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The Application of Intraoperative Swab Among Individuals with Uncomplicated and Complicated Appendicitis Undergoing Appendectomy

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KEYWORDS

Appendicitis, Intraoperative Swab

ABSTRACT:

Introduction-Acute appendicitis is one of the most common abdominal surgical procedures in the emergency setting.

Methodology- In overall, 1570 individuals who were 18 years of age or older and had an appendectomy for acute appendicitis at the Surgery Department of the Meenakshi Medical College, Hospital and Research Institute, Kanchipuram, between 2013 and 2023 have been included in this retrospective cohort analysis. The study excluded patients who had an appendectomy throughout other surgical procedures or who did not have an intraoperative diagnosis of acute appendicitis or a histopathological diagnosis of the condition. Both the Student t-test and the Mann-Whitney U test were used to compare ordinal and metric data. The categorical data was subjected to the chi-square test. At $p < 0.05$, statistical significance was established.

Results- A greater body mass index (BMI) (24.2 vs. 25.8 kg/m2, $p < 0.001$), worse ASA score ($p < 0.001$), higher prevalence of diabetes (8 vs. 3%, $p > 0.001$), higher CRP value (117 vs. 22 mg/l, $p < 0.001$), and a greater incidence of intraabdominal fluid on preoperative sonography (54 vs. 31%, $p < 0.001$) were all significantly older (51 vs. 31 years, $p < 0.001$).

Conclusion: There aren't many therapeutic regimen modifications associated with antibiotic therapy, and it's yet unknown how changing antibiotics will affect the course of medication.

Introduction

Acute appendicitis is one of the most common abdominal surgical procedures in the emergency setting.[1] Over the last decades, the laparoscopic approach has been widely adopted because of its many advantages, such as less postoperative pain, reduced rates of wound infection, and shorter hospital stay.[2,3] However, postoperative intraabdominal abscess (IAA) is still one of the most feared complications after laparoscopic appendectomy (LA), especially in cases of complicated appendicitis.[4]

Different durations have been reported, however the 2020 World Journal of Emergency Surgery (WSES) guidelines indicate a length of 3–5 days of postoperative antibiotics based on the patient condition and recovery dynamic. There is continuous discussion about whether switching antibiotics based on culture results benefits the patient, even though good antibiotic selection and duration should help prevent postoperative problems. This is made worse by the fact that antibiotic susceptibility testing and final culture results—which are often polymicrobial—are sometimes not available for many days following appendectomy.[4]

A typical procedure to identify the bacteria implicated and more accurately focus antimicrobial treatment is

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getting intraabdominal fluid samples for swab culture.[4] The purpose of this research aimed to investigate the impact of intraoperative swab while appendectomy on the postoperative outcome of individuals suffering from both simple and complex appendicitis.

Methodology

In overall, 1570 consecutive individuals who were 18 years of age or older and had an appendectomy for acute appendicitis at the Surgery Department of the Meenakshi Medical College, Hospital and Research Institute, Kanchipuram, between 2013 and 2023 have been included in this retrospective group analysis. The research excluded those who had an appendectomy throughout other types of surgery or who did not have an intraoperative diagnosis of acute appendicitis or a histopathological confirmation of the condition.

The information gathered for analysis included patient demographics, preoperative blood tests, radiological results, intraoperative findings, surgical technique, length of surgery, and the existence of malignancy, along with to information regarding the intraoperative swab and its microbiological investigation. Inpatient records and, if relevant, subsequent visits were among the data gathered. There was not a systematic afterglow. The whole patient cohort's data was analysed, and patients with simple and complex appendicitis were divided into groups. The main goal was to evaluate the impact of bacterial isolation and intraoperative swabs on different outcome criteria (morbidity, infection-related morbidity, significant morbidity, re-surgery, and length of hospital stay). In order to determine predictive factors for bacterial isolation in intraoperative swabs, in-hospital postoperative morbidity, and the need for postoperative antibiotic medication changes, the second goal included performing univariate and multivariate risk factor assessments.

The statistical software SPSS V. 23 was used for the analysis. Both the Student t-test and the Mann-Whitney U test were used for evaluating ordinal and metric data. The information that was categorical was subjected to the chi-square test. At $p < 0.05$, statistical significance was established. In order to determine prognostic indicators for postoperative in-hospital morbidity, the separation of bacteria in acquired intraoperative swabs, and the necessity of modifying postoperative antibiotic medication, multivariate analysis was carried out.

