RESEARCH ARTICLE

NEUTROPHIL/LYMPHOCYTE RATIO COMPARED TO SERUM BILIRUBIN LEVELS AS A PREDICTOR OF SEVERITY IN ACUTE APPENDICITIS

Ofir Rodríguez- Aguilera, [1]Hugo Enrique Reyes- Devesa[2], Reyes Javier Cervantes- Ortiz[3], Verónica Torres- Medina[4] and Sergio Esquivel- Torres[5]

[1]High Specialty Hospital of Veracruz, Veracruz, México; 4th year Surgical Resident
[2]High Specialty Hospital of Veracruz, Veracruz, México;, Hospital Director
[3] High Specialty Hospital of Veracruz, Veracruz, México; General Surgeon
[4]High Specialty Hospital of Veracruz, Veracruz, México; Anesthesiologist
[5] High Specialty Hospital of Veracruz, Veracruz, México; Head of Surgical Department

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ABSTRACT

Objective: To determine the neutrophil/lymphocyte ratio compared to serum bilirubin levels as a predictor of severity in acute appendicitis. **Methodology:** An observational, cross-sectional, retrospective, and descriptive study was conducted in patients admitted for acute appendicitis to compare the positive predictive value of complicated acute appendicitis using the neutrophil-lymphocyte index, with a cutoff point of 3, compared to total serum bilirubin levels with a cutoff point greater than 1.0 mg/dl. It was analyzed with descriptive statistics, diagnostic tests with a 95% confidence interval, and using the SPSSv26.0 statistical package. **Results:** There were 60 patients diagnosed with acute appendicitis, with an average age of 34.4 ± 14.2 years, 35 (58%) were female, with an average evolution time of 2.4 ± 2.1 days, and 4 (6.7%) were hypertensive. No complications were observed in 30 cases (50%), abscess, and perforation in 9 cases (15%), with perforation only occurring at the same frequency. The positive predictive value of the neutrophil/lymphocyte index for the presence of severe complications showed a sensitivity of 100%, while total bilirubin showed 55%; the negative predictive value of the neutrophil/lymphocyte index was 100%, and total bilirubin was 40.6%. ROC curve with IN/L at 0.46 and total bilirubin at 0.36. **Conclusion:** The neutrophil/lymphocyte ratio has higher sensitivity and negative predictive value for complicated acute appendicitis than the level of serum bilirubin.

INTRODUCTION

Acute appendicitis is the most common indication for emergency abdominal surgery; it occurs most frequently between the second and third decades of life and can be a disease with serious repercussions on the patient's health. The lifetime risk of developing acute appendicitis is 8.6% for men and 6.7% for women, with an incidence of 1.5 to 1.9 cases per 1000 inhabitants. The origin of acute appendicitis is the obstruction of the appendicular lumen, which can be secondary to fecaliths, lymphoid hyperplasia, foreign bodies, parasites, primary tumors, etc. Abdominal pain is the central symptom of acute appendicitis, initially diffuse in the lower epigastrium or umbilical area, moderately intense and constant, and later migrating to the right iliac fossa. Occasionally, with intermittent colicky pain, it can present with atypical clinical pictures, mainly in children and the elderly. Vomiting, fever, anorexia, and localized pain in the McBurney point may also occur, making clinical evaluation important for a definitive diagnosis. Marco Gamero reported in a year of emergency surgery that 51% of cases were uncomplicated appendicitis and 49% were complicated.

Complicated acute appendicitis is characterized by diffuse peritonitis, perforation, or abscess, and intestinal perforation can occur 8 to 24 hours after the onset of pain. The risk of mortality in uncomplicated acute appendicitis is less than 0.1%, but the risk increases to 0.6% in complicated appendicitis, while perforated appendicitis has a mortality rate of around 5%. The distinction between complicated and uncomplicated appendicitis is key to the management of appendicitis, and the calculation of the neutrophil/lymphocyte index (INL) can be significantly higher in patients with complicated appendicitis compared to those with simple appendicitis, with a sensitivity of 96%. On the other hand, the liver acts as the first line of defense in clearing toxic substances, bacteria, and their products; if the bacterial load exceeds the function of Kupffer cells, it can lead to dysfunction or damage reflected in an increase in serum bilirubin. Therefore, serum bilirubin levels have been investigated as predictors of severity in acute appendicitis. Palma-Ramírez *et al*. determined that the best cutoff level, total bilirubin ($\geq$1 mg/dl), had a sensitivity of 80% and a specificity of 67.2% for the presence of complicated acute appendicitis.

