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A study of neutrophil lymphocyte ratio (NLR) as a predictor of complicated appendicitis

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Abstract
Introduction: Appendicitis is one of the most common surgical pathologies. It is classified into complicated and uncomplicated appendicitis. Neutrophil Lymphocyte ratio (NLR) is an easily available lab parameter which can be used to differentiate complicated and uncomplicated appendicitis.
Aims and objectives: To identify the reliability of NLR as a predictor of complicated appendicitis and to study the association of increased NLR with complicated appendicitis, among the cases of appendicitis who presented to our tertiary care centre.
Methodology: This a retrospective study of all the cases operated for appendicitis in surgical department of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation over a period of 2 years. Clinical details were retrieved from case records and data was analysed using IBM SPSS version 21.
Results and conclusion: Total sample size was 250 (Male-193, Female-57), Mean age 30.6 ±15.294 years.The mean value of the NLR for Complicated appendicitis based on ROC analysis is 7.3 ± 2.98 and area under ROC curve was 0.7, with a Sensitivity of 98% and a specificity of 65% for predicting complicated appendicitis. NLR is a reliable preoperative investigation to predict complicated appendicitis.

Keywords: NLR, Complicated appendicitis

Introduction
Appendicitis is a common cause of abdominal pain and represents one of the most common surgical emergencies worldwide. The most common cause for appendicitis is luminal obstruction. The other causes are fecalith, lymphoid hyperplasia, parasitic infection, or a tumour (carcinoid, adenocarcinoma, mucocele, or metastatic carcinoma) [1]. It has an approximately 7% lifetime occurrence and complicated appendicitis is observed in one of three cases [2]. It is more common in the second decade of life [3]. Appendicitis can be classified as complicated when there is evidence of a perforated or gangrenous appendix, an intra-abdominal abscess, or faecal peritonitis often resulting in a longer length of stay and greater rates of morbidity and mortality [4].
Age, gender, epigastric pain, diarrhoea or malaise, history of right lower quadrant pain in the past 6 months and delay in presentation are factors with well-established evidence for predicting complicated appendicitis, based on many clinical studies [5]. There are number of screening and scoring tools like the Alvarado score and the Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score to aid in the diagnosis of acute appendicitis, but these have been criticised for not predicting the severity of acute appendicitis. Blood tests like White blood cells (WBC) counts, Elevated serum bilirubin, C-reactive protein (CRP) are being used to predict appendicitis and its severity but these parameters lack sensitivity and specificity making them unreliable for differentiating complicated appendicitis and uncomplicated appendicitis [5].
NLR is a simple inexpensive marker, which is easily calculated from the differential WBC counts. NLR provides information regarding two different immune and inflammatory pathways which may make it a potential marker to predict appendicitis and its severity. The neutrophil count highlights active and continuing inflammation, whereas the lymphocyte count highlights the regulatory pathway. The predictive value of NLR for differentiating complicated and uncomplicated appendicitis has been investigated by some authors [6].

Aim
To identify reliability of NLR as a predictor for complicated appendicitis.

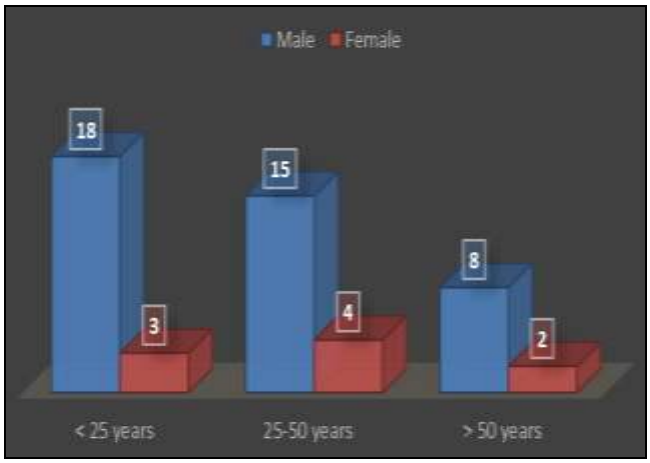
Objectives
To study the association of increased Neutrophil and Lymphocyte ratio with complicated appendicitis.

Inclusion criteria
All patients operated for acute appendicitis.