Results

Of the 1570 participants (average age: 35 years; 48% female) who were part of the research, 1174 had an uncomplicated case of appendicitis and 396 had a complex case. A greater body mass index (BMI) (24.2 vs. 25.8 kg/m2, $p < 0.001$), more serious ASA score ($p < 0.001$), greater incidence of diabetes (8 vs. 3%, $p > 0.001$), more CRP value (117 vs. 22 mg/l, $p < 0.001$), and a greater amount of intraabdominal fluid on preoperative sonography (54 vs. 31%, $p < 0.001$) were all significantly older (51 vs. 31 years, $p < 0.001$). Additionally, patients with complicated appendicitis had a higher prevalence of open and converted appendectomy ($p < 0.001$), longer surgery duration (76 vs. 59 min, $p < 0.001$), and a greater need for cecum resection (13 vs. 2%, $p < 0.001$) (Table 1).

Table 1 Demographic data

	All patients	**Uncomplicated appendicits**	**Complicated**	***p*-value**
Number, *n* (%)	1570	1174 (75)	396 (25)	
Age (years), median (IQR)	35 (26)	31 (22)	51 (28)	**< 0.001**
Gender, *n* (%)				0.163
FemaleMale	747 (48) 823 (52)	571 (49) 603 (51)	176 (44)	
BMI* (kg/m^2), median (IQR)	24.5 (5.9)	24.2 (5.7)	25.8 (6.1)	**< 0.001**

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ASA*, *n* (%)				< **0.001**
I II IIIIV	872 (60) 479 (33) 92 (6) 5 (0)	724 (67) 324 (30) 35 (3) 0 (0)	148 (41) 57 (16)	
Diabetes, *n* (%)	69 (4)	36 (3)	33 (8)	< **0.001**
Preoperative diagnostics				
CRP (mg/l), median (IQR)	38 (87)	22 (59)	117 (136)	< **0.001**

Table 2 Bacteria analysis in all patients with appendectomy for acute appendicitis (*n* = 1570)

		n **(%)**	***P***	***n*** **(%)**	***p***	***n*** **(%)**	***p***	***n*** **(%)**	***p***	***n*** **(%)**	***p***
All patients Number of bacteria No swab 0 1 2 ≥3	1570 1113 (71) 224 (14) 78 (5) 68 (4) 87 (6)	99 (6) 65 (6) 3 (1) 5 (6)	< **0.001**	32 (2) 24 (2) 1 (0) 0 (0)	**0.035**	50 (3) 31 (3) 2 (1) 3 (4)	**0.001**	21 (1) 9 (1) 2 (1) 2 (3)	< **0.001**	209 (13) 132 (12) 15 (19)	< **0.001**
		10 (15)		2 (3)		6 (9)		2 (3)		17 (25)	
		16 (18)		5 (6)		8 (9)		6 (7)		40 (46)	
No swab vs. swab			0.253		0.697		0.205		**0.007**		< **0.001**
Sterile swab vs. positive swab			< **0.001**		**0.037**		< **0.001**		**0.037**		< **0.001**
No swab vs. sterile swab			**0.007**		0.104		0.103		1.000		< **0.001**

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No swab vs. positive swab Patients with bacterial isolation in swab	233	31 (13)	**< 0.001**	7 (3)	0.469	17 (7)	**0.002**	10 (4)	**< 0.001**	102 (44)	**< 0.001**
Kind of bacteria* *E. coli*	128 (55)	24 (19)	**0.011**	7 (6)	**0.017**	11 (9)	0.456	6 (5)	0.761	74 (58)	**< 0.001**

Eight indicators of risk for a positive swab were found in the univariate analysis: older age (46 vs. 31 years, p < 0.001), higher BMI (24.8 vs. 24.1 kg/m2, p = 0.018), worse ASA score (p <0.001), higher prevalence of diabetes (16 vs. 3%, p = 0.004), higher preoperative CRP value (92 vs. 33 mg/l, p < 0.001), higher intraoperative prevalence of perforation (49 vs. 13%, p < 0.001), of necrosis or gangrene (15 vs. 6%, p = 0.001), and of perityphlitic abscess (25 vs. 5%, p < 0.001). An independent risk factor for bacterial isolation in the intraoperative swab was the intraoperative presence of an abscess (OR 3.8, CI 1.4–10.1, p = 0.008) and perforation (OR 2.7, CI 1.5–5.2, p = 0.002), according to a multivariate analysis of variance. In the univariate approach, 11 parameters were linked to a greater morbidity: older age (54 vs. 36 years, p < 0.001), higher BMI (27,4 vs. 24,5 kg/m2, p = 0.026), worse ASA score (p < 0.001), higher prevalence of diabetes (18 vs. 3%, p < 0.001), higher preoperative CRP value (130 vs. 44 mg/l, p < 0.001), intraabdominal fluid in radiological diagnostic (71 vs. 45%, p = 0.004), higher intraoperative prevalence of perforations (68 vs. 28%, p < 0.001) and perityphlitic abscess (38 vs. 13%, p < 0.001), longer surgery period (76 vs. 62 min, p = 0.006), higher rate of cecum resection necessity (15 vs. 5%, p = 0.035), and a greater likelihood of perforation of positive intraoperative swabs (91 vs. 48%, p < 0.001).

