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Pattern of acute appendicitis during COVID 19 pandemic in Saudi Arabia

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ABSTRACT

Background: As a result of the COVID-19 pandemic, acute appendicitis manipulation approaches as well as patient outcomes have been altered. *Aim:* To determine if the COVID-19 pandemic has an impact on complications among acute appendicitis patients matched to the pre-COVID-19 period. *Methods:* A cross-sectional study had been conducted using predesigned google form questionnaire during the period between September 2021 and March 2022. Participants were categorised in two groups, those being affected by acute appendicitis before and those during the pandemic. The collected data were managed by SPSS version 23.0. *Results:* A 2669 respondents (62.2% females and 37.8% males) from different region of the Saudi Arabia. The majority were overweight or obese as seen in 23.9% and 20.1% respectively. A 75.2% had developed appendicitis before, while 24.8% were during COVID 19. The main symptom was right lower abdominal pain (84.8%). Conservative management was employed in 31.9% (p=0.15). A 38.8% believed that their operation was replaced with antibiotic treatment due to pandemic. Complications were significantly reported in those developed acute appendicitis during COVID 19 pandemic (p= <0.001). A 72.1% of those with appendicitis during pandemic refrains from seeing a doctor due to the COVID 19 pandemic until their pain worsened. *Conclusion:* There is an ominously greater prevalence of complication related to acute appendicitis thru the COVID-19.

Keywords: acute appendicitis; COVID-19; non-operative management; operative management; complications.

1. INTRODUCTION

In comparison with other non-traumatic acute abdomen problems, acute appendicitis (AA) is the utmost prevalent emergency. Although technological ameliorations have improved diagnostic methods, appendicitis is still primarily determined by history and physical examination. Despite the ease with which most AA patients can be diagnosed, their signs and symptoms can

be quite variable, making a diagnosis difficult (Qureshi & Idris, 2020). A number of studies have reported a significant change in healthcare utilization due to long-term lockdowns and orders for patients to stay at home in the COVID-19 pandemic. Especially in areas hardest hit by the pandemic, these services have been reduced greatly (Aklilu et al., 2020; Moynihan et al., 2021). There is evidence that people lose faith in the healthcare system when they fear getting sick in hospitals (Gale et al., 2021). Furthermore, during the pandemic, people might afraid of going to the hospital, which has contributed to a decrease in hospital admissions (Pogorelić et al., 2022). By another view, patient developed a tendency of do not seek treatment for their illness or do not send a loved one to a medical facility, making the risk of mortality higher (Aklilu et al., 2020; Gale et al., 2021).

The patient has avoided emergency care during the pandemic even though the likelihood of contracting COVID-19 is low (Gale et al., 2021). In same line, many regulatory decision makers have recommended cancelling elective surgical procedures, which leads to a load on healthcare (Emile et al., 2021; Pogorelić et al., 2022). Studies had proposed that conservative management of AA might be a safe substitute to traditional laparoscopic or open surgical procedures thru the pandemic (Emile et al., 2021; Fadgyas et al., 2021). Despite the intense change in the fashion of urgent surgery in the course of COVID 19 pandemic, AA continues to be a clinical primacy and does not confinement (Emile et al., 2021).

The study intended to evaluate the influence of the COVID-19 pandemic on the outcome of AA and to quantity the participants' perception towards AA.

2. MATERIALS AND METHODS

In the current cross-sectional appraisal data had been collected by means of structured online google form questionnaire during the period between September 2021 and March 2022. The study purpose was to measure the participants' perception towards AA in the course of COVID 19 pandemic. The questionnaire entailed of demographics, knowledge about symptoms of acute appendicitis, mode of treatment they received, complications encountered, and their preference of treatment modality. Participants were categorised in two groups, those being affected by appendicitis before and those during the pandemic. Ethical consideration was maintained throughout the study. Informed consent had been obtained at the commencement of the questionnaire. Project bases were approved by the ethical committee.

Inclusion criteria

All adults from both genders whom managed because of acute appendicitis prior or during COVID 19 pandemic

Data analysis

Google forms were used to collect data, thereafter, encrypted and managed by means of Software Statistical Package for the Social Science (SPSS) version 23.0. Descriptive variables were conveyed as percentages. Chi square was used to investigate the differences between groups of patients with AA during the pandemic. Statistical significance was assumed for p values of 0.05.

