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Community Awareness of the Risks of Delaying Surgical Intervention for Acute Appendicitis in the Northern Border Region of Saudi Arabia: A Cross-Sectional Study

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Abstract **Background:** Appendicitis constitutes one of the most common surgical emergencies world-wide and has always ranked among the top causes of an acute abdomen requiring urgent surgical treatment. Public ignorance and late access to health care could worsen appendicitis and lead to preventable morbidity and mortality. **Objectives:** To measure the awareness of acute appendicitis and the perceived risks of delaying surgical intervention in adults residing in the Northern Border Region of Saudi Arabia. **Methods:** This cross-sectional study in Saudi Arabia evaluated awareness among adults about appendicitis and its complications, as well as those influencing health-seeking behavior. The data of 397 participants were utilized for statistical analysis by Chi-square and logistic regression tests. **Results:** Among 397 respondents, 57.2% were aware with acute appendicitis but only 24.4% considered their knowledge of complications as good or excellent. Overall, a total of 51.6% had poor awareness about appendicitis. Although a total of 84.9% would seek immediate medical help, a considerable proportion, amounting to 44.6%, would attempt first home remedies. Fear, cost and distance are common reasons for delaying care. By multivariable analysis, none of the sociodemographic variables showed a significant association with awareness level (each $p>0.05$). **Conclusion:** The current community-based study from the Northern Border Region in Saudi Arabia, showed that there was poor awareness regarding appendicitis despite being able to identify the risk associated with delayed surgery. Public health educational programs should, therefore, be introduced to improve awareness.

Key Words Acute Appendicitis, Awareness, Delay, Appendectomy, Health-Seeking Behavior, Saudi Arabia

INTRODUCTION

Acute appendicitis is still one of the leading causes of acute abdominal pain and represents a leading indication for urgent abdominal surgery worldwide [1]. The lifetime incidence is estimated to be about 7-8%, with a peak incidence during adolescence and young adulthood [2]. Notwithstanding advances made in diagnosis and care, appendicitis is still a significant contributor to workload in terms of visits to the emergency department and healthcare costs [3].

If left untreated, appendicitis can lead to gangrene, perforation, peritonitis and sepsis. Delayed patient presentation and prolonged operation times have been linked to complications and adverse outcomes [4]. However, there also exist epidemiologic and pathophysiologic arguments for heterogeneity in the natural history of appendicitis, with some cases resolving spontaneously and others progressing rapidly [5,6]. Early evaluation and timely surgical management for suspected acute appendicitis, with a role for nonsurgical management for uncomplicated appendicitis, have been recommended by international guidelines such as the 2020 World Society of Emergency Surgery (WSES) Jerusalem guidelines [7].

Other than hospital-based factors, patient-related barriers, particularly in the community, also play an important part in the disease stage at the time of diagnosis. Other factors that may, to an extent, lead to delayed presentations may include surgical fear, misinterpretation of

symptoms, self-medication, loss of faith in the primary healthcare facilities and socioeconomic inequalities [8,9]. Therefore, it is important that public knowledge about the symptoms of appendicitis (such as migratory right lower quadrant pain, nausea, vomiting and fever) and their understanding of the potential consequences of ignoring these symptoms be emphasized.

Recent studies conducted in the Kingdom of Saudi Arabia have explored the level of awareness regarding appendicitis and its complications among adults as well as parents and selected groups. In general, these studies have observed inadequate levels of knowledge and widespread misconceptions related to appendicitis risks and management. For instance, in a national survey, many participants showed lack of knowledge about postoperative complications and underestimated the danger of late presentation [10].

Information available about the Northern Border Region of Saudi Arabia remains somewhat limited, even with its unique geographical and sociodemographic characteristics, including a mix of urban and rural communities and potential barriers to tertiary care. Reaching an understanding about awareness and beliefs within the Northern Border Region is imperative to effectively inform health education interventions and facilitate Saudi Vision 2030.

