Retrospective Study of Patients Submitted to Appendectomy in a Tertiary Hospital: Is There a Difference between the Public and Supplementary Health System?

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Abstract

Introduction Appendicitis is the surgical disease with the highest prevalence in emergency rooms. Its clinical and/or surgical complications are associated with the time course of symptoms, age, comorbidities, and stages of the disease.

Objectives To analyze the demographic and clinical data of patients who underwent appendectomy for acute appendicitis in a tertiary referral hospital in the city of São Paulo and compare these data between services provided by the Public and Supplementary Health System.

Methodology Retrospective analysis of data from electronic medical records of patients over 14 years old who underwent appendectomy for acute appendicitis at Hospital Santa Marcelina, both in the Public and Supplementary Health Systems from January 2015 to December 2017.

Results A total of 536 patients were analyzed, 354 (66%) of whom were male with a general mean age of 29.85 years (14–81 years). The mean time from symptoms to seeking medical care was 53.84 hours. Regarding the phases of acute appendicitis, a greater number of cases of complicated disease was observed in patients operated on in the Public Health System ($p < 0.0001$), as well as the time course of symptoms ($p = 0.0005$) and

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- acute appendicitis
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hospitalization ($p = 0.0012$). On the other hand, the surgical wound infection rate during the hospitalization period was similar between groups ($p = 0.2118$).

Conclusion There was a predominance of male patients undergoing appendectomy for acute appendicitis, with longer time course of symptoms in those operated on in the Public Health System and a predominance of appendicitis in advanced stages (3 and 4) in this group. However, in this group there was no significant increase in the rate of postoperative infection, and the length of stay was shorter than that of patients operated on in the Supplementary Health System.

Introduction

Described around 140 years ago, acute appendicitis is still one of the most frequent causes of acute abdomen, and its surgical resolution dates back more than a century.[1] The lifetime risk of presenting the problem is around 8.6% in men and 6.7% in women,[2] with more than 300,000 appendectomies performed per year in the United States of America.[3–6] In Brazil, the work conducted by Santos et al.[7] with information from the IT department of the Brazilian Public Unified Health System (DataSus - http://datasus.saude.gov.br), computed between the years 2008 and 2014 the performance of 684,278 appendectomies, with an average of 97,754 per year.

Uncomplicated acute appendicitis is defined as edema or phlegmon of the cecal appendix, corresponding to phases 1 and 2. On the other hand, it is said to be complicated when there is necrosis or perforation of the viscera, as seen in phases 3 and 4.[8] Additionally, one of the most relevant factors involved with this classification is the length of history and symptomatology associated with the delay in seeking help and delay in the medical diagnosis.

The attempt, through clinical history, physical examination, laboratory tests, and imaging methods, to distinguish between these two classifications is of relevant importance, since it affects the type and therapeutic orientation, urgency and rates of complications, and morbidity and mortality, which, although presenting low rates, it is an eminently surgical disease that affects a significant portion of the population.[9–11]

The care systems in Brazil (public and private or supplementary) present diagnostic and therapeutic effectiveness; however, access to both presents notable differences. In the public health system, access to urgent and emergency service is free; however, the high demand overwhelms the system thus generating eventual delays in the diagnosis and management of several conditions, among them acute appendicitis.

The supplementary system, on the other hand, offers access to patients who contribute, having a potential for controlled demand and distribution in different health services, and may provide a faster resolution for an urgent and emergency surgical situation, such as acute appendicitis. Thus, we developed the hypothesis that in the public system, patients will arrive in more advanced stages of acute appendicitis for surgical resolution and that they will potentially have a greater number of complications related to the treatment, generating a longer hospital stay and more morbidities.

Objectives

To analyze the demographic and clinical data of patients undergoing appendectomy for acute appendicitis in a tertiary hospital in the city of São Paulo and compare these data between the public and supplementary health care systems. Another objective is to compare the stages of the disease, time course of symptoms and hospitalization among patients operated on by each health care system.

