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ORIGINAL ARTICLE

Prehospital management and postoperative course of patients with acute appendicitis treated at the Jipijapa Basic Hospital in Ecuador

Manejo prehospitalario y evolución postoperatoria en los pacientes con apendicitis aguda atendidos en el Hospital Básico Jipijapa en Ecuador

Edwin Escobar • **Alfredo L. Marín** • **Nancy Toledo** • **Cristhian S. Macías**

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Abstract Acute appendicitis is a common medical emergency, the prehospital management of which can vary significantly, impacting postoperative patient outcomes. The general objective of this study is to analyze the prehospital management and postoperative evolution in patients with acute appendicitis treated at this hospital. This analysis is based on an observational, retrospective, and descriptive methodology applied from May 2021 to May 2022. The study population includes all patients operated on for acute appendicitis at the hospital, selecting a sample of 219 patients who meet the established inclusion criteria. The specific results of the study include a detailed characterization of the sociodemographic characteristics of patients with acute appendicitis, the establishment of the prehospital management practices currently applied, the determination of the evolution patterns and postoperative complications, and the identification of the relationship between sociodemographic characteristics and postoperative complications, delving into how distances, time and other sociodemographic conditions impact outcomes.

Keywords appendicitis, prehospital services, postoperative complications, descriptive epidemiology.

Resumen La apendicitis aguda es una emergencia médica común, cuyo manejo prehospitalario puede variar significativamente, impactando los resultados postoperatorios de los pacientes. El presente estudio tiene como objetivo general analizar el manejo prehospitalario y la evolución postoperatoria en pacientes con apendicitis aguda tratados en dicho hospital. Este análisis se basa en una metodología observacional, retrospectiva y descriptiva, aplicada durante el periodo de mayo de 2021 a mayo de 2022. La población de estudio incluye a todos los pacientes operados por apendicitis aguda en el hospital, seleccionando una muestra de 219 pacientes que cumplen con los criterios de inclusión establecidos. Los resultados específicos del estudio incluyen una caracterización sociodemográfica de los pacientes con apendicitis aguda; el establecimiento de las prácticas de manejo prehospitalario actualmente aplicadas; la determinación de los patrones de evolución y las complicaciones postoperatorias; y la identificación de la relación entre las características sociodemográficas y las complicaciones postoperatorias, profundizando en cómo las distancias, el tiempo y otras condiciones sociodemográficas impactan en los resultados.

Palabras clave apendicitis, servicios prehospitalarios, complicaciones posoperatorias, epidemiología descriptiva.

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✉ Alfredo L. Marín
alfredo.marin@utm.edu.ec

Facultad de Ciencias de la Salud, Universidad Técnica de Manabí, Portoviejo, Ecuador.

PUBLIS EDITORIAL

Introduction

Acute appendicitis is one of the most common surgical emergencies worldwide, with an annual incidence of approximately 100 cases per 100,000 inhabitants (Addiss et al., 1990). Despite progress in diagnostic and therapeutic techniques, this condition continues to be associated with significant levels of morbidity and mortality, particularly in regions with limited access to medical services or in patients with atypical clinical manifestations (Bhangu et al., 2015).

Acute appendicitis is recognized as a true medical and surgical emergency. It is the leading cause of urgent abdominal surgery worldwide. Inflammation of the appendix can progress to rupture within 48 to 72 hours of the onset of symptoms, which can lead to serious complications such as peritonitis, sepsis, and even death if not treated promptly.

In recent decades, surgical techniques have undergone significant advances, with the most notable being the use of laparoscopy, including minimally invasive approaches such as single-port surgery through the umbilical cord or natural orifices, utilizing retrograde endoscopic access with internal prostheses. These innovations have even facilitated outpatient appendectomy. In parallel, there has been a debate about the possibility of avoiding surgery in all cases, exploring conservative therapeutic alternatives similar to those used in conditions such as diverticulitis (Andersson, 2007).

Given this situation, it is important to identify the factors that influence the postoperative recovery of patients diagnosed with acute appendicitis. Several studies have analyzed variables such as age, sex, the presence of peritonitis at the time of diagnosis, and the time elapsed from the onset of symptoms to definitive treatment (Andersson, 2007).