Objectives

To measure the awareness of acute appendicitis and the perceived risks of delaying surgical intervention in adults residing in the Northern Border Region of Saudi Arabia.

METHODS

Study Design and Setting

The cross-sectional and community-based research was implemented over a period of six months in the Northern Border Region of Saudi Arabia. The research population included the general population aged 15 and above residing within the Northern Border Region of Saudi Arabia. To reduce biases in terms of understanding or knowledge, healthcare practitioners and people with a history of appendicitis or previous appendectomy were not included. Using convenience sampling, a representative sample of the general population was selected. The sample size was estimated to reach a 95% confidence level and included about 384 participants. Ultimately, 397 participants responded to the survey and were used for analysis.

Data Collection Instrument

Data was collected through a structured and self-administered questionnaire, which was designed based on a literature review pertinent to acute appendicitis, treatment delays and awareness studies. The questionnaire was prepared in English and translated into Arabic, with translation review conducted to maintain linguistic uniformity. Content validity was evaluated using a panel of experts in general surgery and community/public health practice, resulting in some modifications to increase validity and culture-fairness. Pilot testing was conducted with a small set of pretest participants and their responses have not been included in the final analysis. The final structured self-administered questionnaire included sections for demographic information, knowledge about symptoms and complications of acute appendicitis, healthcare-seeking practices, barriers and source of information. Each factual question among symptoms, complications and treatment urgency was scored 1 for a positive and 0 for a negative and "I do not know" responses. The total awareness score for each participant was calculated as a percentage of the highest possible scores. Following similar study practices, scores above 60% were defined as good and scores below 60% as a poor level of awareness.

Data Collection Procedure

The questionnaire was also translated to Arabic to cater to participants who do not speak English. Informed consent also formed part of the initial processes to be completed by the participants prior to carrying out the analysis. Online platforms popular in the Kingdom of Saudi Arabia, such as WhatsApp and X/Twitter, were used to distribute the questionnaire link targeting adults in the Northern Border Region of Saudi Arabia. The answers were later analyzed using SPSS version 20 software.

Statistical Analysis

SPSS Statistics version 20 was used in all analyses. For categorical variables, frequencies and percentages were used, whereas for continuous variables, means and standard deviations were used. Results for awareness level (good and poor) were shown through proportion. Chi-square analysis was used in assessing associations between awareness level and sociodemographic variables (age category, gender, education level, marital status and occupation status). A p-value of less than 0.20 in bivariate analysis qualified a variable for inclusion in a binary logistic regression analysis. In binary logistic regression analysis, independent predictors of good awareness were determined using odds ratios with 95% confidence intervals. In this research, significance was set at p-value less than 0.05.

Ethical Considerations

The study protocol was reviewed and approved by the Local Committee of Bioethics at Northern Border University (64/25/H) dated 25-5-2025.

RESULTS

Sociodemographic Characteristics

A total of 397 questionnaires were fully accomplished. The dominant age group was 18 to 35 years old (n = 226, 56.9%), followed by those 36 to 50 years old (n = 135, 34.0%) and those 51 years old and above (n = 36, 9.1%). The majority were male (n = 219, 55.2%), whereas females comprised 178 (44.8%). Regarding education, less than high school education comprised 23 (5.8%), high school 116 (29.2%), diploma bachelor's degree 223 (56.2%) and those with a postgraduate degree 35 (8.8%) (Table 1).

Table1: Sociodemographic Characteristics of Participants (n = 397)

Variable	Category	Frequency (n)	Percentage
Age	18-35	226	56.9
	36-50	135	34.0
	≥51	36	9.1
Gender	Male	219	55.2
	Female	178	44.8
Educational Level	Less than high school	23	5.8
	High school	116	29.2
	Diploma/Bachelor's	223	56.2
	Postgraduate	35	8.8
Place of Residence	Urban	359	90.4
	Rural	38	9.6
Marital Status	Single	190	47.9
	Married	207	52.1
Occupational & Economic Level	Student	97	24.4
	Employee with low income	48	12.1
	Employee with medium income	163	41.1
	Employee with high income	28	7.1
	Unemployed	61	15.4

