0.104	2.112	0.035

directly. (4) The facility condition variable has a t-statistic effect on the net benefit of 2,940 with a p-value of 0.003. These results indicate that the facility condition directly, significantly, and positively influences net benefit. (5) With a p-value of 0.002, the information quality variable has a 3.109 t-statistic influence on user satisfaction. The study results recommend that information quality directly impacts user satisfaction positively and significantly. (6) The service quality variable influences user satisfaction with a p-value of 0.016 and a t-statistic effect of 2,420. The results also suggest that service quality directly influences User Satisfaction with a positive and significant effect. (7) The t-statistic effect of the system quality variable on user satisfaction is 3.288, having a p-value of 0.001. the results add that system quality directly influences user satisfaction positively and significantly. (8) The system quality variable has a t-statistic effect on system use of 2,090 with a p-value of 0.037. These results indicate that the system's quality has a positive and significant influence on the use of the system directly. (9) The organization structure variable positively impacts user satisfaction with a p-value of 0.035 and a t-statistic of 2.112. The facts revealed from the research said that the organization structure directly influences user satisfaction with a positive and significant effect.

Discussion

HOT-FIT variables consist of Humans, namely user satisfaction and system use; organization, namely organizational structure, condition facility, and top management support; technology, namely the system quality, quality of information, and quality of service.[8]

The convergence validity is done by examining the standardized load factor. The indicator is valid if the indicator load factor is positive and more significant than 0.5. This study concludes that the variables top support management, user satisfaction, condition of facilities, information quality, service quality, system quality, net profit, system utilization, and organizational structure have excellent convergence validity. The load factor value for each variable is more than 0.5.

The validity of the discriminant is performed by testing if the value of $\sqrt{}$ave is more than 0.5. we can conclude that the variables top support management, user satisfaction, condition of facilities, information quality, service quality, system quality, net profit, system utilization, and organizational structure have excellent discriminative validity.

The reliability is considered reliable if Cronbach's alpha is indicated to be above 0.6 and the Composite reliability value is above 0.7. The variables top support management, user satisfaction, condition of facilities, information quality, service quality, system quality, net profit, system utilization, and organizational structure have reliability.

This indicates that the value of the adjusted r-square from the user satisfaction variable of 0.898; it shows that the variables of information quality, service quality, system quality, and organization structure can explain 89.8 percent of the user satisfaction variable, while the remaining 10.2 percent can be described by other variables not examined in this study.

With a p-value of 0.002, the information quality variable has a 3.109 t-statistic influence on

user satisfaction. The study's results recommend that information quality directly impacts user satisfaction with a positive and significant effect. This is consistent with the study findings of Putra.[14] User satisfaction is positively impacted by information quality. This is consistent with the studies of Pawirosumarto and Pawirosumarto[15] using a statistical procedure to draw conclusions or hypothesis testing. Analytical methods used generalized structured component analysis information (GSCA) quality focuses on the information generated by the system. The quality of information also means determining the success of the design of a system. This means the information system can succeed if users easily understand a system design.[15] These results indicate that User Satisfaction gives such a positive and also significant influence on the use of the system directly.

The service quality variable influences user satisfaction with a p-value of 0.016 and a t-statistic effect of 2,420. The results also suggest that service quality directly influences user satisfaction with a positive and significant effect. User satisfaction is positively impacted by service quality. This is consistent with the study conducted by Erlirianto et al.[4] Information technology is known as a technology that had such rapid growth during this time. Supporting information technology advances, access to available data or information can occur quickly and accurately. Technology impacts SIMRS because higher-quality systems, information, and services will boost system utilization and user satisfaction.[16]

The t-statistic effect of the system quality variable on user satisfaction is 3.288, having a p-value of 0.001. the results add that system quality directly influences user satisfaction positively and significantly. The system quality variable has a t-statistic effect on system use of 2,090 with a p-value of 0.037. These results indicate that the system's quality has a positive and significant influence on the use of the system directly. On the human factor, user satisfaction is positively related to using the system. This is consistent with studies by Krisbiantoro, which found that user satisfaction had a beneficial impact on system use. With a p-value of 0.035 and a t-statistic of 2.112, the organization structure variable positively impacts user satisfaction. The facts revealed from the research are said that the Organizational factors, namely organizational structure, positively correlate with user satisfaction. An organization is a formal group of people and their inseparable resources to achieve a goal or several goals.[12] The system used is influenced positively by top management support. It is also revealed by the study of Mkonya et al., where evidence was obtained that top management support significantly influences the system and users.[13]

These results imply that the technology element significantly and positively influences system use and user satisfaction. To explicitly accept the concept that system quality affects the system to use and that information, service, and system quality all impact user satisfaction. This is consistent with Putra's studies.[14] Good technology support will benefit the organization and staff. The use of technology in work is beneficial for the users and the hospital.[12,17]

The net benefit variable's adjusted r-square value is 0.753, which indicates that the facility condition and user satisfaction variable can account for 75.3 percent of the net benefit variable. The remaining 24.7 percent are by variables not examined in this study. The facility condition variable has a t-statistic effect on Net Benefit of 2,940 with a p-value of 0.003. These results indicate that the facility condition directly, significantly, and positively influences net benefit. The user satisfaction variable showed a t-statistic influence towards the net benefit of 6.425 with a p-value of 0.000. These findings suggest that user satisfaction also directly, positively, and considerably influences the net benefit. Additionally, user satisfaction is a strong predictor of net benefits. According to Astria dan Nugroho's study, this is accurate.[3] User satisfaction is a general assessment of the user's interaction with the information system and its possible effects. Personal traits, perceived advantages, and user attitudes toward information technology determine user satisfaction. While using the system must precede user satisfaction in processes, a positive experience with using the system will encourage greater user satisfaction in terms of causality. In this case, increasing user satisfaction will encourage increasing the intensity of using information systems.[11]

The system uses the variable's adjusted r-square value is 0.841, which shows that 84.1 percent of the variance can be accounted for by the support of top management, the quality of a system, and also user satisfaction, and the remaining 15.9 percent is becoming able to get accounted for by variables not examined in this study. The top management support variable is significant. These findings show that the support of top management gives such a positive,

significant, and direct influence on system use.

The SIMRS of angsa General Hospital Aceh with the SEM-PLS method using the HOT-FIT framework shows that the SIMRS of Langsa General Hospital Aceh is quite good. The limitations of the researchers are that there are still variables that have not been studied, so future researchers should examine other variables that were not examined in this study to find out more about the quality of SIMRS at Langsa General Hospital Aceh, Indonesia.

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Impact of First Eye Cataract Surgery on Quality of Life

Mayasari Wahyu Kuntorini, Maya Primagustya Achmad, Aldiana Halim
Department of Ophthalmology, Faculty of Medicine, Universitas Padjadjaran, Bandung/National Eye Centre, Cicendo Eye Hospital, Bandung, Indonesia

Abstract

Cataracts are the second leading cause of visual impairment and the first cause of blindness, both globally and Indonesia. Cataracts do not only reduce vision but also the quality of life of the patients. Cataract surgery of at least one eye is expected to improve the patient's visual function and quality of life. This study aimed to assess the quality of life of patients with bilateral senile cataracts after the first eye surgery compared to people with normal vision. This was a cross-sectional study on 75 patients who underwent their first eye cataract surgery at the Cataract and Refractive Surgery Unit and 75 people with normal vision who visited the Refraction, Contact Lens, and Low Vision Unit of the National Eye Center of Cicendo Eye Hospital during the period of March–June 2020. The quality of life assessment was conducted through interviews using the National Eye Institute Visual Function Questionnaire-25. The non-inferiority test with a margin of 20% was performed. The mean age of the subjects was 63.49 years with no difference in the proportion of gender. Presenting visual acuity of binoculars after the first cataract surgery was 0.26 LogMAR and normal vision was 0.07 LogMAR. With a margin of 20%, the patient's quality of life after the first cataract surgery was not inferior to the normal vision subjects (d= -2.45% (95% CI -6.3% to 1.4%)). Hence, patients' quality of life after the first cataract surgery is not inferior to those with normal vision.