3. RESULTS

Demographics

As shown in Table (1) a total of 2669 respondents (62.2% females and 37.8% males) from different region of Saudi Arabia with a majority were descent of western province (38.2%) were participated in the current study. Saudi citizens make up the vast majority of study participants (93.1%). Of the participants 41.3% were married, and 19.85% were smokers. Regarding the weights of the participants, the majority were either overweight or obese as seen in 23.9% and 20.1% respectively.

Knowledge about acute appendicitis

Table (2) refers to information and reports regarding acute appendicitis before and after the COVID 19 report. A total of 1,975 respondents (75.2%) had developed appendicitis before, while 660 respondents (24.8%) had developed appendicitis during COVID 19. Among 36.4% of the respondents reported to have comorbid disease and insignificant differences between the groups were observed as $p>0.05$. The commonest co-morbid diseases were hypertension, diabetes and bronchial asthma that reported in 11.7%, 9.8%, and 6.3% respectively. A 65.5% of the participants did have an idea about the symptoms of acute appendicitis. Their sources of knowledge were variable, included media, friends and doctors as reported in 17.7%, 11.8% and 10.3% respectively, insignificant differences between the groups were observed as $p>0.05$. These symptoms were mainly right lower abdominal pain, followed by nausea, vomiting, and anorexia as reported by 84.8%, 45.2%, 40.9%, and 33.1% respectively.

Table 1 Demographics

Factor		N (%)
Gender	Male	1009 (37.8%)
	Female	1660 (62.2%)
Marital statues	Single	1383 (51.8%)
	Married	1103 (41.3%)
	Divorced	109 (4.1%)
	Widow	74 (2.8%)
Nationality	Saudi	2484 (93.1%)
	Non Saudi	185 (6.9%)
Region	Central region	457 (17.1%)
	Western region	1019 (38.2%)
	Eastern region	252 (9.45%)
	Southern region	525 (19.7%)
	Northern region	416 (15.6%)
Smoking statue	No	2140 (80.2%)
	Yes	529 (19.85)
BMI	Underweight	278 (10.7%)
	Normal	1247 (46.7%)
	Overweight	621 (23.9%)
	Obese	523 (20.1%)

Table 2 knowledge about acute appendicitis

Statement	Item	N	Before COVID 19	During COVID 19	X^2/p value
Acute appendicitis	Before COVID 19	2009 (75.3%)	-	-	-
	During COVID 19	660 (24.7%)	-	-	-
Comorbid disease	Hypertension	313 (11.7%)	240 (11.9%)	73 (11.1%)	0.59/0.44
	Diabetes	263 (9.8%)	204 (10.1%)	59 (8.9%)	1.07/0.30
	Asthma	169 (6.3%)	124 (6.2%)	45 (6.8%)	0.36/0.55
	Gall stone	71 (2.7%)	52 (2.6%)	19 (2.9%)	0.06/0.81
	Others	155 (5.8%)	124 (6.2%)	31 (4.7%)	2.52/0.11
Did you have an idea about the symptoms of acute appendicitis?	No	922 (34.5%)	691 (34.4%)	231 (35%)	0.001/0.99
	Yes	1747(65.5%)	1318 (65.6%)	429 (65%)	
Source of your knowledge	Media	473 (17.7%)	337 (16.8%)	136 (20.6%)	10.53/0.07
	Family	134 (5.02%)	101 (5.03%)	33 (5%)	0.33/0.57
	Friend	315 (11.8%)	226 (11.2%)	89 (13.5%)	1.16/0.28
	Doctor	275 (10.3%)	214 (10.6%)	61 (9.2%)	1.47/0.23
	Nurse	118 (4.4%)	76 (3.8)	42 (6.4%)	3.98 /0.06
	Others	432 (16.2%)	364 (18.1%)	68 (10.3%)	18.21 / 0.09

Management of acute appendicitis

As shown in table 3, the majority (68.1%) of the respondents were managed by appendecectomy, whereas conservative means of management was employed in the reminder 31.9%, the observed difference between groups was statistically insignificant as X^2=2.10, and p=0.15. Nearly, 169 (38.8%) of respondents believed that their operation was replaced with antibiotic treatment due to the pandemic. The incidence of preoperative complications was 3.9% these complications were significantly reported in those developed acute appendicitis during COVID 19 pandemic 8.6% versus 2.3% in whom affected prior to pandemic (X^2=8.19 and p= <0.001).

