Original Article

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Exploring the Impact of Neutrophil to Lymphocyte Ratio in Predicting Acute Appendicitis on Rohingya Children in Cox's Bazar

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Abstract

Background: Acute appendicitis is one of the world's most frequent abdominal events in among pediatric group. Several helpful diagnostic methods are available for acute appendicitis, including evaluation of clinical symptoms, scoring systems, and imaging methods, in the present study, therefore, we tried to explain the usefulness of the Neutrophil-to-lymphocyte ratio (NLR) as a predictor of Rohingya children's acute appendicitis in Cox's Bazar. **Subjects and Methods:** This is a hospital based prospective observational study that was conducted at Palong General Hospital, over a period of 1.5 years from 8th February 2017 to 7th August 2018.The diagnosis of appendicitis of total 100 patients were confirmed by clinically & histopathologically and included in this study. Sample was selected by purposive consecutive sampling technique. **Results:** In the study, out of 24 patients of acute obstructive appendicitis in 5(20.8%) cases NLR was in between 6.1-8.0 and in 19(79.1%) cases it was ≥8.1. On the other hand, in 53(69.7%) patients of acute catarrhal appendicitis NLR was in between 6.1-8.0. The mean NLR value in acute catarrhal appendicitis was 5.2±4.1 and in acute obstructive appendicitis was 8.6±1.7, and there was a significant difference in NLR values between the groups. The p-value is < 0.00001. The result is significant at p <0.05. So, NLR shows a significant association with acute appendicitis in patients. The sensitivity and specificity of NLR to predict the diagnosis of acute appendicitis was 95.6% and 97.4% respectively. **Conclusion:** According to the findings of this study, the NLR is a good predictor of acute appendicitis and can be used in conjunction with other diagnostic methods.

Keywords: Neutrophil-to-lymphocyte ratio (NLR), acute appendicitis, Rohingya children, Remote area.

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Introduction

Acute appendicitis is a common surgical complication. Appendicitis can be difficult to diagnose, especially in children. [1] Surgery is the best choice of treatment for acute appendicitis. Complete blood count, USG of whole abdomen and CT scan of whole abdomen is used for diagnosing acute appendicitis. [2] This is not always possible in our settings because the majority of our patients are from low socioeconomic backgrounds and we have to deal with a large number of patients who require emergency appendectomy. Among them acute appendicitis can be evaluated early for surgical management by Neutrophil-to-lymphocyte ratio which is easily obtained from low-cost complete blood count. This article addressed the issue of neutrophil-to-lymphocyte ratio (NLR) as predictor in the diagnosis of acute appendicitis from the perspective of Rohingya Children in Cox's Bazar.

Subjects and Methods

This is a hospital based prospective observational study which takes 1.5 years (from 8th February 2017 to 7th August 2018) held on Palong General Hospital, Cox'sbazar.

Sample was selected by purposive consecutive sampling technique and included the group of patients with clinically suspected as acute appendicitis and undergone surgery in that hospital. Patients with appendicular lump, perforated appendix and gangrenous appendix were excluded from the study.

Study procedure:

In this study attending physician in the hospital evaluated patients just after admission. He/she would then inform the research physician about patient. Patient was managed according to the feature of corresponding etiology. A venous blood sample was collected from each subject for routine blood tests before administration of antibiotics. White blood cell (WBC) count, neutrophil count, platelet count and neutrophil-to-lymphocyte ratio (NLR) was measured according to reference value. On evaluation of neutrophil-to-lymphocyte ratio (NLR) and clinical findings, suspected acute appendicitis is classified into two grades: acute catarrhal appendicitis and acute obstructive appendicitis. Then proper surgical management was given and operative macroscopic feature of appendix assessed and recorded. Relevant laboratory investigations were performed from Palong General Hospital or any other recognized reputed laboratory. Pre-operative neutrophil-to-lymphocyte ratio (NLR) of acute appendicitis correlates with post-operative histopathological findings. All findings were recorded in case record forms.

