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Laboratory markers predictive of complications in acute appendicitis: relationships between differential leukocyte counts

Marcadores laboratoriais preditivos de complicações na apendicite aguda: relações entre as contagens diferenciais dos leucócitos

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ABSTRACT

Introduction: Acute appendicitis is a leading cause of abdominal pain and acute abdomen. It ranges from mild cases to complications like perforation and peritonitis, and becomes a significant cause of morbidity and mortality when diagnosed late.

Objective: To predict the severity of acute appendicitis through leukogram, offering an earlier and more personalized approach to the diagnosis of the disease and contributing to the reduction of perioperative morbidity and mortality associated with this condition.

Method: Prospective observational study including 507 patients diagnosed with acute appendicitis and undergoing appendectomy. Demographic data, blood count and the degree of appendicitis by intraoperative evaluation were analyzed.

Result: Of the 507 patients included, 285 (56.2%) were male and the overall mean age was 34 years; 312 (61.5%) had uncomplicated appendicitis (grades 1 and 2), while 195 (38.5%) had complicated appendicitis (grades 3, 4 and 5). The analysis revealed statistically significant differences in variables such as neutrophils, lymphocytes and monocytes between the uncomplicated and complicated appendicitis groups. The neutrophil/lymphocyte (NLR) and lymphocyte/monocyte (LMR) ratios also showed statistically significant differences.

Conclusion: The use of laboratory markers and their neutrophil/lymphocyte and lymphocyte/monocyte ratios in the diagnostic evaluation of acute appendicitis can safely predict the degree of disease severity, contributing to more effective and personalized interventions.

KEYWORDS: Acute appendicitis. Laboratory markers. Severity of the disease. Perioperative morbidity and mortality.

RESUMO

Introdução: Apendicite aguda é uma das principais causas de dor abdominal e abdome agudo. Pode variar de quadros leves a complicações como perfuração e peritonite, sendo relevante causa de morbimortalidade quando diagnosticada tardiamente.

Objetivo: Predizer a severidade da apendicite aguda por meio do leucograma, oferecendo abordagem mais precoce e personalizada para o diagnóstico da doença e contribuir para a redução da morbimortalidade perioperatória associada à essa condição.

Método: Estudo observacional prospectivo abrangendo 507 pacientes diagnosticados com apendicite aguda e submetidos à apendicectomia. Foram analisados dados demográficos, hemograma e o grau de apendicite por avaliação transoperatória.

Resultado: Dos 507 pacientes incluídos, 285 (56,2%) eram do sexo masculino e a idade média geral foi de 34 anos; 312 (61,5%) apresentaram apendicites não complicadas (graus 1 e 2), enquanto 195 (38,5%) apresentaram apendicites complicadas (graus 3, 4 e 5). A análise revelou diferenças estatisticamente significativas em variáveis como neutrófilos, linfócitos e monócitos entre os grupos de apendicites não complicadas e complicadas. As razões entre neutrófilos/linfócitos (NLR) e linfócitos/monócitos (LMR) também apresentaram diferenças estatísticas significativas.

Conclusão: O uso dos marcadores laboratoriais e suas relações neutrófilos/linfócitos e linfócitos/monócitos na avaliação diagnóstica da apendicite aguda conseguem predizer o grau de severidade da doença com segurança, contribuindo para intervenções mais eficazes e personalizadas.

PALAVRAS-CHAVE: Apendicite aguda. Marcadores laboratoriais. Severidade da doença.Morbimortalidade perioperatória.

Central Message

This study sought to predict the severity of acute appendicitis through laboratory tests that are easily accessible in the vast majority of services, performing earlier diagnosis and management, thus reducing perioperative morbidity and mortality related to the disease.

Perspective

The use of laboratory markers and their neutrophil/lymphocyte and lymphocyte/moncyte ratios in the diagnostic evaluation of acute appendicitis can reliably predict the degree of disease severity, contributing to more effective and personalized interventions.

