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Level of accuracy in the diagnosis of acute appendicitis: comparative analysis between the scale of Alvarado, RIPASA and new proposal

Escala de mayor precisión para el diagnóstico de apendicitis aguda: análisis comparativo entre la escala de Alvarado, RIPASA y nueva propuesta

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Keywords:
Acute appendicitis, Alvarado scale, RIPASA scale.

Palabras clave:
Apendicitis aguda, escala Alvarado, RIPASA.

ABSTRACT

Objective: To compare the Alvarado scale, RIPASA, and a new proposal the most accurate in the early diagnosis of acute appendicitis. **Setting:** Atizapán General Hospital, ISEM. **Design:** Prospective, cross-sectional, comparative, and observational study. Statistical analysis: measures of central tendency, analysis of diagnostic tests (sensitivity, specificity, predictive values), and ROC curve. **Patients and methods:** At the General Hospital of Atizapán (Period: November 2016-October 2017) the 182 patients studied came to the emergency room with an abdominal pain syndrome suggestive of acute appendicitis. Simultaneously, Alvarado scale, RIPASA, and a new scale were applied. General epidemiological, clinical, and surgical findings were noted correlating them with the histopathology of the appendix as well as post-operative evaluation and complication rate. **Results:** Taking into account the high scores of each scale applied to patients, the sensitivity of Alvarado was 81% with a positive predictive value of 70%, that of RIPASA was 88% with a positive predictive value 92% and the scale proposed had a sensitivity of 91% with a positive predictive value of 98%. The area under the ROC curve of the scale of Alvarado was 0.83, that of RIPASA was 0.85, and the area of the new proposed scale was 0.92. **Conclusions:** The three scales showed good sensitivity in the diagnosis of acute appendicitis. However the proposed new scale is more exact in the diagnosis, with a much higher positive predictive index, favoring not only less white laparotomies but even an earlier and timely diagnosis with a lower rate of advanced phases and complications.

RESUMEN

Objetivo: *Comparar la escala de Alvarado, RIPASA, y una nueva propuesta para conocer cuál es más exacta en el diagnóstico temprano de apendicitis aguda.* ***Sede:*** *Hospital General de Atizapán, ISEM.* ***Diseño:*** *Estudio prospectivo, transversal, comparativo y observacional.* ***Análisis estadístico:*** *Medidas de tendencia central, análisis para pruebas diagnósticas (sensibilidad, especificidad, valores predictivos) y curva ROC.* ***Pacientes y métodos:*** *Se estudiaron 182 pacientes que ingresaron al Servicio de Urgencias del Hospital General de Atizapán en un periodo de noviembre de 2016 a octubre de 2017, con síndrome doloroso abdominal sugestivo de apendicitis aguda; se les realizaron estudios de laboratorio y gabinete, aplicando en forma simultánea las escalas de Alvarado, RIPASA y una nueva escala. Se observaron hallazgos epidemiológicos generales, clínicos y quirúrgicos y se les correlacionó con el resultado de histopatología del apéndice así como con la evolución postquirúrgica y la tasa de complicaciones.* ***Resultados:*** *Tomando las puntuaciones altas de cada escala aplicadas en los pacientes se obtuvo que la sensibilidad de Alvarado fue de 81% con valor predictivo positivo de 70%; RIPASA 88% con valor predictivo positivo de 92% y en la nueva escala propuesta la sensibilidad fue de 91% con valor predictivo positivo de 98%. El área bajo la curva ROC de la escala de Alvarado fue de 0.83, RIPASA fue de 0.85, y la escala propuesta de 0.92.* ***Conclusiones:*** *Las tres escalas mostraron buena sensibilidad para el diagnóstico de apendicitis aguda. Sin embargo, la escala propuesta presenta mayor exactitud diagnóstica con un índice predictivo positivo muy superior, lo que favorece no sólo la disminución de laparotomías blancas, sino un diagnóstico más temprano y oportuno con menor tasa de fases avanzadas y complicaciones.*

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INTRODUCTION

Acute appendicitis (AA) is the most frequent cause of acute abdominal pain: it represents 47.8% of surgical admissions in emergency services.[1] In Mexico, according to figures of the National Institute of Statistics, Geography and Informatics (Instituto Nacional de Estadística Geografía e Informatica, INEGI), in 2008, 60,668 cases of acute appendicitis were admitted in all institutions of the country's health services. In the United States, between 250,000 and 280,000 new cases are documented every year, with a mortality of 0.0002% and a morbidity of 3% when diagnosis and timely treatment are carried out.[2,3] The probability of presenting AA is one in five at birth, one in 35 at age 50 and younger than one in 100 at age 70. One in 15 people will develop an acute appendicular picture at some point in their lives. The literature reports that the overall risk of appendicitis is 8.6% for men and 6.7% for women in all age groups.[4,5] Some authors have mentioned that the population most affected is between 25 and 35 years of age.[6,7] Others mention that the disease occurs at all stages, but is more frequent in the second and third decades of life, in average around 22 years.[2] A general parallelism is known between the amount of lymphoid tissue in the appendix and the frequency of acute appendicitis, the peak of which occurs in mid-adolescence.