Data analysis:

Keeping the research topic in concern, a preset questionnaire was set for data collection. Data for socio-demographic and clinical variables were obtained from all participants using a pre-designed and easily understandable questionnaire. After collection of all information, these data were checked, verified for consistency and edited for finalized result. Data processing work will consist of registration schedules, editing computerization, preparation of dummy table, analyzing and matching of data. After editing and coding, the coded data directly entered into the computer by using SPSS 22. Data cleaning validation and analysis was performed using the SPSS/PC software and graph and chart by MS excel. The result was presented in tables in proportion. P value <0.05 considered as significant.

Ethical measures:

- The aims and objectives of the study along with its procedure, method, risks & benefits was explained to the respondents in easily understandable local language and then informed written consent was taken from each patient.
- They were assured that all the information and records would be kept confidential and the procedure will be helpful for both the physician and the patients in making rational approach of the case management.

Results

Frequency of acute appendicitis is predominant at adolescent in both sex, 57.83% and 52.94% respectively. [Figure 1]

On clinical impression, 24.0% of patients suspected as acute obstructive appendicitis and remaining 76.0% patients suspected as acute catarrhal appendicitis. [Figure 2]

Present study shows that Peri-umbilical colic present in 100.0% of patients and nausea, vomiting in 74.0% patients and also gives impression that fever, anorexia; shifting pain to the right iliac fossa was the other commonest presentation (47.0%, 42.0% and 38.0% respectively). [Table 1]

On physical examination, findings revealed that tenderness in right iliac fossa present in 100.0% of patients, followed by rebound tenderness in 86.0% patients, localized peritonitis in 46.0%, and generalized peritonitis in 9.0% of patients. [Table2]

In this series, correlation had done between different types of appendicitis with neutrophil-to-lymphocyte ratio (NLR). Out of 24 patients of acute obstructive appendicitis, in 5(20.8%) cases NLR was in between 6.1-8.0 and in 19(79.1%) cases was ≥8.1. On the other hand, among the 76 patients of acute catarrhal appendicitis, in 53(69.7%) cases NLR was in between 6.1-8.0. The mean NLR value in acute catarrhal appendicitis was 5.2±4.1 and in acute obstructive appendicitis was 8.6±1.7, and there was a significant difference in NLR values between the groups. The p-value is < 0.00001. The result is significant at $p < 0.05$. So, neutrophil-to-lymphocyte ratio (NLR) shows a significant association with patients of acute appendicitis. [Table 3]

Postoperative histopathological findings revealed that, 77.0% of appendicitis diagnosed as acute catarrhal appendicitis and 23.0% regarded as acute obstructive. [Figure 3]

Among the 24 cases of acute obstructive appendicitis, histopathological and clinical findings confirmed that 22(95.6%) cases is acute obstructive appendicitis which correlates with NLR prediction, but 2(2.5%) cases proven as acute catarrhal appendicitis. In 76 cases of acute catarrhal appendicitis, histopathological and morphological findings confirmed that 75(97.4%) cases is acute catarrhal appendicitis which correlates with NLR prediction, but 1(4.3%) patient proven acute obstructive appendicitis. So effectiveness of NLR has proven significant in diagnosis of acute obstructive appendicitis. [Table 4]

In this study, the sensitivity and specificity of the Neutrophil-to-lymphocyte ratio (NLR) to predict the diagnosis of acute appendicitis was 95.6% and 97.4% respectively. [Figure 4]

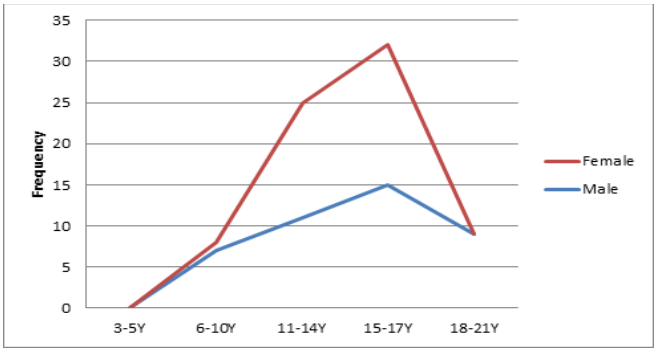

Figure 1: Line chart showing the frequency of disease with age variation (n=100)