The most prevalent preoperative complication was appendicular mass (2.3%) followed by abscess/peritonitis (1.6%), both were significantly commoner in those affected during pandemic X^2=64.9, p= <0.001 and X^2=12.201, p= <0.001 respectively. In the participants that treated surgically, postoperative complications were developed in 8.2% (7.1% before, and 11.6% during pandemic), the difference was significant during COVID 19 pandemic (X^2=88.88 and p= <0.001). The most common postoperative complications were abdominal pain after discharge from hospital seen in 4.5% (3.8% before, and 6.6% during pandemic), and surgical site infection in 3.7% (3.3% before, and 5.01% during pandemic), the difference was significant during COVID 19 pandemic (X^2=88.88 and p= <0.001).

Table 3 appendicitis management issues

Statement	Item	N (%)	Before COVID 19	During COVID 19	X^2/p value
What do you think is the first line of treatment?	Antibiotic	1064 (39.5%)	783 (38.3%)	281(42.6%)	3.32/0.07
	Surgery	1605 (60.5%)	1226 (61.02%)	379 (57.4%)	
How were you treated?	Conservatively (Antibiotics)	851 (31.9%)	626 (31.2%)	225 (34.1%)	2.10 / 0.15
	Surgically (Appendicectomy)	1818 (68.1%)	1383 (68.8%)	435 (65.9%)	
Complication upon the diagnosis	No	2566 (96.1%)	1963 (97.7%)	603 (91.4%)	8.19 / 0.02
	Yes	103 (3.9%)	46 (2.3%)	57 (8.6%)	
	Peritonitis/ Abscess	43 (1.6%)	20 (0.99%)	23 (3.5%)	12.201/ <0.001
	Appendicular mass	60 (2.3%)	26 (1.3%)	34 (5.2%)	64.90 / <0.001
Post-operative complication	No	1474 (91.8%)	1139 (92.9%)	335 (88.4%)	88.88 / <0.001
	Yes	131 (8.2%)	87 (7.1%)	44 (11.6%)	
	Surgical site infection	59 (3.7%)	40 (3.3%)	19 (5.01%)	4.32 / 0.038
	Abdominal pain after discharge	72 (4.5%)	47 (3.8%)	25 (6.6%)	12.201/ <0.001
Effects behind complications	Affect daily physical activity	55 (2.1%)	38 (1.9%)	17 (2.6%)	1.11 / 0.27
	Stay in hospital for more than a week	117 (4.4%)	66 (3.3%)	51 (7.7%)	12.25 / <0.001
What is preferred management of acute appendicitis?	Laparoscopic appendicectomy	1246 (46.7%)	920 (45.8%)	326 (49.4%)	27.87 / 0.3
	Open appendicectomy	388 (14.5%)	265 (13.2%)	123 (18.6%)	
	Non-operative management with antibiotics	336 (12.6%)	252 (12.5%)	84 (12.7%)	
	Did not change	699 (26.2%)	572 (28.5%)	127 (19.2%)	

These complications let 4.4% of participants (7.7% during the pandemic vs 3.3% before the pandemic) to stay in hospital for more than one week, the difference was significant as X^2=12.25 and p <0.001. Severe complication that affected their daily physical

activity developed in 2.1% 2.6% during vs 1.9% before the pandemic). Hospital stay was significantly less in group of patients treated by non-operative means in both pre and during COVID 19 pandemic, P=0.032 and P=0.037 respectively. There was tendency to develop such complications in those affected during the course of pandemic because 72.1% of them refrain from seeing a doctor due to the COVID 19 pandemic until their pain worsened (Figure 1). The comorbidity has no effect on the outcome (P>0.05).

The majority of respondents (60.5%) they think surgery is the first line option of treatment of acute appendicitis, the difference between groups was insignificant as X^2= 3.32, and p=0.07. Regarding preference of the mode of management of acute appendicitis, the majority (61.2%) preferring surgical mode of management (laparoscopic in 46.7%, open in 14.5%), whereas non operative mode was preferred by 12.6%, and the remainder 26.2% stated that there is no preference and both methods are acceptable. When comparing the result between groups there was no significant difference as p=0.3 (Table, Figure 2).