The diagnosis of acute appendicitis is primarily clinical; however, it is difficult in the initial stages of the process because findings can be confusing, especially at the extremes of life and in patients who consume steroids, pain relievers or antibiotics, those immunosuppressed or during pregnancy. Although the symptomatic background may vary, cardinal symptoms are generally present.

Some authors are in favor of carrying out imaging procedures to all patients with a clinical suspicion of appendicitis,[8] others prefer that this be carried out only in doubtful cases, and a few assure that diagnostic images are not useful.[9] Multiple reports have been published. Articles regarding the efficiency of various imaging modalities for the diagnosis of acute appendicitis depending on variables such as age, gender, and specific clinical conditions, have been published.[9]

This has led to numerous investigations to identify clinical, laboratory, and radiological findings with greater diagnostic certainty for AA and the development of clinical scoring systems to guide the physician to the correct diagnosis, to reduce delay and decreased rates of negative appendectomies. However, the diagnostic scales (Alvarado and Modified Alvarado) have a sensitivity and specificity of less than 90%, which still leads to delayed diagnosis and early treatment, with an impact on morbidity and mortality rates, and increased costs. The RIPASA scale (named after its origin in the Raja Isteri Pengiran Anak Saleha Hospital, in the north of the island of Borneo, in Southeast Asia), increases its sensitivity. However, surgeries continue to be carried out in patients complicated by long evolution, even of weeks' length, having been managed with multiple treatments for diverse diagnoses which modify the condition, leading to serious complications, and putting patients and the entire medical staff, from the outpatient clinic, the emergency room, and even the surgical team, in medical-legal danger.

Since its inception, the diagnosis of acute appendicitis is clinical, with a characteristic symptomatic evolution even in atypical cases. We already know its symptomatic variants and its anatomical variants, so early surgical management should not be delayed in a patient with symptoms of abdominal pain characteristic of acute appendicitis.

On the other hand, there is sometimes no laboratory or imagery support in some first-contact medical facilities, mistakenly prescribing medical treatment for a different diagnosis, altering the evolution of the condition, and leading to complications that can be catastrophic.

As Dr. Weber recently mentioned: "it is unfortunate that, based on fashions in other countries, less and less physicians are seen to carry out a thorough history or palpate the abdomen, basing their diagnosis only on laboratory or "routine" imaging. It is condemnable to belittle clinical intuition, based on knowledge and experience, not taking into account its usefulness, cost, risk and the

Table 1: Alvarado diagnostic scale for acute appendicitis.

Parameter	Observations	Score
Signs	Migration of pain	1
	Anorexia and/or urinary ketone bodies	1
	Nausea and vomiting	1
Symptoms	Pain in Right Iliac Fossa (RIF)	2
	Rebound pain	1
	Fever	1
Laboratory	Leukocytosis (+ 10,000)	2
	Left shift (neutrophils > 75%)	1

According to the score, management is suggested: If the score is from 1 to 4, there is a very low probability of appendicitis. With 5 and 6 points, the patient presents with probable appendicitis and will require serial clinical and laboratory evaluations, as well as some imaging studies (US, TAC). A score greater than 7 as a "unique strategy" to decide which patient requires surgery.
Source: Alvarado, 1986.[11]

benefit they can provide to the specific case, and not making a rational and proportionate use of diagnostic methods".[10] Perhaps we should resume and reinforce specific skills, competences, and know-how to carry out a good semiology of acute abdomen at the universities.

Diagnostic scales

Of the clinical scales for the diagnosis of appendicitis, the best known are: that of Alvarado, Solís-Mena, Teicher, Ramírez and Lindberg, and more recently that of RIPASA.

The clinical scale proposed by Dr. Alfredo Alvarado in 1986[11] has demonstrated its utility as a typing tool for the management and treatment of patients with acute appendicitis. It included the most frequent symptoms and signs found in patients with suspected acute appendicitis. It considered eight main characteristics extracted from the clinical picture of acute appendicitis and grouped under the MANTRELS mnemonic, for those signs and symptoms considered important in the disease, these are Migratory pain (to the lower right quadrant), Anorexia and/or ketonuria, Nausea and/or vomiting, Tenderness in the right lower quadrant, Rebound sign, Elevation of temperature, Leukocytosis, and neutrophil Shift to the left *(Table 1)*.

