



**LATE DIAGNOSIS AND SURGICAL SITE INFECTION IN SUBJECTS AFTER  
APPENDECTOMY**  
**DIAGNÓSTICO TARDIO E INFECÇÃO DE SÍTIO CIRÚRGICO EM SUJEITOS SUBMETIDOS A  
APENDICECTOMIA**  
**EL DIAGNÓSTICO TARDÍO Y LA INFECCIÓN DE SITIO QUIRÚRGICO EN SUJETOS SOMETIDOS A  
APENDICECTOMIA**

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**ABSTRACT**

**Objective:** to assess the association between evolutionary degree of appendicitis with surgical site infection in subjects after appendectomy. **Method:** retrospective, descriptive and quantitative study, from the examination of the medical records of subjects that underwent appendectomy. The statistical analysis was done through Variance analysis. **Results:** the sample consisted of 60 patients, with a predominance of males, the classic symptoms of appendicitis registered in most subjects included abdominal pain in the epigastric or periumbilical region that radiated to the right iliac fossa. The distribution of the subjects according to the laparoscopic classification was: degree 1 (18.33%); 2 (28.33%); 3 (26.67%); 4A (8.33%); 4C (10%); 5 (5%); not specified (3.33%). The rate of surgical site infection was 15%. **Conclusion:** evolutionary degree and surgical site infection are dependent variables, because the complications were more frequent in more advanced phases of appendicitis (degree 4). The nursing performance through measures directed to preventing and controlling nosocomial infections, especially surgical site infections, is essential. **Descriptors:** Appendectomy; Digestive System Surgical Procedures; Surgical Wound Infection; Unified Health System; Perioperative Nursing; Nursing.

**RESUMO**

**Objetivo:** verificar a associação grau evolutivo da apendicite com a infecção de sítio cirúrgico em sujeitos submetidos a apendicectomia. **Método:** estudo quantitativo retrospectivo e descritivo, a partir do exame dos prontuários médicos de sujeitos submetidos a apendicectomia. A análise estatística foi feita através da Análise de variância. **Resultados:** a amostra foi constituída por 60 pacientes, com predomínio do sexo masculino, a sintomatologia clássica da apendicite registrada na maioria dos sujeitos, incluiu a dor abdominal na região epigástrica ou periumbilical que irradiava para fossa ilíaca direita. A distribuição dos sujeitos segundo a classificação laparoscópica foi: grau 1 (18,33%); 2 (28,33%); 3 (26,67%); 4A (8,33%); 4C (10%); 5 (5%); não especificado (3,33%). A taxa de infecção de sítio cirúrgico foi de 15%. **Conclusão:** grau evolutivo e infecção de sítio cirúrgico são variáveis dependentes, pois as complicações foram mais frequentes em fases mais avançadas da apendicite (Grau 4). É fundamental a atuação da enfermagem através de medidas direcionadas à prevenção e controle das infecções hospitalares, sobretudo, da infecção de sítio cirúrgico. **Descritores:** Apendicectomia; Procedimentos Cirúrgicos do Sistema Digestório; Infecção da ferida cirúrgica; Sistema Único de Saúde; Enfermagem Perioperatória; Enfermagem.

**RESUMEN**

**Objetivo:** evaluar la asociación entre el grado evolutivo de la apendicitis con infección de sitio quirúrgico en sujetos sometidos a apendicectomía. **Método:** estudio retrospectivo, descriptivo y cuantitativo, a partir del examen de los registros médicos de los sujetos sometidos a apendicectomía. El análisis estadístico se realizó mediante el Análisis de varianza. **Resultados:** la muestra estuvo constituída por 60 pacientes, con un predominio del sexo masculino, los síntomas clásicos de apendicitis registrados en la mayoría de los sujetos incluyeron dolor abdominal en la región epigástrica o periumbilical, que irradia a la fosa ilíaca derecha. La distribución de los temas según la clasificación laparoscópica fue: grado 1 (18,33%); 2 (28,33%); 3 (26,67%); 4A (8,33%); 4C (10%); 5 (5%); no especificado (3,33%). La tasa de infección del sitio quirúrgico fue de 15%. **Conclusión:** grado evolutivo y la infección de sitio quirúrgico son variables dependientes, porque las complicaciones fueron más frecuentes en fases más avanzadas de la apendicitis (grado 4). Es esencial el desempeño de la enfermería a través de medidas dirigidas a la prevención y el control de las infecciones nosocomiales, especialmente de la infección del sitio quirúrgico. **Descriptor:** Apendicectomía; Procedimientos Quirúrgicos del Sistema Digestivo; Infección de la Herida Quirúrgica; Enfermería Perioperatoria; Sistema Único de Salud; Enfermería.