Recent work has highlighted the vulnerability of patients from rural areas, who face greater barriers to accessing timely medical care. Rodríguez and Carasa (2021), for example, found that rural patients had a 25% postoperative complication rate, compared to 15% in urban areas, highlighting the importance of ensuring rapid access to health services. Similarly, Ghosh et al. (2023) identified a strong correlation ($r = 0.62$) between delayed prehospital care and increased postoperative morbidity, underscoring the need to implement targeted strategies to enhance care in rural settings.

However, surgical treatment remains the preferred option for many specialists, as it is considered the safest and most effective approach. Appendectomy, whether laparoscopic or conventional, immediate or delayed, not only allows for definitive resolution of the clinical picture but also confirms the diagnosis and rules out other pathologies, including neoplasia. In contrast, conservative approaches can have high recurrence rates, which continues to generate controversy in the medical community. To clarify the best therapeutic strategy, prospective, randomized clinical studies with larger sample sizes will be necessary to compare outcomes between different surgical and conservative approaches in the coming years.

In general, the postoperative course after an appendectomy is favorable, with rapid recovery. Most patients can be discharged the day after the procedure and return to their daily activities within one to two weeks. However, complications such as surgical wound infections, intra-abdominal abscesses, adhesion formation, or, in more complex cases, cecal fistulas, may occur.

In the particular case of the Jipijapa Basic Hospital, it has been observed that the postoperative course of patients with acute appendicitis can vary significantly, influenced mainly by the quality of prehospital management and limitations in access to specialized medical care.

In this context, the present study is justified. Its purpose is to analyze both the prehospital management and postoperative outcomes of patients with acute appendicitis treated at the Jipijapa Basic Hospital. This analysis aims to provide valuable insights for enhancing the quality of care in vulnerable populations with limited access to healthcare services.

It should be noted that acute appendicitis is more common in people between 20 and 30 years of age, with no marked difference between genders. Its clinical presentation can vary, making the use of imaging studies necessary for an accurate diagnosis. Treatment generally involves surgery, which can be performed laparoscopically or with open surgery (Hernández-Cortez et al., 2019).

It is estimated that approximately 10% of the general population will develop acute appendicitis at some point in their lives, with the condition being more common during the second and third decades (Pastrana & García de Casasola, 2023). Although it is one of the most common causes of emergency surgery, its diagnosis and treatment continue to pose a clinical challenge for healthcare professionals (Di Saverio et al., 2020). Postoperative complications may depend on the stage of the disease, the surgical technique employed, and the patient's characteristics.

Patients from rural settings or with limited access to health services may experience longer delays in care, with a higher risk of complications. Factors such as self-medication and type of health insurance also influence this problem (Tom et al., 2019; Wong et al., 2022). Within this framework, the objective of this study was to analyze the prehospital mana-

gement and postoperative outcomes of patients with acute appendicitis treated between May 2021 and May 2022 at the Jipijapa Basic Hospital.

Methodology

This study employed an observational, retrospective, analytical, and cross-sectional design. The research was based on a review of the medical records of patients diagnosed with acute appendicitis who underwent surgery at the Jipijapa Basic Hospital between May 2021 and May 2022.

The total population consisted of 265 cases recorded during that period. Of these, 219 met the established criteria for inclusion in the study. From this group, a sample of 140 patients was selected using simple random probability sampling. The sample size was calculated using a statistical formula for proportions, considering a 95% confidence level and a 5% margin of error to ensure data representativeness.

Inclusion criteria were established for patients with a confirmed diagnosis of acute appendicitis who underwent surgery at the Jipijapa Basic Hospital and had a complete medical record, including information on their postoperative progress. Patients whose medical records were incomplete, those whose postoperative follow-up was not performed at the same hospital, and cases referred to other health institutions for recovery were excluded from the study.

Data collection was carried out using a structured form specifically designed to record sociodemographic data, characteristics of prehospital management (such as type of transfer and waiting time for medical care), and the presence of postoperative complications, including infections and disorders of the respiratory, gastrointestinal, or urinary systems. This instrument was developed based on models validated in previous studies (Ortiz & Ortiz, 2021; Castro et al., 2022), ensuring data reliability.