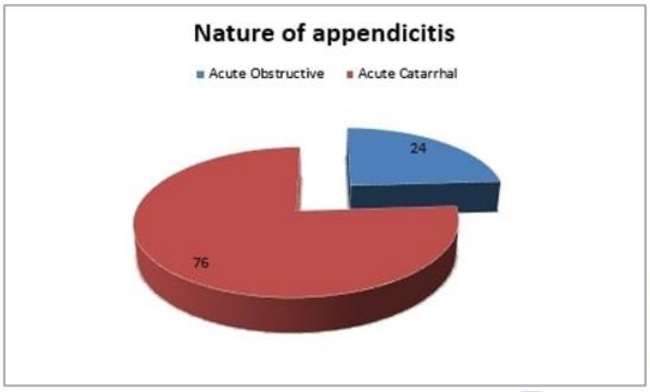

Figure 2: Clinical impression at presentation (n=100)

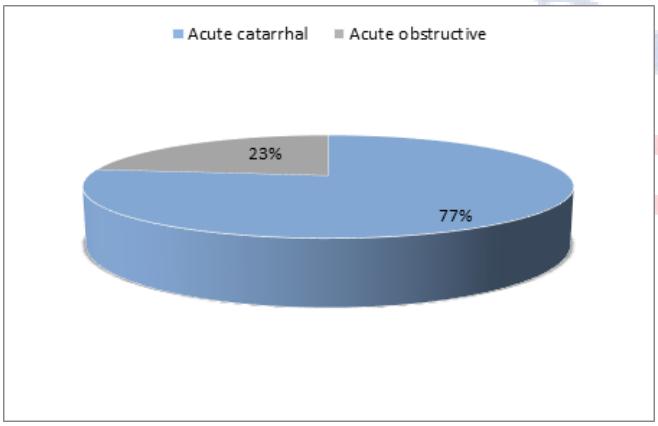

Figure 3: Histopathological and morphological evaluation of resected appendix (n=100)

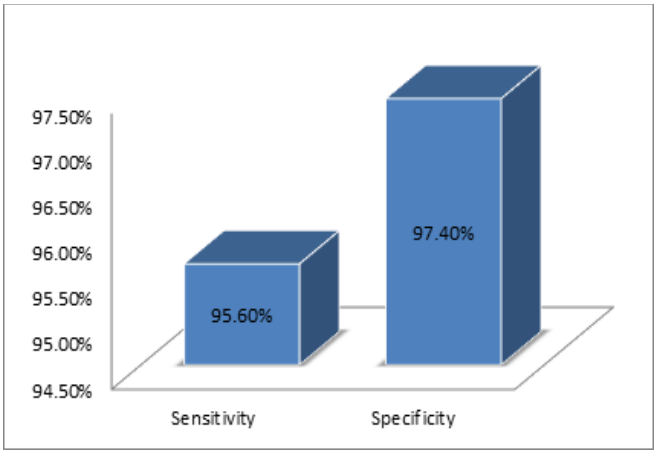

Figure 4: Determination of sensitivity, specificity of NLR (n=100)

Table 1: Clinical symptoms of Acute appendicitis (n=100)

Symptoms	Number of patients	Percentage (%)
Peri-umbilical colic	100	100
Nausea, vomiting	74	74
Fever	47	47
Anorexia	42	42
Pain shifts to the right iliac fossa	38	38
Diarrhea	6	6

Table 2: Clinical signs of Acute appendicitis (n=100)