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## INTRODUCTION

Acute appendicitis is one of the most frequent abdominal, surgical, emergency diseases throughout the world. The risk estimates for developing it throughout life, for men and women, are 8.6% and 6.7%, respectively.<sup>1</sup> Furthermore, this disease can affect any age group, especially young adults, with a predominance of males.<sup>2-3</sup>

This condition is defined as the presence of inflammation of the cecal appendix caused by obstruction of the intestinal lumen, being the most frequent causes the hyperplasia of the lymphoid tissue, fecaliths, foreign bodies, worms or neoplasms.<sup>4</sup> The patient often develops a picture of abdominal pain, initially located in the epigastric or periumbilical region, with migration to the right iliac fossa, and fortuitously reported in other locations, depending on the position of the appendix. These symptoms may be accompanied by nausea, vomiting and fever, which intensifies as the disease progresses.<sup>3</sup>

Although the diagnosis of acute appendicitis is predominantly clinical, in dubious situations, laboratory and imaging examinations are great contributors.<sup>5</sup> However, the delay in recognizing this pathology and starting its proper treatment contribute to the emergence of complications, especially Surgical Site Infection (SSI), attributed to the seriousness of the evolutionary process of the appendicular inflammation, favoring the increased morbidity and mortality.<sup>6</sup>

Surgical site infection is one of the most frequent complications, corresponding to approximately 14% to 16% of infections found in hospitalized subjects.<sup>7</sup> The Brazilian incidence varies from 2.8 to 20%, depending on factors such as the type of surveillance, hospital characteristics, the subject and the surgical procedure.<sup>8</sup> Moreover, it constitutes one of the most frequent complications after appendectomy.<sup>9</sup>

In any case, surgical site infection is characterized by the presence of microorganisms capable of changing and delaying the healing process of tissues and are related to the presence of purulent secretion in the incision and signs of phlogose, such as: pain, increased sensitivity, edema, erythema and local heat, in addition to fever and leukocytosis.<sup>10</sup>

This wound complication presents various etiologic factors that predispose and favor its emergence, especially due to the direct relationship between appendicitis severity and the duration and evolutionary degree of

inflammation of the appendix, becoming necessary and extremely relevant the early detection and immediate treatment in order to prevent its occurrence.

In this line of thought, seeking to contribute to the improvement of the assistance provided to subjects undergoing surgeries and the scarcity of studies that relate the diagnostic approach of appendicitis and the influence of the degree of appendicitis for surgical site infection in the nursing area, this study was proposed, reflecting the influence of late diagnosis of Acute Appendicitis, the pathological stage of the appendix as the most important factor in the onset of complications after appendectomy, mainly in the development of surgical site infection.

## OBJECTIVES

- To assess the association between evolutionary degree of appendicitis and surgical site infection in subjects that underwent appendectomy.
- To describe the signs and symptoms recorded at admission in subjects that underwent appendectomy.

## METHOD

Quantitative, retrospective and descriptive study developed at a public hospital in the city of Itabuna/BA. The institution has 208 beds, serving a population of approximately 1,618,519 inhabitants, distributed in 67 municipalities. It provides medium- and high complexity assistance, being a reference in cases of urgency and emergency.

The sample included all available records of subjects, both genders, that underwent appendectomy in that hospital in 2016, which represented 60 medical records.

Data collection was performed in March and April 2017 from the information contained in the medical records stored in the Medical Archive and Statistical Service (SAME - *Serviço de Arquivo Médico e Estatística*) using a specific form prepared by the researchers. This instrument had issues related to subjects' characterization, data related to pre, intra and post-operative and the diagnostic criteria for surgical site infection.

In relation to the sample characterization and the data related to pre-, intra- and postoperative period, the researchers analyzed issues concerning age, sex, date of hospitalization, surgery, notification of Surgical Site Infection and discharge, signs and symptoms presented at admission, duration of symptoms prior to seeking medical and

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surgical intervention, laboratory and imaging results, administration of antibiotic prophylaxis, type of procedure performed, intra-operative findings.

The collected data regarding the diagnostic criteria are related to the appearance of signs and symptoms that characterize the Surgical Site Infection, such as purulent secretion in the wound, fever ( $>38^{\circ}\text{C}$ ), dehiscence of stitches and leukocytosis.

