



# ACUTE APPENDICITIS: CLINICAL, SURGICAL AND PATHOLOGICAL CONCORDANCE IN A PERUVIAN EMERGENCY HOSPITAL

APENDICITIS AGUDA: CONCORDANCIA CLÍNICA, QUIRÚRGICA Y ANATOMOPATOLÓGICA EN UN HOSPITAL DE EMERGENCIAS PERUANO

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## ABSTRACT

**Introduction:** Acute appendicitis is the most frequent pathology in surgical emergencies. The timeliness and effectiveness of the diagnosis are parameters for evaluating the quality of care. **Objective:** To determine the concordance between clinical, surgical, and pathological diagnosis in patients with acute appendicitis, "José Casimiro Ulloa" Emergency Hospital, Lima - Peru, 2018. **Methods:** Observational, cross-sectional, retrospective, analytical study. Medical records of 222 patients diagnosed with acute appendicitis in 2018 were reviewed. Sample calculation with a known population (1200), probabilistic sampling. Patients > 18 years old diagnosed with acute appendicitis, operated on, who had a pathological study, excluding pregnant women and patients with comorbidities, were included. The data were processed and analyzed with SPSS v.25. Descriptive statistics and kappa coefficient were used to analyze concordance, using the Landis and Koch assessment: slight concordance (Kappa= 0.01-0.20), acceptable (0.21-0.40), moderate (0.41-0.60), considerable (0.61-0.80) and almost perfect (0.81-1). **Results:** Adults (50.9%), males (56.8%) predominated. (83.8%) were clinically diagnosed with appendicitis requiring surgery. The predominant surgical diagnosis was suppurative appendicitis (32.4%), and the predominant pathological diagnosis was phlegmonous appendix (72.7%). A case of the normal appendix in anatomopathological diagnosis. Clinical-surgical diagnostic agreement was (kappa=4.18), clinical-pathological diagnosis (kappa=0.66), and surgical and pathological diagnosis agreement (kappa=0.497). **Conclusions:** Moderate concordance between clinical-surgical diagnosis and considerable clinical-pathological concordance diagnosis, reaffirming the clinical importance in decision-making for timely surgical intervention. Surgical and pathological diagnostic concordance was moderate, observing a moderate degree of certainty of the surgeons and pathologists.

**Keywords:** Appendicitis; Correspondence; Clinical and surgical diagnosis; Pathology. (Source: MeSH NLM)

## RESUMEN

**Introducción:** Apendicitis aguda es la patología más frecuente en emergencia quirúrgica. La oportunidad y eficacia del diagnóstico es un parámetro de evaluación de la calidad de atención. **Objetivo:** Determinar la concordancia entre diagnóstico clínico, quirúrgico y anatomopatológico en pacientes con apendicitis aguda, Hospital de Emergencia "José Casimiro Ulloa", Lima - Perú, 2018. **Métodos:** Estudio observacional, transversal, retrospectivo, analítico. Se revisaron historias clínicas de 222 pacientes diagnosticados de apendicitis aguda el 2018. Cálculo muestral con población conocida (1200), muestreo probabilístico. Se incluyeron pacientes > 18 años diagnosticados de apendicitis aguda, intervenidos quirúrgicamente, que contaban con estudio anatomopatológico, excluyendo gestantes y pacientes con comorbilidades. Los datos se procesaron y analizaron con SPSS v.25. Se utilizó estadística descriptiva, y coeficiente kappa para analizar la concordancia, usando la valoración de Landis y Koch: concordancia leve (Kappa= 0,01-0,20), aceptable (0,21 -0,40), moderada (0,41-0,60), considerable (0,61- 0,80) y casi perfecta (0.81-1). **Resultados:** Predominaron adultos (50,9%), varones (56,8%). (83,8%) fueron diagnosticados clínicamente como apendicitis que requerían cirugía. El diagnóstico quirúrgico predominante fue apéndice supurado (32,4%) y diagnóstico anatomopatológico predominante apéndice flemonoso (72,7%). Un caso de apéndice normal en diagnóstico anatomopatológico. La concordancia diagnóstico clínico-quirúrgico fue (kappa=4,18), diagnóstico clínico-anatomopatológico (kappa=0,66), y la concordancia diagnóstico quirúrgico y anatomopatológico (kappa=0,497). **Conclusiones:** Se halló moderada concordancia entre diagnóstico clínico - quirúrgico, considerable concordancia diagnóstico clínico - anatomopatológico, reaffirmando la importancia clínica en toma de decisiones para una intervención quirúrgica oportuna. La concordancia diagnóstico quirúrgico y anatomopatológico fue moderada, observando un moderado grado de certeza de los cirujanos y patólogos.