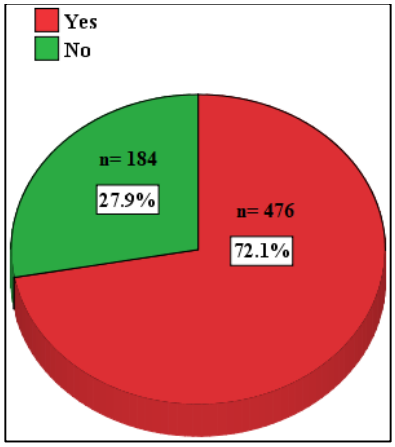

Figure 1 Refrain from seeing a doctor due to the COVID 19 pandemic until your pain worsened

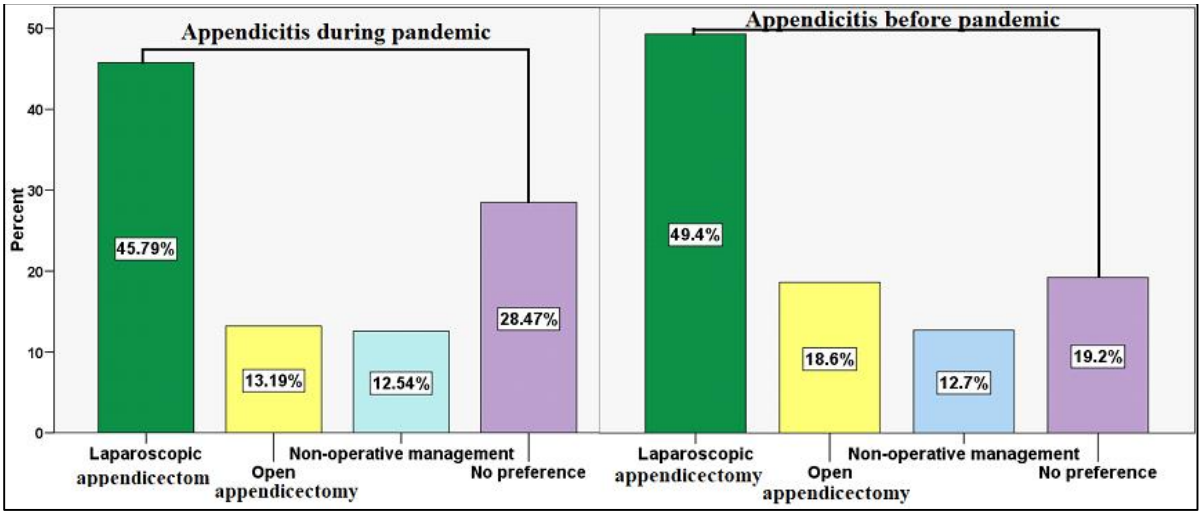

Figure 2 Preferred mode of treatment

4. DISCUSSION

In terms of surgical emergencies, AA remains a common condition. At some point in their lives, 8.6% of men and 6.7% of women will experience AA (Snyder et al., 2018). Despite that most of our participants were female and this in harmony with other research that concluded that female participant in online survey were higher than male (Romero et al., 2020). The preponderance of participants BMI were normal weight followed by overweight participants, this is in agreement with the study by Al Ajerami, (2012) where, postulated that the AA can be diagnosed with ultrasound fairly accurately (high sensitivity and specificity), principally among those of normal weight. Meanwhile, obesity rates rose from 7.9% pre-covid-19 to 9.2% during the covid-19 pandemic, primarily due to the effects of a sedentary lifestyle imposed by the pandemic. This was in keeping with other studies that found an increase in BMI during the Covid-19 pandemic (Gao et al., 2020).

The study found there is a regional variation of acute appendicitis across the Saudi Arabia. The finding is in line with Islam et al., (2019) who stated that the regional variations in acute appendicitis are substantial and the reasons behind these variations remain unclear (Gao et al., 2020). Never married participants had a higher incidence of acute appendicitis this result in inconsistency with the study that was conducted in China where the majority of were married (Islam et al., 2019). Most horrible prediction in acute appendicitis ensues in those with concomitant comorbidities (Iamarino et al., 2017). Herein, the study discovered that about 36.4% of the respondents had comorbid disease.

