



The Correlation between Leukocyte, Neutrophil and C-reactive Protein Count with Non Perforated and Perforated Appendicitis in Pediatrics



Tubagus Odih¹ and Ruankha Bilommi^{2*}

¹Faculty of medicine of Riau University Arifin Ahmad General Hospital, Jakarta, Indonesia

²Faculty of medicine of YARSI University, Mitra Keluarga General Hospital, Jakarta, Indonesia

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***Corresponding author:** Bilommi R, Department of Pediatrics Surgery, Mitra Keluarga Hospital, Indonesia, Tel: 6281319426287; Email: Rbilommi@gmail.com

Abstract

Background: A Pediatric Perforated Appendicitis is likely to be more often than non-perforated with the ratio of male and female is 3:2 in the highest incidence on 12-18years old. Generally leucocytes count slightly increased in non perforated appendicitis is about 11.000-14.000/mm³ and over 18.000/mm³ on perforated appendicitis, other markers for diagnose are neutrophils and C-reactive protein (CRP).

Method: During November 2015 until December 2016, obtained 30 patients who divided into 2 groups: 15 patients with non perforated appendicitis (A) and 15 patients with perforated appendicitis (B). Data is displayed descriptively and showed correlation between variables.

Result: The group of Non perforated appendicitis, there were 3 patient on aged <5 years old, 12 patient on aged >5 years old with 12 males and 3 females, the lowest leucocytes count was 8370/dL and the highest was 13.900/dL with Ratio (R) 10,776/dL, the lowest Neutrophils count was 68% and the highest one was 82% (R=77.2%), the lowest CRP count was <5ng/L and the highest was 192ng/L (R=30, 2ng/L). Sample on perforated appendicitis group was 1 patient in aged <5 years old, 14 in aged >5 years old with 7 males and 8 females, the lowest leucocytes was 10.200/dL and the highest was 34.100/dL (R=21.380/dl), the lowest count of Neutrophils is 92% and the highest is 79% (R=93.87%), the lowest count of c-RP was 5ng/L, the highest one was 192ng/L (R=109, 3ng/L) The correlation of Leucocytes, neutrophils and C-RP count with group A and B was p<0.05.

Conclusion: There is a significant correlation between the leukocytes, neutrophils and C-RP count with perforation Appendicitis and non perforation appendicitis.

Keywords: Perforated; Non perforated

Introduction

One of difficulty to early diagnose of Pediatric appendicitis is communication problems, because the patient is a children. This leads to perforation (30-60%) with group of 1-4 years old (70-75%) and 30-40% in adolescence are in the high risk. Pediatric Appendicitis in America showed 63.5% appendicitis perforation and 36.5% simple appendicitis. In the same study showed a comparison between the men and women is 3:2, with the highest incidence of age 12-18 years old.

Acute appendicitis

In patients with acute appendicitis, the laboratory results show the increasing 70-90% of leukocytes and neutrophils,

although this is not the specific characteristic. Leukocytes count is generally slightly increased in acute appendicitis. Leukocytes count in simple appendicitis is 11.000-14.000/mm³ and more than 18.000/mm³ showed in a perforated appendicitis. Increasing of leukocyte count more indicates on a bacterial infection rather than viral. Other conditions such as neutrophil is generally accompany in appendicitis.

Other inflammatory markers that can be used in the diagnosis of acute appendicitis is C-Reactive protein (CRP). Marker of acute inflammatory response (acute phase response) using CPR has been widely used in developed countries. The value of sensitivity and specificity CRP is 80-90% and more than 90%.

Result

Characteristics of research subjects

Data has conducted from patient during November 2015 to December 2016 at Arifin Achmad Pekanbaru General Hospital. The data collected included age, intervention, result of leukocytes, neutrophils, and CRP count, as in the following Table 1.

Table 1: Table of age Characteristic.

No.	Variable	Group	
		Non Perforated (A)	Perforated (B)
1	Age (years old)		
	<1	0	0
	1 – 5	3	1
2	>5	12	14
	Sex		
	Male	12	7
	Female	3	8

The data explained that the age of the patient either perforated or non perforated appendicitis is more happened in the group of age over 5 years (school age).

With more detail as follows:

Group of age 1 – 5 years old

- 3 patient with Non perforated appendicitis.
- 12 patient with perforated appendicitis.

Group of age >5 years old

- 1 patient with Non perforated appendicitis.
- 14 patients with perforated appendicitis.

The data by sex featuring in group A (non-perforated) is a significant difference between male and female, while in group B (perforated) the difference is thinner (female is more than the male).

Group A (non-perforated): 12 males (80%) and 3 females (20%).