**Palabras Claves:** Apendicitis; Correspondencia; Diagnóstico clínico; Quirúrgico; Patología. (Fuente: DeCS BIREME)

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## INTRODUCTION

Acute appendicitis (AA) is the most frequently diagnosed surgical condition in hospital emergency services and is one of the main causes of surgical interventions performed<sup>(1)</sup>. It is the acute inflammatory process of the vermiform appendix, which spreads to reach other structures<sup>(2)</sup>. It is not known exactly what is the reason for its development until now<sup>(3)</sup>. However, it is suspected that it may be caused by obstruction of the lumen, mainly by fecaliths<sup>(4)</sup>. The characteristic clinical picture is pain of sudden onset, located in the epigastrium, usually accompanied by nausea, being McBurney's point the most representative.

Its diagnosis is mainly clinical, except for particular cases. There are various diagnostic scales, including the modified Alvarado Score, the most widely accepted in emergency services worldwide, with a sensitivity of 68-82% and a specificity of 75-87.9%<sup>(5)</sup>. The final diagnosis is anatomopathological from the surgical sample, and up to 10% of appendectomies without an inflammatory process in the histopathological study are accepted, although other authors report higher percentages<sup>(6)</sup>.

Worldwide, appendicitis is the main cause of acute surgical abdomen in 50% and makes up 2/3 of the laparotomies performed. seven to 12% of the population will suffer from appendicitis at some point in their life<sup>(1)</sup>, with the highest incidence between 10 and 30 years<sup>(7)</sup>. Adults are the most affected, with males predominating more than 60%<sup>(1)</sup>.

The José Casimiro Ulloa Emergency Hospital, in Lima-Peru, an emblematic institution for emergency care, reported in 2010 acute appendicitis as the main cause of hospitalization, with 773 annual cases (23%), the highest record compared to years. Likewise, a progressive increase was observed in recent years<sup>(8)</sup>. This pathology of high morbidity and low mortality requires accurate diagnosis and timely intervention, thus avoiding complications with prolonged hospital stays that would generate unnecessary costs for the institution, the patient, and society.

Various publications report differences between the surgical, pathological, and clinical diagnoses, thus, Soto-López (Cuba) finds very good clinical-surgical correlation, Kappa value of 0.92, good clinical-pathological agreement with Kappa of 0.71, and surgical-pathological agreement with Kappa of 0.71. value of 0.79<sup>(9)</sup>. Unlike Segovia (Paraguay), it reports poor surgical-pathological concordance, kappa of 0.3466<sup>(10)</sup>. Barcos, Peru found that both the surgical and pathological diagnoses predominate the necrotic type, which concludes that there is a considerable concordance, Kappa value 0.694<sup>(11)</sup>.

Knowing the degree of concordance between the clinical, surgical, and pathological diagnoses allows us to compare standards of care worldwide and the efficiency of the medical staff. In our country, the concordance between the three diagnoses in a defined population has not been studied, motivating this research to determine the concordance between the clinical diagnosis, surgical and pathological findings in patients with Acute Appendicitis in the José Casimiro Emergency Hospital. Ulloa, Lima-Peru, 2018; considering that the higher the concordance, the patient care will be of higher quality.