The RIPASA Scale

In 2010, a scale was developed at the RIPAS Hospital in the north of Borneo, Southeast Asia, to improve the early diagnosis of acute appendicitis, called the RIPASA Scale, carried out by Brunei Durussalam at the Raja Hospital Isteri Pengiran Anak Saleha (RIPASA) as a need to adapt ethnic differences, diet, lifestyle, and type of population (migration) *(Table 2)*. It was reported in 2012 in a study from the Hospital General de México with better sensitivity (91%) and specificity (84%).[12]

Integral proposed scale

Several diagnostic scales have been proposed in AA. However, we are moving away from the foundation, which is to simplify the diagnosis, and make it essentially clinical. Some scales are complex and do not simplify the process, either greater specificity and sensitivity must be found or continue with the Alvarado scale. Actually, this is not so complex, we must return to the basis of the cardinal points of acute appendicitis and focus on them for early diagnosis. The following integrated scale is

suggested based on the most representative signs and symptoms of the disease, i.e., what motivates the surgeon in practice to operate on a patient based on clinical manifestations and laboratory and cabinet support, based on signs and symptoms mentioned by several authors as the most frequent and with a positive predictive value above 90% *(Table 3)*.[13-15]

Table 2: RIPASA scale.

Data	Score
Male	1
Female	0.5
< 39.9 years	1
> 40 Years	0.5
Foreign National Registration Identity Card	1
Symptoms	
Pain in RIF	0.5
Nausea/vomiting	1
Migratory pain	0.5
Anorexia	1
Symptoms < 48 hours	1
Symptoms > 48 hours	0.5
Signs	
Hypersensitivity in RIF	1
Voluntary muscular resistance	2
Rebound	1
Rovsing	2
Fever > 37 °C < 39 °C	1
Laboratory	
Leucocytosis	1
Negative urinalysis	1

Interpretation of RIPASA. According to the score, management is suggested: • <5 points (unlikely): observation of the patient and applying a scale again in one to two hours, if the score decreases, the pathology is ruled out, if it increases, it is revalued with the score obtained . • 5-7 points (low probability): observation in the emergency department and repeat the scale in one to two hours, or perform an abdominal ultrasound. Stay under observation. • 7.5-11.5 points (high probability of acute appendicitis): evaluation by the surgeon and preparing the patient for an appendectomy, if he decides to continue the observation, it is repeated in one hour. In case of being a woman, assess ultrasound to rule out gynecological pathology. • > 12 points (diagnosis of appendicitis): assessment by the surgeon for treatment or refer if necessary. Source: Reyes, 2012.[12]

This scale integrates the pillars or cardinal points of diagnosis of acute appendicitis, it is easy to apply. Even when we do not have laboratory and images it gives us an adequate score to indicate early surgery, avoiding white laparotomies (in our opinion, the delay in treatment is more serious), but also the late diagnosis that leads to complicated phases and higher morbidity and mortality rates.

METHODOLOGY OF INVESTIGATION

A prospective, cross-sectional, observational, and analytical study was conducted in a population of 182 patients admitted to the Atizapán General Hospital. State of Mexico between November 2016 and October 2017 with the probable diagnosis of acute appendicitis.

The study protocol was approved by the Research and Ethics Committees (authorization document for the head of teaching and research, Dr. César Bernal Hernández, dated September 29, 2016 is attached). The confidentiality of the information obtained with strict respect for human dignity was respected at all times. The study did not imply any risk for the patients, since only the diagnostic scales were applied to each patient by the author, and correlated with the surgical finding, the phase and verification of the diagnosis, without influencing the decision of the surgeon assigned to the Emergency Department regarding studies, medical decisions or surgical intervention. Confirmation of acute appendicitis was made with the histopathological findings of the appendix.

Patients were included prospectively, from age two to geriatric age. The scales of Alvarado, RIPASA, and the one proposed were applied simultaneously. The data collected were: gender, age, days of evolution, signs, and symptoms, clinical findings on physical examination, score of the three scales, surgical findings, phase of acute appendicitis, days of hospitalization, reoperations, complications, mortality and histopathological result. We performed an appendectomy in the 182

Table 3: Diagnostic scale of acute appendicitis (Hernández-Orduña).

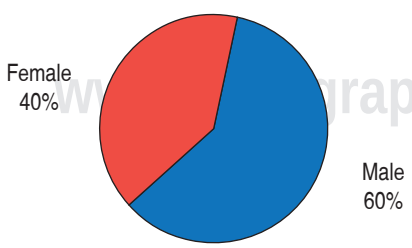
Criteria	Score
Symptoms	
Initial periumbilical or RIF pain	1
Migration and / or persistent pain in RIF	2
Nausea, vomiting, and/or anorexia	1
Signs	
Positive appendicular signs (McBurney)	2
Muscular resistance in RIF	1
Positive rebound (Von Blumberg)	1
Laboratory	
Leukocytosis greater than 10,000 and/or neutrophilia greater than 70%	1
Image	
Radiographic data suggestive of peritoneal irritation in RIF, US and/or CT scan positive	1

Interpretation of scale. According to the score, management is suggested: low or negative risk of 0-4 points, medium or observation risk of 5-6 points and complement studies (TAC, USG). High positive risk, more than 6 points to perform early surgery.
Source: Elaboration by the author Hernández-Orduña, 2018.

patients and the result of the histopathological report was obtained.