Methodology

Retrospective analysis of data from electronic medical records of patients over 14 years of age who underwent conventional appendectomy for acute appendicitis at Hospital Santa Marcelina, both in the Public and Supplementary Health Systema from January 2015 to December 2017. Patients whose medical records were incomplete and those in which the indication for appendectomy was a surgical tactic and not due to macroscopic signs of acute appendicitis were excluded.

The GraphPad Prism 9 (GraphPad Software, Inc., La Jolla, CA, USA) software was used to perform the inferential analysis of the data. The Shapiro-Wilk test was applied to verify the normality of the variables. Quantitative variables showed non-parametric distribution and, therefore, the Mann-Whitney test was used. The Spearman test was applied to investigate correlations. For all analyses, $p < 0.05$ was considered statistically significant.

For the Spearman test, it is considered that both positive and negative values between 0.00 and 0.19 demonstrate a very weak correlation, between 0.20 and 0.39 weak, between 0.40 and 0.69 moderate, from 0.70 to 0.89 strong, and values between 0.9 and 1.0 a very strong correlation.

Results

General Data

Between January 2015 and December 2017, 536 patients over 14 years of age operated on at Hospital Santa Marcelina —São Paulo, Brazil—due to acute appendicitis were analyzed. The mean age was 29.85 years (14–81 years), and 354 (66%) patients were male. The average time from symptoms to seeking medical attention was 53.84 hours, and the average time from hospitalization was 2.73 days (1–13 days).

Table 1 Comparison regarding the time course of symptoms between uncomplicated (phases 1 and 2) and complicated (phases 2 and 3) appendicitis

	Uncomplicated appendicitis (phases 1 and 2)	Complicated appendicitis (phases 3 and 4)	*p*
Hours of symptoms (average)	41.2	79.3	< 0.0001
Standard deviation	36.1	63.1	

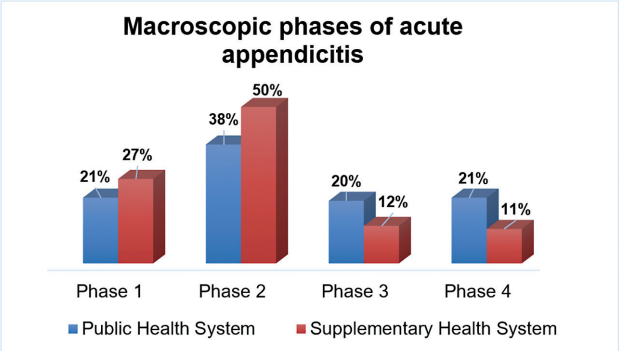

Fig. 1 Macroscopic phases of acute appendicitis in patients submitted to appendectomy performed by the Public Health System (in blue) and Supplementary Health System (in red).

Regarding the stages of acute appendicitis, 125 (23.3%) patients had stage 1 appendicitis; 231 (43.1%) stage 2; 88 (16.4%) stage 3; and 92 (17.2%) stage. When comparing, in general, the stages of appendicitis grouped into uncomplicated (stages 1 and 2) and complicated (stages 3 and 4) with time course of symptoms, it was verified, according to ►**Table 1**, that patients in the initial stages had a shorter time of symptoms until medical attention ($p < 0.0001$).

In the postoperative period, 466 patients (86.9%) evolved without complications, 49 (9.2%) had surgical wound infection, 14 (2.6%) had paralytic ileus, and 7 (1.3%) presented intracavitary abscess, and only 5 patients (0.93%) required reoperation.

Of those patients who had some type of complication, the acute appendicitis phase was complicated in 58.2% and, of those with intracavitary abscess, 71.4% were in these phases. Furthermore, among patients requiring reoperation, 80% had appendicitis with signs of necrosis or necro-perforation.

In most patients, surgical access was locoregional through the Mc Burney or Davis incision. Forty-eight patients (8.96%) underwent surgery with a median incision. Of these, 77.1% had stage 3 or 4 appendicitis and 45.8% had some type of complication, the most common being surgical wound infection. In addition, it was observed that of the patients who underwent a median incision, 44 (91.7%) came from the Public Health System.