## METHODS

### Design and study area

Quantitative, observational, retrospective, cross-sectional, and analytical study: It was performed at the José Casimiro Ulloa Emergency Hospital (HEJCU) in Lima, Peru.

### Population and sample

The sample calculation was carried out using the Epi Info software, for a population of 1,200 cases of acute appendicitis per year, according to the statistical report of the José Casimiro Ulloa Hospital of 2018<sup>(8)</sup>. Considering an expected frequency of 23%, a confidence interval of 95%, and a margin of error of 5%, the calculated sample size was 222 patients diagnosed with acute appendicitis in 2018, obtained by systematic random selection, where the medical records used were a multiple of 3, which guaranteed us that all medical records had the same chance of being selected; Likewise, these met the inclusion criteria, which were: medical records of patients over 18 years of age with a

diagnosis of AA, who underwent surgery and who had a pathology study. The medical records of pregnant women and patients with comorbidities were excluded.

### Variables and instruments

The own collection form was used, validated by 3 experts on the subject, obtaining an agreement of 95.2%. This file contains the variables of age, sex, place of origin, pathological diagnosis, postoperative diagnosis, and clinical diagnosis that was evaluated through the modified Alvarado Score, which allows patients to be classified into three groups: low risk (zero to four points), intermediate risk (five to seven points) and high risk (eight to ten points)<sup>(12)</sup>.

### Procedures

The data was collected from the HEJCU statistical office, where the selected medical records were reviewed in the study period, 2018, reviewing the operative report and the pathology report, in which the diagnosis of acute appendicitis made by the internist was verified in an emergency (clinical diagnosis), the diagnosis made by the specialist in surgery, who performed the surgical intervention (surgical diagnosis), and the diagnosis

of the specialist in pathology, who carried out the pathological analysis of the surgical sample (pathological diagnosis).

### Statistical analysis

Univariate analysis was performed with descriptive frequency statistics; and for the analysis of concordance between the variables (clinical diagnosis, surgical diagnosis, and anatomopathological diagnosis, the kappa index was used, considering - one (total disagreement) to one (total agreement), taking the assessment according to Landis and Koch, mild (0, 01-0.20), acceptable (0.21-0.40), moderate (0.41-0.60), considerable (0.61-0.80) and almost perfect (0.81-1)<sup>(13)</sup>. The statistical program SPSS version 25 was used.

### Ethical Aspects

The project was evaluated and approved by the Ethics Committee of the Faculty of Human Medicine of the University of San Martín de Porres and the José Casimiro Ulloa Emergency Hospital. Anonymity was guaranteed of the patients by coding the data, which was eliminated at the end of the investigation.

### RESULTS

The present study shows the male sex predominates (56.8%) and with a slight predominance in adults (50.9%). See Table 1

**Table 1.** Sociodemographic characteristics of patients >18 years old diagnosed with acute appendicitis Hospital José Casimiro Ulloa, 2018.

Sociodemographic variables N=222	Frequency	Percentage
<b>Age</b>		
Young people (18-29 years)	96	43.2
Adults (30-59 years)	113	50.9
Older adults (≥60 years)	13	5.9
<b>Sex</b>		
Female	96	43.2
Male	126	56.8
<b>Place of origin</b>		
Surquillo	6	2.7
Barranco	8	3.6
Miraflores	9	4.1
Villa María del Triunfo	19	8.6
Santiago de Surco	28	12.6
San Juan de Miraflores	32	14.4
Chorrillos	41	18.5
Others*	79	36.8

\*Ate vitarte, Villa el Salvador (2.3%), Jesús María (1.8%), La Molina, Callao, San Juan Miraflores (1.4%), among others.



More than 80% of patients were clinically diagnosed with appendicitis requiring surgery. The predominant surgical diagnosis was a suppurative or phlegmonous

appendix in more than a third (32.4%), similar to the pathological diagnosis of the phlegmonous appendix, which was close to 75% of the patients. See Table 2.