The purpose of this study is to compare the effectiveness of the neutrophil/lymphocyte ratio with serum bilirubin levels to predict the presence of complicated acute appendicitis.

MATERIALS AND METHODS

Through an observational, prospective, cross-sectional, and analytical design, a study was conducted on patients over 18 years old who presented to the emergency department of the Hospital de Alta Especialidad de Veracruz with clinical symptoms compatible with acute appendicitis. Patients with a history of hemolytic, hepatic, and/or biliary diseases or those with pregnancy were excluded. The sample size was calculated using a formula for descriptive studies without knowing the universe. Subsequently, the study was explained to the patient, informed consent was obtained, a complete medical history was taken, and preoperative laboratory studies, including liver function tests to measure serum bilirubin levels, were performed. These were then analyzed along with the surgical findings of appendectomy. The neutrophil/lymphocyte index was defined as the absolute count of neutrophils divided by the count of lymphocytes, obtained: INL = Neutrophils/Lymphocytes. We used the cutoff point to define hyperbilirubinemia as total bilirubin > 1.0 mg/dl. Both were compared along with the presence of complications such as gangrene, perforation, sepsis, and peritonitis. The data obtained were entered into an Excel table for descriptive analysis, using measures of central tendency: mean, median, mode; diagnostic tests with a 95% confidence interval, and obtaining the AUC curve, supported by the SPSSv26.0 statistical package.

RESULTS

Sixty patients with a diagnosis of acute appendicitis were selected, with a mean age of 34.4 ± 14.2 years, female predominance (58%), an average evolution time of 2.4 ± 2.1 days, and comorbidity of arterial hypertension in 4 cases (6.7%), type 2 diabetes mellitus in 2 cases (3.3%). As shown in Figure 1.
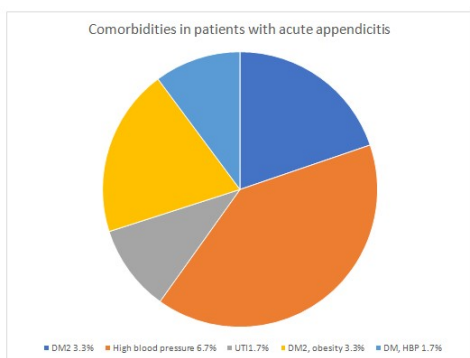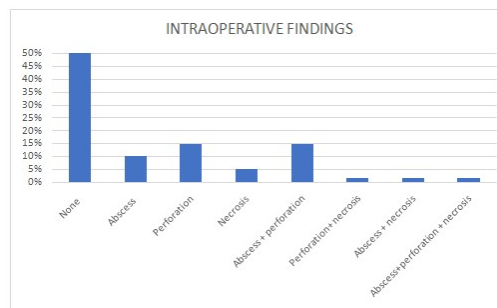

SOURCE: HAEV

Figure 1. Comorbidities in patients with acute appendicitis

There was no complicated acute appendicitis in 30 cases (50%); in cases of complicated acute appendicitis, there was abscess and perforation in 9 cases (15%). As seen in Figure 2. The predictive value of the neutrophil/lymphocyte index (IN/L) for the presence of complicated acute appendicitis shows a sensitivity of 100% (95% CI 84.5-100); Total serum bilirubin levels 55% (40-69); negative predictive value of IN/L 100% (95% CI 67.6-100); while total bilirubin was 40.6% (25.5-58). As shown in Table 1.
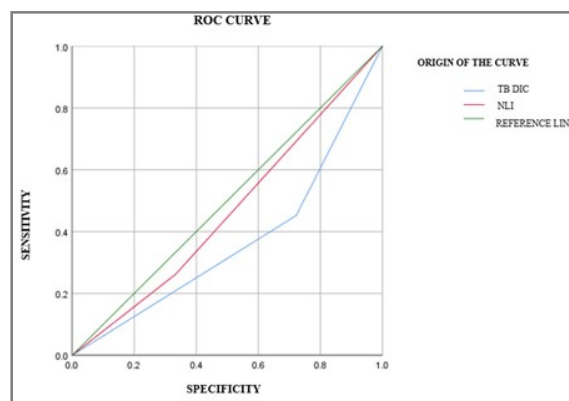