Group B (perforated): 7males (47%) and 8 females (53%) (Table 2).

Table 2: Table of Leucocyte, Neurtophil and CRP count characteristic.

Group	Variable		
	Leucocyte	Neutrophil	CRP
A (non-perforated)			
1	9.570/dL	68%	92 mg/L
2	8.370/dL	76%	91 mg/L
3	10.100/dL	74%	12 mg/L
4	13.400/dL	73%	192 mg/L
5	13.900/dL	78%	15 mg/L
6	12.100/dL	82%	<5 mg/L

7	11.200/dL	78%	<5 mg/L
8	10.400/dL	81%	<5 mg/L
9	10.400/dL	78%	<5 mg/L
10	10.800/dL	79%	<5 mg/L
11	10.400/dL	78%	<5 mg/L
12	10.200/dL	81%	<5 mg/L
13	10.400/dL	78%	<5 mg/L
14	10.000/dL	76%	<5 mg/L
15	10.400/dL	77%	<5 mg/L
	R 161.640	R 1157	R 452
	10.776/dL	77.20%	30.2 mg/L
B (Perforated)			
1	20.800/dL	83%	192 mg/L
2	22.200/dL	92%	192 mg/L
3	34.100/dL	87%	142 mg/L
4	32.800/dL	91%	114 mg/L
5	20.400/dL	91%	192 mg/L
6	20.800/dL	90%	192 mg/L
7	18.600/dL	78%	98 mg/L
8	20.600/dL	91%	102 mg/L
9	19.300/dL	91%	91 mg/L
10	23.200/dL	92%	102 mg/L
11	18.300/dL	92%	102 mg/L
12	10.200/dL	81%	5 mg/L
13	18.400/dL	87%	102 mg/L
14	21.200/dL	92%	105 mg/L
15	19.800/dL	79%	102 mg/L
	R 320.700	R 1408	R 1640
	21.380/dL	93.87%	109.3 mg/L

In Group A (non-perforated): The lowest of leukocyte count is 8270/dL and the highest is 13.900/dL, with more detail as follows: 11 patients (73%) with a normal leukocytes count and 4 patients (27%) over than the normal count. This can happen because of Non Perforated appendicitis begins from simple appendicitis/hyperemia up to superlative. Leukocytes count increases at superlative stage.

Overview of neutrophils count

Based on Alvarado scores that neutrophil count is significant if the value is more than 75%. Neutrophils count in group A showed the lowest is 68% and the highest is 82%, as follows:

12 patients (80%) more than 75% and 3 patients (20%) less than 75%. Thus, 12 patients (80%) comes in an acute situation that required immediate surgery.

Overview of CRP count

C - reactive protein is known abnormal if valued > 5 mg/L which indicated an infection. In A group obtained the lowest value is 5% ng/L and the highest is 192ng / L, with details;

10 patients (67%) value of CRP <5 ng/L, 5 patients (33%) CRP values >5 ng/L.

Obstruction is the most common etiology of appendicitis, which develop to the stage of necrosis perforation (peritonitis/severe pain). Non-perforated condition is still at the stage of luminal obstruction of the appendix.

Characteristics of group B (perforated)

Overview of the leukocytes count

According Raffensperger theory that leukocytosis is a condition when the count of leucocytes is more than 11,000/dL.

4.4.1. The data obtained: 14 patients (93%) is more than 11,000/dL, 1 patient (7%) is less than 11,000/dL. Peritonitis (perforation) is a condition of severe infection, but there was one patient (simple) who had leucocytes count less than 11,000/dL.

Neutrophils count overview

Based on Alvarado scores that neutrophil count is significant if the count is more than 75%. Group B got 100% value is more than 75% that indicating patients in acute condition and requires immediate patient.

CRP count overview

C-reactive protein is significant if the value is greater than 5mg/L which indicated a severe infection. Group B showed 100% value greater than 5 mg/L. This is in accordance with the pathogenesis, when the perforation means obstruction condition, resulting necrosis (Table 3).

Table 3: Table of correlation of leucocyte count with Non Perforated and Perforated Appendicitis.

Variable	Group	
	Non Perforated (A)	Perforated (B)
Leucocyte		
1	9.570/dL	20.800/dL
2	8.370/dL	22.200/dL
3	10.100/dL	34.100/dL
4	13.400/dL	32.800/dL
5	13.900/dL	20.400/dL
6	12.100/dL	20.800/dL
7	11.200/dL	18.600/dL
8	10.400/dL	20.600/dL
9	10.400/dL	19.300/dL
10	10.800/dL	23.200/dL
11	10.400/dL	18.300/dL
12	10.200/dL	10.200/dL
13	10.400/dL	18.400/dL
14	10.000/dL	21.200/dL
15	10.400/dL	19.800/dL

Data presented the differences of leukocytes count between groups A and B clearly, from 30 patients were divided 15 patients in each group. It refers to the correlation with the pathoetiology appendicitis (Table 4).