The descriptive analysis was performed from simple absolute and percentage frequencies, by Software Microsoft Office Excel version 2013. The statistical analysis used was the Analysis of variance (ANOVA) that verified the association between the degree of acute appendicitis and surgical site infection. The established level of significance was 5 %.

This study was developed respecting all ethical procedures for researches involving human beings. The Research Ethics Committee (CEP) of the State University of Santa Cruz approved this study, CAAE 59540416.0.0000.5526.

## RESULTS

The sample for this study consisted of 60 medical records of subjects who met the inclusion criteria of this research, with ages ranging from 14 to 60 years and a mean of 30.2 years. Of these, 36 (60%) individuals were males and 24 (40%) were female.

Regarding age, there was a greater frequency of subjects between 20 to 34 years, corresponding to 36 (55%) individuals in this sample, in both sexes, and only two (3.33%) individuals were more than 60 years. In addition, only one (1.67%) subject presented associated comorbidities, including hypertension, hepatic steatosis Degree III and gaseous distension.

Concerning the subjects included in this study that sought the emergency service of

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the hospital for the treatment of acute abdominal pain, 37 (61.67%) came from regions close to the study site, 21 (35%) were from the city of Itabuna/BA (local residents) and only two (3.33%) lived in another state.

With regard to the classical symptoms recorded, 23 (38.33%) subjects reported over two classic symptoms of appendicitis at hospital admission and 21 (35%) mentioned more than five, and 16 medical records (26.67%) contained only one reported symptom.

There was predominance of abdominal pain, initially epigastric or periumbilical with migration to the right iliac fossa in 55 (91.67%) subjects, 40 subjects had nausea and vomiting (66.67%), 26 had fever (43.33%), 22 reported anorexia (36.67%).

The constipation was reported by 10 subjects (16.67%), diarrhea by three (5%), four individuals with diminished air-fluid noises (6.67%), the palpable plastron was identified in two subjects (3.33%). Other reported symptoms included the abdominal distension, headache and vaginal discharge, present in one subject (1.67%). The Blumberg's sign was positive in 38 (63.33%) subjects and only four (6.67%) subjects presented Rovsing's sign.

The mean time between the onset of symptoms and the surgical treatment was 3.8 days, which ranged from a few hours to 21 days, and most subjects sought the hospital emergency service in up to five days (Table 1).

The anamnesis and physical examination were sufficient for diagnosing appendicitis in most cases, however, as additional resource, 50 (83.33%) subjects underwent hemogram before surgical intervention.

Table 1. Distribution of the patients that underwent appendectomy according to the number of days between the onset of symptoms and signs and surgical intervention. Itabuna, BA, Brazil, 2017.

History time (days)	N	%
Up to 1	9	15
2 - 5	36	60
6 - 9	4	6.67
> 10	5	8.33
Ignored	6	10
Total	60	100

The classification of acute appendicitis in this study obeyed the surgical description made by surgeons during intraoperative period (Table 2). Due to the absence of the registration of such classification in some

records, two (3.33%) subjects were included in the studied sample as non-specified degree.

Ten (16.67%) subjects presented complications from appendicitis, such as intra-abdominal abscess, and only one subject presented diffuse peritonitis (1.67%) and

concurrently with this pathology, one subject presented the ruptured ovarian cyst (1.67%).

The average hospital stay was 5.85 days. The hospitalization period ranged from one to 14 days. Thirty-three subjects (55%) remained

hospitalized in this hospital during four through seven days; other 15 (25%) continued at this institution for treatment for more than eight days and 12 (20%) subjects were hospitalized from one to three days.

Table 2. Distribution of patients that underwent appendectomy at a hospital, according to intra-operative findings. Itabuna (BA), Brazil, 2017.

Evolutionary degree	n	%
Degree 1	11	18.33
Degree 2	17	28.33
Degree 3	16	26.67
Degree 4 A	5	8.33
Degree 4 B	0	0
Degree 4 C	6	10
Degree 5	3	5
Non-specified	2	3.33
Total	60	100

In relation to the treatment, all subjects of the sample with initial diagnosis of Acute Appendicitis underwent appendectomy by laparotomy with Invagination of the appendicular stump, by purse surgical suture.

The rate of surgical site infection was 15%, calculated as indicated in the Manual of Diagnostic Criteria of Healthcare-Related Infections.<sup>7</sup> Regarding the patients that developed this wound complication, they emerged between the 3<sup>rd</sup> and the 5<sup>th</sup> postoperative day. Concomitantly to this complication, five subjects had operative wound dehiscence (8.33%), two subjects had septicemia (3.33%) and one died (1.67%).

