

DIFFERENCES IN LEUKOCYTE RATE BETWEEN ACUTE NONPERFORATED AND PERFORATED APPENDICITIS IN HOSPITALISED PATIENTS BANDAR LAMPUNG-INDONESIA

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ABSTRACT

Background: Acute appendicitis is one of the most common acute abdominal pain. A late check up and diagnosis could bring harms which is turning into perforated appendicitis. Leukocyte count is a laboratory collation that is generous and quick to diagnose the acute apendicitis and perforated appendicitis, however there's no certain limit of the leukocytes count to recognize whether it is acute apendicitis or perforated apendicitis.

Purpose: This research was to find out the comparison of leucocyte count average between acute apendicitis and perforation apendicitis in Dr. H. Abdul Moeleok public hospital of Lampung province in 2014-2016.

Methods: An analytic research with cross sectional approach. Population was 382 patients with apendicitis in Dr. Hi. Abdul Moeloek public hospital. Samples were taken using total sampling technique with 196 respondent samples for acute apendicitis and 196 respondent samples for perforation apendicitis. Data were analyzed by using univariate analysis with percentage and bivariate analysis with t-test.

Results: the average of leucocyte count of acute apendicitis patients was 10,907 with minimum and maximum leucocyte count of 5,000 and 18,500 respectively. The average of leucocyte count of perforation apendicitis patients was 22,789 with minimum and maximum leucocyte count of 16,500 and 31,000 respectively. There were differences of leucocyte counts between acute apendicitis patients and perforation apendicitis patients with p-value < 0.05.

Conclusion: there were significant differences of leucocyte count averages between acute apendicitis and perforation apendicitis.

Keywords : Acute apendicitis, perforation apendicitis, leucocyte

INTRODUCTION

One of the major surgical diseases that often occurs is apendicitis (Panidis et al., 2011). Apendicitis is an acute abdominal pain that often occurs today, especially in developed countries. Based on epidemiological research the influence of constipation and low fiber food eating habits can lead to increased degrees of apendicitis (Wani, 2009). The vermiform appendix is one of the sites of acute primary inflammation (Nasution, 2013). Inflammation of the vermiform appendix can affect all walls of the organ which can eventually cause apendicitis (Panidis et al., 2011). The main cause of acute abdominal surgery in the United Kingdom is acute apendicitis, but its incidence is rarely reported. This disease is the most common disease in the second decade and third life (Nasution, 2013). The incidence of acute apendicitis between the ages of 10 and 30 years is around 7.0% of the population. Apendicitis in children less than 1 year is rarely reported, generally incidence in men and women is

comparable (Omari et al. ., 2014). Based on a study in Sweden conducted by Pieper and Kager, it was estimated that the incidence of annual apendicitis cases was 1.33 per thousand male population and 0.99 per thousand female population (Nasution, 2013). According to Global Burden Disease data WHO 2007 there were 259 million cases of apendicitis in men worldwide who were undiagnosed, whereas in women there were 1 60 million cases of apendicitis are undiagnosed (Omari et al., 2014).

In elderly patients with apendicitis it is often difficult to diagnose compared to younger patients, because there are many possible differential diagnoses obtained in elderly patients with apendicitis, and the difficulty of getting effective communication. So that this event can be a factor that contributes to the very high rate of perforation (Shenoy et al., 2014).

Vague and blunt pain in the epigastric region is a typical symptom that arises in acute apendicitis (Wani, 2009). If the pain occurs over a period of

time it will move to the lower right quadrant of the abdomen at point *McBurney's*, accompanied by nausea, vomiting and anorexia. If left for a long time it will cause complications such as perforation, peritonitis, abscesses, and surgical wound infections. Late examination and diagnosis can increase morbidity and mortality due to the risk of perforated appendicitis. In elderly patients it is often difficult to determine the diagnosis, so that it requires a supporting examination to make a diagnosis. One of the difficulties in diagnosing acute appendicitis is because of the number of *negative appendectomy* which is still a problem to date because it ranges from 15-20%. Some investigations can be *Ultrasonography* (USG), *Computed Tomography* (CT Scan), and blood leukocyte count (Brunicardi, 2000).