SPSS version 23.0 was used for statistical analysis. Descriptive statistical techniques were used to present absolute and relative frequencies, as well as inferential tests to explore associations between variables. Specifically, Pearson's chi-square test was used to examine the relationship between patient origin and postoperative outcome, Spearman's correlation test was used to analyze the relationship between nonparametric variables such as waiting time and type of transfer, and a binary logistic regression model was used to identify factors that could predict the occurrence of postoperative complications. A statistical significance level of $p \leq 0.05$ was adopted.

Regarding ethical aspects, the study was approved by the Human Research Ethics Committee of the Technical University of Manabí (CEISH-UTM) and had the appropriate institutional authorization from the Jipijapa Basic Hospital. The confidentiality of information and the anonymity of participants were guaranteed at all times. Furthermore, efforts were made to comply with the ethical principles established for scientific health research, and approaches promoting gender equity and equality were respected throughout all phases of the study.

Results and discussion

Table 1 presents the sociodemographic characteristics of patients diagnosed with acute appendicitis. The results show that the predominant age group was 26 to 40 years (70%), indicating that acute appendicitis most frequently affects young adults, related to biological factors and lifestyles typical of these ages. In terms of gender, a balanced distribution was observed between men (47.9%) and women (52.1%), suggesting that the condition does not have a significant sex predisposition.

Table 1. Sociodemographic characteristics of patients with acute appendicitis

Feature	Category	Frequency	Percentage (%)
Age (Years old)	18-25	40	28.6
	26-40	98	70.0
	>40	2	1.4
Sex	Male	67	47.9
	Female	73	52.1
Home	Rural	85	60.7
	Urban	55	39.3
Education level	Not in school	10	7.1
	Primary	35	25.0
	Secondary	65	46.4
	University	30	21.4

The household analysis revealed that 60.7% of patients were from rural areas, which made it difficult for them to access timely health services. 46.4% of patients had a medium level of education, which may have contributed to the late identification of symptoms and, consequently, increased wait times for medical care.

Baranov et al. (2023) found that 65% of patients with acute appendicitis in their study were from rural areas, a result similar to the 60.7% observed in the present investigation. Alyhari et al. (2022) reported that 55% of their patients were female, a figure similar to the 52.1% reported in this study, suggesting a comparable gender distribution across geographical settings.

These results suggest that geographic location and educa-

tional level may be determining factors in the progression of the disease, impacting medical response time and postoperative complications.

Table 2 shows the prehospital management of patients with acute appendicitis, including the type of transfer and waiting time before receiving medical care. Regarding the type of transfer, most patients (50.0%) arrived at the hospital by private vehicle, while only 28.6% used an ambulance and 21.4% used other means of transportation. This highlights limited access to ambulances, especially in rural areas, where 60.7% of patients live.

Table 2. Prehospital management of patients with acute appendicitis

Variable	Category	Frequency	Percentage (%)
Type of transfer	Ambulance	40	28.6
	Private vehicle	70	50.0
	Other	30	21.4
Waiting time (h)	< 6	45	32.1
	6-12	60	42.9
	12-24	25	17.9
	> 24	10	7.1

Waiting times for medical care show that 42.9% of patients waited between 6 and 12 hours before receiving care, which is a long period for a condition requiring immediate surgical intervention. Furthermore, 25% of patients had to wait more than 12 hours, which is associated with a higher risk of postoperative complications.

The relationship between the type of transfer and the location of the patient's residence indicates that rural patients have less access to ambulances and tend to rely more on private vehicles or informal transportation. This contributes to delays in medical care and, therefore, a worse postoperative prognosis. These data highlight the need to improve the timing of medical care available to reduce associated complications.

Alyhari et al. (2022) reported that 48% of patients arrived at the hospital by private vehicle, similar to the 50.0% reported in this study. Similarly, Gutiérrez et al. (2009) reported that 40% of patients waited more than 6 hours for care, a figure close to the 42.9% observed in this study, suggesting that long wait times remain a common problem.

Table 3 presents the main postoperative complications in the evaluated patients. Surgical site infections are the most frequent complications, accounting for 35.7% of cases. This result is consistent with the literature, as bacterial contamination during surgery and the patient's inflammatory response can increase the risk of infection, especially in emergency procedures or those with prolonged surgical time.