The Analysis of Variance (ANOVA) was used to verify the association of the variables evolutionary degree of appendicitis and surgical site infection, demonstrating a statistically significant difference ( $p=0.0000385$ ).

For a better visualization of this relationship, a boxplot (Figure 1) was built, converting the degree of appendix into numerical values, allowing observing that the surgical site infection was more frequent in advanced degrees of the disease.

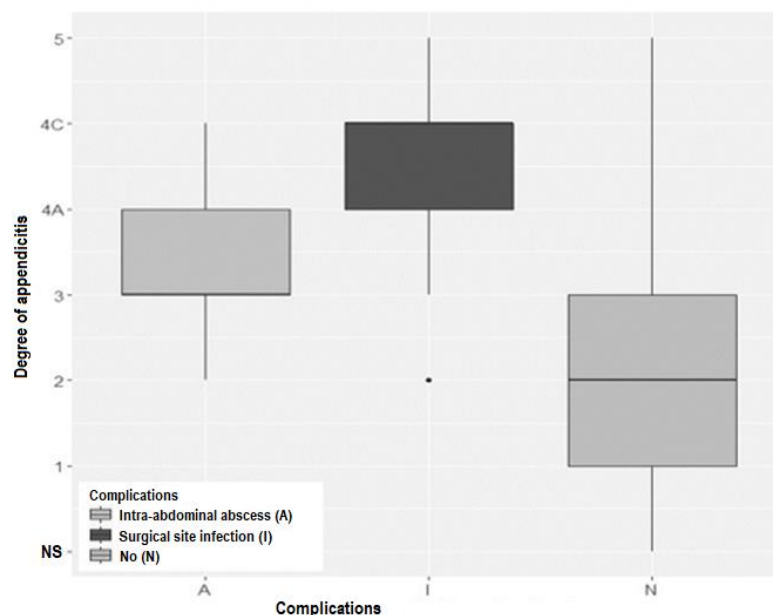


Figure 1. Relationship between evolutionary degree of appendicitis and surgical site infection. Itabuna (BA), Brazil, 2017.

NS: Not specified.



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Another aspect in this study relates to antibiotic prophylaxis, held in 46 (76.67%) individuals, being the first-generation cephalosporin and benzimidazoles the most used antimicrobial classes in this hospital.

## DISCUSSION

Acute Appendicitis is a common disease in young people, being present in approximately 5% to 10% of elders.<sup>2</sup> It presents a relatively higher incidence in male individuals.<sup>3, 9, 11</sup>

It is a serious clinical condition in elders, with high morbidity and mortality. In this perspective, some factors may contribute to the development of major postoperative complications in this population group, such as delayed diagnosis, the subject's delay to search for care, as well as associated comorbidities, vascular insufficiency and severe infection.<sup>2</sup>

In this study, there was a predominance of male individuals, in the second and third decade of life, and, specifically in the elderly population, only one elder presented with associated comorbidities, with late diagnosis of appendicitis performed 21 days after the onset of symptoms until the implementation of the appendectomy, resulting in worsened clinical condition, with postoperative complications and death. In a study on risk factors for perforation of the appendix, Omari et al.<sup>2</sup> observed that two elderly patients died due to uncontrollable septicemia, which shows the importance of diagnosis and immediate treatment in these subjects.

Undoubtedly, clinic is mandatory for early recognition of appendicitis<sup>3</sup>. However, the diagnosis continues to be a challenge for professionals, mainly due to atypical manifestations of the disease, and children, elders and women at reproductive age are the most difficult to be diagnosed, thus contributing to worsening this condition, leading to complications.<sup>12</sup>

In this way, it is important to introduce into practice diagnostic tools that assist in the definition and clarification of acute appendicitis<sup>11</sup>. The Alvarado's score has been an important tool to assist in the diagnosis of this disease. A study conducted by Sousa-Rodrigues et al.<sup>11</sup> confirmed the relationship between the Alvarado's score and the macroscopic aspect of the appendix, i.e., a high score is directly related to advanced evolutionary stages of this abdominal disease.

Among the fundamental tests used in the diagnosis of appendicitis, hemogram is very useful, when performed before the surgical decision<sup>13</sup>. Leukocytosis exceeding

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20,000/mm<sup>3</sup> can be indicative of complications<sup>6</sup>. In this study, the hemogram was performed before the surgery, and the patients showed leucometria that ranged from 8.500.00 mm<sup>3</sup> to 24.100.00 mm<sup>3</sup>, with deviation to the left.