Keywords: Bilateral senile cataract, first eye cataract surgery, normal vision, quality of life

Introduction

Cataracts are the second leading cause of visual impairment and the first cause of blindness in the world. According to the International Agency for the Prevention of Blindness (IAPB), the proportion of blindness due to cataracts is around 45% in developing countries, including Indonesia. As many as 2.8% of the population aged > 50 years suffered from bilateral blindness in West Java, and 71.7% of them were caused by cataracts.[1–3]

This high prevalence of cataracts indicates the population's high disease burden. However, another factor that may be considered to measure the degree of burden is assessing cataracts' impact on daily life. The impact of cataracts is generally assessed objectively, such as by examining visual acuity, contrast sensitivity, and stereopsis. Previous objective examinations have yet to be able to represent the overall visual function assessment. In addition, the objective examination does not describe the true impact of visual impairment. Therefore, holistic and subjective visual function examinations from the patient's point of view should be considered. One such examination is an assessment of the quality of life.[4] Quality of life-related to vision is an individual's perception of his vision that impacts the ability to carry out activities, including social, emotional, and economic well-being. *National Eye Institute Visual Function Questionnaire-2*5 (NEI VFQ-25) is one of the questionnaires that is considered specific and efficient to assess the impact of visual impairment on quality of life.[5–7]

A severe burden of cataracts is disease progression causing blindness. Prevention of blindness due to cataracts is through surgery. However, a satisfactory outcome after the first cataract surgery does not necessarily increase the patient's desire to undergo cataract surgery for the second eye. This phenomenon is often found in several developing countries. Mahajan et al. proposed a study regarding barriers to cataract surgery for the second eye in rural India. These barriers include patients already

Corresponding Author:
Mayasari Wahyu Kuntorini
Department of Ophthalmology, Faculty of Medicine, Universitas Padjadjaran, Bandung/National Eye Centre, Cicendo Eye Hospital, Bandung, Indonesia
Email: maya.sari@unpad.ac.id

feeling that they can see with only one eye and the cost of surgery is relatively high. In contrast to developed countries, the barrier to cataract surgery for the second eye is a long surgery queue period.[7,8]

Through this study, researchers aimed to determine the quality of life of bilateral senile cataract patients after the first eye surgery, then compare them with the quality of life of people with normal vision.[6,7,9–12]

Methods

This study was a cross-sectional study. Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Medicine, Universitas Padjadjaran, with protocol number 426/UN6.KEP/EC/2020.

Seventy-five case group subjects were taken from 199 medical records of bilateral senile cataract patients who had their first eye cataract surgery performed in June 2019–March 2020 at the Refractive Cataract Surgery Unit at National Cicendo Eye Hospital and who met the inclusion and exclusion criteria. While 75 control group subjects were taken from 724 medical records of normal vision patients in January 2019–March 2020 at the Refraction, Contact Lens, and Low Vision Units who met the inclusion and exclusion criteria. The matching process for gender and age was carried out on the control group subject to the case group subject.

The inclusion criteria for the case group in this study were: aged ≥50 years; no other ocular abnormalities other than cataract; had undergone first eye cataract surgery; preoperative binocular presenting visual acuity (PVA) <6/60; and one-month postoperative binocular PVA ≥6/18. The inclusion criteria for the control group were: aged ≥50 years; binocular PVA ≥6/12; with phakic eyes. Exclusion criteria in this study were: diagnosis of other ocular disorders that interfere with the visual axis; history of other intraocular surgery; intra and post operative complications; uncooperative patients; systemic disorders that were not controlled; could not be contacted via telephone; refused to participate; had a second eye cataract surgery performed elsewhere; and have passed away.

Data were obtained from medical record data and interview results from March-June 2020. The medical record data taken was PVA binoculars, then the data was converted into LogMAR notation. Experienced refractionist opticians conducted PVA measurements. Information obtained from interviews included age, gender, education level, occupation, income, use of glasses, systemic disorders, and quality of life through the Indonesian version of the NEI VFQ-25 questionnaire. The interview was conducted by a single general practitioner who had undergone training in the interviewing process. The interviewer was blinded from the study subjects throughout the data collection process.

The NEI VFQ-25 questionnaire consists of a base set of 25 vision-targeted questions representing 11 vision-related constructs, with an additional single-item general health rating question. This questionnaire generates the following vision-targeted subscales: global vision rating (1), difficulty with near vision activities (3), difficulty with distance vision activities (3), limitations in social functioning due to vision (2), role limitations due to vision (2), dependency on others due to vision (3), mental health symptoms due to vision (4), driving difficulties (3), limitations with peripheral (1) and color vision (1), and ocular pain (2). The VFQ-25 also contains a single general health rating question which is a robust predictor of future health and mortality in population-based studies.[5]

For each question, responses were presented in a Likert scale format in which patients were asked to rate the difficulty level of specific visual symptoms or activities. Scales were later calculated according to the methods described by the NEI-VFQ developers which range from 0 to 100, with 100 representing the best possible score and 0 representing the worst. Scores were then grouped and calculated in 12-sub scales and as well as a combined total score.[5]
The Indonesian adaptation of the NEI VFQ-25 questionnaire was developed according to international standards. The questionnaire was translated using the forward-backward translation method and conducted by two bilingual translators (English and Indonesian as the mother language) with a Cambridge English for Speakers of Other Languages certificate. Then the Indonesian version of the questionnaire was tested for validity and reliability before the research was conducted.

A validity and reliability test were conducted with a total of 30 samples from the Cataract Refractive Surgery Unit and Refraction, Contact Lens, and Low Vision Unit of the National Eye Center Cicendo Eye Hospital. Validity assesses how well a measure adequately represents the domains or constructs of interest. In this study, validity was assessed using Pearson Product

Moment correlation which found all questions of the Indonesian adaptation of the NEI VFQ-25 questionnaire to be valid (value of count r 0.61 was greater than r table 0.361 at a significance level of 5%). Reliability assesses the internal consistency of the questionnaire. To assess reliability, we calculated Cronbach alpha and found internal consistency for the Indonesian adaptation of NEI VFQ-25 of 0.961, indicating the questionnaire to be reliable (r>0.7).[13]

The data was processed computerized using Microsoft Office Excel 2016 and analyzed using the Statistical Package for the Social Sciences version 24.0. For numerical data, the p-value was tested by unpaired T-test if the data were normally distributed and the Mann-Whitney test if the data were not normally distributed. For categorical data, the p-value was calculated based on the Chi-Square test and Kolmogorov Smirnov and Exact Fisher tests if the Chi-Square requirements were not met. Statistical analysis was also performed by non-inferiority test using a margin of 20%. The results obtained were displayed in the form of tables and diagrams.

Results

The research was conducted from March to June 2020 at National Cicendo Eye Hospital. This study compared the quality of life of the case group to the control group of 150 study subjects.

The mean age of subjects in the case group was 63.49 years and most of them were in the range of 61–75 years (56.0%). The gender proportion was the same between men and women. The majority of the case group subjects had a low level of education (52.0%), not working/housewife (45.3%), low income (70.7%), married status (81.3%), not living alone (92.0%), not using glasses (81.3%), and had systemic disorders (56.0%) (Table 1).

Subjects in the control group had the characteristics of age (mean 63.55 years) and gender did not differ from the case group. Although with different proportions, the control group subjects were also dominated by low education level (36.0%), not working/housewife (33.3%), low income (49.3%), married status (72.0%), and not living alone (97.3%). The difference with the case group was that the control group subjects used glasses more (81.3%) and had no systemic abnormalities (73.3%) (Table 1).

Characteristics of income, use of glasses, and systemic disorders were statistically significant between the case group and the control group (p>0.05). Furthermore, bivariate and multivariate analyses were carried out on the sociodemographic characteristics data with the results that the two research groups were not homogeneous.