A pilot test was carried out, to modify, adjust, and improve the measurement instrument. It was then validated and applied to the 182 patients by quantitative validation methods: the Cronbach's alpha method was used, in which the acceptable values must be > 0.7. A higher value was obtained, 0.89, which indicates high reliability. The validation was carried out by Joel Cárdenas Antúnez, Ph. D in education and quantitative research. The qualitative validation was done together with the author.

Descriptive statistics of demographic data, measures of central tendency and analysis of diagnostic tests (sensitivity, specificity, positive and negative predictive values) were performed, and the area under the curve (AUC) was calculated to assess the three scales with a 95% confidence interval, using a 2 × 2 table and the Epidat 3.1 system.



Source: Elaborated by the author.

Figure 1: *Frequency of acute appendicitis by sex.*

RESULTS

Of the 182 cases reviewed, 110 patients were male and 72 were female, with a male/female ratio of 1.5/1. Most frequently ages were between 10 and 25 years *(Figures 1 and 2, and Table 4)*. Pediatric patients were operated on in the morning shift by pediatric surgery and in the other shifts by general surgeons, since pediatric surgeons were not available.

In the research instrument (research data sheet *[Annex 1]*), gender, age, days of evolution, month, most commonly symptoms and signs reported, a score of diagnostic scales, surgery performed, findings, evolution, complications, reoperations, mortality, and histopathological study were collected, from which the following results emerge.

The evolution time of the clinical picture before entering the hospital was two to three days on average, except in complicated cases, which was of 15 days in average. The months with the highest prevalence were from March

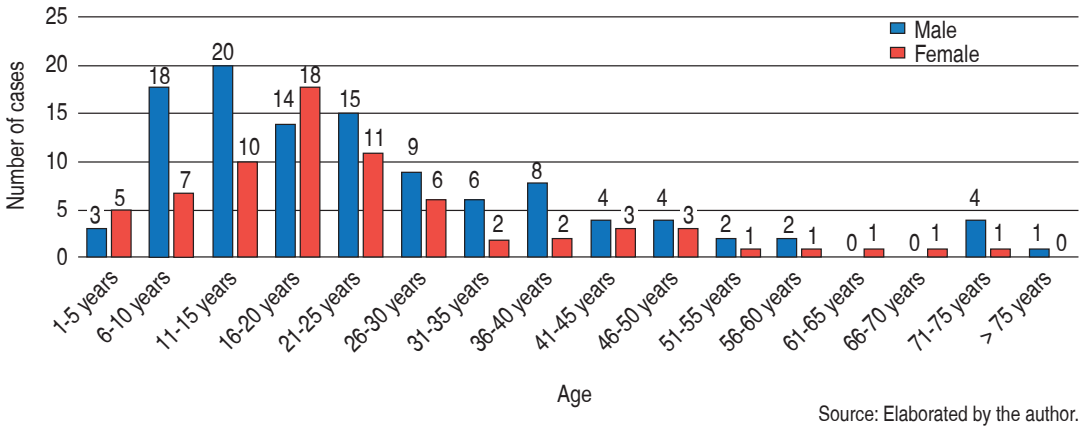


Figure 2:

Population table of acute appendicitis by sex and age.

Source: Elaborated by the author.

to May. The most common symptoms were pain in the right iliac fossa, pain migration (90%), nausea or vomiting (90%), and the least common symptom (18%) was anorexia. The most commonly signs were: McBurney (98.6%) and Von Blumberg (90%).

Table 4: General characteristics of the study group.

Age range	Sex male	Sex female	Total
1-5	3	5	8
6-10	18	7	25
11-15	20	10	30
16-20	14	18	32
21-25	15	11	26
26-30	9	6	15
31-35	6	2	8
36-40	8	2	10
41-45	4	3	7
46-50	4	3	7
51-55	2	1	3
56-60	2	1	3
61-65		1	1
66-70		1	1
71-75	4	1	5
< 75	1		1
Total	110	72	182
Mean	25	22	
Median		21	19
SD	17	15	
Variance	315	231	

Source: Result of the study.

Post-operative complications were 19% with infection of the operative site, reoperation in nine cases for infection of the operative site of the organ-space type (established classification of infection of the surgical site whether superficial, deep, or site of the organ with abscess, be it superficial, deep or in cavity fascia). Two cases required hemicolectomy and stoma with an evolution time of 15-20 days and necrosis and perforation of the cecum.

