ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 10, Issue, 06, pp. 36431-36434, June, 2020
https://doi.org/10.37118/ijdr.18959.06.2020

RESEARCH ARTICLE OPEN ACCESS

THE RELATIONSHIP BETWEEN BLOOD TEST, PAS SCORE AND OUTER DIAMETER OF THE APPENDIX IN THE DIAGNOSIS OF PEDIATRIC ACUTE APPENDICITIS

***[1,2]Erdenetsetseg, Ch., [1]Bayartsetseg A., [2]Ganbayar G., [3]Davaalkham D., [4]Ganbayar L., [1]Zorig D., and [1]Puntsag Ch.**

[1]MNUMS, School of Medicine, Department of Surgery; [2]MNUMS, Mongolian-Japan Teaching Hospital; [3]MNUMS, School of Public Health; [4]National Center for Maternal and Child Health

ARTICLE INFO

Article History:
Received 17th March, 2020
Received in revised form
28th April, 2020
Accepted 20th May, 2020
Published online 25th June, 2020

Key Words:

Pediatric appendicitis, Outer diameter of appendix, Neutrophil to lymphocytes ratio, Pediatric appendicitis score.

****Corresponding author: Erdenetsetseg, Ch***

ABSTRACT

Acute appendicitis is the common cause of surgery for acute abdominal pain in children. We ought to assess the relationship between white blood cell count, PAS (pediatric appendicitis score) clinical scoring and the measurement of the outer diameter of the appendix. This study includes 480 pediatric patients who underwent surgery for suspected acute appendicitis at the General Surgery Department of the National Center for Maternal and Child Health hospital between May 2019 and December 2019. Clinical diagnosis was conducted using the PAS score based on the pre-operative blood test results including white blood cells count, neutrophil count, lymphocytes count, and neutrophil-lymphocytes ratio (NLR) . The diameter of the appendix was determined by ultrasound (US). A total of 516 children (≤18 years old) underwent surgical removal of the appendix following the suspicion of acute appendicitis. PAS and NLR, and PAS and outer diameter of the appendix are been with middle correlation to each others.(r=0.494 and r=0.437) But NLR and outer diameter of the appendix are poor correlation.(r=0.169). In cases with an outer appendix diameter ≤6mm, 44% were inflamed and 56% were not. This diagnostic accuracy can be enhanced with the combined use of the PAS system and the assessment of the neutrophil-lymphocyte ratio.

Citation: ***Erdenetsetseg, Ch., Bayartsetseg A., Ganbayar G., Davaalkham D., Ganbayar L., Zorig D., and Puntsag Ch.*.** "The relationship between blood test, pas score and outer diameter of the appendix in the diagnosis of pediatric acute appendicitis*", International Journal of Development Research*, 10, (06), 36431-36434.

INTRODUCTION

Acute appendicitis is the common cause of surgery for acute abdominal pain in children. The diagnosis of acute appendicitis in pediatric patients remains a challenge internationally. This disease is most common among patients between the age of 10 and 19 years old (Daldal & Dagmura, 2020). The main curative treatment is surgical remove of the appendix. Antibiotics can be used to treat uncomplicated cases (Styrud *et al*., 2006; Varadhan, Humes, Neal, & Lobo, 2010; Wilms, De Hoog, de Visser, & Janzing, 2011). The surgical removal of a healthy appendix occurs in 15% of male patients and 26% of female patients with suspected appendicitis (Flum & Koepsell, 2002). The most common symptoms of appendicitis are pain in the right lower abdomen, nausea, vomiting and loss of appetite. In pediatric patients about 30% of cases have an abnormal presentation (Daldal & Dagmura, 2020; Jones, Peña, Dunn, Nadalo, & Mangram, 2004).