The mean binocular PVA measured preoperatively of the first eye was 1.23 LogMAR, and postoperatively of the first eye was 0.26 LogMAR in the case group. Meanwhile, the mean binocular PVA in the control group was 0.07 LogMAR. The results of the statistical test showed that there was a significant difference between the binocular PVA in the case group and the binocular PVA in the control group (p<0.05) (Table 2).

The mean and standard deviation of the quality of life for the control and case groups

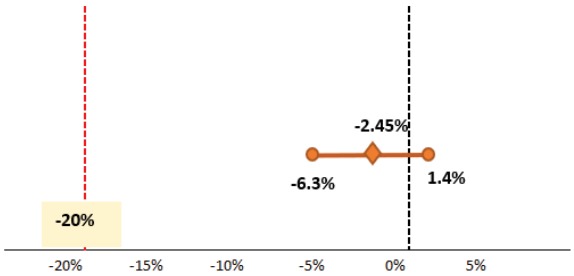

Figure Non-Inferiority Test Diagram: Combined Quality of Life

The non-inferiority test in this study used a margin of 20% with a 95% confidence interval (CI). The non-inferiority test refers to the difference in the mean quality of life (delta/d) in the case group to the control group. The non-inferiority test chart shows the results of d = - 2.45% (95% CI -6.3% to 1.4%) with a margin of 20%

Table 1 Sociodemographic Characteristics Relationship between Case and Control Group

Variable	Group		P value
	Cases (n=75)	Control (n=75)	
Age (years)			0.993
50–55	20 (26.7%)	20 (26.7%)	
56–60	9 (12.0%)	9 (12.0%)	
61–65	13 (17.3%)	13 (17.3%)	
66–70	14 (18.7%)	14 (18.7%)	
71–75	15 (20.0%)	15 (20.0%)	
76–80	3 (4.0%)	3 (4.0%)	
>80 Median	1 (1.3%)	1 (1.3%)	
Range (min-max)	6.49 ± 8.341 50–81	63.55 ± 8.683 51–82	
Gender			1.000
Men	37 (49.3%)	37(49.3%)	
Women	38 (50.7%)	38(50.7%)	
Education			0.110
No school	7 (9.3%)	5 (6.7%)	
Low (Elementary school/JHS)	39 (5.0%)	27 (36.0%)	
Middle (SHS)	16 (21.3%)	19 (25.3%)	
High (University)	13 (17.3%)	24 (32.0%)	
Occupation			0.653
No job/housewife	34 (45.3%)	25 (3.3%)	
Retired	13 (17.3%)	11 (14.7%)	
Farmer/fisherman/labor	10 (13.3%)	6 (8.0%)	
Entrepreneur	10 (13.3%)	9 (12.0%)	
Employee	6 (8.0%)	23 (30.7%)	
Others	2 (2.7%)	1 (1.3%)	
Income			0.021*
Low (< IDR 1,500.000)	53(70.7%)	37 (49.3%)	
Medium (IDR 1.500,000–2,500,000)	6 (8.0%)	6 (8.0%)	
High (IDR 2,500,000–3,500,000)	7 (9.3%)	8 (10.7%)	
Very high (>IDR 3,500,000)	9 (12.0%)	24 (32.0%)	
Marital status			0.900
Married	61 (81.3%)	54 (72.0%)	
Widower/widow	13 (17.3%)	21 (28.0%)	
Not married	1 (1.3%)	0 (0.0%)	
Living alone			0.276
Yes	6 (8.0%)	2 (2.7%)	
No	69 (92.0%)	73 (97.3%)	

Table 1 (Continued)

Variable	Group		P value
	Cases	Control	
Use of glasses			0.0001*
Yes	14 (18.7%)	61 (81.3%)	
No	61 (81.3%)	14 (18.7%)	
Systemic disorder			0.002*
Nothing	33 (44.0%)	55 (73.3%)	
Diabetes mellitus	9 (12.0%)	4 (5.3%)	
Hypertension	24 (32.0%)	14 (18.7%)	
Diabetes mellitus and hypertension	9 (12.0%)	2 (2.7%)	

Note: For numerical data, the p-value was tested by unpaired T-test if the data were normally distributed and the Mann-Whitney test if the data were not normally distributed. For categorical data, the p-value was calculated based on the Chi-Square test and Kolmogorov Smirnov and Exact Fisher tests if the Chi-Square requirements were not met. The sign (*) indicates the p-value <0.05, which means that it is significantly different or statistically significant. Abbreviation: JHS (Junior High School), SHS (Senior High School)

Table 2 Binocular Presenting Visual Acuity Relationship between Case and Control Group

Variable	Group		P value
	Cases (n=75)	Control (n=75)	
binocular PVA** (LogMAR)			0.0001*
Mean ± Std	0.26±0.187	0.07±0.108	
Range	0.0–0.5	0.0–0.3	

The unpaired T-test was used if the data were normally distributed and the Mann-Whitney test if the data were not normally distributed. The sign (*) indicates the p-value <0.05, which means that it is significantly different or statistically significant. (**) Post-operative PVA for cases group. Abbreviation: PVA (Presenting Visual Acuity)

Table 3 Differences in Mean Quality of Life between Control and Case Group

Subscale	Control group (mean ± SD)	Case group (mean ± SD)	Mean difference (%)	Lower limit. upper limit (%)*
General health	50.33 ± 15.097	60.00 ± 27.262	-9.67	-16.79. -2.54
Vision health	76.80 ± 12.230	77.60 ± 13.934	-0.08	-5.04. 3.44
Discomfort	90.83 ±14.866	89.83 ± 14.917	1.00	-3.81. 5.81
Near vision	95.83 ± 8.745	91.28 ± 14.174	4.56	0.75. 8.36
Far vision	99.00 ± 3.865	95.50 ± 8.846	3.50	1.29. 5.71
Social function	99.50 ± 3.210	98.50 ± 6.485	1.00	-0.66. 2.66
Mental health	97.75 ± 4.191	94.83 ± 10.345	2.92	0.36. 5.47
Role limitations	98.83 ± 5.106	97.00 ± 11.036	1.80	-0.95. 4.62
Dependency	100.00	97.11 ± 10.655	2.89	0.44. 5.34
Color vision	99.33 ± 4.055	97.67 ± 9.348	1.67	0.67. 4.00
Peripheral vision	100.00	98.67 ± 6.991	1.33	-0.28. 2.94
Combined	94.84 ± 2.562	92.56 ± 7.509	-2.45	-6.30. 1.40

* CI 95%

were 94.84±2.562 and 92.56±7.509, respectively (Table 3). If reviewed based on the subscale, the mean and standard deviation of the quality of life in general health, vision health, eye discomfort, near vision, far vision, social function, mental health, role limitations, dependence on others, color vision, and peripheral vision in the control group were 50.33±15.097, 76.80±12.230, 90.83 ±14,866, 95.83±8,745, 99.00±3,865, 99.50± 3,210, 97.75±4.191, 98.83±5.106, 100,00, 99.33± 4,055, 100,00, while the case groups were 60.00 ±27.262, 77.60±13.934, 89.83±14.917, 91.28 ±14.174, 95.50±8.846, 98.50±6.485, 94.83 ±10.345, 97.00±11.036, 97.11±10.655, 97.67± 9.348, 98.67 ± 6.991. The driving subscale was not analyzed further due to many missing values.

The non-inferiority test in this study used a margin of 20% with a 95% confidence interval (CI). The non-inferiority test refers to the difference between the mean quality of life (delta/d) in the case and control groups. The non-inferiority test chart shows the results of d= -2.45% (95% CI -6.3% to 1.4%) with a margin of 20% (Figure 1).

Based on 95% CI, the lower and upper limits of the mean quality of life were obtained in percentages. None of the lower limit percentages were lower than -20%, meaning that the combined quality of life and per subscale of the case group was not inferior to that of the control group (Table 3).