Table 3- Bacteria analysis in all patients with appendectomy for acute appendicitis stratified to uncomplicated (*n* = 1174) and complicated appendicitis (*n* = 396)

Number of patients		**Morbidity**		**Infectious morbidity**		**Major morbidity**		**Re-surgery**		**Prolonged hospital stay (> 5 POD)**	
		***n* (%)**	***p***	***n* (%)**	***p***	***n* (%)**	***p***	***n* (%)**	***p***	***n* (%)**	***p***
Patients with uncompl. app	1174	33 (2)		6 (1)		16 (1)		7 (1)		57 (5)	
Number of bacteria			**0.006**		0.231		**0.003**		**0.018**		**< 0.001**
No swab	882 (75)	24 (3)		5 (1)		10 (1)		3 (0)		39 (4)	

0	190 (16)	1 (1)	0 (0)		0 (0)		0 (0)		2 (1)		
1	51 (4)	2 (4)		0 (0)		2 (4)		2 (4)		6 (12)	
2	28 (2)	3 (11)		1 (4)		3 (11)		1 (4)		3 (11)	
≥3	23 (2)	3 (13)		0 (0)		1 (4)		1 (4)		7 (30)	
No swab vs. swab			0.838		1.000		0.248		0.069		0.270
Sterile swab vs. positive swab			**0.001**		0.349		**0.002**		**0.014**		**< 0.001**
No swab vs. sterile swab			0.106		0.593		0.224		0.639		**0.034**
No swab vs. positive swab			**0.013**		1.000		**0.004**		**0.003**		**< 0.001**
Patients with compl. App	396	66 (17)		26 (7)		34 (9)		4 (4)		152 (38)	
Number of bacteria			0.373		0.290		0.799		0.199		**0.001**
No swab	231 (58)	41 (18)		19 (8)		21 (9)		6 (3)		93 (40)	
0	34 (9)	2 (6)		1 (3)		2 (6)		2 (6)		3 (9)	
1	27 (7)	3 (11)		0 (0)		1 (4)		0 (0)		9 (33)	
2	40 (10)	7 (18)		1 (3)		3 (8)		1 (3)		14 (35)	
≥3	64 (16)	13 (20)		5 (8)		7 (11)		5 (8)		33 (52)	

No swab vs. swab			0.585		0.150		0.719		0.275		0.402
Sterile swab vs. positive swab			0.091		1.000		0.740		1.000		< **0.001**
No swab vs. sterile swab			0.080		0.337		0.749		0.602		< **0.001**
No swab vs. positive swab			1.000		0.205		0.851		0.364		0.658

Discussion

The value of obtaining intraoperative swabs during an appendectomy is a topic of continuing discussion. The capacity to administer tailored antimicrobial medication during the recovery phase is the primary justification. Furthermore, taking an intraoperative swab is rapid, doable, and inexpensive per patient. The infrequent detrimental effects of collecting an intraoperative swab, the incapacity to lower the incidence of intraabdominal abscesses by adjusting the antibiotic and collecting swabs, and the total pertinent expenses associated with the procedure are some of the counterarguments. The percentage of bacteria found in intraoperative swabs in our sample was 51%, so it falls between the broad range of positive cultures documented in the scientific literature for acute appendicitis.[5, 6] According to a recent investigation, the rate of bacteria detection differed greatly depending on the kind of appendicitis (complex versus complicated), reaching 79% in individuals with difficult appendicitis.[7] The research mentions that the collection technique affects the detection rate in addition to the condition of appendiceal inflammation (complex versus complicated).[5, 6] Nevertheless, our investigation did not look into this element. According to our research, the intraoperative presence of an abscess, perforation, or both could be independent predictors of the presence of bacteria in the intraoperative swab.

Anaerobic gram-negative bacteria are more common in peritoneal fluid than gram-positive bacteria, with anaerobic bacteria having the lowest prevalence, according to the literature.[8,10] In particular, it has been found that intraoperative swabs frequently contain the bacteria Escherichia coli, Bacteroides fragilis, Pseudomonas aeruginosa, Proteus mirabilis, and Citrobacter freudii.8 Consistent with earlier results, our data set showed a greater incidence of E. Coli, Bacteroides spp., Streptococcus spp., and Pseudomonas spp.[7,9] In our investigation, E. coli was found to be specifically associated with poorer outcomes (morbidity, infectious morbidity, and extended hospital stay).

Conclusion

There is a correlation between the isolation of bacteria in swab samples taken following an appendectomy for acute appendicitis and increased rates of postoperative morbidity, repeat surgery, and prolonged hospital stays. Thus, intraoperative swabs may be useful in identifying patients who are more likely to have worse postoperative outcomes. Nonetheless, there aren't many therapeutic regimen modifications associated with antibiotic therapy, and it's still unknown how changing antibiotics would affect the course of therapy.

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