SOURCE: HAEV

Figure 2. Intraoperative findings in acute appendicitis

Table 1. Predictive value of the neutrophil/lymphocyte index and total bilirubin as predictors of severe complications in acute appendicitis

Diagnostic Test	Neutrophil/ Lymphocyte Ratio (Ci 95)	Total bilirrubin (ci 95%)
Sensitivity	100% (84.5-100)	55% (40-69)
Specificity	27% (14.2-44.4)	72% (49-87.5)
Positive Predictive Value	49% (34.6-63.2)	82% (64.4-92)
Negative Predictive Value	100% (67.6-100)	40.6% (25.5-58)
% False Positives	73% (55.6-85.8)	28% (12.5-51)
% False Negatives	0% (0-15.5)	45.2% (31.2-60)

SOURCE: HAEV

Figure 3. Area under the ROC curve for the neutrophil/ lymphocyte index and total bilirubin as predictors of severe complications in acute appendicitis N = 60

Areaunder the curve					
Test Outcome Variables	Area	Error Desv[a]	A symptotic significance[b]	95% Asymptotic Confidence Interval	
				LowerLimit	UpperLimit
TB dic	.365	.077	.100	.213	.517
NLI	.464	.083	.663	.302	.626

The test outcome variables TB dic, NLI have at least one tie between the true positive and true negative groups.
The statistics may be biased a. Under the non- parametric assumption. b. Null hypothesis: true area= 0.5

The ROC curve had a discrimination for the presence of complications of 0.36 for total bilirubin and 0.46 for IN/L. As detailed in Figure 1.

DISCUSSION

In this study, 60 patients with acute appendicitis were selected, with an average age of 34.4 years and a female predominance of 58%, which were similar to the study by Guevara Castro *et al.*, where female predominance was also 54%; but different from the sex frequency in the study by Quizhpi Guamán *et al.*, where acute appendicitis was more frequent in men at 58%, and the average age was 25 years.

Comorbidity of arterial hypertension was observed in 7%, and diabetes mellitus type 2 was lower at 3.3%; similar to that reported in the study by Pineda Villeda, which mentions diabetes mellitus at 6% and hypertension at 3%. In our study population, 50% of cases of acute appendicitis were complicated, with the most frequent complication being the presence of perforation and abscess; which agrees with the research by Aguiló J., *et al*., in which complicated appendicitis with perforation/peritonitis was the most frequent.

The predictive value of the neutrophil/lymphocyte index for the presence of complicated acute appendicitis has a sensitivity of 100%, negative predictive value of 100%, which in the study by Ahmed S. *et al*., using a cutoff point of 6.1, demonstrated diagnostic capacity for complicated acute appendicitis, sensitivity 69.8%, and negative predictive value of 38%; with values lower than our study. However, Seclén-Hidalgo *et al*., with a cutoff point of 6 for the IN/L, showed sensitivity of 78%, specificity of 84%, positive predictive values of 82% and negative predictive values of 80.8%, in a higher proportion than in our study subjects. Regarding the effectiveness of serum bilirubin as predictors of the severity of acute appendicitis, sensitivity was 55%, and positive predictive value was 82%, with sensitivity lower than that found in the study by Palma-Ramírez E, *et al*.; at 80%. The ROC curve, which helps differentiate subjects with the presence of complicated acute appendicitis, showed IN/L at 0.46 and total bilirubin at 0.36.

CONCLUSSION

The neutrophil/lymphocyte index as a predictor of complicated acute appendicitis showed a better negative predictive capacity and good discrimination compared to total bilirubin.

Conflict of Interest: None

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