Table 2: Awareness and Knowledge Regarding Acute Appendicitis (n = 397)

Variable	Category	Frequency (n)	Percentage
Are you familiar with the concept of acute appendicitis?	No	170	42.8
	Yes	227	57.2
How would you rate your knowledge of the symptoms associated with acute appendicitis?	Very Poor	39	9.8
	Poor	106	26.7
	Average	186	46.9
	Good	43	10.8
	Excellent	23	5.8
Are you aware that delaying surgical intervention can lead to severe complications such as appendiceal rupture or widespread infection?	No	72	18.1
	Yes	325	81.9
How do you evaluate your knowledge of the complications that may result from delayed surgical intervention for appendicitis?	Very Poor	38	9.6
	Poor	81	20.4
	Average	181	45.6
	Good	66	16.6
	Excellent	31	7.8

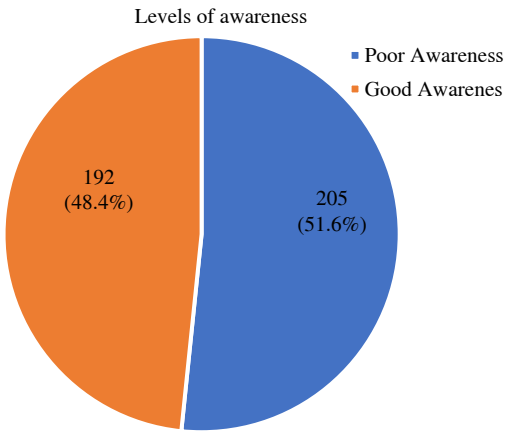

Figure 1: Overall Awareness Level

Awareness and Knowledge of Acute Appendicitis

Table 2 from the original analysis included an assessment of awareness and subjective levels of knowledge. In essence, 227 (57.2%) were aware of the condition known as acute appendicitis and 170 (42.8%) were unaware of it. In terms of subjective levels of personal knowledge regarding the symptoms of the condition, 39 (9.8%) described it very poor, 106 (26.7%) poor, 186 (46.9%) average, 43 (10.8%) good and 23 (5.8%) as excellent.

The knowledge level concerning the consequences of delayed treatment was slightly higher, with 325 (81.9%) believing that if surgery is postponed, there can be severe consequences such as rupture of appendix or general infection, compared to 72 (18.1%) who do not have this knowledge. The level of confidence concerning personal knowledge of complications from delay, however, was not so high, with 38 (9.6%) feeling that it was very poor, 81 (20.4%) poor, 181 (45.6%) average, 66 (16.6%) good and 31 (7.8%) excellent.

Of the 397 participants, 338 (85.1%) were able to recognize the symptom of right lower quadrant pain, while the ability to recognize the other symptoms was lower: 190 (47.9%) for nausea and vomiting, 152 (38.3%) for high fever and 149 (37.5%) for loss of appetite. According to the overall awareness score, 205 participants (51.6%) demonstrated poor overall awareness, as the score was <60%, while 192 (48.4%) demonstrated good overall awareness, as the score was ≥60% (Figure 1).

Healthcare-Seeking Behavior

Most of the respondents stated they would go straight to healthcare if they experienced severe abdominal pain, which was 337 or 84.9%. Only 60 respondents or 15.1% stated they won't go right away. The majority, 177 or 44.6%, stated yes when asked if they would attempt to treat it with home

remedies or over-the-counter medicines without seeking medical attention, while 220 or 55.4% stated no (Table 3).

There was a divergent view on the trust of the healthcare institutions on the part of the respondents, as 256 (64.5%) trusted hospital emergency or higher-level centers to diagnose and treat suspected cases of appendicitis. On the contrary, the number of people who did not trust primary health care centers to be quick in diagnosing acute appendicitis was 141 (35.5%). Moreover, personal and family experiences influenced many respondents' decisions to seek medical attention, as 226 (56.9%) believed so.