Comparison between Patients Operated on for Acute Appendicitis in the Public Health System (group 1) and Supplementary Health System (group 2)

During the study period, 326 patients were operated on by the Public Health System (60.8%) and 210 by the Supplementary Health System (39.2%). In both places of care, there was a predominance of male patients undergoing appendectomy, 67.5% in group 1 and 64.3% in group 2 ($p = 0.5126$). Regarding mean age, time course of symptoms, and hospitalization period, ►**Table 2** compares the two groups, with a shorter symptom period being observed in patients from group 2 ($p = 0.0005$) and a shorter hospitalization period in group 1 ($p = 0.0012$).

When comparing the macroscopic phases of acute appendicitis between the groups, the distribution can be seen in ►**Fig. 1**.

Still regarding the phases of acute appendicitis, when classifying between uncomplicated (phases 1 and 2) and complicated (phases 3 and 4) appendicitis, a greater number of cases of complicated disease can be observed in patients in group 1 ($p < 0.0001$), as shown in ►**Table 3**.

When analyzing the time course of clinical symptoms between patients in group 1 and group 2 in relation to the uncomplicated and complicated phases of acute appendicitis, it was observed that there was no statistically significant difference between them in phases 1 and 2 (44 ± 40.7 hours $\times$ 37.7 ± 29.3 hours, respectively. $P = 0.79$). On the other hand, the difference regarding the time course of symptoms in patients submitted to appendectomy for acute appendicitis stages 3 and 4 was significant when comparing patients assisted by the Supplementary Health System and the Public Health System (59 ± 43.3 hours $\times$ 86.6 ± 67.5 hours, respectively. $P = 0.0056$).

Regarding the percentage of surgical wound infection detected during the hospitalization period, the rate was 7.7% in group 1 and 4.7% in group 2 ($p = 0.2118$), with 2 cases (0.6%) requiring reoperation in patients submitted to appendectomy in the Public Health System and 3 (1.4%) in the Supplementary Health System ($p = 0.3868$).

Table 2 Comparison regarding mean age, time course of symptoms, and length of stay between patients undergoing appendectomy by the Public Health System (group 1) and Supplementary Health System (group 2)

	Group 1	Group 2	*p*
Age in years (average ± SD)	30.78 ± 13.42	28.42 ± 9.57	0.3593
Time course of symptoms in hours (average ± SD)	61.39 ± 57.12	42.2 ± 33.88	0.0005
Hospitalization period in days (average ± SD)	2.62 ± 1.88	2.91 ± 1.76	0.0012

Abbreviation: SD, standard deviation.

Table 3 Comparison between uncomplicated (phases 1 and 2) and complicated (phases 3 and 4) appendicitis between patients operated on by the Public Health System (group 1) and by the Supplementary Health System (group 2)

	Uncomplicated appendicitis (phases 1 and 2)	Complicated appendicitis (phases 3 and 4)	Total	*p*
Group 1 (number of patients)	194	132	326	< 0.0001
Group 2 (number of patients)	162	48	210	
Total	356	180	536	

Table 4 Spearman correlation between age, time course of symptoms, and period of hospitalization in the Public Health System (group 1)

	Age	Time course of symptoms	Hospitalization period
Age		0.106	0.128*
Time course of symptoms	0.106		0.341
Hospitalization period	0.128*	0.341	

*$p = 0.021$.

Correlations between Age, Time Course of Symptoms, Stages of Acute Appendicitis, and Period of Hospitalization in the Public Health System

According to ►**Table 4**, when comparing age with time course of symptoms (and vice versa) in patients submitted to appendectomy by the Public Health System, a very weak correlation was observed, as well as for age and length of hospital stay (and vice versa), but with the latter showed statistical significance ($p = 0.021$). On the other hand, the correlation between time course of symptoms and hospitalization (and vice versa) was weak in group 1.