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INTRODUCTION

Acute appendicitis is among the most common causes of both abdominal pain and acute inflammatory abdomen.[1] Its incidence is higher in young men, but the disease is present in both sexes and in all age groups.[2] Its pathogenesis in most cases is related to obstruction of the appendix lumen, causing inflammation at the site; however, in some cases it is due to primary bacterial infection at the site.[3,4] It can range from mild to develop perforation, abscesses, and generalized peritonitis, and is an important cause of morbidity and mortality in the population when its diagnosis is made in more advanced stages.[5,6] Its most accepted treatment is currently surgical, through appendectomy, which can be laparotomy or laparoscopic.[1]

The diagnosis of the disease continues to be challenging, especially in females, and involves clinical and laboratory criteria and imaging findings. There are several diagnostic scores in the literature[5] that seek to indicate a greater or lesser diagnostic probability based on anamnesis, physical examination, and the use of inflammatory markers; however, in most cases, imaging tests are still necessary, especially computed tomography (CT)[1,7] which, despite being a diagnostic method with high sensitivity and specificity, has some disadvantages, such as radiation, which translates into a 0.2% increase in the risk of developing neoplasms in one exam. In addition, it adds costs to the service and longer hospital stay for the patient.[8-10]

In view of all the above, this study sought to predict the severity of acute appendicitis through laboratory tests that are easily accessible in the vast majority of services, performing earlier diagnosis and management, and thus reducing perioperative morbidity and mortality related to the disease.

METHOD

The study was approved by the Research Ethics Committee (REC) of the institution under CAAE 58148222.0.0000.0113.

A prospective observational study was carried out with all patients admitted to the Hospital Regional de São José Dr. Homero de Miranda Gomes in São José, SC, Brazil, diagnosed with acute appendicitis from May 2022 to January 2024, having undergone urgent laparotomic or laparoscopic appendectomy, over 15 years of age and both sexes. Those who had a complete blood count among their admission tests were included. The exclusion criterion for the study was the lack of a blood count and incomplete data in the medical records. The sample studied totaled 507 patients.

Data were collected through the electronic medical records of those included. The variables of interest were recorded in a Windows Excel spreadsheet for statistical analysis using the IBM Statistical Package for the Social Sciences (SPSS).

The following were analyzed: gender (male/female), age (years), blood count at hospital admission, and the degree of appendicitis by transoperative evaluation with the naked eye. Regarding the blood count, the differential counts of the leukogram cells were studied, and the neutrophil/lymphocyte ratios (NLR), neutrophils/monocytes (NMR) and lymphocytes/monocytes (MRL) in absolute numbers.

Acute appendicitis was classified according to the intraoperative findings of the surgical descriptions as proposed by Gomes and Nunes in 200611, as follows: grade 0 – normal appendix; 1 - hyperemia and edema; 2 - fibrinous exudate; 3 - segmental necrosis; 4A - abscess; 4B - regional peritonitis; 4C - necrosis of the base of the appendix; 5 – diffuse peritonitis. Subsequently, there was a division into 2 groups according to the degrees of severity, with uncomplicated appendicitis being grades 1 and 2 and complicated grades 3, 4, and 5.

Statistical analysis

Regarding the blood count, its measures of central tendency (mean) and dispersion (standard deviation) were studied, as well as the Mann-Whitney U test, in which the equality of the medians is tested.

RESULT

Regarding demographic characteristics, of the 507 patients, 222 (43.8%) were female and 285 (56.2%) were male. In addition, individuals with a mean age of 34 years were observed, with 32 years as the median for women and 30 for men, with a standard deviation of 14 years for both sexes (Table 1).

Observing the phase of the disease, it was divided by degree of severity, so that grades 1 and 2 represent uncomplicated appendicitis, and these were 312 (61.5%) cases. Complicated cases, which include grades 3, 4 and 5, corresponded to 195 (38.5%) cases. There was a predominance of grade 2, with 255 (50.3%) cases, and grade 4, with 87 (17.2%) cases (Table 1).

Regarding the laboratory data of the blood count, statistically significant differences were found in the following variables: neutrophils, lymphocytes and monocytes. For neutrophils/lymphocytes (NLR) and lymphocytes/monocytes (MRL) ratios, statistically significant differences were also observed between the groups of uncomplicated and complicated appendicitis (Table 2).