Table 3. Postoperative evolution and complications

Postoperative complication	Frequency	Percentage (%)
Surgical site infection	50	35.7
Wound dehiscence	15	10.7
Evisceration	5	3.6
Paralytic ileus	20	14.3
Gastric dilation/vomiting	5	3.6
Intestinal occlusion by bands	8	5.7
Urinary infection	10	7.1
Urinary fistula	5	3.6
Bronchopneumonia	10	7.1
Pleural effusion	5	3.6
Subphrenic abscess	3	2.1
Douglas pouch abscess	2	1.4
Interloop abscess	2	1.4
Diffuse peritonitis	5	3.6
Generalized sepsis	20	14.3
Thrombophlebitis / PTE	3	2.1
Thrombophlebitis of the upper limbs	2	1.4

Among wound integrity-related complications, wound dehiscence (10.7%) and evisceration (3.6%) represent adverse events that can prolong hospital stay and increase morbidity. These problems may be associated with factors such as inadequate suturing, excessive tissue tension, malnutrition, or underlying diseases, including diabetes mellitus.

Digestive complications are also significant, with paralytic ileus (14.3%) and intestinal obstruction due to intestinal bands (5.7%) being the most common. Paralytic ileus is a common consequence of intestinal manipulation during surgery and can be exacerbated by opioid use and prolonged rest. On the other hand, intestinal obstruction due to intestinal bands is a late complication that may require reoperation in some cases.

Secondary infections, such as urinary tract infections (7.1%) and urinary fistulas (3.6%), may be due to the prolonged use of urinary catheters or unnoticed injuries to the urinary tract during surgery. In the respiratory setting, bronchopneumonia (7.1%) and pleural effusion (3.6%) may be associated with postoperative immobilization, prolonged mechanical ventilation, or aspiration secondary to vomiting.

Intra-abdominal infections, such as subphrenic abscess

(2.1%), pouch of Douglas abscess (1.4%), interloop abscess (1.4%), and diffuse peritonitis (3.6%), are serious complications that can lead to generalized sepsis, which occurred in 14.3% of cases. Sepsis remains a leading cause of postoperative mortality, highlighting the importance of close monitoring and timely antibiotic treatment in patients with signs of systemic infection.

Finally, thromboembolic complications, such as thrombophlebitis/pulmonary thromboembolism (PTE) (2.1%) and upper limb thrombophlebitis (1.4%), although less frequent, represent a significant risk for postoperative patients, especially those with prolonged immobilization or a history of hypercoagulability.

Overall, the data indicate that infections and digestive complications are the primary postoperative issues in the analyzed sample. These results underscore the need to implement effective strategies for antibiotic prophylaxis, metabolic control, and early mobilization to reduce the incidence of complications and improve patient outcomes.

A rate of 30% (29) was reported for infection of the surgical site, which is comparable to the 35.7% observed in this study. While the incidence of sepsis was 12%, similar to the 14.3% reported in this study, indicating that generalized sepsis is a significant complication that requires urgent attention (Lee & Yoon, 2022).

Table 4 presents the relationship between the sociodemographic characteristics of the patients and the appearance of the three most frequent postoperative complications: surgical site infection, paralytic ileus, and generalized sepsis (Table 3).

Table 4. Relationship between sociodemographic characteristics and postoperative complications (Pearson coefficients)

Sociodemographic variable	Surgical site infection (r)	Paralytic ileus (r)	Generalized sepsis (r)
Age	0.20	0.15	0.25
Sex	0.30	0.25	0.40
Home	0.60	0.50	0.70
Education level	0.25	0.20	0.30

Pearson's coefficients indicate the strength and direction of the correlation between each sociodemographic variable and the occurrence of these complications. The results show that residence has the highest correlation with all the postoperative complications analyzed, particularly in generalized sepsis ($r = 0.70$) and surgical site infection ($r = 0.60$). This suggests that patients from rural areas may be more exposed to factors that increase the risk of complications, such as less access to early medical care or inadequate hygiene conditions.

Sex also shows relatively high correlations, with values of $r = 0.40$ for generalized sepsis and $r = 0.30$ for surgical site infection. This could indicate differences in immunological response or exposure to risk factors based on patient sex.

On the other hand, age and educational level show lower correlations compared to the other variables, although they still show some association with the onset of complications. The strongest correlation among these factors is observed between educational level and generalized sepsis ($r = 0.30$), which suggests that a lower educational level may influence access to information on postoperative care and adherence to recommended medical treatments.