Concerning the appendicular phase corroborated by histopathological study, we observed a higher frequency of phase 4 *(Table 5)*. In no patient tumors or parasites were reported. 8.7% of the patients were not diagnosed as appendicitis. The most complicated symptoms with the longest evolution time, for delayed diagnosis, were found in 26.37%, more frequent in children, women and the elderly patients. This led to longer hospital stay, surgical and post-surgical complications, and higher hospital costs *(Table 6)*. As can be seen in *Figures 3 to 6*, the scale proposed yielded the most frequent and exact diagnosis.

The Alvarado scale had a sensitivity of 90% and specificity of 77%, with a positive predictive value of 91% and a negative predictive factor of 90%. The RIPASA scale showed a sensitivity of 90% and specificity of 81%, with a positive predictive value of 93% and a negative value of 90%. Our proposed scale showed a sensitivity of 91% and specificity of 94% with a positive predictive value of 98% and a negative predictive value of 91%. The area under the curve of the Alvarado scale was 0.83, that

Table 5: Histopathological diagnosis of appendectomies.

Phase	n	%
Phase 0	16	8.79
Phase 1	7	3.84
Phase 2	47	25.82
Phase 3	27	14.83
Phase 4	85	46.70
	Total 182	

Source: Result of the study.

of RIPASA 0.85, and in our scale it was 0.92 *(Table 7)*.

As observed, the scales have similar sensitivity when considered in general in almost all the studies reviewed, whether there is a positive limit score of 6 or a score of 10. The statistical measure takes both into account as positive without differentiating that surgical treatment may be delayed in the former, to carry out further studies of for observation purposes. In the latter, the diagnosis leaves no room for doubt in the application of early surgical management. This becomes more important in cases of late diagnosis, which in this study was 26.7%. Patients in whom early diagnosis was not made in the first consultation(s) and medical management was prescribed for other diagnosis would later appear in already complicated phases, which leaded to higher hospital stay, morbidity, mortality, and costs.

Table 6: List of cases with late diagnosis of acute appendicitis, days of evolution and finding of perforated appendicitis.

	Cases	Average days of evolution
Child	10 (1 to 10 years of age)	5
Adult	33	7
Elderly	5	7
Total	48 (26.37%) of the total 182	

Source: Result of the study.

In *Figures 3 to 5*, we see on the Alvarado and RIPASA scales heterogeneous graphs with a variability of scores, and on the scale proposed a homogeneous graph, because it has a higher positive prediction index.

If the surgical decision had been made based on the proposed scale, negative appendectomies could have occurred 17% less frequently. But more importantly, late diagnoses, which had already been evaluated, with consequent complicated phases, would have been avoided in 26% less cases *(Figure 7)*.

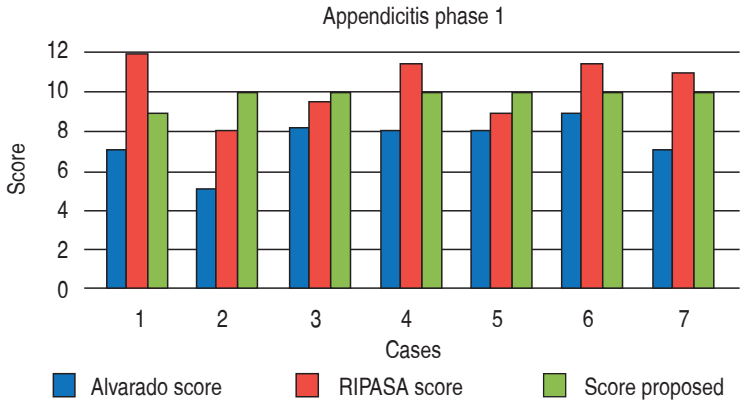
Therefore, it is necessary to determine the sensitivity of the scale concerning the highest scores, which gives a timely early diagnosis. We took 9 and 10 as the highest score in Alvarado and the proposed scale, above 10 in RIPASA, we assessed which scale gave us the highest score in each case and calculated the sensitivity in these patients, and obtained the following result *(Figure 8)*.

Alvarado's sensitivity was 81% with a positive predictive value of 70%, RIPASA's was 88% with a positive predictive value of 92%, and on our proposed scale sensitivity was 91% with a positive predictive value of 98%. The proposed diagnostic scale gave us greater sensitivity, lead us not only to a lower frequency of white laparotomies but, and more importantly, to early diagnoses with a high positive predictive value. It gave us the ability to perform earlier surgeries with lower morbidity and mortality rate.