A possible postoperative complication is the formation of adhesion at the site of the surgery which may lead to the obstruction of the bowel and lead to a second operation (Hansson, Khorram-Manesh, Alwindawe, & Lundholm, 2014). Delaying the treatment does not only increase the risk of complications but can also lead to death. Therefore, adequate diagnosis is essential to reduce the risk of unnecessary surgeries and perforation (Andersson, 2007). In recent years, there has been a significant increase in the use of imaging techniques in the diagnosis of acute appendicitis. Studies have shown that CT scans have a sensitivity and specificity of up to 95% in diagnosing appendicitis (Pickhardt, Lawrence, Pooler, & Bruce, 2011; Rao, Rhea, Novelline, Mostafavi, & McCabe, 1998). However, CT scans carry the risk of exposing children to radiation (Pogorelic, Rak, Mrklic, & Juric, 2015; Russell *et al*., 2013). In addition, the increase in the outer width of the appendix is important in the diagnosis of appendicitis (Chabanova *et al*., 2011). Also, researches continue to confirm

the effectiveness of blood cell tests. Numerous studies have highlighted the white blood cell, neutrophil to lymphocytes ratio, neutrophil cells, lymphocytes, C- reactive protein, mean platelet volume and platelet count in this study, (Boshnak, Boshnaq, & Elgohary, 2018; Khan *et al*., 2018; Poudel & Bhandari, 2017; Shimizu, Ishizuka, & Kubota, 2016). We ought to assess the relationship between blood tests, PAS clinical scoring and the measurement of the outer diameter of the appendix.

MATERIALS AND METHODS

This study includes 480 pediatric patients who underwent surgery for suspected acute appendicitis at the General Surgery Department of the MCHHC between May 2019 and December 2019. A postoperative histological evaluation divided the participants into two groups: those with a positive diagnosis (appendicitis) and those with a negative diagnoses (non-appendicitis). Clinical diagnosis was conducted using the PAS scoring system based on the pre-operative blood test results including white blood cells count, neutrophil count, lymphocytes count, and neutrophil-lymphocytes ratio (NLR). The width of the appendix was determined by ultrasound (US). Patients who didn't undergo US imaging, didn't present signs of appendicitis upon US evaluation, had an incomplete blood test result, and previously underwent abdominal surgery were excluded from this study. All the statistical analysis were conducted using SPSS (Version 20.0,SPSS Inc.,Chicago, IL, USA). The Shapiro-Wilk method was used if the parameters were normal. If not, the Mann-Whitney U test was used if the parameters were abnormal and didn't present any correlation. The Spearman correlation test was used to compare the parameters, while the (ROC receiver operating characteristic) curve analysis calculated the cut-off point and diagnostic accuracy of each parameter. The statistical significance was set at $p<0.05$.

RESULTS

A total of 516 children (≤18 years old) underwent surgical removal of the appendix following the suspicion of acute appendicitis. 36 children were excluded from this study as they didn't meet the selection criteria. Thus, the results were calculated from a total of 480 children, 269 (56%) male, and

Table 1. Comparison of the histological study results and outer diameter of the appendix measurements

Diameter		Histological results		Total	p-value
		+	-		
Diameter	6>	81(44%)	103(56%)	184(100%)	<0.001
	≥6	280(94.6%)	16(5.4%)	296(100%)	
Total		361(75%)	119(25%)	480(100%)	

Table 2. Correlation of the white blood cell count and PAS evaluation in patients with an outer diameter of the appendix ≤6mm

Parameters	Pathological diagnoses	N	mean±SD	median	Min-max	p-value
WBC	Inflammation	81	14.5±6.06	13.6	4.73-31.06	<0.001
	No inflammation	103	11.2±4.94	9.7	3.5-28.33	
NC	Inflammation	81	10.4±5.7	9.5	2.5-25.7	0.002
	No inflammation	103	7.9±4.6	6.9	0.8-25	
NLR	Inflammation	81	6.8±4.7	4.8	1.6-19	0.062
	No inflammation	103	5.1±6.5	3.9	0.98-9.8	
PAS	Inflammation	81	6.5±1.2	6	4-9	<0.001
	No inflammation	103	4.2±1.8	4	1-9	

Table 3. Correlation of the white blood cells count and PAS evaluation in patients with an outer diameter of the appendix >6mm

Parameters	Pathological diagnoses	N	mean±SD	median	Min-max	p-value
WBC	Inflammation	280	16.01±5.9	15.4	5.3-30.87	<0.001
	No inflammation	16	10±3.9	9.3	4.5-17.1	
NC	Inflammation	280	12.6±6.2	11.9	1-28.66	<0.001
	No inflammation	16	6.6±2.6	6.1	2.03-11.66	
NLR	Inflammation	280	8±6.07	6.3	0.41-32.5	0.052
	No inflammation	16	5.08±2.9	3.9	1.39-10.73	
PAS	Inflammation	280	7.1±1.34	7	1-10	<0.001
	No inflammation	16	4.3±1.45	4.5	2-7	