Table 4: Table of correlation between Neutrophil count Non Perforated and Perforated Appendicitis.

ccc	Group	
	Non Perforated (A)	Perforated (B)
Neutrophil		
1	68%	83%
2	76%	92%
3	74%	87%
4	73%	91%
5	78%	91%
6	82%	90%
7	78%	78%
8	81%	91%
9	78%	91%
10	79%	92%
11	78%	92%
12	81%	81%
13	78%	87%
14	76%	92%
15	77%	79%

Neutrophil is one of indicator for acute inflammatory process, refer to the components of Alvarado Score. Neutrophils value of significant acute infection when obtained more than 75% (Table 5).

Table 5: Table of correlation between CRP count with Non Perforated and Perforated Appendicitis.

Variable	Group	
	Non Perforated (A)	Perforated (B)
CRP		
1	92 mg/L	192 mg/L
2	91 mg/L	192 mg/L
3	12 mg/L	142 mg/L
4	192 mg/L	114 mg/L
5	15 mg/L	192 mg/L
6	<5 mg/L	192 mg/L
7	<5 mg/L	98 mg/L
8	<5 mg/L	102 mg/L
9	<5 mg/L	91 mg/L
10	<5 mg/L	102 mg/L
11	<5 mg/L	102 mg/L
12	<5 mg/L	5 mg/L
13	<5 mg/L	102 mg/L
14	<5 mg/L	105 mg/L
15	<5 mg/L	102 mg/L

In group B, which showed peritonitis condition (which is a severe infection of the abdominal cavity), wholly meaningful more than 75%, with the highest count is 92% and the lowest is 81%. In

group A, which is a condition of the appendix lumen obstruction and have not reached to perforation stage obtained in 12 patients (%) > 75% and 3 patients (%) < 75% (Table 6) (Figure 1-3).

Table 6

		Descriptive							
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Leukosite	Non Perforated	15	1.08E+04	1412.171	364.621	9993.97	11558.03	8370	13900
	Perforated	15	2.14E+04	5709.541	1474.197	18218.16	24541.84	10200	34100
	Total	30	1.61E+04	6766.141	1235.323	13551.48	18604.52	8370	34100
Neutrofile	Non Perforated	15	77.13	3.523	0.91	75.18	79.08	68	82
	Perforated	15	87.8	5.074	1.31	84.99	90.61	78	92
	Total	30	82.47	6.917	1.263	79.88	85.05	68	92
CRP	Non Perforated	15	30.13	53.857	13.906	0.31	59.96	5	192
	Perforated	15	122.2	51.809	13.377	93.51	150.89	5	192
	Total	30	76.17	69.916	12.765	50.06	102.27	5	192