TABLE 1 — Epidemiology and clinical-surgical parameters

Variables	n (n=507)	% (100%)
Sex		
Female	222	43,80%
Male	285	56,20%
Age group – average and median by sex		
Average: 34 years ~ standard deviation 14 years		
Median female: 32 years old	-	-
Male median: 30 years old	-	-
Degree of severity		
Not complicated	312	61,50%
Grade 1	57	11,20%
Grade 2	255	50,30%
Complicated	195	38,50%
Grade 3	83	16,40%
Grade 4	87	17,20%
Grade 5	25	4,90%

TABLE 2 — Comparison of leukogram cells and their relationships according to groups

Parameters	Groups	n	Average	Standard deviation	p-value
Leukogram	Not complicated	312	12691	4498	0,09
	Complicated	195	14519	4885	
Neutrophils	Not complicated	312	9562	4275	0,001
	Complicated	195	11645	4526	
Lymphocytes	Not complicated	312	1965	983	0,005
	Complicated	195	1468	832	
Monocytes	Not complicated	312	893	422	0,000
	Complicated	195	967	528	
Neutrophils/Lymphocytes (NLR)	Not complicated	312	6,7	8,58	0,000
	Complicated	195	11,24	10,82	
Neutrophils/Monocytes (NMR)	Not complicated	312	16,32	51,37	0,34
	Complicated	195	17,65	19,1	
Lymphocytes/Monocytes (MRL)	Not complicated	312	3,12	7,07	0,003
	Complicated	195	1,98	1,99	

DISCUSSION

The present prospective study sought to evaluate the influence of laboratory test results on the diagnosis of acute appendicitis severity, specifically by analyzing the differential leukocyte count in the blood count, regarding the ratio between neutrophils and lymphocytes, neutrophils and monocytes, and lymphocytes and monocytes, in a significant "n" of patients for the period of time analyzed.

For the study population, it was observed that the epidemiology of acute appendicitis is very similar to that found in the literature, in which it is observed that the disease occurs in Brazil with an incidence that varies between 57.3% and 59.03% for men and that the average age of its diagnosis is 35.35 years.[12-15]

The relationship between the absolute value of the leukocyte count and the severity of the disease was established, and values above 14,519 p/mm^3 show an association with intraoperative complication findings, data tending to statistical significance (p = 0.09). Other authors describe similar findings in the literature, corroborating the present study. Elgamal, Omran and Meselhy16 also found a directly proportional relationship between the variables of interest, with statistical significance (p = 0.03), in addition to showing that values above 14,010 were related to complicated acute appendicitis. For Melo et al.[17] value above 14,141 was related to suppurative appendicitis.[17]

The leukocyte differential plays an important role as an inflammatory marker in several clinical conditions, including acute inflammatory processes. Its main components – neutrophils, lymphocytes, and monocytes – were also statistically relevant in the present study and, when evaluated together with other clinical-laboratory markers, allow a more comprehensive assessment of the patient's health status, as well as provide valuable information on the type of inflammatory response.

For laboratory markers, it was observed that values in neutrophil/lymphocyte ratios (NLR) above 11.24 and lymphocytes/monocyte ratios (MRL) below 1.98 may be indicative of complicated acute appendicitis (p <0.05).

With regard to the NLR, it was found that the higher the value of the ratio, the greater the degree of complication of the disease, and the worse the patient's prognosis. This fact is also verified in other studies that evaluated this marker in patients with sepsis, such as Lin et al.[18] It was further observed that NLR is an independent predictor of mortality.[18,19]

In a study similar to the one carried out at the Regional Hospital of São José, but retrospectively, Mori et al.[20] evaluated the preoperative RLN in patients with acute appendicitis and concluded that this is the most useful indicator for predicting postoperative complications, especially infectious complications.[20] In addition, Wautier and Wautier[21] showed that in other conditions involving systemic inflammation, such as neoplasms, the findings of the present study are corroborated, in which worse outcomes are observed in patients with higher values of the ratio under study.[21]

The limitations of the study refer to the fact that it was an observational study, with an opportunity sample. Thus, it could only be inferred that, for similar populations, similar results are expected, but a random sample would be necessary for the data to be extrapolated to the general population. It is suggested, therefore, that new studies on the subject be carried out to enrich the data obtained.

CONCLUSION

The use of laboratory markers and their neutrophil/lymphocyte and lymphocyte/moncyte ratios in the diagnostic evaluation of acute appendicitis can predict the degree of severity of the disease with confidence, so that therapeutic interventions can be carried out early and assertively, improving the prognosis of these patients.

Authors' contributions

Marcos Tulio Silva – Conceptualization, Writing – proofreading and editing
Nicolau Fernandes Kruel - Formal Analysis, Project Management
Orli Franzon - Research
André Luiz Parizi Mello - Methodology
Gabriel Ferreira Pires - Validation
Matheus Vinícius Sevald Vicente - Writing – original draft

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