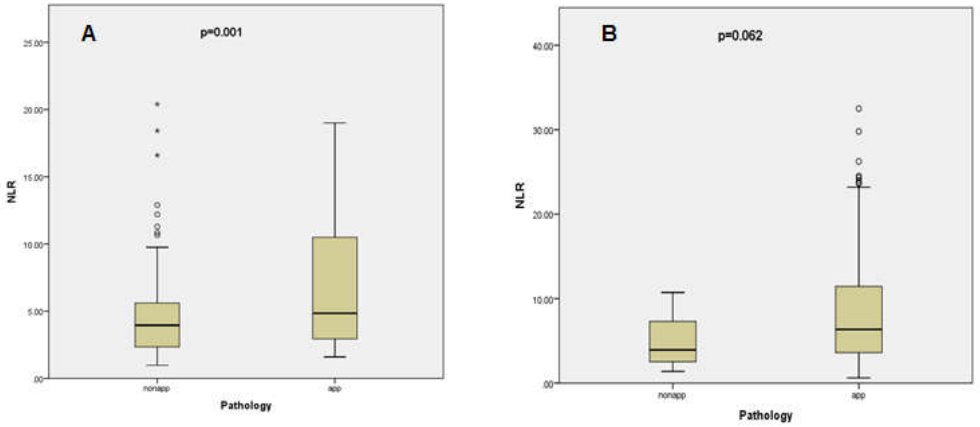

Figure 1a-PAS<6 and 1b-PAS ≥6 Neutrophil-lymphocyte ratio for each pathological diagnosis (inflammatoty and non-inflammatory)

Table 4. Area under the ROC

Parameters	Area under the curve	Standard error	95% CI
WBC	0.614	0.030	0.556-0.672
NC	0.716	0.026	0.666-0.766
NLR	0.934	0.013	0.909-0.960
PAS	0.889	0.017	0.851-0.926

Table 5. Diagnostic accuracy of each cut-off point of the white blood cells and PAS

Parameters	Cut-off point	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
WBC	12.7	57.7%	62.5%	82.2%	33.03%	58.9%
NC	9.6	62.5%	75.8%	88.5%	40.2%	65.8%
NLR	4.97	89.4%	83.3%	94.1%	72.4%	87.9%
PAS	6	90.8%	81.6%	93.6%	74.8%	88.5%