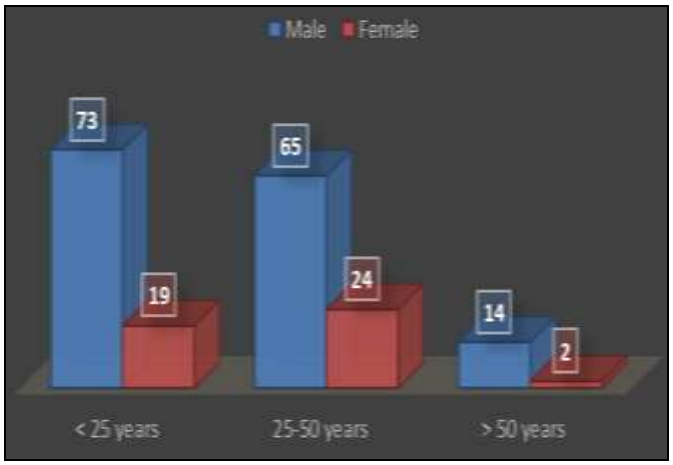
Exclusion criteria
Immunocompromised patients Patients who underwent conservative management for appendicular mass Patients who underwent negative appendectomy Patients whose histopathology reports are not available.

Methodology
This a retrospective study of all the cases operated for appendicitis in surgical department of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation during period of 2 years from September 2019 – August 2021. Demographic data is collected from case sheet records. Clinical and lab parameters, Ultrasonography or CECT reports are the tools used for diagnosing acute appendicitis. Intra operative findings and histopathological findings were retrieved for confirmation of diagnosis.
Data was analysed using IBM SPSS version 21.

Results
250 appendectomies were performed over a study period of two years. Male gender was more common (n = 193). Mean age across the cohort was 30.6 ±15.294 years.
Bar Diagrams 1, 2 depicts the age and gender distribution among complicated and uncomplicated appendicitis cohorts



Bar Diagram 1: Complicated appendicitis



Bar Diagram 2: Complicated appendicitis

Table 1, 2: depicts gender distribution among complicated and uncomplicated appendicitis cohorts.

Table 1		
Complicated Appendicitis		
Gender	Number	Percentage (%)
F	9	18
M	41	82
Total	50	100.0

Table 2		
Uncomplicated Appendicitis		
Gender	Number	Percentage (%)
F	48	24.0
M	152	76.0
Total	200	100.0

Table 3 represents data about different histopathological diagnosis. Of the total 250 cases, inflamed appendicitis was present in 200 specimens (80%) and complicated appendicitis in 50 specimens (20%) of which 19 were gangrenous appendicitis (7.6%), 22 were perforated appendicitis (8.8%) and 9 were Intra-abdominal abscess (3.6%).

Table 3: Represents data about different histopathological diagnosis

Histology	**Number**	**Percentage** (%)
Inflamed	200	80.0
Perforated	22	8.8
Gangrenous	19	7.6
Abscess	9	3.6
Total	250	100.0

The mean value of the NLR for Complicated appendicitis based on ROC analysis is 7.3 ± 2.98, Area under ROC curve was 0.7, with Sensitivity of 98% and specificity of 65% for predicting complicated appendicitis.
The mean value of NLR for Uncomplicated appendicitis is 4.98 ± 4.2, Area under ROC curve is 0.25, which is less significant when compared to complicated appendicitis group.