DISCUSSION

Regarding the age and sex of the patients who presented appendicitis, they agree with studies carried out in other institutions.[16] We know that acute appendicitis is a frequent pediatric surgical condition that affects 0.3% of children aged 0-15 years.[17]

The evolution time is a variable out of the control of surgeons, since it depends on variables attributable to patients or their relatives, to the first consultation, generally at a first level of care, making the nature of the disease more difficult to establish a certain diagnosis. A large percentage of patients receive a medical management, "masking" the clinical picture. In this study times of



Source: Elaborated by the author.

Figure 3: *Cases diagnosed with the scales and phase 1 histopathological result.*

evolution ranged from six hours to 25 days, especially when the symptoms are atypical.[16] Concerning the symptoms, and contrary to other authors[13] who detected anorexia in 39.4%, in our study it was the least common symptom (18%).

The rate of complicated appendicitis, with a perforation, abscess or peritonitis, is variable according to the studies, in about a quarter of the cases. In a homogeneous series of 648 patients[18] this rate was 19.3 and 30% in series by other authors. The younger the patient, the higher the frequency.[19,20] In our study, we found a higher frequency of phase 4, almost 50%, which is closely related to late diagnosis due to the lack of competence. It has arisen due to the need of US, CT, or even MRI in doubtful cases, giving 100% diagnostic possibility to CT. It has even been mentioned that when there is no defense, fever, or leukocytosis, the patient can return home and come back for consultation within 48 hours, which is not feasible considering the risks of perforation and septic complications.[15]

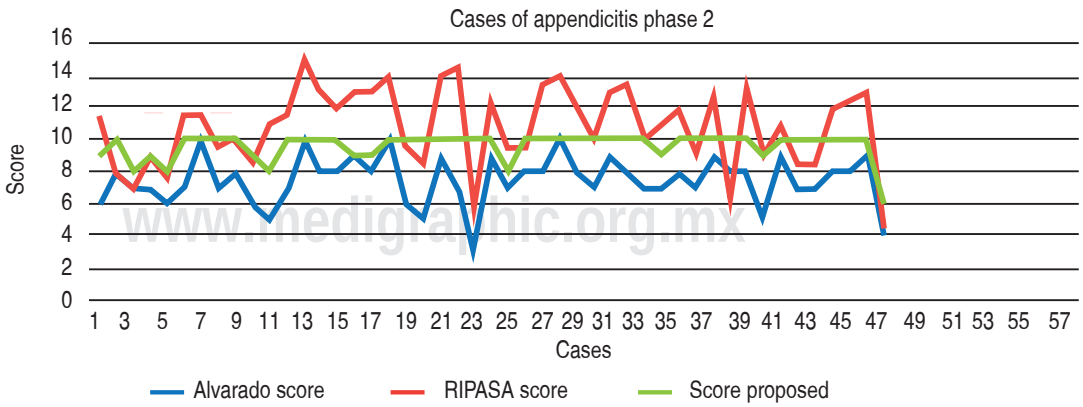
A delayed or incorrect diagnosis can lead to multiple complications such as infection of the surgical wound (8 to 15%), perforation (5 to 40%), abscesses (2 to 6%), sepsis, and death (0.5 to 5%).[21,22] In our study, a higher rate of infection of the operative site was found, and although nine cases were operated for residual abscesses, we did not have any deaths.

To avoid late diagnoses, scales have been applied. However, there are still cases of white laparotomies, a fact given great importance, but the most serious are those late diagnoses medically managed in emergency rooms, even with advanced and complicated symptoms.

Some authors have mentioned that all these instruments have limitations (sensitivity and specificity less than 90%), and that it is not feasible nor recommended to use scales as a diagnostic method.[23] For this reason, multiple studies have been carried out to define the sensitivity and specificity of the best-known scales such as RIPASA and Alvarado, with a variety of results. Recently, the usefulness of the RIPASA scale was evaluated at the General Hospital of Mexico, comparing it with the Alvarado scale in 70 patients. The Alvarado scale presented a sensitivity of 89.5% and specificity of 69.2%;

Figure 4:

Cases diagnosed with the scales and phase 2 histopathological result.



In the scale proposed an almost homogenous line, due to its diagnostic precision can be observed.

Source: Elaborated by the author.