**Table 2.** Classification of cases of acute appendicitis clinical diagnosis (according to the Alvarado score\*), surgical and pathological diagnosis, Hospital José Casimiro Ulloa, 2018.

Clinical diagnosis	N=222	Surgical	Diagnosis Pathological diagnosis		
			n (%)		n (%)
<b>Low probability (1-4 points)</b>	n (%) 4 (1.8)	Normal appendix	n (%) 3 (1.4)	Apéndice normal	n (%) 1 (5)
<b>Probable appendicitis (5-6 points)</b>	32(14.4)	Appendix edematous or engorged	13 (5.9)	Apéndice congestiva	34 (15.5)
<b>Appendicitis requiring surgery (≥7 points)</b>	186 (83.8)	Suppurative or phlegmonous appendix	72 (32.4)	Apéndice flegmonosa	160 (72.7)
		Appendix necrotic, but not perforated	45 (20.3)	Apéndice necrosada	19 (8.6)
		Perforated appendix with localized abscess	59 (26.6)	Apéndice perforada	6 (2.7)
		Generalized peritonitis	30 (13.5)		

\*Alvarado score<sup>(13)</sup>

98.6% of patients were diagnosed as AA by the surgeon and 82.9% were clinically registered as appendicitis requiring surgery, however, the concordance analyzed with the Kappa index is less than 0.5. See table 3.

99.5% of cases were diagnosed as appendicitis by the pathologist, and 83.6% were clinically diagnosed as appendicitis requiring surgery, obtaining concordance greater than 0.5 (Kappa). See Table 3.

**Table 3.** Clinical diagnosis versus surgical or pathological diagnosis of patients older than 18 years old diagnosed with acute appendicitis, Hospital José Casimiro Ulloa, 2018.

Clinical	Surgical Diagnosis		Pathological Diagnosis	
	Acute appendicitis n (%)	No inflammatory signs n (%)	Acute appendicitis n (%)	No inflammatory signs n (%)
<b>Probable appendicitis</b>	35 (15.8)	1 (0.5)	35 (15.9)	0 (0)
<b>Appendicitis requires surgery</b>	184 (82.9)	2 (0.9)	184 (83.6)	1 (0.5)
<b>Total</b>	219 (98.6)	3 (1.4)	219 (99.5)	1 (0.5)

Índice de kappa: 0,418 IC:0,95Índice de kappa: 0,663 IC:0,95



When comparing the diagnoses of the surgeon with those of the pathologist, the surgeons were correct in 98.6% when appendicitis was present. The concordance by means of kappa was obtained close to 0.5. See Table 4.

**Table 4.** Surgical vs Pathological diagnosis of patients older than 18 years old diagnosed with acute appendicitis, Hospital José Casimiro Ulloa, 2018.

		Pathological diagnosis		Total n (%)
		Acute Appendicitis n (%)	Without inflammatory signs n (%)	
<b>Diagnosis Surgical</b>	<b>Acute appendicitis</b>	219 (98.6)	0 (0)	219 (98.6)
	<b>Without inflammatory signs</b>	2 (0.9)	1 (0.5)	3 (1.4)
<b>Total</b>		221 (99.5)	1 (0.5)	222 (100)

0.497 CI: 0.95:Analyzing

The surgical and pathological diagnosis of complicated and uncomplicated acute appendicitis, the surgeons classified 88 cases as uncomplicated appendicitis and

the pathologists classified 194 as uncomplicated cases. A kappa index of less than 0.2 was obtained. See table 5.

**Table 5.** Uncomplicated and complicated acute appendicitis, according to pathological and surgical diagnosis in patients over 18 years of age, José Casimiro Ulloa Hospital, 2018.

		Surgical diagnosis		Total
		Uncomplicated n (%)	Complicated n (%)	
<b>PATHOLOGY</b>	<b>Uncomplicated</b>	87 (39.2)	107 (48.2)	194 (87.4)
	<b>Complicated</b>	1 (0.5)	27 (12.2)	28 (12.6)
<b>Total</b>		88 (39.6)	134 (60.4)	222 (100)

Kappa index: 0.158 CI: 0.95

Similarly, the staging of cases of acute appendicitis performed by surgeons and pathologists have a concordance of less than 0.2 (kappa index).