Discussion

This study compared the quality of life-related to patients' vision after the first eye cataract surgery with the quality of life of people with normal vision. Previous studies have only focused on improving the quality of life of cataract patients after cataract surgery. Only Tiihonen et al. reported quality of life before and after cataract surgery, then compared with the normal population in Finland. However, Tiihonen et al. assessed health-related quality of life using a 15-Dimension questionnaire. The items measured were more general, so the results obtained were minor improvements in quality of life.[6,7,9–12,14] In the current study, we assessed the quality of life using the Indonesian adaptation of the NEI VFQ-25 questionnaire.

The NEI VFQ-25 questionnaire, which was the main instrument in this study, has power over the items being assessed. The assessment measured not only difficulty in daily activities but also the effect of visual impairment on social functioning, mental health, role limitations, and dependency on others. Through this questionnaire, we expected that the magnitude of cataract surgery benefits could be assessed subjectively as the information was obtained directly from the patients.[5–7]

To et al. mentioned that confounding factors in post-cataract surgery quality of life studies included age, gender, education, income, marital status, drug use, use of glasses, and comorbidities. The current study found that the characteristics of income, use of glasses, and systemic disorders significantly differed between subjects and subjects with normal vision after their first eye cataract surgery.[7]

In this study, post-cataract surgery subjects were primarily low-income (70.7%). A person's economic status can affect health information acquisition, mainly information about cataracts and cataract surgery. A low economic status will hinder one's priority of eye health until vision is significantly impaired. In addition, low economic status can be a barrier to undergoing cataract surgery due to its high costs, as reported by Ratnaningsih et al. several subscales of quality of life can be influenced by economic status, including general health, visual health, social functioning, mental health, role limitations, and dependence on others.[15,16] Not all patients after cataract surgery obtain optimal visual acuity, even though the preparation for surgery was carried out appropriately. Some patients still need refractive correction. Furthermore, the loss of accommodation in the operated eye and the intraoperatively implanted mono-focal lens causes most patients to have difficulty performing activities that require good vision.[4]

The majority of subjects after cataract surgery in this study did not use glasses (81.3%). Prescription glasses, either bifocal, progressive, or reading glasses, are usually only given after the second eye cataract surgery at the Cataract and Refractive Surgery Unit at National Cicendo Eye Hospital with the consideration that the time of the second eye surgery is not more than three months. Chen added that there was pseudo-accommodation one year after cataract surgery, which caused some patients to be still able to see at close range.[17]

Systemic disorders are difficult to avoid in elderly individuals. The decline in organ function occurs due to the aging process. Many subjects after cataract surgery in this study had systemic disorders (56.0%). To et al. and Fraser et al. reported that 60.8% and 79.8% of their study subjects also had comorbidities. The impact of

comorbidities presence on research±al health subscale. However, this study used uncontrolled systemic disorders as an exclusion criterion to minimize this impact.[6,7]

Cataract surgery in the elderly aims to restore visual function so that they have independence in daily activities and work, affecting their social and mental status. Several previous observational and experimental studies have shown that cataract surgery in the first eye significantly improves visual function and the quality of life of sufferers.[6,7]

The mean postoperative binocular PVA of the first eye cataract in this study was 0.26 LogMAR, from 1.23 LogMAR preoperatively. The PVA results were classified as good because most patients were free from visual disturbances based on World Health Organization standards. Compared to other studies, the PVA before and after this study's first eye cataract surgery was lower. An Australian study reported a preoperative binocular acuity was 0.23 LogMAR and postoperative was 0.05 LogMAR. In comparison, a study in Vietnam reported a preoperative binocular acuity was 0.58 LogMAR, and postoperative of the first eye was 0.16 LogMAR. Both studies included tests for contrast sensitivity and stereopsis. The results obtained were an increase in contrast sensitivity and stereopsis were directly proportional to an increase in quality of life but not with an increase in visual acuity.[6,7]

Quality of life is a multidisciplinary and multidimensional concept. Quality of life refers to physical, mental, social, and functional well-being. The positive impact of recovering visual function is improving a person's quality of life. The combined mean quality of life of subjects after this study's first eye cataract surgery was 92.56, and for subjects with normal vision was 94.84. Furthermore, a non-inferiority test was carried out with a margin of 20% and a CI of 95%. The results obtained were d = -2.45% (95% CI -6.3% to 1.4%), which suggests that the quality of life of the subject after the first eye cataract surgery was not inferior to the quality of life of normal vision subjects in this study.[18.19]

The quality-of-life value in this study was obtained with the condition of the two research groups' subjects inhomogeneous from the characteristics of income, use of glasses, systemic disorders, and binocular PVA. However, patients' quality of life after cataract surgery in the first eye was inferior to that of people with normal vision. In that case, these inhomogeneous characteristics could be a confounding factor.

There have been no studies similar to this study so the results in this study cannot be compared with other studies. Vietnam, Australia, and China reported a combined mean quality of life after cataract surgery of the first eye was 88.02, 88.51, and 89.36, respectively. Individual perceptions in responding to each question on the questionnaire could be different, similar to the level of satisfaction with the quality of vision they had. [6,7]

The quality of life of each patient subscale after the first eye cataract surgery showed results equal to people with normal vision in this study. Although using different statistical tests, To et al. reported that all quality of life subscales increased significantly pre- and post-first eye cataract surgery, even with CI >99%. This proves that cataract surgery has benefits not only in improving daily activities but also has broad social and mental health benefits.[7]

The COVID-19 pandemic caused several limitations to this study. These limitations include retrospective study, quality of life assessment which was only performed postoperatively, and evaluation of current clinical conditions was not carried out. Another limitation of this study was the lack of data on post-operative PVA day-1, day-7, and day-30 to detect intraoperative complications that may affect post-operative PVA. Furthermore, ocular computed tomography (OCT) and funduscopic tests were not conducted, which could be used to detect macular abnormalities that may affect post-operative PVA. In addition, this study was unable to differentiate whether postoperative PVA results were due to surgery alone or underlying disease.

In conclusion, this study found that patients' quality of life after cataract surgery in the first eye was not inferior to that of people with normal vision. Researchers suggest that further research can be carried out prospectively and assess the quality of life before cataract surgery to obtain an overview of the quality-of-life improvement of cataract patients who have surgery.

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Malaria Infection and Socioeconomics in Malaria Endemic Areas of East Nusa Tenggara, Indonesia

Nisa Fauziah,[1] Edina U. Anindhita,[2] Savira Ekawardhani,[1] Deviyanthi N. Afifah,[3] Jontari Hutagalung[4]
[1]Division of Parasitology, Department of Biomedical Sciences, Faculty of Medicine Universitas Padjadjaran, Indonesia
[2]Undergraduate Medical Study Program, Faculty of Medicine Universitas Padjadjaran, Indonesia
[3]Study Program of Pharmacy, Indonesian Health Institute, Indonesia
[4]Laboratory of Parasitology, Biomedical, and Basic Health Technology, National Institute of Health Research and Development, Ministry of Health, Indonesia

Abstract

More than 1.1 million people, or 20.90% of the population in East Nusa Tenggara (NTT), Indonesia, live below the poverty line, making NTT the third province with the highest number of poor people in Indonesia. The region of NTT, which is well known as one of the endemic areas for malaria in Indonesia, also has the highest number of adults with low nutritional status. This study aimed to assess the influence of socioeconomic factors on malaria-endemic areas in eastern Indonesia. A cross-sectional study was conducted in East Nusa Tenggara from January to March 2020. Bivariate and multivariate analyses were then performed on 317 population data of adults with low socioeconomic status. It was found that one of the socioeconomic factors, i.e., the age, is significantly associated with malaria (p-value=0.031; OR=1.684) with 40 being the age with the highest association. Thus, age is associated with malaria incidence in endemic areas.