Examination of blood leukocytes is one of the quick and inexpensive laboratory tests to determine the diagnosis of acute appendicitis and perforated appendicitis. Leukocytosis is usually found on laboratory examination and is often found in cases with complications such as perforation. It was reported that the incidence of perforation of around 60% was found in patients over the age of 60 years (Nasution, 2013). The anatomical changes in the vermiform appendix include narrowing of the lumen, unusual symptoms, late treatment, and arteriosclerosis are factors that influence the high incidence of perforated appendicitis (Mani et al, 2018). Blood leukocyte values increase > 10,000 / mm³ and blood leukocyte counts have a leftward shift in patients with acute appendicitis. While a study conducted by John et al in 2012, states that

leukocytosis of more than 13,000 / mm³ is an indication of acute appendicitis. Examination of blood leukocyte counts has sensitivity, and specificity of 97.82% and 55.55% respectively (Omari et al., 2014). In patients with increased blood leukocytes > 18,000 cells / mm³ it is possible for perforated appendicitis (Shenoy & Nileshwar, 2014). Whereas in a study conducted by Goulart et al., It was said that as many as 57% of patients with perforated appendicitis had blood leukocyte counts greater than or equal to 20,000 cells / mm³ (Omari et al., 2014).

Until now there have been no studies on differences mean blood leukocyte count in patients with acute appendicitis with perforated appendicitis in RSUD. Dr. H. Abdul Moeloek Lampung Province. Whereas to diagnose in patients with acute appendicitis and perforated appendicitis in the RSUD that is by doing anamnesis, physical examination and investigation. Therefore the authors are interested in conducting a study of the mean comparison between the number of blood leukocytes in patients with acute appendicitis with perforated appendicitis.

RESEARCH METHODS

Type of analytic research with *cross sectional approach*. The population of this study was 382 respondents with appendicitis in Abdul Moeloek Hospital, with a sample of 196 acute appendicitis patients and 196 perforated appendicitis patients, a sampling technique that was *total sampling*. Univariate data analysis with percentage and bivariate (*t-test*)

RESEARCH RESULTS

Table 1.Characteristics Based on Age (N=382)

Age	Acute Appendicitis		Perforated Appendicitis	
	F	%	F	%
<25 years	115	58,6	89	45.4
25- 50 years	49	25,0	77	39.2
> 50 years	32	16.4	30	15.3
Total	196	100	196	100

Based on table 1 <25 years of age is the age group most diagnosed with appendicitis namely 115 (58.6%) patients with acute appendicitis and 89 (45, 4%) perforated appendicitis patients, aged 25-50 years 49 (25.0%)

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patients with acute appendicitis and 77 (39.2%) perforated appendicitis patients. At the age of 50 years 32 (16.4%) patients with acute appendicitis and 30 (15.3%) patients with perforated appendicitis.

Table 2. Characteristics Based on Gender (N=382)

Gender	Acute Appendicitis		Perforated appendicitis	
	F	%	F	%
Female	72	36.7	82	41.9
Male	124	63.2	114	58.1
Total	196	100	196	100

Base on gender characteristics, 124 (63.2%) patients with acute appendicitis and 114 (58.1%) perforated appendicitis patients of male sex and 72 (36.7%) patients with acute appendicitis and 82 (41.8%) patients with perforated appendicitis of female sex.

Table 3. Average of Leukocyte Count

Leukocyte	Mean	Median	Min	Max	SD	N
Acute Appendicitis	10.907	11,000	5000	18,500	3055,6	196
Perforated Appendicitis	22,789	23,000	16,500	31,000	3009.7	196

Based on table 3 above known average leukocyte count in patients with mean acute appendicitis leukocytes 10.907 with a minimum value of 5,000 and a maximum of 18,500 while in patients with average leukocyte perforated appendicitis 22,789 with a minimum value of 16,500 and a maximum of 31,000

Table 4. Normality of Data Test

Appendicitis (App)	Skewness	Std. Error	Skewness Std.Error	Note
App. Acute	0.039	0.174	0.22	Normal
App. Perforation	0.115	0.174	0.16	Normal

Based on table 4 above each variable has a value *skewness* and *standard error*, if the skewness value for the produces a number ≤ 2 , then the distribution is normal, if the data is normally distributed then it can be continued for the test (*t dependent*)

Table 5. Comparison of Leukocyte Count (N=382)