Clinical sign	Number of patients	Percentage (%)
Tenderness in right iliac fossa	100	100.0
Rebound tenderness	86	86.0
Muscle guarding	38	38.0
Localized peritonitis	46	46.0
Generalized peritonitis	9	9.0
Rigidity	22	22.0

Table 3: Evaluation of validity of Neutrophil-to-lymphocyte ratio (NLR) to predict the diagnosis of acute appendicitis (n=100)

Neutrophil-to-lymphocyte ratio (NLR)	Type of appendicitis		P-value
	Acute catarrhal (non-obstructive), n=76	Acute obstructive appendicitis, n=24	
2.1-4.0	6 (7.8%)	0	0.00001
4.1-6.0	17 (22.3%)	0	
6.1-8.0	53 (69.7%)	5 (20.8%)	
≥8.1	0	19 (79.1%)	
Mean ± SD	5.2±4.1	8.6±1.7	

Table 4: Correlation of NLR with histopathological and Clinical diagnosis (n=100)

NLR prediction of acute obstructive appendicitis	Obstruction of appendix	
	Positive (n=23)	Negative (n=77)
Positive (n=24)	22(95.6%)	2(2.5%)
Negative (n=76)	1(4.3%)	75(97.4%)

True positive (TP) =22

False positive (FP) =2
False negative (FN) =1
True negative (TN) =75

Discussion

The present study was carried out with an objective to observing whether the validity of NLR in diagnosing acute appendicitis.

In the study, the maximum incidence was seen in the adolescent male and female patients.

Present study shows that peri-umbilical colic present in 100.0% of patient and nausea, vomiting in 74.0% patients. On physical examination, findings revealed that tenderness in right iliac fossa present in 100.0% of patient, followed by rebound tenderness in 86.0% patients, localized peritonitis in 46.0%, and generalized peritonitis in 9.0% of patients.

Findings of this study accordance with result of other study. Study by Colvin et al. reveals predominantly presented with inability to walk (82%), maximal right lower quadrant tenderness (82%), nausea (79%), pain with percussion, hopping, coughing (79%), and anorexia (75%) in their study. Fewer patients with appendicitis presented with a history of vomiting (66%), fever (47%), or diarrhea (16%), and these findings were not associated with the diagnosis. [3] Although physical examinations in younger children can be challenging at best, the physical examination (including repeat examinations, close follow-up, and observation) and history are key to making the diagnosis. Other study reported that classic signs of appendicitis on physical examination are: local tenderness with some rigidity of the abdominal wall at or near McBurney's point, positive Rovsing's sign, Obturator sign and Iliopsoas sign. [4]

Clinical impression suggested that, 24.0% of patients suspected as acute obstructive appendicitis and remaining 76.0% patients as acute catarrhal appendicitis. In all patients NLR was assessed according to operational definition. Out of 24 patients of acute obstructive appendicitis, in 5(20.8%) cases NLR was in between 6.1-8.0 and in 19(79.1%) cases was ≥8.1. On the other hand, among the 76 patients of acute catarrhal appendicitis, in 53(69.7%) cases NLR was in between 6.1-8.0. The mean NLR value in acute catarrhal appendicitis was 5.2±4.1 and in acute obstructive appendicitis was 8.6±1.7, and there was a significant difference in NLR values between the groups. So, neutrophil-to-lymphocyte ratio (NLR) shows a significant association with patients of acute appendicitis.

Result of this study correlates with similar study in abroad. In a study 1067 patients were analyzed. Mean NLR values for acute catarrhal appendicitis and acute obstructive appendicitis were 9.85±8.68 (SD) and 7.77±6.59 (SD), respectively, and there was a significant difference in NLR values between the groups. [5] Another study demonstrated that NLR seems a valuable marker to diagnose acute appendicitis. NLR was also significantly higher in the complicated acute appendicitis group than the uncomplicated appendicitis group (P = 0.008).[6] Preoperative NLR is a useful parameter to aid in the diagnosis of acute appendicitis and differentiate between catarrhal and obstructive appendicitis, and can be used as an adjunct to the clinical examination.[7] In another study reported that average value of NLR was detected as 8.06±5.97. In the obstructive appendicitis group, when compared with other appendicitis types a significantly high values have been detected (p<0.001). [8] So all finding indicates that NLR is a more precise diagnostic test for prediction of obstructive appendicitis.