Keywords: Malaria, socioeconomic, East Nusa Tenggara, Indonesia

Introduction

In 2021, based on socioeconomic data for the East Nusa Tenggara province report, more than 20.90% population in East Nusa Tenggara lived in poverty, most of which lived in rural areas. East Nusa Tenggara (ENT) has become Indonesia's third province with the highest poor population. However, the ENT population shows an increase in expected and mean years of schooling. Those factors contribute to the human development index, which will later determine the quality of life.[1] In terms of nutrition, ENT Province is reported to have the highest number of the adult population with low nutritional status based on body mass index (BMI), with 8.8% adult population of ENT (≥ 218 thousand adults) with low nutritional status.[2]

East Nusa Tenggara Province also has one of the highest malaria cases in Indonesia. In 2017 that reported 211.409 malaria cases annual parasite incidence (API) 5,76‰. However, in 2018 decreased become 18.053 cases with API 3,6‰.[3,4] Up to date MoH reported a decrease in the case number of malaria cases in ENT though is still in the process of malaria elimination.

Malaria in South East Asia (SEA) region alone accounts for 6.3 million cases and 9,000 deaths. World Malaria Report 2020, most of the countries in SEA, including Indonesia, reported a decrease in malaria case incidence estimated at 40% or more. However, Indonesia still keeps trying to reach being free from malaria in 2030.[5]

Other studies have suggested that socioeconomic and demographic factors are more critical for developing severe malaria than other factors. A study in Mutasa and Nyanga districts found factors such as maternal education, adequate knowledge about malaria, and the number of children associated with severe malaria. [6]

To assess individuals and communities, we used a standard form and questionnaire combination of health determinants such as the socioeconomic environment, the physical environment, and the person's characteristics and

Corresponding Author:
Nisa Fauziah
Division of Parasitology, Department of Biomedical Sciences, Faculty of Medicine Universitas Padjadjaran, Bandung, Indonesia
Email: nisa@unpad.ac.id

behaviors. In infectious diseases, socioeconomic factors hold a significant role. Poverty, illiteracy, gender inequality, and rapid urbanization are the major determinants that make the population vulnerable. Host individual characteristics usually called host factors, such as age, sex, and nutritional status, also influence one's exposure, susceptibility, or response to an agent. Understanding health determinants related to malaria will contribute to the elimination efforts of malaria and intervention programs towards the problems in the socioeconomic sector. This study will analyze malaria association with socioeconomic and host factors in a low socio-economic, malaria-endemic region, South Central Timor Regency, East Nusa Tenggara.

Methods

A cross-sectional study using data from East Nusa Tenggara was used in this study. All the analyses were conducted from January until March 2020 in the Faculty of Medicine, Universitas Padjadjaran. Three hundred seventeen data from the low social and economic adult population were obtained by systematic random sampling. Data assessments, including; age, body weight, body height, sex, occupation, education history, number of people per household, and malaria confirmation by an nPCR exam, are used in this study (Figure).

Independent variables will be classified into two categories: respondents' host factors and socioeconomic factors. All data were collected by local health workers and central researchers using a standard questionnaire including; age, sex, occupation, education, history, and the number of households. Bodyweight and body height were also collected for anthropometry measurement. BMI was obtained by calculating the body height and body weight data with the BMI equation and then classified into Indonesia's BMI classification (<18.5= underweight and 18.5-25= normal). The dependent variable is malaria status, confirmed by an nPCR examination conducted in the parasitology laboratory. Data were collected via direct assessment at a household visit.

Data analysis in this study using IBM® SPSS® 25th version software and Microsoft Excel. Bivariate and multivariate analyses were used with a p-value <0.05 and a confidence interval of 95%. Multivariate analysis with the entering method was conducted on all variables, and then the variables were eliminated one by one based on the p-value. This research has been approved by the Health Research Ethical Committee of the Faculty of Medicine, Universitas Padjadjaran, with ethical license number 1196/UN6.KEP/EC/2020.

Results

This study obtained a total sample of 317. As shown in (Table 1), the respondents were 126 males and 191 females. More than half of the respondents (59.2%) had a normal Body Mass Index. Age group 30–39 had the highest prevalence of malaria cases among all age groups. Both the prevalence of malaria nPCR positive and negative results are higher in females. Most of the respondents were homemakers, and most had elementary school as their highest level of education. Table 2 shows the results of a bivariate analysis of malaria status, host, and socio-economic factors. Of the six variables, age

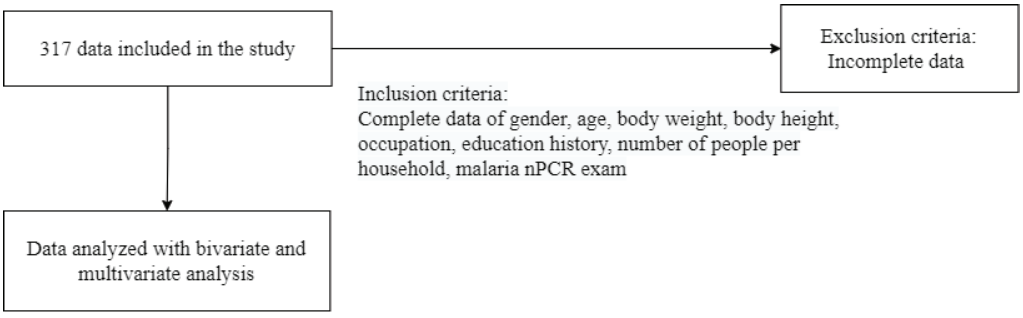

Figure Research Flowchart

Table 1 Characteristics of the Respondents

Variable	Malaria Status		n (%)
	Positive (%)	Negative (%)	
Age			
20–29	8 (7.4)	44 (21.1)	52 (16.4)
30–39	35 (32.4)	67 (32.1)	103 (32.2)
40–49	32 (29.6)	64 (30.6)	96 (30.3)
50–59	33 (30.6)	34 (16.3)	67 (21.1)
Sex			
Male	46 (42.6)	80 (38.3)	126 (39.7)
Female	62 (57.4)	129 (61.7)	191 (60.3)
BMI			
Underweight	35 (32.4)	72 (34.4)	107 (33.8)
Normal	73 (67.6)	137 (65.6)	210 (66.2)
Education			
College	3 (2.8)	9 (4.3)	12 (3.8)
Senior high school	7 (6.5)	28 (13.4)	35 (11.0)
Junior high school	18 (16.7)	38 (18.2)	56 (17.7)
Elementary school	46 (42.6)	68 (32.5)	114 (36.0)
Not finishing elementary school	34 (31.5)	66 (31.6)	100 (31.5)
Occupation			
Housewife	61 (56.5)	132 (63.2)	193 (60.9)
Private employee	6 (5.6)	4 (1.9)	10 (3.2)
Farmer	41 (38.0)	74 (34.9)	114 (36.0)
Household size			
<5	50 (46.3)	89 (42.6)	139 (43.8)
5–8	56 (51.9)	116 (55.5)	172 (54.3)
9–11	2 (1.9)	4 (1.9)	6 (1.9)

shows a significant relationship with malaria at the p-value < 0.05.