Number of Leukocytes	N	Mean	SD	T-test	p-value	95% CI	Note
Acute Appendicitis	196	10.907	3055	49.974	0,000	11,350-12,233	There are differences
Perforated Appendicitis	196	22,789	3009	106,007	0,000	22,363-23,213	

Based on table 5 it is known in appendicitis acute leukocyte mean was 10.907 with standard deviation of 3055. In mean leukocyte perforated

appendicitis it was 22789 with standard deviation of 3009. It was seen that the difference between leukocytes between acute appendicitis and

perforated appendicitis was 11,882. The statistical test results obtained *p-value* 0,000 <0,05, it can be concluded that there are significant differences between the number of blood leukocytes in patients with acute appendicitis with perforated appendicitis. From the results of this test, the highest leukocytes were found in the perforated appendicitis group because among the two groups, the perforated appendicitis group had the highest mean value of 23376.5

DISCUSSION

The results of the statistical test obtained *p-value* <0.05, it can be concluded that there was a mean difference between the number of blood leukocytes in patients with acute appendicitis with perforated appendicitis. The results of this test which showed the highest leukocytes were found in the perforated appendicitis group because among the two groups, the perforated appendicitis group had the highest mean value of 22789.80. Examination of blood leukocytes is one of the quick and inexpensive laboratory tests to determine the diagnosis of acute appendicitis and perforated appendicitis. Leukocytosis is usually found on laboratory examination and is often found in cases with complications such as perforation. It was reported that the incidence of perforation of around 60% was found in patients over the age of 60 years (Nasution, 2013). The anatomical changes in the vermiform appendix in the form of narrowing of the lumen, non-distinctive symptoms, late treatment, and arteriosclerosis are factors that influence the high incidence of perforated appendicitis (Wani, 2009). Blood leukocyte values increase > 10,000 / mm³ and blood leukocyte counts have a leftward shift in patients with acute appendicitis. While research is carried out by (John et al., 1993). states that leukocytosis of more than 13,000 / mm³ is an indication of acute appendicitis. Examination of blood leukocyte counts has sensitivity, and specificity of 97.82% and 55.55% respectively (Omari et al., 2014).

In patients with increased blood leukocytes > 18,000 cells / mm³ it is possible for appendicitis to occur perforation (Shenoy et al., 2014). Whereas in the research conducted by Goulart et al (2012). It is said that as many as 57% of patients with perforated appendicitis have blood leukocyte

counts greater than or equal to 20,000 cells / mm³ (Omari et al., 2014).

Stage of perforated appendicitis appendix has ruptured, ruptured or perforated, and pus contained within the lumen the appendix can spread out to other organs and inside the fossa appendix vermiform which can cause peritonitis, and allow the germs to develop and cause more infections (Cameron & Cameron, 2014). This situation will stimulate the body's immune response by producing more leukocytes or neutrophils which serve as a defense against infectious agents (Humes & Simpson, 2006).

The number of leukocytes in perforated appendicitis is usually above 18000 / mm³. Another opinion stated that the number of leukocytes above 20000 / mm³ indicates a perforated appendix or peritonitis (Paulson et al., 2003). This difference can occur due to several weaknesses in this study. Research for this diagnostic test should use the anatomical pathology laboratory results as the *gold standard* because it has the best sensitivity compared to other examinations (Doherty & Way, 2006).

Patients with appendicitis generally experience leukocytosis, which is an increase in the number of leukocytes above 10,000 cells / mm³. The leukocyte count in patients is generally around 10,000-18,000 cells / mm³. Leukocyte values less than 18,000 cells / mm³ generally occur in simple appendicitis and leukocytes with more than 18,000 cells / mm³ indicating perforation. Leukocytosis can occur physiologically or pathologically. Physiological leukocytosis, due to the physiological response of the body to stress as an effect of epinephrine such as exercise, acute emotional stress, exposure to extreme heat or cold, after bleeding or acute hemolysis and childbirth. Pathological leukocytosis is often followed by an absolute increase in one or more leukocytes caused by infection, inflammation, tissue necrosis and metabolic disorders. Increased leukocytes in the blood indicate an infection or inflammation in the body. Appendicitis indicates an inflammatory process in the appendix. In accordance with its function in the body's defenses, leukocytes migrate from the lumen of blood vessels to places that are inflamed to phagocytize, so that when the inflammation process takes place there is an increasing number of leukocytes signaling a great

inflammatory process and the wider area of inflammation (Cameron & Cameron, 2014) In addition, age and onset of inflammation also affect the amount of leukocytes in the body (Doherty & Way, 2006).