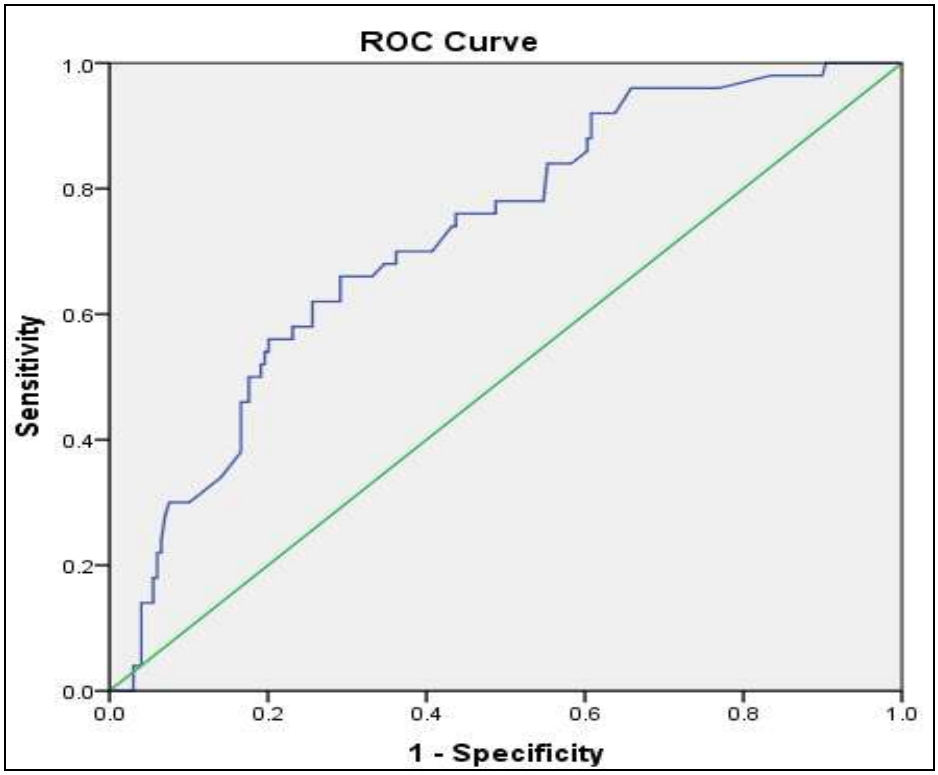


Fig 1: Mean Length of post-operative stay in complicated appendicitis is 5.64 ± 4.07 days

Table 4: Mean Length of post-operative stay in Un-Complicated appendicitis is 3.71 ± 1.25 days.

Post Op Stay					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Complicated	50	3.00	20.00	5.6400	4.07962
Un-Complicated	200	2.00	10.00	3.7100	1.25850

Correlation between NLR and length of post-operative stay, based on pearson correlation tests projected a R value - 0.05 and P value - 0.4 which was insignificant.

Discussion

Appendicitis is the most common surgical emergency with a male predominance and a high prevalence in the 2nd decade of life [3].

In the present study both complicated and uncomplicated appendicitis prevalence is more among younger age group with 113 patients <25 years of age in total of 250 cases (45.2%). In the case of complicated appendicitis group, prevalence is more common among patients < 25 years of age and >50 years of age with 31 out of 50 complicated appendicitis cases (62%) falling into these two groups.

In the present study, percentage of male and female patients were 77.2%, 22.8% respectively. Percentage of male and female patients were 82% and 18% in complicated appendicitis and 76%, 24% in uncomplicated appendicitis respectively, which shows a clear male predominance in all the three cohorts.

Fundamental treatment of acute appendicitis has been an emergency surgery until recent times. Conservative management of uncomplicated appendicitis is being emphasised for the past few decades with evidence supporting over all low complication rates and better outcome. However ideal serum marker to differentiate complicated and uncomplicated appendicitis pre-operatively has not been described. This study demonstrates that NLR is a useful diagnostic indicator of severity in acute appendicitis, which can be utilized to determine need of emergency surgery.

In the present study NLR value had Sensitivity of 98% and specificity of 65% for predicting complicated appendicitis with AUC of 0.7.

In a similar study by Jung SK, Rhee DY, Lee WJ et al, the AUC value of NLR was 0.755, sensitivity & specificity were 78.0 %, 65.9 % respectively and NLR was mentioned as an independent factor in determining perforated appendicitis.

In a meta-analysis by Hajibandeh S, Hajibandeh S, Hobbs N, et al. NLR had sensitivity of 76.92% and specificity of 100% with AUC of 0.91 for complicated appendicitis.

However in the present study correlation between NLR and Length of Post-operative stay was analysed which did not show any significant correlation.

Conclusion

In the present era of conservative management for acute appendicitis there is still no conclusive evidence for definitive indicators to differentiate complicated and uncomplicated appendicitis, both of which differ in management. Complicated appendicitis needs an emergency surgical procedure whereas uncomplicated appendicitis can be given a trial of conservative management. NLR which can be easily calculated from basic hemogram, is a less invasive, widely available and an economical parameter. Hence we propose NLR as a reliable lab parameter for differentiating complicated and uncomplicated appendicitis. However, this needs further research with bigger sample size and clinical trials.

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