Multivariate results of malaria status, host, and socio-economic factors are shown in Table 3. All variables were included in the analysis and then excluded one by one by looking at the p-value with the entering method. The result shows that age is significant for malaria (p value=0.025) and

Table 2 Health Determinants and Association with Malaria

Variable	Malaria Status		n (%)	P-value	95% CI	
	Positive (%)	Negative (%)			Lower	Upper
Age						
<40	43 (39.8)	111 (53.1)	154 (48.6)	0.025	1.069	2.743
≥40	65 (60.2)	98 (46.9)	163 (51.4)			
Sex						
Male	46 (42.6)	80 (38.3)	126 (39.7)	0.457	.764	1.919
Female	62 (57.4)	129 (61.7)	191 (60.3)			
BMI						
Normal	73 (67.6)	137 (65.6)	210 (66.2)	0.716	.557	1.495
Underweight	35 (32.4)	72 (34.4)	107 (33.8)			
Education						
High	10 (9.3)	37 (17.7)	47 (14.8)	0.045	1.005	4.424
Low	98 (90.7)	172 (82.3)	270 (85.2)			
Occupation						
Unemployed	47 (43.5)	77 (36.8)	124 (39.1)	0.248	.472	1.215
Employed	61 (56.5)	132 (63.2)	193 (60.9)			
Household size						
<5	50 (46.3)	89 (42.6)	139 (43.8)	0.528	.729	1.854
5–11	58 (53.7)	120 (57.4)	178 (56.2)			

Note: OR: Odds Ratio, 95% CI: 95% Confidence Interval

Table 3 Multivariate Result of the Effects of Host and Socioeconomic Factors on Malaria

Initial multivariate result

Variable	B	OR	P-value	95% CI		R square
				Lower	Upper	
Constant	61.963		.999			0.064
Age	.530	1.699	.031	1.049	2.750	
Sex	-20.855	.000	.999	.000		
BMI	-.143	.866	.581	.521	1.442	
Education	.717	2.048	.063	.961	4.363	
Occupation	-21.080	.000	.999	.000		
Household size	.145	1.156	.556	.714	1.872	

Level 1

Variable	B	OR	P-value	95% CI		OR changes (%)
				Lower	Upper	
Age	.501	1.650	.041	1.022	2.664	2.899
BMI	-.180	.835	.485	.504	1.395	3.579
Education	.754	2.125	.050	1.001	4.513	3.759
Occupation	-.277	.758	.264	.466	1.232	
Household size	.177	1.193	.470	.739	1.926	3.200

Level 2

Variable	B	OR	P-value	95% CI		OR changes (%)
				Lower	Upper	
Age	.503	1.698	.029	1.055	2.733	.000
BMI	-.173	.841	.502	.508	1.394	2.886
Education	.720	2.055	.059	.972	4.344	.314
Household size	.157	1.170	.518	.727	1.885	1.196

Level 3

Variable	B	OR	P-value	95% CI		R square
				Lower	Upper	
Constant	-1.121					
Age	.521	1.684	.031	1.048	2.707	0.040
Education	.705	2.025	.064	.959	4.270	
Household size	.142	1.152	.558	.717	1.851	

age is a risk factor for malaria (OR=1.684). No variable shows OR changes >10%, meaning this study has no confounding factor.

Discussion

East Nusa Tenggara is a province with a low socio-economic level. Other than that, ENT has also known as a malaria-endemic area. Three hundred seventeen data of low socio-economic population were obtained from 5 areas of ENT based on the API level, and 108 people were positive for malaria. Malaria is a disease that can affect anyone regardless of gender and age; 42.6% of males and 57.4% of females were positive for malaria in this study. Idris et al. [7] reported that the risk for disease severity was higher in female patients, and Gondwe et al.[8] reported that female patients were at a higher risk for mortality. The female rate of malaria infection is higher, especially during pregnancy, because of the decrease in immunity.[9,10]

The age group shows a significant association with malaria (p value=0.031), an individual age ≥40 was found to be 1.684 times more susceptible to malaria. Infants, children under 5 years of age, pregnant women, immunocompromised, and nonimmune populations were said to have a higher risk of malaria. A study in southeast Nigeria by Nwaorgu et al.[9] and a study in Cameroon by Sakwe et al.[10] found that malaria is the most prevalent in children under 5 years old. An analysis of *Palcifarum* malaria in nonimmune found a significantly higher rate of severe disease and mortality among patients <40 years of age.[11] Idris et al.[7] studied imported malaria cases in South Sudan; 182 of the patients

in that study were infected with *P. falciparum.* Of these patients, 13 were defined as having severe malaria. Comparing the groups with severe and nonsevere diseases, they found that age did not significantly contribute to severity. Other studies, however, support our findings. Sylvester et al.[12] Most of these nonimmune subjects were moved to new villages in a malarious area. Mortality from malaria was highest in the youngest (<2 years) and oldest age groups (>40 years), 2.2% and 2.5%, respectively, compared with 0%–0.9% for patients who were 2–40 years of age.

Two Italian studies showed similar results. O'Brien et al.[13] studied disease in 194 cases due to *P. falciparum*, 9% of which fulfilled the criteria of severe malaria. The number of severe cases increased with age as follows: 3.2% of cases in patients who were <30 years of age; 5.3% for patients 30–39 years of age; 9.8% for patients 40–49 years of age; and 23.5%, for patients ⩽50 years of age. Eli Schwartz et al.[14], who studied mortality in malaria patients, showed a 2.3% case fatality rate in patients with malaria due to *P. falciparum*, with an increment in mortality by age. There were no deaths in this series among those patients who were <20 years of age; the mortality rate was 0.5% in patients 21–30 years of age; 2.3% in patients 31–40 years of age; 1.7% in patients 41–50 years of age; and 5.4%, in patients ⩽51 years of age.

A decline of immunity in old age is called immunosenescence. Immunosenescence causes a vulnerability to infectious diseases and causes morbidity and mortality in the old population.[15] In this study, the subject is the adult population, (20–59) immunosenescence may play a role, therefore, found that individuals with age ≥40 are more susceptible to malaria, proven by the number of cases higher in population with age group ≥40 than <40-year-old.

Nutritional status, assessed by Body Mass Index (BMI), shows no significant effect on malaria. Several studies also found the same result, but on the other hand, some studies found a two-way association between malaria and malnutrition. [10,16] This conflicting result may appear because the study was the different metrics used and subject choices.

Infectious diseases are already known to correlate with socioeconomic factors. Malaria is often mentioned as the disease of poor people with low education levels, who are more likely to develop malaria than those with higher education levels. [10,17] People with higher education levels could understand more about health education, especially about malaria disease, so they change their health-related behavior and decrease malaria infection.[10,18] People with higher education also tend to have higher income and better housing, schooling, and preventive measures such as insecticide-treated nets (ITNs) that later can prevent and lower malaria incidence.[19,20] However, the education variable in this study is not statistically significant towards malaria with OR>1 (p-value: 0.064, OR: 2.025). Population data is based on populations with low education.

Occupation, too, cannot be ignored in malaria. Some occupations may have a higher risk of malaria because of the higher time or chance exposed to Plasmodium-infected female Anopheles. In this study, the highest malaria prevalence occurred in homemakers. Traditional homemakers usually wake up early to prepare household needs or cook evening meals outdoors. The second highest malaria prevalence occurred in farmers. Working outdoors may put farmers at greater risk because they work during peak mosquito-biting time.[10]

Regarding household size, a previous study by Sharma et al.[20] in Central India reported a significant association between households and malaria, the same result obtained by Guerra et al.[21] This is because large household size results in a high concentration of mosquito-attracting human emanations that *Plasmodium*-infected mosquitos are more likely to bite those people. This study found no association between household size and malaria. Nevertheless, we did not include the housing characteristics that might influence the theory mentioned, such as the wall, roof, and floor conditions.

Indonesia is experiencing a demographic bonus, meaning the working-age population is higher than the non-working-age population. A demographic bonus is an opportunity to positively impact economic growth for Indonesia in general and for underdeveloped and poor areas like East Nusa Tenggara in particular. In this study, the subjects were of working age, and it was found that age is associated with malaria. If the population's health is not good, in this case, is infected with malaria, the opportunity cannot be fully utilized; even a demographic bonus may lead to a demographic burden.[22,23] To prevent this from happening, the malaria elimination program that has been regulated in Keputusan Menteri Kesehatan Republik Indonesia
No. 239 Tahun 2009 must be implemented correctly by the health workers and government, especially in endemic areas.
Since this study uses secondary data, there

was a limitation in the selection of variables. Additional variables that may support socio-economic factors, such as monthly income, could have been obtained so that this study can better prove the effect of socio-economic factors by first classifying the socio-economic status following an index. The R square in this study is 0.040, meaning this study only explains 4% of independent variables. Therefore, more research needs to be done to understand more about malaria.

