

# Impact of Covid-19 Pandemic on Incidence of Complicated Appendicitis: A Retrospective Study

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## ABSTRACT

**Purpose:** The COVID-19 pandemic has posed new challenges at all levels of the healthcare system. In the state of Arizona, the stay-at-home orders were implemented on March 30th, 2020. Following this, there was suspension of nonemergent surgeries, and the public was advised to avoid the emergency department unless deemed necessary. The progression of acute appendicitis is time-sensitive and early presentation is critical to prevent complications such as perforation with peritonitis, abscess formation and phlegmon. The primary objective of this study is to compare the incidence of complicated appendicitis during the initial 6 months of the COVID-19 pandemic with prior years.

**Methods:** We performed a retrospective analysis of all patients who were treated for acute appendicitis during the initial COVID-19 era of March 30th - August 30th, 2020. Data was compared for the same time intervals of the 3 prior years and of the 36 months preceding the pandemic. We evaluated hospital length of stay, surgery times and return visits for all groups.

**Results:** The incidence of complicated appendicitis was 25% (21/85) during the COVID-19 era. Although this incidence was greater than the similar time intervals for 2019 and 2018 with 20% (20/98) and 16% (12/75) respectively, the 2017 time period had the highest complication rate of 35% (22/63). There was a shorter mean length of stay during the COVID era, but we found no significant difference in surgery times or total charges among the groups.

**Conclusion:** The incidence of complicated appendicitis during the early part of the COVID-19 pandemic increased when compared to the two previous years but was still lower than the 2017-time interval. During pandemics health care providers should provide ongoing public information on why and how to seek timely medical care for potentially life-threatening conditions.

## BACKGROUND

- Coronavirus-2019 pandemic changed the way medicine is being practiced
- Hospitals were forced to postpone elective surgeries, and many states implemented stay-at-home orders
- These changes triggered a reduction in the number of patients presenting to Emergency Departments
- Published reports have indicated a rise in delayed presentations of medical and surgical conditions<sup>1-3</sup>
- Acute appendicitis is a common surgical emergency that is not expected to resolve without medical or surgical intervention
- Several studies have shown a higher rate of perforation and longer duration of symptoms during the pandemic, while others actually found a decreased incidence of complicated appendicitis<sup>1, 4, 5</sup>
- The data is inconclusive and no association with morbidity has been adequately proven

## RESEARCH QUESTION

Was the incidence of complicated appendicitis higher during the coronavirus-2019 pandemic when compared to pre-/post-pandemic time periods?

## METHODS

- **Design:** Retrospective analysis of all patients (aged 0 months- 99 yrs) treated for acute appendicitis at either Maryvale or Valleywise Emergency Department during the COVID-19 era of March 30<sup>th</sup> - August 30<sup>th</sup>, 2020
  - Data compared for the same time intervals of the 3 prior years and of the 36 months preceding the pandemic to account for possible seasonal and annual fluctuations
  - Also evaluated secondary outcomes
  - Data, including demographic data, collected from Epic electronic medical records with chart review performed to fill in any missing information
  - **Exclusion criteria:** Patients who presented with 1) acute on chronic appendicitis, 2) post-operative complications of acute appendicitis, or 3) were transferred to another facility for management of acute appendicitis
  - **Primary outcome:** incidence of complicated acute appendicitis during the COVID era compared to prior years
  - **Secondary outcomes:**
    - length of stay
    - total surgical time
    - total hospital charges
- **Statistical analysis:**
  - Exploratory analysis to examine the incidence of uncomplicated and complicated acute appendicitis
  - Description of the baseline characteristics of the included sample
  - Chi squared test used to compare categorical data
  - Kruskal-Wallis test or Wilcoxon rank-sum test\*\* used for continuous variables
  - P-value of 0.05 to determine significance

## RESULTS

Table 1: Frequency of acute appendicitis in 5 time periods

Periods	Total cases of appendicitis	Avg cases per 30 day period
Post Covid Mar31-Aug31 2020	85	17.8
Precovid Mar31 2017-Mar31 2020	572	15.7
Precovid Ma 31-Aug31 2017	63	12.4
Precovid Mar31-Aug31 2018	75	14.7
Precovid Mar31-Aug31 2019	98	19.4

## RESULTS

Table 2: Characteristic comparison of acute appendicitis in pre- and post- Covid era

	Post COVID Mar 31-Aug 31 2020	Pre Covid Mar 31 2017-Aug 2020	P-value
Total number of patients	85	572	-
Age at encounter	29	26	0.036
Mean Temp (F)	98.6	98.5	0.415
Mean HR	102	96	0.089
Hospital Length of Stay (mean hours)	36	40	0.416
Mean Hospital cost	43943	50178	<0.001

Table 3: Characteristic comparison of complicated appendicitis between post-Covid (2020) and prior 3 years

	Mar 31-Aug 31 2020	Mar 31-Aug 31 2019	Mar 31-Aug 31 2018	Mar 31-Aug 31 2017
Complicated appendicitis n/total patient (%)	21/85 (25%)	20/98 (20%)	12/75 (16%)	22/63 (35%)
Mean Age, years (range)	31(8-69)	29(5-64)	21(4-55)	24(2-64)
Mean duration of symptoms, days	2.35	2.35	2.33	2.64
WBC count X10 <sup>9</sup>	13.9	13.8	15.3	16.4

Table 4: Secondary outcomes of complicated appendicitis comparing post-Covid (2020) to prior 3 years

Time interval of Mar 31-Aug 31	Hospital length of stay hrs (n)	P-value**	Surgery duration in hours (n)	P-value**	Average total hospital cost in USD, mean (median, range)	P-value**
2017	74	0.245	96	0.415	55845 (56647, 10968-96026)	0.463
2018	88	0.170	108	0.586	63234 (59777, 22028-134136)	0.329
2019	85	0.163	99	0.858	68015 (55587, 12326-195980)	0.543
2020	36	Ref	85	Ref	43944 (41731, 5213-157792)	Ref

## DISCUSSION

- Our study found a higher incidence of complicated appendicitis during the pandemic compared to the prior two years. Explanations for the observed trend is multifactorial. Public fear about risking exposure to COVID-19 as well as hospital restrictions due to state-mandated lockdowns resulted in reduced access to health care
- Interestingly, hospital lengths of stay were significantly shorter during the pandemic. We postulate that patients were discharged sooner in order to assure adequate hospital resources for the very sick COVID patients
- Fluctuations in seasonal and annual incidence were controlled for by comparing to the same months in prior years, and preceding 30 months
- The population consisted of predominantly Hispanic patients which lessens confounding among socio-cultural premises. However, due to limited diversity of the patients the results may not be generalizable to the entire US population
- Our study adds to the growing body of literature that suggests that the COVID-19 pandemic potentiated a delay of medical care which may be associated with worse clinical outcomes
- We are currently in the process of expanding this study to include the identical timeframes for the two years following the COVID-19 stay at home orders.

## REFERENCES

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