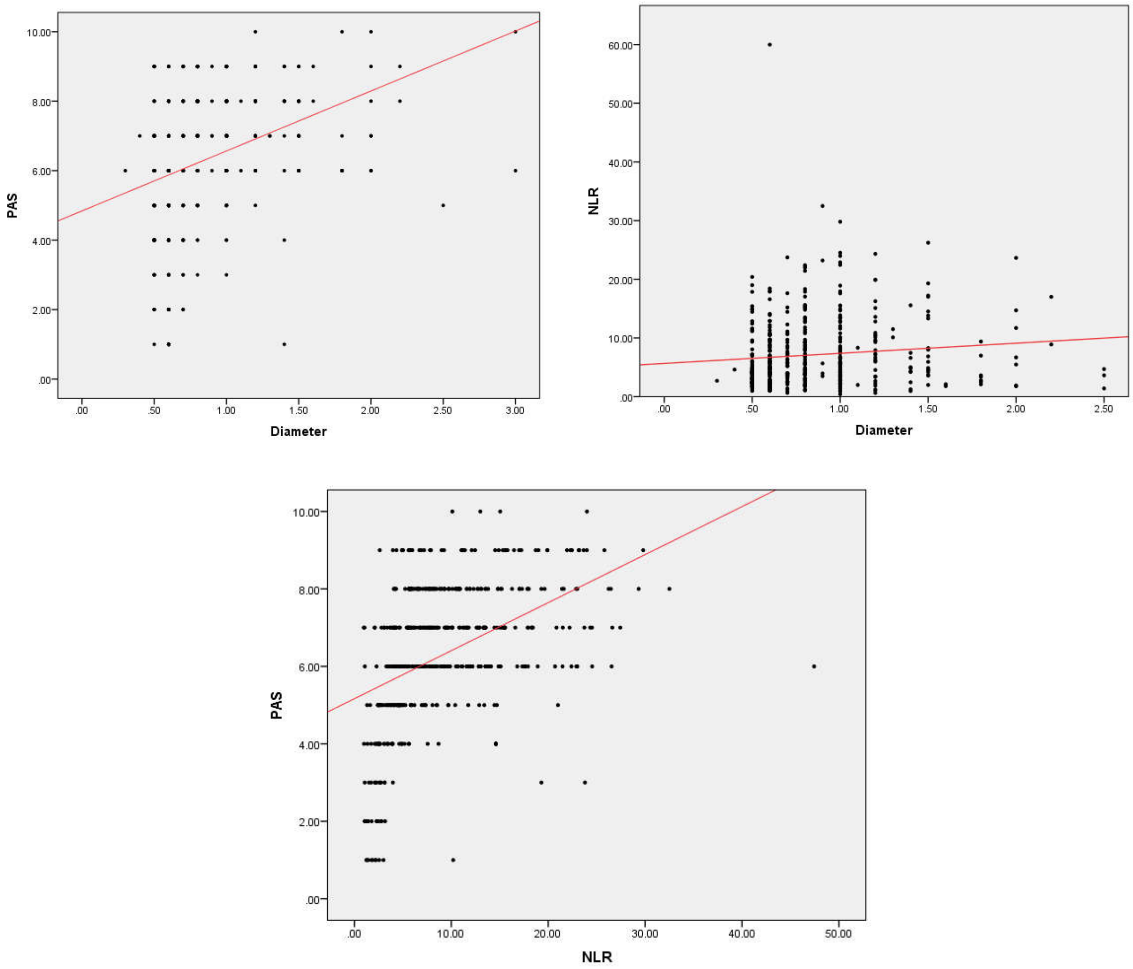

Figure 3. Scatter plot between the parameters

211(44%) female. The male to female ratio was 1.3:1. The mean age was 10.57±3.53. The relationship between PAS, NLR and the outer diameter of the appendix are shown in Figure3. The comparison of pathological study between the two outer diameter categories are presented in Table 1. PAS and NLR, and PAS and outer diameter of the appendix are been with middle correlation to each others.(r=0.494 and r=0.437) But NLR and outer diameter of the appendix are poor correlation.(r=0.169). Among the cases with an outer appendix diameter>6mm, 94.6% were inflammatory (positive diagnosis) and 5.4% didn't present any inflammation (negative diagnosis). In cases with an outer appendix diameter ≤6mm, 44% were inflamed and 56% were not. The diagnostic potential of each parameter and the area under the ROC are presented in Table 4 and 5. Figure 1 presents the changes in NRL based on the pathological diagnosis in the case of outer appendix diameter ≤6mm and >6mm. The area under the ROC of white blood cell count, neutrophil count, lymphocyte count, NLR and PAS criteria are presented in Figure 2. The white blood cell count and PAS criteria were significantly different between the pathological diagnosis groups (inflammatory and non-inflammatory) for an outer appendix diameter ≤6mm. The white blood cell count, neutrophil count and PAS criteria were significantly different when assessing the cases with an outer appendix diameter >6mm (Table 2,3).

DISCUSSION

In this study, we observed that NLR and PAS score values are higher in acute appendicitis cases than in non-appendicitis cases. The diagnostic accuracy of ultrasound imaging using the 6mm cut-off value is 88.4%(Daldal & Dagmura, 2020). It has

also shown that white blood cell count and neutrophil count can be used for the diagnosis. It should be noted that the increase in white blood cells and neutrophils during the initial examination can also occur in other inflammatory diseases. Acute appendicitis is usually diagnosed on the basis of a clinical presentation. The accurate diagnosis of the disease lead to a prompt initiation of treatment and avoid unnecessary surgical removal of the appendix. Researchers continue to highlight the importance of assessing the size of the appendix to diagnose. However, 5.4% of the appendices removed with an outer diameter greater than 6mm are in fact uninflamed and healthy. The parameter with the highest sensitivity is the PAS score, but it has low specificity. The NLR has the highest specificity. Other studies have reported that NLR is more important than the white blood count here in the diagnosis of appendicitis. The NLR is an effective, simple, and inexpensive test that can be easily calculated from a blood test. Our study shows that blood test results and PAS score are important when measuring the diameter of the appendix to diagnose appendicitis. There are, in fact, many advantages to using a combination of the less expensive and accessible diagnostic tests.

Conclusion

The outer diameter of the appendix measurement has 79.8% accuracy. This diagnostic accuracy can be enhanced with the combined usage of the PAS score and the assessment of the neutrophil-lymphocyte ratio.