Perceived Barriers and Information Sources

The most significant potential barrier that might delay seeking medical care, was the lack of knowledge about how severe the symptoms were, identified by 239 participants (60.2%). Fear of surgical procedures reflecting concerns about anesthesia, postoperative pain or complications. was another significant potential barrier (n = 209, 52.6%). Cost (n = 102, 25.7%) and distance (n = 103, 25.9%) were identified as barriers, particularly in those who were unemployed or had limited incomes (Table 4).

In both bivariate tests, overall awareness level (good vs. poor) did not have a significant difference based on age (p = 0.857), gender category (p = 0.232), education level (p = 0.094), location of residence (p = 0.417), marital status (p = 0.189) and occupational/economic status (p = 0.851). There were a few tendencies, more so for females and better educated individuals but these did not reach statistical significance.

The overwhelming majority-367, representing 92.4%-believed that misinformation or lack of awareness is one of the causes of delaying the treatment of acute appendicitis. Regarding preferred sources of information, the following were identified: direct consultation with healthcare professionals (304, 76.6%), social media (209, 52.6%), TV channels (111, 28.0%) and printed brochures or pamphlets (59, 14.9%).

A total of 370 respondents, 93.2%, agreed that public awareness campaigns could help people seek care more quickly for acute appendicitis, while 343 participants or 86.4%, indicated that they would like to receive more information on the recognition of its symptoms and possible complications.

Association Between Sociodemographic Factors and Awareness Level

Overall awareness level (good vs. poor) did not have a significant difference based on age (p = 0.857), gender category (p = 0.232), education level (p = 0.094), location of residence (p = 0.417), marital status (p = 0.189) and occupational/economic status (p = 0.851). There were a few tendencies, more so for females and better educated individuals but these did not reach statistical significance (Table 5).

Binary logistic regression was used to evaluate whether sociodemographic variables independently predicted good awareness. Using the youngest age category (18-35 years), male gender, single marital status, urban residence and "student" occupational status as reference categories, none of the examined variables showed a statistically significant association with awareness levels. All p-values were greater than 0.05 and 95% CIs for odds ratios crossed 1 (Table 6).

Table 3: Healthcare-Seeking Behavior Related to Acute Appendicitis (N = 397)

Variable	Category	Frequency (n)	Percentage
If you experience severe abdominal pain, would you immediately seek medical care?	No	60	15.1
	Yes	337	84.9
If similar symptoms occur, would you prefer home remedies or over-the-counter medications before consulting a doctor?	No	220	55.4
	Yes	177	44.6
Do you trust primary healthcare centers to promptly diagnose acute appendicitis?	No	141	35.5
	Yes	256	64.5
Do you believe that personal experiences or stories from others influence your decision to seek medical help?	No	171	43.1
	Yes	226	56.9

Title 4: Perceived Factors Influencing Care-Seeking Behavior and Information Sources

Variable	Category	Frequency (n)	Percentage
Factors that may delay seeking medical care	Financial cost	102	25.7
	Geographical distance from healthcare facilities	103	25.9
	Fear of surgical procedures	209	52.6
	Cultural beliefs or local customs	81	20.4
	Uncertainty about the severity of the condition	239	60.2
Does misinformation or lack of awareness contribute to delays in receiving treatment?	No	30	7.6
	Yes	367	92.4
Preferred sources of information about acute appendicitis	Television channels	111	28.0
	Social media platforms	209	52.6
	Printed brochures or pamphlets	59	14.9
	Direct consultations with healthcare professionals	304	76.6
Do public awareness campaigns improve timeliness of seeking medical care?	No	27	6.8
	Yes	370	93.2
Would you like more information on recognizing symptoms and complications?	No	54	13.6
	Yes	343	86.4

Title 5: Association Between Sociodemographic Characteristics and Awareness Level Regarding Acute Appendicitis