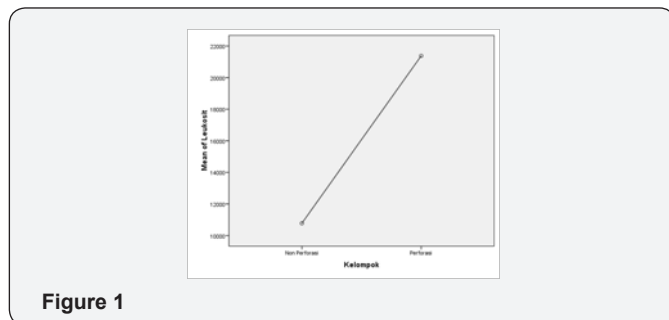


Figure 1

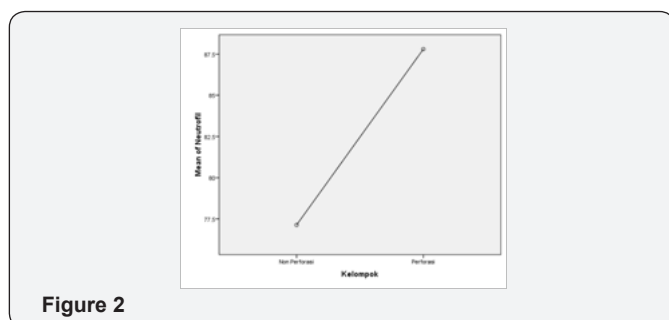


Figure 2

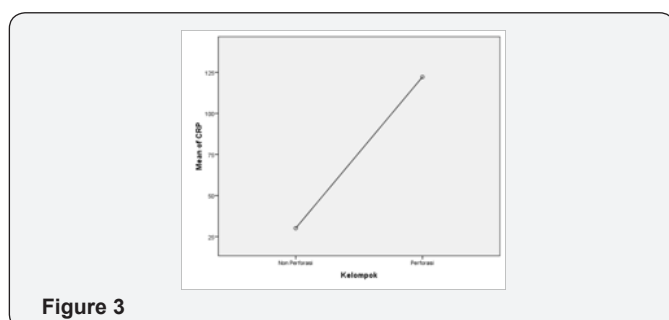


Figure 3

Discussion

Characteristics of research subjects

Based on the research results those 30 patients appendicitis divided into two groups: 15 patients in group A (non-perforated appendicitis) and 15 patients in group B (perforated appendicitis). It showed in a group A that 12 patients (80%) were male and 3 patient were female (0.20%), whereas in the group of B, there were 7 male (47%) and 8 female (53%).

In group A, the number of male more than female, this is in agreement with Cloud [1], Hartman [2] and Jablonski [3]. However, it was different condition in group B that the number of female patient more than male.

Data based on aged group that the age group of >5 years old more than <5 years old group, both in group A or group B. This is consistent with Jablonski's [3] research in the multi-ethnic race in the United States.

Leukocyte count in two groups (A and B)

Blood tests showed that in group A and B showed mixed leukocytes count.

In group A: leukocytes with the lowest count is 8370/dL and the highest is 13,900/dL, with an average is 10,776/dL.

In group B: leukocytes with the lowest count is 10,200/dL and the highest is 34,100/dL, with a average is 21.380/dL.

Group A (non-perforated) based on pathoetiology and pathogenesis occurs only at the stage of appendicitis with the appendix lumen obstruction to superlative phase, that means it

is still at the phase of obstruction lumen if leukocytes count was normal (11 patients (73%) with leukocyte count <11,000/dL) [4], others (4 patients (27%) are in the phase of superlative (not being perforated) with leukocytes count >11,000/dL with a maximum count of 13,000/dL. It is in line with what was described by Raffensperger [4].

Group B (perforated) which is a condition has occurred peritonitis infection of the abdominal cavity, the leucocytes count was dominant obtained from 14 patients (93%)>11,000/dL and only 1 patient (7%)<11,000/dL. It is also in accordance with what is described by Raffensperger [4] and Kim et al. [5] that leukocytes count more than 14,000/dL was found in appendicitis perforation, while there was one patient (%) with a value of <11,000/dL is very likely the patient has gained previous antibiotic therapy, although granting antibiotic is not much affect the perforations and cannot avoid surgery.

Neutrophils count in two groups (A and B)

Data were obtained from two groups described that significant value if neutrophil count more than 75%, or indicating an acute condition that requires a surgery.

In group A only 3 patients (20%) whose neutrophil count are

below 75%, while the remaining 12 patients (80%) count more than 75%.

Group B (15 patients) 100% neutrophil count is more than 75%

This is in accordance with a parameter in the Alvarado Score at Acute appendicitis conditions that require follow surgery is a neutrophils value above 75%.

Value of C-Reactive Protein (CRP) in the two groups (A and B)

Data were obtained, demonstrating that:

Group A : 10 patients <5mg/dL and 5 patients >5m/dL.

Group B: 1 patients <5mg/dL and 14 patients>5mg/dL.

Value possibility CRP count is more than 5ng/dL mean Reactive which is a sign on the inflammatory response. Showed from the data that the group B which is an acute and severe conditions a CRP count was dominant >5ng/dL.

This is in agreement with a research by Kim & Shili [5] that CRP has a value sufficiently high sensitivity, so that it can be used as indicators of an inflammatory response (Table 7).

Table 7

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Leukosit	Between Groups	8.43E+08	1	8.43E+08	48.758	0
	Within Groups	4.84E+08	28	1.73E+07		
	Total	1.33E+09	29			
Neutrofil	Between Groups	853.333	1	853.333	44.733	0
	Within Groups	534.133	28	19.076		
	Total	1387.467	29			
CRP	Between Groups	63572.033	1	63572.033	22.766	0
	Within Groups	78186.133	28	2792.362		
	Total	141758.167	29			

Leucocyte, neutrophils and CRP count based on statistics obtained variable p<0.05, so as to show a significant Correlation in both study groups

Conclusion

There is a significant Correlation between the two groups (Perforated and non Perforated) with leucocytes, neutrophil and C-RP count.

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