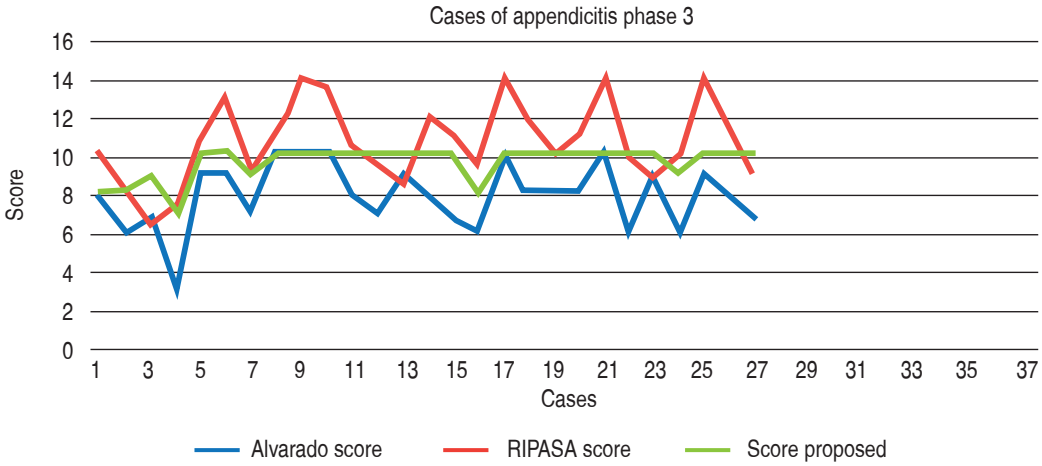


Figure 5:

Cases diagnosed with the scales and phase 3 histopathological result.

In the scale proposed an almost homogenous line, due to its diagnostic precision can be observed.

Source: Elaborated by the author.

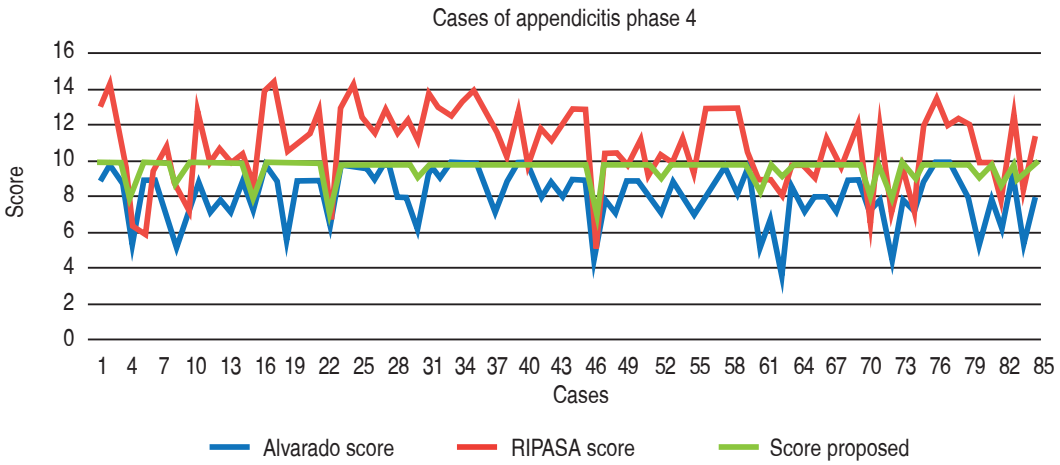


Figure 6:

Cases diagnosed with the scales and phase 4 histopathological result.

In the scale proposed an almost homogenous line, due to its diagnostic precision can be observed.

Source: Elaborated by the author.

Table 7: Statistical diagnostic value of the scales.

Test	Alvarado	RIPASA	Proposed
Sensitivity (%)	90.47	90.64	91.06
Specificity (%)	77.00	81.00	94.00
Positive predictive value (%)	91.00	93.00	98.00
Negative predictive value (%)	90.40	90.60	91.06
Area under the curve (AUC)	0.835	0.855	0.925

Source: Result of the study.

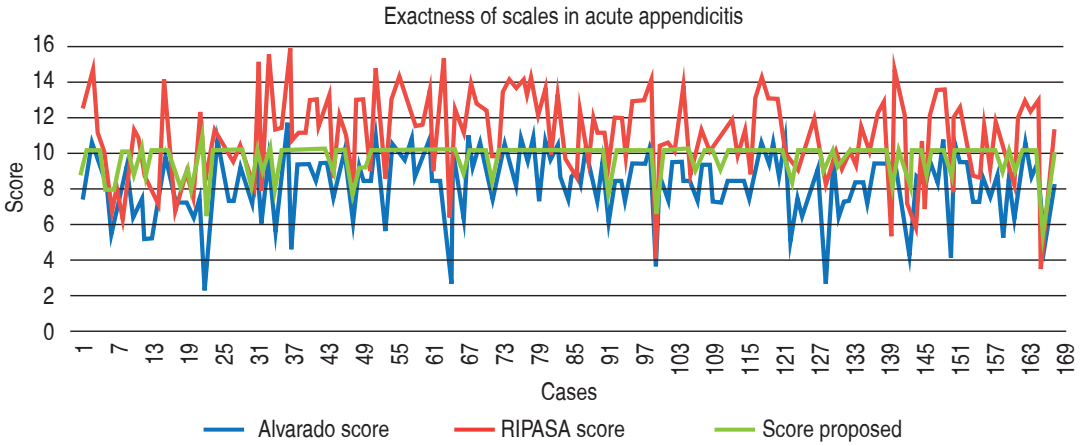


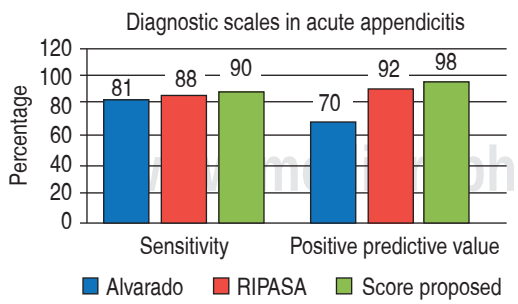
Figure 7:

Comparison of the accuracy in the diagnosis of acute appendicitis.

In the scale proposed an almost homogenous line, due to its diagnostic precision can be observed.

Source: Elaborated by the author.

RIPASA showed a sensitivity of 91.2% and a specificity of 84.6%.[12] Other authors have given different degrees of sensitivity and specificity to these scales. At the PEMEX Regional Hospital Salamanca, a second-level hospital, a sensitivity of 99%, a specificity of 62%, a positive predictive value of 92%, and a negative predictive value of 93% were obtained on the Alvarado scale.[24] At the General Hospital of Veracruz, the Alvarado scale at a cut-off point greater than 5 gave greater diagnostic precision, with a sensitivity of 0.96%, specificity of 0.72%, a positive predictive value of 0.93% and a negative predictive value of 0.82%.[25] Other authors in Colombia have reported on the Alvarado sensitivity, with an average of less than 80%.[26]



Source: Elaborated by the author.

Figure 8: *Accuracy of diagnostic scales for acute appendicitis with a high score.*

CONCLUSIONS

The three scales presented good sensitivity and specificity. However, we can predict that the higher the score, the closer to a correct diagnosis. We recommend, therefore, that the cut-off point be used with greater equilibrium and utility, the clinical expression of which would be a greater number of true positives.

We share this knowledge of a more clinical diagnostic scale, in such a way that although we do not have laboratory and an imaging, the diagnosis of acute appendicitis can be statistically supported, which gives us the certainty of a referral or of performing early and timely surgical interventions.

We leave it to the consideration of the medical and surgical community with the sole intention of providing a comprehensive clinical tool for early diagnosis in a more specific and sensitive way to decrease white appendectomy rates, but most importantly, not letting it evolve to complicated phases that put at risk the life of the patient, and neither our legal-medical status.

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Annex 1: Investigation instrument.	
Criteria	**Result**
File	
Sex	
Age	
Time of evolution	
Symptoms: periumbilical pain (), FID (), pain migration (), nausea (), vomiting (), anorexia (), diarrhea (), fever ()	
Signs: McBurney ( ), Von Blumberg ( ), Rovsing ( ), Lecene ( ), psoas ( ), obturator ( )	

Alvarado Scale.

Parameter	Observations	Score	Result
Signs	Migratory pain	1	
	Anorexia and/or urinary ketone bodies	1	
	Nausea and vomiting	1	
Symptoms	Pain in RIF	2	
	Rebound pain	1	
	Fever	1	
Laboratory	Leucocytosis (> 10,000)	2	
	Shift to the left (neutrophils > 75%)	1	

RIPASA Scale.

Data	Score	Result
Male	1	
Female	0.5	
< 39.9 years	1	
> 40 years	0.5	
Foreign National Registration Identity Card	1	
Symptoms		
Pain in RIF	0.5	
Nausea/vomiting	1	
Pain migration	0.5	
Anorexia	1	
Symptoms < 48 hours	1	
Symptoms > 48 hours	0.5	
Signs		
Hypersensitivity in the right iliac fossa	1	
Voluntary muscular resistance	2	
Rebound	1	

Continued from Annex 1: Investigation instrument.

RIPASA Scale.

Data	Score	Result
Rovsing	2	
Fever > 37 ºC < 39 ºC	1	
Laboratory		
Leucocytosis	1	
Negative urinalysis	1	
Total	17.5	

Integrated Diagnostic Scale for Acute Appendicitis (Hernández-Orduña, 2016).

Critera	Score	Result
Symptoms		
Initial periumbilical pain or in RIF	1	
Migration and persistent pain in RIF	2	
Nausea, vomiting, and/or anorexia	1	
Signs		
Positive appendicular signs (McBurney)	2	
Muscular resistance in RIF	1	
Poisitive rebound	1	
Laboratory		
Leucocytosis greater than 10,000 and/or neutrophilia greater than 70%	1	
Image		
Radiographic data suggestive of peritoneal irritation in RIF and/or positive US	1	
Total		

Pathological phase & Maingot
Surgical technique
Histopathological report
Complications
Reoperations
Mortality
Days of hospital stay