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Pneumonia Clinical Features in Under-Five Children Treated in Atma Jaya Hospital in 2017–2020

Rachel Roselany,[1] Edward Surjono[2]
[1]Faculty of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia
[2]Department of Pediatrics, Faculty of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia

Abstract

Pneumonia is the leading cause of infection-related death among children and still remains a global health problem, especially for children under five. This study aimed to identify the clinical features of pneumonia in under-five chilren treated at Atma Jaya Hospital during the period of 2017–2020. This was a cross-sectional retrospective descriptive study on all under-five patients diagnosed with pneumonia treated in Atma Jaya Hospital. Data were collected from November 2021–January 2022 from the medical records of these children (n=148) and analyzed using the univariate analysis. Results showed that most subjects of this study were boys (60.8%), in the age group of 1–4 years old (62.2%), with fever as the most common pnemonia clinical symptom (93.9%). Physical examinations revealed that the average pulse of the subjects were 131.2 beats/minute and the average temperature was 37.1°C. Other signs and symptoms identified during physical examinations were tachypnea (20,3%), retractions (56.1%), crackles (82.4%), and wheezing (22,3%). The laboratory findings presented a mean hemoglobin of 11.0 g/dL, a mean hematocrit of 32.5%, and a mean CRP of 13.2 mg/dL, while most subjects had normal leukocyte (58.1%) and platelet counts (52.0%). The most common chest X-ray finding of pneumonia in these children was infiltrate (92.6%) and the average length of stay was 4 days. Most under-five children experiencing pneumonia recovered after treatment (97.3%).

Keywords: Clinical features, pneumonia, under five

Introduction

Pneumonia is the leading cause of death due to infection in children and is still a world health problem, especially in children under five. The World Health Organization (WHO) stated that 15% of all deaths in children under five years were caused by pneumonia, with the death rate reaching 808,964 children in 2017.[1] More than 1,400 cases of pneumonia per 100,000 children or 1 case per 71 children each year occur globally, with the highest incidence occurring in South Asia (2,500 cases per 100,000 children) and West and Central Africa (1,620 cases per 100,000 children).[2] The prevalence of pneumonia in children under five in Indonesia, according to the Basic Health Research (RISKESDAS) in 2018, was 4.8% based on the diagnosis of medical personnel or symptoms experienced by the patient.[3] The 2019 Indonesian Health Profile stated that pneumonia is one of the causes of death in children under five, with a death toll of 277 cases or 9.5% of the total under-five deaths in Indonesia. The prevalence of pneumonia in children under five in Indonesia and Jakarta is 3.55% and 4.24%.[4]

The alveoli of pneumonia patients are filled with pus and fluid, increasing breathing effort and using accessory respiratory muscles to fulfill the body's oxygen demands. Pneumonia risk factors among children under five can be classified into child and environmental factors. Child factors that play a role include malnutrition, not exclusively breastfed, and pre-existing illnesses such as HIV infections and measles, which weaken the child's immune system. Environmental factors, including indoor air pollution, overcrowding homes, and parental smoking, also increase the susceptibility of pneumonia in children.[1]

Atma Jaya Hospital was chosen as the research location in this study because it is located close to the Faculty of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia,

Corresponding Author:
Edward Surjono
Department of Pediatrics, Faculty of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia, North Jakarta, Indonesia
Email: edward.surjono@atmajaya.ac.id

North Jakarta. Research on the clinical features of pneumonia in children under five has never been conducted in Jakarta, especially in North Jakarta and Atma Jaya Hospital in 2017–2020. The high pneumonia mortality rate in children under five requires further research attention and treatment. Therefore, this study aimed to identify the characteristics of pneumonia, clinical symptoms, laboratory examination findings, and chest X-ray imaging in children under five at Atma Jaya Hospital in 2017–2020.

Methods

This cross-sectional retrospective descriptive study was conducted at Atma Jaya Hospital, Penjaringan, North Jakarta, from November 2021 to January 2022, using the medical records of under-five patients from January 2017 to December 2020.

The inclusion criteria in this study were as the following: (1) a pneumonia patient aged under five years by the time the case was reported, (2) a case reported between January 2017 to December 2020 and was treated at Atma Jaya Hospital. The exclusion criteria in this study were pneumonia patients under five years who were treated at Atma Jaya Hospital between January 2017 to December 2020 and did not have chest X-ray expertise.

A total sampling method was applied to all children under five with pneumonia in Atma Jaya Hospital that met the inclusion criteria in that period will be used for this study. Data collected then were analyzed using the IBM SPSS for Windows version 25. A univariate analysis was performed to understand the characteristics of children under five with pneumonia, clinical symptoms, physical examination findings, laboratory examination findings, and chest X-ray images. The Health Research Ethical Committee of Atma Jaya Catholic University of Indonesia approved this study for Ethical clearance with the number 08/10/KEP-FKIKUAJ/2021.

Table 1 Characteristics of Patients

Characteristics	n=148	%
Sex		
Boys	90	60.8
Girls	58	39.2
Age		
<1 year	56	37.8
1–4 years	92	62.2

Results

One hundred forty-eight medical records fulfilled the inclusion criteria. Table 1 shows that more patients with pneumonia were boys (60.8%) than girls (39.2%). Characteristics of patients based on age were higher in the age group of 1-4 years (62.2%) compared to <1 year (37.8%).

Table 2 shows that fever (93.9%) was the most common clinical symptom in pneumonia patients under five, followed by cough (91.2%)

Table 2 Characteristics of Clinical Features of Pneumonia in Children Under Five

Characteristics	n=148	%
Symptoms		
Fever	139	93.9
Cough	135	91.2
Runny nose	84	56.7
Dyspnea	52	35.1
Liquid defecation	51	34.4
Vomiting	70	47.2
Seizure	17	11.4
Decreased intake	40	27.0
Weight loss	3	2.0
Cyanosis	4	2.7
Nasal flaring	2	1.3
Respiratory rate		
Tachypnea	30	20.3
No tachypnea	118	79.7
Retractions		
Retractions	83	56.1
No retractions	65	43.9
Crackles		
Crackles	122	82.4
No crackles	26	17.6
Wheezing		
Wheezing	33	22.3
No wheezing	115	77.7
Leukocytes level		
Normal	86	58.1
Leukocytosis	50	33.8
Leukocytopenia	12	8.1
Thrombocytes level		
Normal	77	52.0
Thrombocytosis	65	43.9
Thrombocytopenia	6	4.1
Chest x-ray		
Infiltrates	137	92.6
Consolidation	1	0.6
Opacification	6	4.1
No infiltrates	4	2.7
Outcome		
Recovered	144	97.3
Had not recovered	4	2.7

Table 3 Characteristics of Clinical Features' Mean Value of Pneumonia in Children Under Five

Characteristics	(n=148)
Vital Signs	
Pulse, mean (SD) beats/ minute	131.2 (19.2)
Temperature, mean (SD) °C	37.1 (0.7)
Blood Results	
Hemoglobin, mean (SD) g/dL	11.0 (1.3)
Hematocrit, mean (SD) %	32.5 (3.7)
CRP, mean (SD) mg/dL	13.2 (16.6)
Length of Stay	
Length of stay, mean (SD) days	4.7 (3.0)

and runny nose (56.7%). The respiratory rate in pneumonia under five was tachypnea (20.3%) and no tachypnea (79.7%). The physical examination of retractions shows there were retractions (56,1%) and no retractions (43,9%). The physical examination of crackles shows there were crackles (82.4%) and no crackles (17.6%). The physical examination of wheezing shows that there was wheezing (22,3%) and no wheezing (77,7%). The laboratory examination of leukocytes was normal (58.1%), followed by leukocytosis (33.8%) and leukocytopenia (8.1%). The laboratory examination of thrombocytes was normal (52.0%), followed by thrombocytosis (43.9%) and thrombocytopenia (4.1%). Chest X-ray images in pneumonia patients under five were infiltrates (92.6%), followed by opacification (4.1%), no infiltrates (2.7%), and consolidation (0.6%). The outcome of pneumonia patients under five was recovered (97.9%) and had not recovered (2.1%).