REFERENCES

Andersson, R. E. 2007. The natural history and traditional management of appendicitis revisited: spontaneous resolution and predominance of prehospital perforations imply that a correct diagnosis is more important than an early diagnosis. *World journal of surgery, 31*(1), 86-92.

Boshnak, N., Boshnaq, M., & Elgohary, H. (2018). Evaluation of platelet indices and red cell distribution width as new biomarkers for the diagnosis of acute appendicitis. *Journal of Investigative Surgery, 31*(2), 121-129.

Chabanova, E., Balslev, I., Achiam, M., Nielsen, Y. W., Adamsen, S., Gocht-Jensen, P., . . . Thomsen, H. S. (2011). Unenhanced MR Imaging in adults with clinically suspected acute appendicitis. *European journal of radiology, 79*(2), 206-210.

Daldal, E., & Dagmura, H. (2020). *The Correlation between Complete Blood Count Parameters and Appendix Diameter for the Diagnosis of Acute Appendicitis.* Paper presented at the Healthcare.

Flum, D. R., & Koepsell, T. (2002). The clinical and economic correlates of misdiagnosed appendicitis: nationwide analysis. *Archives of surgery, 137*(7), 799-804.

Hansson, J., Khorram-Manesh, A., Alwindawe, A., & Lundholm, K. (2014). A model to select patients who may benefit from antibiotic therapy as the first line treatment of acute appendicitis at high probability. *Journal of Gastrointestinal Surgery, 18*(5), 961-967.

Jones, K., Peña, A. A., Dunn, E. L., Nadalo, L., & Mangram, A. J. (2004). Are negative appendectomies still acceptable? *The American journal of surgery, 188*(6), 748-754.

Khan, A., Riaz, M., Kelly, M. E., Khan, W., Waldron, R., Barry, K., & Khan, I. (2018). Prospective validation of neutrophil-to-lymphocyte ratio as a diagnostic and management adjunct in acute appendicitis. *Irish Journal of Medical Science (1971-), 187*(2), 379-384.

Pickhardt, P. J., Lawrence, E. M., Pooler, B. D., & Bruce, R. J. (2011). Diagnostic performance of multidetector computed tomography for suspected acute appendicitis. *Annals of internal medicine, 154*(12), 789-796.

Pogorelic, Z., Rak, S., Mrklic, I., & Juric, I. (2015). Prospective validation of Alvarado score and Pediatric Appendicitis Score for the diagnosis of acute appendicitis in children. *Pediatric emergency care, 31*(3), 164-168.

Poudel, R., & Bhandari, T. R. (2017). Risk factors for complications in acute appendicitis among paediatric population. *JNMA J Nepal Med Assoc, 56*(205), 145-148.

Rao, P. M., Rhea, J. T., Novelline, R. A., Mostafavi, A. A., & McCabe, C. J. (1998). Effect of computed tomography of the appendix on treatment of patients and use of hospital resources. *New England Journal of Medicine, 338*(3), 141-146.

Russell, W. S., Schuh, A. M., Hill, J. G., Hebra, A., Cina, R. A., Smith, C. D., & Streck, C. J. (2013). Clinical practice guidelines for pediatric appendicitis evaluation can decrease computed tomography utilization while maintaining diagnostic accuracy. *Pediatric emergency care, 29*(5), 568-573.

Shimizu, T., Ishizuka, M., & Kubota, K. (2016). A lower neutrophil to lymphocyte ratio is closely associated with catarrhal appendicitis versus severe appendicitis. *Surgery today, 46*(1), 84-89.

Styrud, J., Eriksson, S., Nilsson, I., Ahlberg, G., Haapaniemi, S., Neovius, G., . . . Granström, L. (2006). Appendectomy versus antibiotic treatment in acute appendicitis. a prospective multicenter randomized controlled trial. *World journal of surgery, 30*(6), 1033.

Varadhan, K. K., Humes, D. J., Neal, K. R., & Lobo, D. N. (2010). Antibiotic therapy versus appendectomy for acute appendicitis: a meta-analysis. *World journal of surgery, 34*(2), 199-209.

Wilms, I. M., De Hoog, D. E., de Visser, D. C., & Janzing, H. M. (2011). Appendectomy versus antibiotic treatment for acute appendicitis. *Cochrane database of systematic reviews*(11).

****