The type of appendix where surgeons and pathologists agreed most frequently was the suppurative appendix in almost a quarter of the cases. See table 6.

**Table 6.** Stages of Acute Appendicitis according to surgical and pathological findings in patients >18 years old, José Casimiro Ulloa Hospital, 2018.

		Surgical Diagnosis					Total n (%)
		Appendix Normal n (%)	Congestive appendix n (%)	Suppurative appendix n (%)	Appendix Necrotic n (%)	Perforated appendix n (%)	
<b>Normal appendix</b>		1 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.5)
<b>Congestive appendix</b>		2 (0.9%)	11 (5)	15 (6.8)	1 (0.5)	3 (1.4)	32 (14.4)
<b>ANATOMICAL PATHOLOGICAL DIAGNOSIS</b>	<b>Suppurative appendix</b>	0 (0)	2 (0.9)	56 (25.2)	38 (17.1)	64 (28.8)	160 (72.1)
	<b>Appendix</b>	0 (0)	0 (0)	1 (0.5)	6 (2.7)	19 (8.6)	26 (11.7)
	<b>Perforated appendix</b>	0 (0)	0 (0)	0 (0)	0 (0)	3 (1.4)	3 (1.4)
	<b>Total</b>	3 (1.4)	13 (5.9)	72 (32.4)	45 (20.3)	89 (40.1)	222 (100)

Kappa index: 0.104 CI: 0.95

## DISCUSSION

Moderate concordance is found between the clinical-surgical diagnosis ( $\kappa=0.418$ ) and a considerable concordance between clinical-pathological diagnoses ( $\kappa=0.663$ ). These results are close to those obtained by Soto-López, et al. <sup>(9)</sup> in the province of Cienfuegos (Cuba), where the clinical-surgical agreement was very good (Kappa of 0.92) and the clinical-pathological agreement was considered equally consistent (Kappa of 0.71), which shows that the clinical diagnosis is closer to the anatomopathological one, than to the surgical diagnosis, and reaffirms the clinical importance in making decisions to perform a timely surgical intervention and avoid future complications in the patient, with prolonged hospital stays and greater use of resources.

Likewise, the anatomopathological diagnosis reaffirms the decision of the clinicians at the time of diagnosing acute appendicitis, showing that the management of this pathology in the Hospital studied is in non-ideal standards but close to the international level as expected since It is a Hospital specialized in emergency care in the country.

In our study, it is observed that according to the clinical characteristics, 83.8% of patients were categorized as appendicitis requiring urgent surgery, higher than that obtained by Alarcón <sup>(14)</sup>, where 63.9% obtained a score  $\geq$  seven on the Alvarado score. which is highly suggestive of acute appendicitis that requires surgery according to the clinic, highlighting the importance of clinical diagnosis in a surgical emergency, such as acute appendicitis.

The concordance between the surgical and pathological diagnosis was moderate ( $\kappa=0.497$ ) regarding the existence or not of acute appendicitis, indicating that the diagnoses of the surgeon with those of the pathologist are 98.6% correct. Those results are similar to the ones obtained by Ramírez P <sup>(15)</sup> in a population of 507 patients, where the existence or not of acute appendicitis from the surgical and pathological point of view obtained a moderate concordance ( $\kappa: 0.49$ ); showing that surgeons have greater difficulty in correctly categorizing healthy appendices <sup>(15)</sup>. Although both results do not reach a very good or considerable concordance, a good degree of certainty is observed on the part of surgeons and pathologists when evaluating macroscopically and microscopically, respectively.