The research conducted by Nasution with the results of the data was analyzed using the test *chi square*. Acute appendicitis patients with 5,000-10,000 cell / mm³ leukocytes were³ found in 20 patients (33.33%), 10,000-18,000 cells / mm³ were found in 38 patients (63.33%) and > 18,000 cells / mm³ found in 2 patients (3.34%). Perforated appendicitis patients with 5,000-10,000 cell / mm³ leukocytes were³ found in 7 patients (17.5%), 10,000-18,000 cells / mm³ were found in 16 patients (40%) and > 18,000 cells / mm³ in 17 patients (42.5%). There was a very statistically significant relationship between the number of leukocytes and acute appendicitis and perforated appendicitis ($p = 0,000$). So the conclusion of this study found a very significant relationship between the increase in the number of leukocytes with the incidence of acute appendicitis and perforated appendicitis in the Hospital of Doctor Soedarso Pontianak. Research that has been conducted at Sardjito Hospital in Yogyakarta, found a relationship between leukocyte values and simple acute appendicitis and complications, in addition to the value of leukocytes can also distinguish between simple and complicated acute appendicitis (Sofii, Barmawi, & Dachlan, 2007). Increasing the number of leukocytes can determine the severity of appendicitis (Kaplan et al., 2009). Research conducted by Beltran et al. (2009). at the Chilean De Ovale Hospital, concluding that leukocyte counts can help diagnose appendicitis. A few hours after the inflammation process occurs in the body, leukocytes will be released from the blood vessels to the inflamed tissue. Increased leukocyte counts are due to the release of chemical mediators and leukocytosis induction factors simultaneously from inflamed tissue. These factors will enter the blood vessels and stimulate the release of leukocytes contained in the bone marrow to an inflamed place. So when an examination of leukocyte count in appendicitis patients will be found leukocytosis. Research conducted by Tuggle et al. (2010). in Madrid which stated that the number of leukocytes was not significant in diagnosing appendicitis where the

results of the statistical analysis obtained a value of $p = 0.3$. In his study, there were more appendicitis patients with normal leukocyte counts, this was probably because the patient had a *self-limiting appendicitis* which took place spontaneously. Currently the use of drugs such as analgesics, antipyretics and antibiotics is very widely used without a doctor's prescription. Free use of antibiotics by appendicitis patients before hospital admission can affect the results of examination of leukocyte counts (Tsai et al., 2008).

This study was obtained, the limit of blood leukocyte numbers was at the cut off point of 13,900 cells / mm³ with a sensitivity of 83.75% and specificity of 54.2%. The results of the Independent T-test were $p < 0.001$. So the conclusion of this study found a significant difference between the number of blood leukocytes in patients with acute appendicitis with perforated appendicitis.

The diagnosis of appendicitis can be made based on several findings, both physical findings, laboratory examinations and radiographic examinations (Cameron & Cameron, 2014). One of the laboratory tests that is often used is the examination of blood leukocyte counts. This examination is usually used to help diagnose appendicitis. Several studies have been conducted stating that 80% to 85% of patients with acute appendicitis will have a blood leukocyte count of more than 11,000 cells / mm³ (Humes & Simpson, 2006).

In the opinion of the researcher the delay in diagnosing acute appendicitis can increase the occurrence of complications in the form of perforation. The number of blood leukocytes will increase and mild leukocytosis occurs in patients with acute appendicitis and even leukocytosis will be more severe in patients who have perforated (Sjamsuhidajat & De Jong, 2005).

CONCLUSION

Most patients from 382 patients, 196 patients with acute appendicitis and 196 patients with perforated appendicitis, mean number of leukocytes 10.907 with a minimum value of 5000 and a maximum of 18,500 while in patients with appendicitis mean leukocytes 22789.80 with a minimum value of 16,500 and a maximum of 31,000. And there is a significant difference between the number of blood leukocytes in

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patients with acute appendicitis with perforated appendicitis with p -value $0,000 < 0,05$

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