Other studies also appraised the value of NLR in routine surgical practice. NLR is a simple, non-invasive and cost-effective marker of inflammation in various diseases and is calculated using data obtained from the complete blood count. NLR has been tested to date regarding its ability to accurately diagnose acute appendicitis preoperatively in unselected patients.[9] Another study reported among complicated acute appendicitis cases, NLR value was significantly higher (10.9±7.2 vs. 6.7±3.3, p=0.04), and the number of patients with WBC greater than 12x103 and CRP value greater than 15 mg/dl were significantly higher than the non-complicated group (65.8% vs. 34.3%, p=0.035 and 67.1% vs. 32.9%, p=0.046, respectively). In diagnosis of complicated acute appendicitis, the cut-off value for NLR was determined as 7.2 (p=0.017) (Sensitivity 83.6%, specificity 69.6%). [10] Moreover, some studies reported that NLR could also predict severity of the appendicitis as Ishizuka et al. showed that NLR > 8 shows a significant association with acute obstructive appendicitis in patients undergoing appendectomy. [11]

Postoperative histopathological findings revealed that, 77.0% of appendicitis diagnosed as acute catarrhal appendicitis and 23.0% regarded as acute obstructive appendicitis. Histopathological and clinical findings were correlated with NLR prediction. Among the 24 cases of suspected acute obstructive appendicitis, histopathological and clinical findings confirmed that 22(95.6%) cases are acute obstructive appendicitis which correlates with NLR prediction, but 2(2.5%) cases proven as acute catarrhal appendicitis. In 76 cases of acute catarrhal appendicitis, histopathological and clinical findings confirmed that 75(97.4%) cases is acute catarrhal appendicitis which correlates with NLR prediction, but 1(4.3%) patient proven as acute obstructive appendicitis. The sensitivity and specificity of the Neutrophil-to-lymphocyte ratio (NLR) to predict the diagnosis of acute appendicitis was 95.6% and 97.4% respectively. So effectiveness of NLR finding is significant in diagnosis of acute appendicitis has proven.

Our results show that mean value of NLR with acute obstructive appendicitis was significantly higher than acute catarrhal appendicitis. This value is much higher than the numbers given in previous reports. [12,13,14] In a study shows cut-off value of NLR was 4.68, giving a sensitivity of 65.3% and specificity of 54.7%. Negative predictive value (NPV)

was 23.0% and positive predictive value (PPV) was 88.4%. [15] Another study reported sensitivity and specificity were 84.2% and 56.7%, respectively. [16] Therefore, the current study demonstrated that NLR seems a valuable marker to diagnose acute appendicitis and good predictor of acute appendicitis.

Conclusion

This study reveals that acute appendicitis can be predicted considerably by NLR. NLR well monitors and reflects the evolution of acute appendicitis by inflammatory process and may be beneficial for the evaluation of acute appendicitis severity. We have identified a high positive association between NLR and histological results. Due to the strong specificity and sensitivity, easy availability and practical use, NLR can in particular be utilized for diagnosing acute appendicitis in remote locations with other diagnostic modalities; if there can be no imaging facilities for surgeons to exclude D/Ds.

Authors' contributions:
Adnan Walid is in charge of the work's idea development and design, as well as data collecting, analysis, and interpretation. Adnan Walid also wrote the manuscript, with assistance from Md Tameem Shafayat Chowdhury, Md Sharif Imam, Effat Sharmin, Showkat Azad, Mymoon Redwan Chowdhury, Efat Sharmin and Tanzil Farhad in drafting or critically revising it for important intellectual content. Adnan Walid has handled all of the patients' surgical needs. The final manuscript was read and approved by all authors.

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