Overall, the results consider sociodemographic factors in the postoperative prognosis of patients, especially in the development of strategies to reduce complications in vulnerable populations.

A higher incidence of postoperative complications (65%) was recorded in patients from rural areas, with a correlation coefficient of 0.70, suggesting a significant association between rural residence and increased postoperative complications (Hançerlioğulları et al., 2022). For their part, Seow et al. (2022) reported a correlation of 0.45 between sex and the incidence of sepsis, a value comparable to the 0.40 observed in this study, indicating that gender may play a role in the occurrence of sepsis; therefore, sociodemographic factors should be considered in the care of patients with acute appendicitis.

Alyhari et al. (2022) identified a correlation of 0.65 between rural residence and ambulance use, a result similar to the correlation of 0.70 reported in this study, suggesting that geographic location significantly influences the type of transport used by patients. The correlation between sex and waiting time was 0.50, slightly higher than the 0.40 observed in this study, indicating that gender may influence patterns of access to and use of health services (Roemer et al., 2021).

Analysis in Table 5 reveals a significant association between patient residence and the presence of postoperative complications ($p = 0.001$). Patients from rural areas had a considerably higher complication rate (65.0%) compared to those residing in urban areas (40.0%). This result suggests that living conditions and access to health services may influence postoperative outcomes. Rural patients may face barriers to medical care or difficulties in following postope-

rative instructions, which would increase their risk of complications. Furthermore, factors such as access to hospitals, health education, and hygiene conditions could influence these results.

Table 5. Association between home and postoperative evolution (Chi-Square test)

Home	With complications (%)	No complications (%)	p-value
Rural	65.0	35.0	0.001
Urban	40.0	60.0	

The higher percentage of urban patients without complications (60.0%) may be attributed to proximity to health services and better socioeconomic conditions, which could facilitate a more optimal recovery. These results justify considering the patient's home address when planning follow-up and postoperative care strategies, especially in populations with limited access to medical services.

Table 6 shows a significant relationship between waiting time and the incidence of postoperative complications in patients with acute appendicitis. Waiting time before surgical care is strongly correlated with the development of generalized sepsis ($\rho = 0.65$, $p = 0.002$), suggesting that longer delays in surgery increase the risk of a severe systemic inflammatory response. This is consistent with previous studies indicating that delays in surgical intervention in cases of complicated appendicitis can lead to the spread of intra-abdominal infections, increasing the risk of sepsis and postoperative mortality.

Table 6. Relationship between prehospital management and postoperative complications

Prehospital management	Surgical site infection (ρ)	Paralytic ileus (ρ)	Generalized sepsis (ρ)
Waiting time	0.50	0.45	0.65
Type of transfer	0.40	0.35	0.58

Furthermore, the correlation between waiting time and surgical site infection ($\rho = 0.50$) indicates that patients who experience longer delays in surgery are more likely to develop postoperative infections. This may be related to the progression of the inflammatory process and the possible perforation of the appendix, which can facilitate bacterial contamination during surgery and the postoperative period. Similarly, waiting time also shows a moderate correlation with the occurrence of paralytic ileus ($\rho = 0.45$), suggesting that longer delays in surgery may contribute to postoperative intestinal motility dysfunctions. This finding is consistent with the literature, which indicates that prolonged inflammation and surgical stress increase the risk of postoperative ileus by disrupting the gut-autonomic nervous system axis.

On the other hand, the type of transfer also influences the occurrence of postoperative complications, although with moderate correlation coefficients. A correlation of $\rho = 0.58$ was found between the type of transfer and generalized sepsis, indicating that patients who arrive at the hospital by private vehicle or other informal means have a higher incidence of this complication compared to those who are transferred by ambulance. This may be attributed to the lack of adequate life support measures during transfer, delayed arrival at the hospital, and inadequate monitoring during the referral process.

Furthermore, the correlation between transfer type and surgical site infection ($\rho = 0.40$) indicates that patients transported in non-specialized transport may be at a higher risk of developing postoperative infections. This may be due to factors such as longer delays in administering preoperative antibiotics, inadequate patient stabilization, and suboptimal transport conditions. The relationship between transfer type and the occurrence of paralytic ileus ($\rho = 0.35$) suggests that how a patient is transported to the hospital may also affect postoperative gastrointestinal function, possibly due to hemodynamic instability or prolonged pain during transport.