Table 3 shows an average pulse of 131.2 beats/minute and an average temperature of 37.1 °C from physical examination results of pneumonia patients under five. The laboratory examination results of pneumonia in children under five show a mean hemoglobin of 11.0 g/dL, a mean hematocrit of 32.5%, and a mean CRP of 13.2%. The average length of stay for pneumonia patients under five was four days.

Discussion

The 2018 Riskesdas National Report results showed a higher incidence of pneumonia in boys.[3] The 2019 Indonesian Health Profile stated that boys had more pneumonia cases than girls.[4] The same result was also found by Omaridegun et al.,[6] who found that pneumonia was generally reported more frequently in boys than girls. Boys are thought to be more vulnerable to pneumonia because they are given more attention in the community than girls.[5]

The number of pneumonia cases was higher in the age group of 1–4 years than in the age group of <1 year, according to the 2019 Indonesian Health Profile.[4] The 2018 Riskesdas National Report results found that the prevalence in the age group of 1–4 years was higher compared to the age group of <1 year.[3] Research conducted by Kasundriya et al.[7] stated that the global prevalence of pneumonia in children under five was highest in the age group of 1–4 years.

A study conducted by Monita[8] found that fever was the most common clinical symptom in pediatric pneumonia patients (92.7%). Research by Kaunang[9] obtained different results, with dyspnea (93.7%) as the most common clinical symptom among pediatric pneumonia patients. The difference in the results of these studies was influenced by the alloanamnesis of the mother, who was more sensitive to fever than other symptoms.

The study by Kaunang[9] found that the average pulse rate was 194.7 beats/minute, the average respiratory rate was 60.4 breaths/minute, and the average temperature was 37.8°C. This may be because the study was conducted in the pediatric intensive care unit, showing a more severe condition; some respondents were older than five years old. Another study by Nurjannah[10] found that the average pulse rate was 147 beats/minute, the average respiratory rate was 60 breaths/minute, and the average temperature was 38°C. These results showed quite a significant difference in the average pulse rate, which could be caused by some of the respondents' age of more than five years. WHO clinical criteria for pneumonia have been reported to have poor sensitivity in diagnosing pneumonia in children. However, according to the WHO respiratory rate threshold definition, children with tachypnea were less likely to develop pneumonia than children without tachypnea. The WHO respiratory rate thresholds are as follows: 60 breaths/minute for children under two months, 50 breaths/minute for children 2–12 months, and 40 breaths/minute for children 1–5 years.[11]

Some studies by Monita[8] and Nurjannah[10] found that most patients had retractions. Retraction is an abnormal inward movement of the subcostal tissue during inspiration. Pulmonary compliance

decreases as inflammation of the airways and alveoli continues during pneumonia. Greater inspiratory force is generated to maintain adequate tidal respiratory volume by increasing the negative intrapleural pressure. Increased negative intrapleural pressure during inspiration can pull the subcostal tissue inward. The need to produce a more negative intrapleural pressure due to worsening lung compliance necessitates the use of accessory muscles of respiration, such as the intercostal, sternocleidomastoid, and scalenus muscles that lie between the ribs and the lateral neck.[12]

Monita,[8] Kaunang,[9] and Nurjannah[10] found crackles in almost all the respondents of the studies. Crackles are associated with a sudden opening of the airways or movement of air through obstructed airways. This condition can impair ventilation/perfusion, a significant cause of hypoxemia.[13]

The study by Monita[8] found that there were only 26 cases of wheezing (14.6%). Wheezing is a musical sound of high frequency caused by air movement through narrowed small airways. These sounds occur predominantly during expiration. They may occur during inspiration and expiration or, in particular cases, depending on the individual physical state and its correlation with the pathology.[14] Wheezing is more common in pneumonia caused by viruses, *M. pneumoniae*, and *C. pneumoniae*.[15]

The case fatality rate of pneumonia was higher in children with anemia than in children without. Anemia remained an independent risk factor for death in children hospitalized from pneumonia or severe pneumonia after adjusting for confounding factors. The trend of anemia prevalence was inversely proportional to increasing age among children under five years hospitalized due to pneumonia or severe pneumonia. This may be due to the higher prevalence of severe diseases associated with anemia, such as severe acute malnutrition and severe sepsis, in infants compared to older children.[16]

The hematocrit range varies by sex and age. Decreased hematocrit can be found in anemia, leukemias, lymphomas, Hodgkin disease, myeloproliferative disorders, adrenal insufficiency, chronic disease, acute and chronic blood loss, hemolytic transfusion reactions, and pregnancy. Increased hematocrit can be found in erythrocytosis, polycythemia vera, and hemoconcentration from hypovolemia.[17]

Tarhani[18] in Iran stated that 53.7% of patients had leukocyte levels higher than normal. Other laboratory tests, including stool examination, urinalysis, urine culture, ESR, CRP, and blood glucose, were normal in most patients.

Some studies by Kiyawat[19] and Chandrakala[20] found that thrombocytosis was frequently associated with pneumonia in children. Children with thrombocytosis could develop chronic disease and complications that result in an extended hospital stay. The degree of thrombocytosis was directly correlated with the severity of the disease. The degree of thrombocytosis was directly correlated with the severity of the disease.

Studies conducted by Monita[8] and Kaunang[9] stated that the most frequently found chest X-ray images were the presence of infiltrates. An alveolar infiltrate is a dense or smooth opacity that occupies a portion or whole lobe, or of the entire lung, that may or may not contain air bronchograms. An interstitial infiltrate is a lacy pattern involving both lungs, featuring peribronchial thickening and multiple areas of atelectasis. It also includes minor patchy infiltrates that are not sufficient to be defined as consolidation and small areas of atelectasis that in children may be difficult to distinguish from consolidation. A radiograph is identified as having to infiltrate if there is either an alveolar infiltrate, interstitial infiltrate, or both.[21]

Nurjannah[10] found that the average length of stay was eight days. Monita[8] found the highest frequency of length of stay at 5–10 days. The median time to recover was four days, according to Tirore et al.[22] Recovery time from severe pneumonia was significantly affected by weight, age, first antibiotic administration, and antibiotic change. This was done to provide nutritious food for children, underweight children.

The most outcome showed recovery or improvement (56,7%) in the study conducted by Monita.[8] Le observed low mortality from pneumonia in a study conducted in South Africa. Clinical factors associated with death or ICU admission included age under two months, premature birth, or hypoxia. Doctors should consider these risk factors to identify children who may need additional monitoring or early treatment.

This study was able to see the characteristics distribution of pneumonia in children under five at Atma Jaya Hospital in 2017–2020. This study had not observed the factors influencing pneumonia in children under five, including low birth weight, prematurity, nutritional status, exclusive breastfeeding, history of respiratory infections, primary immunization status,

socioeconomic status, parental education, residential density, and exposure to cigarette smoke. This study had yet to observe blood gas analysis and oxygen saturation examination.

The first limitations of this study were the incomplete coding of the medical records; therefore, not all data were taken. Second, medical records were not recorded entirely. Third, Jakarta's implementation of restrictions on community activities in response to the COVID-19 pandemic.

In conclusion, the characteristics of children under five who experience pneumonia are mostly boys (60.8%) and the age group of 1-4 years (62.2%). The most common clinical symptom of pneumonia in children under five is fever (93.9%). The physical examination results for pneumonia in children under five showed an average pulse rate of 131.2 beats/minute and an average temperature of 37.1°C. Other physical examinations are tachypnea (20.3%), retractions (56.1%), crackles (82.4%), and wheezing (22.3%). The laboratory examination results of pneumonia in children under five show a mean hemoglobin of 11.0 g/dL, a mean hematocrit of 32.5%, and a mean CRP of 13.2 mg/dL. Other laboratory examinations are average leukocyte count (58.1%) and normal platelet count (52.0%). The most common chest X-ray finding of pneumonia in children under five is infiltrated (92.6%). The average length of stay for pneumonia in children under five is four days. The most common outcome of pneumonia in children under five is a recovery (97.3%).

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