Variable	Category	Overall Awareness Level		p-value
		Poor	Good	
Age Group	18-35 years	117 (57.1%)	109 (56.8%)	0.857
	36-50 years	68 (33.2%)	67 (34.9%)	
	≥ 51	20 (9.8%)	16 (8.3%)	
Gender	Male	119 (58.0%)	100 (52.1%)	0.232
	Female	86 (42.0%)	92 (47.9%)	
Educational Level	Less than high school	12 (5.9%)	11 (5.7%)	0.094
	High school	50 (24.4%)	66 (34.4%)	
	Diploma/Bachelor's	127 (62.0%)	96 (50.0%)	
	Postgraduate	16 (7.8%)	19 (9.9%)	
Place of Residence	Urban	183 (89.3%)	176 (91.7%)	0.417
	Rural	22 (10.7%)	16 (8.3%)	
Marital Status	Single	103 (50.2%)	87 (45.3%)	0.189
	Married	102 (49.8%)	105 (54.7%)	
Occupational and Economic Level	Student	51 (24.9%)	46 (24.0%)	0.851
	Employee with low income	24 (11.7%)	24 (12.5%)	
	Employee with medium income	84 (41.0%)	79 (41.1%)	
	Employee with high income	12 (5.9%)	16 (8.3%)	
	Unemployed	34 (16.6%)	27 (14.1%)	

Table 6: Multivariate Logistic Regression Analysis of Risk Factors Associated with Awareness Level Regarding Acute Appendicitis

Variable	p-value	Odd ratio	95% Confidence Interval	
			Lower	Upper
Age group (years)				
18-35 (ref.)	-	-	-	-
36-50	0.277	1.585	0.691	3.636
≥51	0.584	1.247	0.565	2.754
Gender				
Female vs. Male	0.059	0.643	0.407	1.016
Marital status				
Married vs. Single	0.290	0.738	0.420	1.295
Place of Residence				
Rural vs. Urban	0.446	1.319	0.647	2.688
Educational Level				
Less than high school (ref.)	-	-	-	-
High school	0.949	0.964	0.314	2.960
Diploma/Bachelor's	0.397	1.438	0.620	3.334
Postgraduate	0.307	0.672	0.313	1.442
Occupational and Economic Level				
Student (ref.)	-	-	-	-
Employee with low income	0.275	1.544	0.707	3.370
Employee with medium income	0.420	1.381	0.629	3.032
Employee with high income	0.211	1.521	0.788	2.936
Unemployed	0.062	2.678	0.950	7.548

Overall, these findings suggest that, within this sample, awareness of acute appendicitis and its complications is suboptimal across multiple demographic strata, rather than being confined to a specific subgroup.

DISCUSSION

Globally, acute appendicitis is still a significant source of surgical emergencies that require consideration of diagnosis and treatment to prevent complications of perforation, development of an appendix abscess and sepsis [11]. Significant observations in large databases, including the POSAW Study, have established that most cases of appendicitis undergo appendectomy with minimal mortality when diagnosis is made promptly and not delayed [12]. However, more cases of a perforated appendix in Saudi Arabia relate to delayed presentation of disease and not delayed surgical care, which warrants increased awareness about surgical risk in relation to delay in treatment of acute appendicitis in the general community [13]. This study provides a community-level assessment of awareness of acute appendicitis and risks of delayed surgical intervention in the Northern Border Region of Saudi Arabia. A total of 397 respondents were successfully administered questionnaires. Roughly half of the respondents showed low awareness even with understanding about significant risk of complications with delayed surgical treatment. There have been significant observations about awareness patterns and attitudes of healthcare practices.

Awareness and Knowledge of Acute Appendicitis

Our result, showing 51.6% of poor level of public awareness, is mostly in line with most of the studies done in Saudi Arabia, reporting low to moderately poor public knowledge about the complications of appendicitis and appendectomy.

Alsulaimani *et al.* [14] tried to determine the level of parental knowledge about appendicitis and its treatment options in Makkah, finding only a quarter of parents with good knowledge about it, with serious misconceptions about the chance of perforation and consequences of delayed management.