In the current study there was noticeable drop in AA count. Globally, it has been observed that COVID-19 delays the presentation of non-COVID pathologies. In similar way, a number of studies showed that the incidence of AA declined during the COVID-19 pandemic (Bosak et al., 2022; Romero et al., 2020; Tankel et al., 2020). In contrary Zaikos et al., (2021) stated that there is no change in their incidence, whereas, Stamov & Stamova (2021) in their study found a slight increase in AA counts during the course of the pandemic. Vast majority were aware of the symptoms of AA. Media was the main source of information about its symptoms for 17.7% of participants. This result wasn't surprise as people nowadays are dependent on the media as their main source of receiving information other than relying on reliable source which led to a lot of misdiagnosis and mismanagement which eventually lead to increase in complication.

Through a number of factors contributing to COVID-19's pandemic, the disease negatively affected millions, mutually directly and indirectly, destabilizing the treatment of other diseases not associated with COVID 19 (Bowen et al., 2021). In this context, there are significant sequelae of a late diagnosis of AA (Sivit et al., 2001). The majority of respondents with AA during the course of the pandemic had developed pre and postoperative complications including perforation of the appendix (Peritonitis/abscess), appendicular mass, and surgical site infection which is significantly higher in whom affected by acute appendicitis during COVID 19 pandemic might be because of their late presentation, diagnoses, and treatment, this was in concordance with others (Kumaira et al., 2020; Pogorelić et al., 2022; Romero et al., 2020; Velayos et al., 2020).

Studies showed that complicated appendicitis often results in lengthier hospital stays and higher morbidity rates (Pogorelić et al., 2022). Currently, the prolongation of the hospital stay was mainly seen in those developed complications during the pandemic. Presence of comorbid diseases including obesity did not affect the outcome. In contrary, there is evidence that obese patients are more likely to suffer postoperative complications, embracing surgical site infection, and lengthier hospital stay (Delgado-Miguel et al., 2020).

The majority of respondents from both groups considered surgery to be the best treatment option for acute appendicitis. Likewise, they prefer to be managed surgically. On the other hand, non-operative treatment increased during COVID 19 pandemic. This is consistent with the literature, since antibiotics have been used more frequently to treat AA cases during the pandemic (Lotfallah et al., 2021; Zhou & Cen, 2020).

Limitations of the study

No study without limitations. In this is a population survey study, although closed questions provided a faster and easier way to deliver and analyse data, as a result some information might not have been captured. Because the survey was distributed anonymously, respondents may have biases when selecting themselves for the sample.

5. CONCLUSION

In this analysis, it was found that complicated appendicitis rates were significantly higher during the COVID-19 pandemic period. There is a liaison between the severity of appendicitis and the number of appendectomies, which suggests patients with mild appendicitis are unlikely to seek treatment until symptoms worsen. Furthermore, a larger percentage of participants during the pandemic were treated through non-operative means than they were prior to the pandemic. In spite of the fact that surgical procedures remain the gold standard for treating acute appendicitis, still a debate persists about when conservative management should be used to treat acute appendicitis instead of appendectomy. It may be necessary to conduct a larger study based on hospitals data to confirm the findings.

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Authors' contribution

Boshra AA: Is the main conductor of the project; he contributed in article conceptualization, main contributor to the introduction and discussion sections.

Norah SA: Participated in the study design, writing introduction and revised critically for important intellectual content.

Saeed AA: Participated in data management, identified the relevant articles for inclusion, main contributor in result section and reviewed all drafts.

Abdalmajid MA: Participated in the study design, writing discussion section, and contributed in the result section.

Rakan HA: Participated in data collection, identified the relevant articles for inclusion, main contributor in material and method section and reviewed all drafts.

Khalid RA: Participated in data collection, and revised critically for important intellectual content, Contributed in the writing of introduction and section.

Halima ME: Participated in data collection, coordination and revised critically for important intellectual content, Contributed in the writing of introduction and discussion sections.

Saadeldin AI: Is the project coordinator, specified the content of the manuscript, and performed reviewed data analysis, revised critically for important intellectual content.

Ethical approval

The study was approved by the Medical Ethics Committee of University of Hail, Saudi Arabia (Ethical approval code: H-2021-179).

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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