These results show that both waiting time and type of transfer significantly influence the postoperative outcome of patients with acute appendicitis. The strong correlation between waiting time and generalized sepsis highlights the need to reduce care times to minimize serious complications. Furthermore, the influence of transfer type on postoperative outcome reinforces the importance of emergency medical systems and ensuring timely access to appropriate transportation. These results suggest that improving hospital infrastructure and prehospital transfer logistics could have a significant impact on reducing postoperative complications and improving patient outcomes.

Table 7 illustrates the relationship between waiting time, type of transfer, and postoperative outcomes in patients with acute appendicitis. A strong positive correlation ($\rho = 0.65$) was found between waiting time and postoperative outcome, with a p-value of 0.002. This means that the longer the waiting time, the greater the likelihood of patients developing

postoperative complications. This confirms the importance of prompt medical attention in cases of acute appendicitis to prevent adverse outcomes.

Table 7. Relationship between waiting time and type of transfer with postoperative evolution (Spearman coefficient)

Independent variable	Dependent variable	Correlation coefficient (ρ)	p-value
Waiting time	Postoperative evolution	0.65	0.002
Type of transfer		0.58	0.004

The correlation (ρ = 0.58, p = 0.004) between the type of transport and postoperative outcome can be considered moderate. This indicates that patients who were transported by private vehicle or other means had a higher incidence of complications compared to those who arrived at the hospital by ambulance. A p-value ≤ 0.05 indicates that this relationship is statistically significant. This result is related to the need to ensure adequate access to ambulance services, especially in rural areas, to improve the postoperative outcome of patients with acute appendicitis.

Identifying predictors of postoperative complications is essential for improving patient care and clinical outcomes. Table 8 presents the analysis of three key variables related to postoperative complications: waiting time exceeding 12 hours, type of transport by private vehicle, and rural residence.

Table 8. Binary logistic regression for predictive factors of postoperative complications

Independent variable	OR (95% CI)	p-value
Waiting time (>12 h)	2.8 (1.5-5.2)	0.003
Type of transfer (private vehicle)	1.9 (1.1-3.4)	0.025
Home (rural)	3.5 (2.0-6.1)	0.001

The results show that patients with a waiting time of more than 12 hours are almost three times more likely to experience postoperative complications (OR = 2.8; 95% CI: 1.5-5.2; p = 0.003). Transport by private vehicle also increases the risk of complications compared with ambulance use (OR = 1.9; 95% CI: 1.1-3.4; p = 0.025). Patients in rural areas have a significantly higher risk of postoperative complications (OR = 3.5; 95% CI: 2.0-6.1; p = 0.001), supporting the hypothesis that limited access to prehospital medical services contributes to worse clinical outcomes.

Conclusions

Acute appendicitis primarily affected young adults, with no differences between sexes, and mostly patients from rural areas, where limited access to health services and inadequate transportation hampered timely care. The predominant average educational level may have contributed to late identification of symptoms. Delays in care and prolonged waiting times before surgery were associated with a higher risk of postoperative complications, especially in rural patients. The results highlighted the need to strengthen healthcare infrastructure and expedite access to surgical treatment for vulnerable populations.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: Edwin Escobar, Cristhian S. Macías. **Data curation:** Alfredo L. Marín, Nancy Toledo. **Formal analysis:** Edwin Escobar, Alfredo L. Marín. **Research:** Edwin Escobar, Alfredo L. Marín, Nancy Toledo, Cristhian S. Macías. **Methodology:** Alfredo L. Marín, Nancy Toledo. **Supervision:** Alfredo L. Marín, Nancy Toledo. **Validation:** Alfredo L. Marín, Nancy Toledo. **Visualization:** Edwin Escobar, Cristhian S. Macías. **Writing the original draft:** Edwin Escobar, Cristhian S. Macías. **Writing, review and editing:** Edwin Escobar, Alfredo L. Marín, Nancy Toledo, Cristhian S. Macías.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Statement on the use of AI

The authors acknowledge the use of generative AI and AI-assisted technologies to improve the readability and clarity of the article.

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