Regarding the stage of acute appendicitis, the concordance between the staging carried out by the surgeons and the pathologists is considered to be a slight concordance ( $\kappa=0.104$ ), similar to what was



found by Vásquez-Estudillo et al., who obtained a low concordance ( $\kappa$ : 0.18) between surgeons and pathologists when categorizing appendicitis by phases<sup>(16)</sup>. However, in a study carried out by Cordero in Nicaragua, he obtained a very good concordance ( $\kappa$ : 0.8544) between the surgical and histopathological findings<sup>(17)</sup>. This could be due to the convenience sampling carried out in the said study, which would generate an increase in the probability that the concordance between both diagnoses is greater compared to our study, where the sampling was systematically random, or due to the expertise of the staff involved.

Among the operative and pathological findings, the suppurative or phlegmonous appendix predominated with a frequency of 32.4% and 72.7%, respectively, similar to the study by Pablo Barco, where the suppurative appendix was more frequent (39.52%)<sup>(11)</sup>. In our study, when analyzing the cases of acute appendicitis diagnosed by the surgeons, with pathological confirmation that were classified as complicated or uncomplicated, it was observed that the surgeons classified 39.6% as uncomplicated, while the pathologists 87, 4%, found a poor concordance between both diagnoses ( $\kappa$ =0.158).

The scale used (modified Alvarado) by surgeons has clinical and laboratory variables for its classification into various subgroups in the staging diagnosis of AA, this higher staging diagnosis could have been made to prevent the patient from complications and prolong your hospitalization, or due to the experience of each surgeon. Similar to what was reported by Ponsky T et al. in which they observed little agreement between surgeons to assess the severity of appendicitis and the existence of inter-observer variation (27%) in the macroscopic evaluation of appendicitis staging between surgeons<sup>(18)</sup>.

Regarding the sociodemographic characteristics, in various studies<sup>(14-17)</sup> it has been shown that Acute Appendicitis is a pathology that occurs more frequently in the male population, as evidenced in the results obtained in the present investigation, where it is observed in 56.8% of the total number of patients who underwent surgery were male. On the other hand, the age group where where this pathology occurred most

frequently is the adult population at 50.9%, ranging from 30 to 59 years, results that agree with the literature described<sup>(15,16)</sup>. In relation to the place of origin, the patients who were admitted to the José Casimiro Ulloa hospital due to an emergency came more frequently from the districts of Chorrillos and San Juan de Miraflores by 18.5% and 14.4% respectively, in agreement with the reports delivered in 2018 by the statistics and informatics department of HEJCU, in which 16.3% of attentions are from patients who come from the district of Chorrillos<sup>(8)</sup>.

The present study evaluates the concordance between the clinical, surgical, and pathological diagnosis, which is important because similar studies have not been carried out in an emergency hospital in the country; Likewise, the care cycle of the patient with AA is evaluated from the clinical diagnosis on admission to the pathological study on discharge.

One limitation was that the results of the anatomopathological study were not found in all the medical records, therefore, they were not selected in the present study.

## CONCLUSION:

It is concluded that in the diagnosis of AA, the clinical diagnosis with the surgical diagnosis has moderate concordance and considerable concordance with the pathological diagnosis; highlighting the clinical diagnosis in surgical pathology and its timely treatment at the Casimiro Ulloa Emergency Hospital in Lima - Peru. The concordance between the surgical and pathological diagnoses was moderate with respect to the existence of inflammatory signs of acute appendicitis, and the concordance between the diagnoses between surgeons and pathologists when classifying the type of appendix was considered slight ( $\kappa$ =0.104). There was a higher percentage of uncomplicated appendicitis in the pathology area compared to the surgery area, where complicated appendicitis predominated. It would be appropriate to carry out multicenter studies in the country, showing the reality in other hospitals in the country. This research is part of a thesis that was presented by the authors to obtain the degree of Medical Surgeon.



**Author contributions:** MRP and KQR designed the study; they managed the permits, carried out the data collection and its respective analysis, wrote the manuscript and its final version. LRPS participated in the study design, data analysis, article writing, and final writing of the manuscript. All authors approved the final version and assumed responsibility for the article's content.

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