When analyzing the time course of symptoms with the uncomplicated or complicated phases of acute appendicitis in group 1, it was observed that the average time between the onset of symptoms and seeking medical assistance was 44.1 hours (±40.7 hours) in those patients operated on for acute appendicitis phases 1 and 2 and 86.6 hours (±67.5 hours) in phases 3 and 4 ($p < 0.0001$).

Correlations between Age, Time Course of Symptoms, Stages of Acute Appendicitis, and Period of Hospitalization in the Supplementary Health System

As shown in ►**Table 5**, when correlating age with time course of symptoms (and vice versa) in patients undergoing appendectomy through the Supplementary Health System, a very weak correlation was observed, as well as for age and length of stay (and vice versa). On the other hand, the correlation between time of symptoms and hospitalization (and vice versa) was weak, with statistical significance ($p = 0.004$) in group 2.

Table 5 Spearman correlation between age, time course of symptoms, and period of hospitalization in the Supplementary Health System (group 2)

	Age	Time course of symptoms	Hospitalization period
Age		-0.031	0.107
Time course of symptoms	-0.031		0.196*
Hospitalization period	0.107	0.196*	

*$p = 0.004$.

When analyzing the time course of symptoms with the uncomplicated or complicated phases of acute appendicitis in group 2, it was observed that the average time between the onset of symptoms and seeking medical assistance was 37.7 hours (±29.3 hours) in those patients operated on for acute appendicitis phases 1 and 2 and 59 hours (±43.3 hours) in phases 3 and 4 ($p = 0.0008$).

Discussion

The present study analyzed 536 patients who underwent appendectomy via laparotomic access—48 cases through median incision (8.96%) - at Hospital Santa Marcelina, São Paulo, Brazil—between January 2015 and December 2017 due to acute appendicitis, 60.8% of which were treated by the Public Health System.

Lima et al.[12] evaluated 638 cases of surgical treatment of acute appendicitis over a period of 5 years, with an average of 127.6 patients operated per year, while the present study showed an average of 178.7 cases per year. Similarly, Moreira et al.[13] retrospectively analyzed 1,241 cases of appendicitis in 5 years, presenting an average of 248.2 appendectomies per year. In addition, data collected by Santos et al.[7] from DataSUS between 2008 and 2014 reveal a national average of 97,754 appendectomies per year.

Regarding the mean age, there was an overall mean of 29.85 years and 66% of male patients, consistent with work in the literature in which the mean age was 32 years and the rate of male patients was 65.2%12. Similarly, Silva et al.[14] had, in their analysis, 72% of male patients operated on for acute appendicitis and Fisher et al. had 70%.[15]

Regarding the stages of acute appendicitis, the present study demonstrated that 125 (23.3%) patients had stage 1 appendicitis; 231 (43.1%) stage 2; 88 (16.4%) stage 3; and 92 (17.2%) stage 4. Similarly, a Brazilian study[12] found 22.3% of patients operated on for stage 1 appendicitis; 34.3% stage 2; 25.4% stage 3; and 17.4% four, with 0.6% having no macroscopic signs of acute appendicitis during surgical procedure. Still, the study by Iamarino et al.[16] analyzed 402 patients in 1 year, presenting the epidemiology of 58 (14.4%) patients in the edematous phase; 145 (36%) in the phlegmonous phase; 107 (26.6%) in gangrenous phase; 88 (21.9%) in the perforated phase; and 4 (1%) patients with normal appendices (tactical appendectomy).

Silva et al.[14] demonstrated a rate of surgical site infection of 10.4% and intracavitary abscess of 3.8%. We, on the other hand, verified these complications in 9.2 and 1.3%, respectively, with the need for reoperation in only 5 patients (0.93%).