Likewise, a research conducted in El Obeid in Western Sudan found a lack of awareness with consequent delay in the diagnosis of acute appendicitis. The need for increased awareness and more accurate methods of diagnosis was highlighted [15]. Compared with these studies, it would appear that our findings indicate a similar trend, although many respondents in the Northern Border Region were apparently aware of appendicitis and its danger in relation to time but their understanding of its symptoms and consequences could be rated as poor and their level of awareness categorized as having 'good awareness' in the score. This reinforces that gaps in knowledge are widespread across different regions of Saudi Arabia and are not limited to a single city or population subgroup.

Healthcare-Seeking Behavior and Perceived Barriers

One of the encouraging findings of this research is that many participants (84.9%) reported that they would present themselves for immediate medical attention in case of severe abdominal pain. Nonetheless, that nearly 45% of respondents may turn to alternative treatments or over-the-counter medications before considering formal treatment could mean that certain members of a population may potentially delay formal care when they use self-management approaches. This could potentially prove to be a problem in a situation involving appendicitis, when even a slight delay in treatment could potentially lead to a higher risk of complicated disease among high-risk patients [16].

Uncertainty regarding the level of symptoms expressed came forward as having been the most often-quoted barrier to seeking timely treatment, fear of surgical procedures ranking second. This is consistent with findings in the existing literature that abdominal pain perception and concerns about surgical or anesthetic procedures may serve as deterrents in seeking early treatment [17]. Furthermore, cost and distance were noted by about one-fourth of participants

It is pertinent to highlight that over one-third of the respondents reported that they did not have much confidence in the ability of primary health care centers for the timely diagnosis of acute appendicitis; hence, they would seek care in the hospitals. It may be hypothesized that the relative lack of confidence in the capabilities of primary health care facilities may perpetuate these delays, where patients may delay presentation for treatment until they can gain access to the emergency department. As such, the enhancement of the capabilities for early triage and referral for appendicitis, within primary care, may be considered essential.

The high degree of preference for information from healthcare professionals (76.6%), in addition to their usage of social media (52.6%) and interest in awareness campaigns (93.2%) presents an opportunity. Combined education efforts that prevent the spread of incorrect digital health content while providing counseling directly at healthcare facilities can be most effectively achieved in this media age.

Sociodemographic Factors and Awareness

In both bivariate and multivariable analysis, there was no significant association of sociodemographic variables such as age, gender and education level with the level of awareness. This is somewhat at odds with some previous work that found greater knowledge to be associated with higher educational levels or prior familiarity with appendicitis [18]. In this sample, it appears that awareness is evenly dispersed across groups, indicating that interventions need to target the community generally rather than a specific group. The trend, not significant but with an odds ratio indicating greater awareness for females and for persons with greater educational attainment, with p-values just above conventional significant levels may still be relevant from a practical standpoint but cannot be definitively confirmed at these sample sizes.

Strengths and Limitations

This study's strengths include focusing on an under-studied region of Saudi Arabia, using a structured questionnaire to capture awareness and health-seeking behavior, exceeding the minimum sample size for the estimated prevalence and incorporating bivariate and multivariable approaches. Several limitations should be acknowledged. First, convenience sampling and an online questionnaire may limit generalizability, especially for those with limited internet access or literacy. Second, the study design based on both fact and self-report questions may result in social desirability or recall biases. Third, the study design does not establish any causal relationship, making it difficult to determine the impact of awareness on delay in care and outcomes.

CONCLUSIONS

This study revealed that a considerable proportion of respondents in the Northern Border Region of Saudi Arabia, demonstrated poor general knowledge about acute appendicitis and complications despite widespread recognition that any delay in surgical treatment could be potentially harmful. Targeted public health measures with a focus on educational campaigns conducted via healthcare providers, social networking platforms and means of trusted communication may potentially improve public awareness levels about the symptom of appendicitis, clarify misconceptions about the surgery procedure and motivate more patients to seek timely medical advice.

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