In the United States and Western countries, for example, before the surgical decision, imaging tests are routinely requested in order to increase diagnostic accuracy<sup>1</sup>. In these countries, the acute appendicitis is rarely diagnosed only by clinical history and physical examination, thus contributing to reducing negative rates of appendectomy and, consequently, to reducing hospital costs.

In the performed analysis, the earliest and most common symptom of acute appendicitis presented by most patients was abdominal pain located in the right iliac fossa, classical manifestation of the disease, suggestive of peritoneal irritation, as well as in other studies.<sup>3, 14</sup>

Appendectomy has been pointed out as the best therapeutic resource for acute appendicitis<sup>14</sup>. Usually, it is one of the most performed emergency surgeries, and the laparoscopic approach is the most indicated. In addition, the laparoscopic appendectomy offers numerous benefits, such as decreased incidence of complications, specifically surgical site infection, and reduced hospital costs and hospital stay.<sup>1, 8</sup>

The mean duration of surgery in this study was 54.06 minutes, different from other studies<sup>9, 15</sup>. The main postoperative complication was surgical site infection, presenting an average of 15%. This fact was also observed by Neves et al.<sup>15</sup> in which surgical site infection was the main complication, with a rate of 9.7% of cases.

This incidence is within the expected values for contaminated (10 - 17%) and infected surgeries (above 27%), since the degree of contamination contributes to the occurrence of surgical site infection.<sup>16</sup>

In addition, among the nine patients (15%) who developed this complication, only two subjects had appendicitis degree 2 and 3, all the others were classified as degree 4A, 4C and 5, i.e., they can be related to the degree of appendicular inflammation. One of the factors that may have favored this process was the time elapsed between the onset of the clinical picture and the surgery, with an average of 6.7 days, reflecting on the extension of 9.4 days in hospital stay.

Regarding the association of the variables evolutionary degree of appendicitis and surgical site infection, these two variables are dependent, suggesting that the higher the

appendicitis degree, the greater the chances of developing SSI.

Although 16.67% of the studied subjects of the sample showed no surgical site infection, the hospitalization was extended from eight to 11 days, and, from these, 6.67% developed fever and presented leukocytosis in the postoperative period. Nevertheless, in the remaining patients, this aspect could not be measured, because these records did not contain the hemogram.

Another aspect observed in this research referred to the description of the characteristics of the surgical wound, which were incomplete, with absence of the characterization of the wound bed and exudate characteristics. The evaluation of the surgical site includes the inspection conducted by the examination of the wound, the characteristics of the healing tissue and the adjacent skin, type and amount of exudate, size, color, and palpation of the incision.<sup>10</sup>

Regarding the antibiotic prophylaxis, a preventive measure against surgical site infection, the first dose of antimicrobial drug should be administered in until one hour before the surgical incision and suspended within 24 hours, except in cases of cardiac surgery and implantation of prosthesis, which extend up to 48 hours.<sup>7</sup>

In relation to this aspect, in this study, 33.33% of the subjects received exclusively cefazolin as prophylaxis in the surgical procedure, the other included various other medicines, such as ciprofloxacin, metronidazole, gentamicin and amoxicilin, administered alone or combined.

Another interesting aspect refers to the notification of cases of surgical site infection, dehiscence of surgical wound and sepsis. In this study, some cases were underreported, because, of the nine (15%) medical records with complications, only three (5%) were reported by the nursing staff to the Nosocomial Infection Control Commission (NICC).

Therefore, although the control of nosocomial infections is a challenge, it is important to supervise and implement rules and routines of the NICC aiming at actions of prevention and control of surgical site infection, since they can contribute significantly to reducing the incidence in the institutions.<sup>17</sup>

## CONCLUSION

Given the addressed issues, the study discussed the importance of actions directed to the early diagnosis of appendicitis, through anamnesis and meticulous physical examination, the use of the Alvarado's score, which can assist in reducing negative appendicectomy, contributing to reducing hospital costs. Furthermore, the delay to identify this pathology can result in complications, such as the development of surgical site infection.

The clinical evaluation is extremely important, through meticulous and systematic anamnesis and physical examination, directed to the subject with acute abdominal pain, either in the emergency sector or even at basic health units and during nursing consultations, in order to ensure greater diagnostic accuracy, especially considering the initial presentation or previous history of symptoms, evolution and change in the characteristics of pain, because they are important aspects for early recognition of potential risks of complications of Acute Appendicitis, such as surgical site infection.

Therefore, all health team members are responsible for assessing each subject, with the aim of recognizing his/her particularities, as well as observing the wound site and assigned risks, and personal and collective potential that can be explored, from systematic and integral observation to solve health problems of each subject seeking health services.

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