These same authors[14] demonstrated in their work involving 500 patients undergoing appendectomy an average time of symptoms of 67.9 hours and included patients over 12 years of age. We, on the other hand, included patients older than 14 years and the mean time course of symptoms was 53.84 hours. Comparing the attendances and operations for acute appendicitis between patients from the public health service and supplementary health, the average time of symptoms was 61.39 ± 57.12 hours and 42.2 ± 33.88 hours, respectively ($p = 0.0005$).

On the other hand, the average length of stay in the present study was 2.73 days, with a shorter period in those patients operated by physicians from the public health system when compared with those who underwent surgery performed by professionals from the supplementary health system ($2.62 \pm 1.88 \times 2.91 \pm 1.72$ days - $p = 0.012$). Silva et al.[14] observed in their study an average length of stay of 5.19 ± 3.8 days. Santos et al.,[7] when evaluating DataSUS data from 684,278 patients who underwent appendectomy, observed a mean hospital stay of 3.8 days for those who underwent surgery via laparotomy and 3.6 days for laparoscopic surgery.

Lima et al.[12] verified a mean length of stay of 7.03 days, with a longer period in those undergoing appendectomy for stage 4 appendicitis, with a statistically significant difference when compared with the length of stay with patients operated on for stage 1 acute appendicitis ($p = 0.001$). Similarly, Sulu et al.[17] observed a mean length of stay of 4.16 ± 2.36 days, with 3.96 ± 2.2 days for patients undergoing appendectomy for uncomplicated appendicitis and 5 days for complicated ones. We, on the other hand, demonstrated a weak correlation between the time course of symptoms and hospital stay (and vice versa) both in patients operated by doctors from the Public System and the Supplementary Health System.

In the present study, it was verified that, both for patients operated on by the Public Health System and by the Supplementary Health System, those with complicated appendicitis had a longer clinical history than in the initial phases. Furthermore, when comparing the groups, in patients operated on for appendicitis stages 3 and 4, the duration of symptoms was shorter in those in group 2 ($p = 0.0056$), and it is known that delay in diagnosis and treatment are important factors related to perforation of the cecal appendix.[15,18,19]

Coelho et al.[19] compared the data of patients who underwent appendectomy, similar to ours, between the Public Health System and the Supplementary Health System and found that in 200 patients analyzed (100 in each group), the mean age and gender distribution were similar between the groups. Similarly, the present study demonstrated equivalent results in the analysis of 326 patients operated on by the Public Health System and 210 by the Supplementary Health System.

In the present study, it was demonstrated that the time course of symptoms of patients operated on by the Public Health System was longer than those submitted to appendectomy by the Supplementary Health System ($p = 0.0005$). Coelho et al.[19] also observed this difference ($p < 0.0001$), as well as a higher percentage of complicated phases of acute appendicitis in patients operated on by the Public Health System ($p = 0.0127$). However, unlike us, these authors found a longer hospital stay in patients treated by the Public Health System ($p = 0.0024$).

As limiting factors in our study, no case of appendectomy without macroscopic evidence of acute appendicitis was described, which contradicts the incidence of 10 to 20% of this occurrence in the literature. Furthermore, the surgical site infection (SSI) rate analysis was only during the hospitalization period and not in the first 30 postoperative days. Another point is that in hospitals with medical residency, in the Public Health System, appendectomy is an operation performed by a resident of 1 or 2 years, and in the Supplementary Health System, this operation is more commonly performed by doctors. Therefore, doctors with greater expertise, longer experience, and greater surgical volume should have better results in the operation and in the earlier diagnosis.

However, as positive points it is possible to mention the significant number of cases raised through electronic medical records and the fact that the cases of a single health center, whether public or supplementary, were studied.

Conclusion

In the present study, a predominance of male patients undergoing appendectomy for acute appendicitis was demonstrated, with longer time course of symptoms in those operated on in the Public Health System and a predominance of appendicitis in advanced stages (3 and 4) in this group. However, in this group there was no significant increase in the rate of postoperative infection, and the length of stay was shorter than that of patients operated on in the Supplementary Health System.

Conflict of Interests
The authors have no conflict of interests to declare.

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