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Research Article

Effect of Antibiotic on Surgical Site Infections

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Abstract

Appendicitis is a disease of youth and 40% of its cases are between 10-29 years old. In current study which is based on Randomized Clinical Trial, we have examined the effect of antibiotic on surgical site infection in non-perforated appendicitis after appendectomy in patients admitted in Imam Khomeini of Sari and Razi of Qaemshahr hospitals. The study population included those who were from the beginning of the year (90) to (91) hospitalized due to acute appendicitis in the surgical wards of these two centers. In conclusion administration of antibiotic has no effect on surgical site infections so it should be accurately administrated due to costs, bacterial resistance and side effects.

Keywords: Antibiotic; Surgery; Infection

Introduction

Appendicitis is a disease of youth and 40% of its cases are between 10-29 years old. 12% of men and 25% of women, with approximately 7% of all people undergoing appendectomy due to acute appendicitis during their lifetime (5). Classically pain is initially diffusely centered in the lower epigastrium and umbilical area, is moderately severe, and is steady, sometimes with intermittent cramping superimposed. After a period varying from 1 to 12 hours, (but usually within 4 to 6 hours), the pain localizes to the RLQ. This classic pain sequence, although usual, is not invariable. Sometimes the pain begins in the RLQ and remains there. Variations in the anatomic location of the appendix account for many of the variations in the principal locus of the somatic phase of the pain. (9)

Non-perforated appendicitis is classified as contaminated wounds while perforated appendicitis is in dirty wounds group. Appendectomy is the specific treatment of appendicitis and a single dose of preoperative antibiotic should be administrated. Administration of postoperative antibiotic is a controversial in non-perforated appendicitis, as administration of postoperative antibiotic is advised in some references within 48 to 72 hours after operative intervention (3). Postoperative antibiotic in non-perforated appendicitis is a controversial between surgical references, current study defines that if post appendectomy antibiotic administration impresses risk of surgical site infections or not. And also helps to accurately administrate antibiotics considering costs, bacterial resistance and side effects.

Methodology

Current study is designed in Randomized Clinical Trial (RCT).

Inclusion criteria of study patients:

Patients with a diagnosis of acute appendicitis in health centers of Imam Khomeini of Sari and Razi of Qaemshahr.

Exclusion criteria of study patients:

A: during surgery, it was determined that the appendix is perforated.

B: patients whom undergoing appendectomy associated with immune compromised conditions such as 1. Longtime corticosteroids application 2. Cancers 3. Diabetes mellitus 4. Hematologic diseases with leukocytes malfunction 5. Immune suppressor infection diseases like AIDS and measles. 6. Malnutrition and etc. that received antibiotic therapy.

C: patients with BMI greater value than 30 or less than 19.

D: appendectomy surgical operations took more than one hour.

For randomization we used table of random numbers. All the patients were applied in clinic for follow up and visited by physician then completed relating forms. Patients underwent open appendectomy diagnosed non-perforated appendicitis by surgeon, all divided into two groups randomly. This study was single blind and patients haven't been informed receiving antibiotic or placebo. Group one received a single dose of antibiotic before operation (amp ceftriaxone 1gr + amp metronidazole 500 m.gr) and they received placebo instead after appendectomy. Group two received a single dose of antibiotic before operation (amp ceftriaxone 1gr + amp metronidazole 500 m.gr) and received same antibiotics (amp ceftriaxone 1 gr BD + amp metronidazole 500 m.gr TDS) in first 48 hours after appendectomy. Also they have been followed up in clinic in first, second and fourth week after surgical operation and clinically examined in this outpatient follow ups. In inspection and examination of surgical wound if there were any discharge or redness and inflammation in skin and subcutaneous layer without involvement of deep tissues and mass lesions, would be considered as superficial infection. If there were any mass lesion with pus drainage (with or without associated symptoms like pain and fever) the wound would be considered as deep infection. Deep infections with seroma aspirated for culture and due to culture result, positive ones would be considered as deep infection and negative cultures would be excluded from study. Inter organic abscess result of sonography in patients with abdominal pain, with or without mass associated with symptoms like fever, would be considered as inter organic infection. A questionnaire is been provided which contains all information about patients, such as: age, sex, BMI, existence of symptoms of surgical site infection including superficial, deep and inter organic infections in first second and fourth weeks after appendectomy. This information are recorded for all of the patients. Statistical analysis was that if the "t-test" for the quantitative variables and "Chi-square-test" was used for qualitative variables. These tests were analyzed by statistical software "SPSS16" and $P<0.05$ was significant.

Result

In current study which is based on Randomized Clinical Trial, we have examined the effect of antibiotic on surgical site infection in non-perforated appendicitis after appendectomy in patients admitted in Imam Khomeini of Sari and Razi of Qaemshahr hospitals.

The study population included those who were from the beginning of the year (90) to (91) hospitalized due to acute appendicitis in the surgical wards of these two centers. Diagnosis of acute appendicitis in these patients were done based on both, clinical and laboratory findings.

The average age of this study, 23.27 years is the minimum age of 12 and the maximum of 68 years old. The study population included 135 males (61.4%) and 85 females (38.6%). Among these 220 patients with non-perforated appendicitis, 110 patients received postoperative antibiotic and 110 remained patients received placebo (distilled water) instead of antibiotic therapy. The average BMI in the patients of this study, 23.54 is the minimum of 20.02 and maximum value of 29.38.

Antibiotic received group was with an average age of 27.28 and the placebo received group was with an average of 27.18 and this difference in surgical site infection was not significant (P>0.05) statistically. Among patients who received antibiotic, 75 people were males (68.2%) and 35 people were females (31.8%) and the maximum BMI in this group was 27.75 and the minimum was 20.76 with an average of 23.266. On the other side among patients who received placebo, 60 people were males (54.5%) and 50 people were females (45.5%) and the maximum BMI in this group was 29.38 and the minimum was 20.02 with an average of 23.833. There weren't any significant relationship between infection and age, sex and BMI in patients (P<0.05). Epidemiologic characteristic data of patients in each group are listed in Tables 1 & 2.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	110	12.00	68.00	26.7909	10.91678
BMI	110	20.02	29.38	23.8332	2.58798
Gender	110	0.00	1.00		0.50021
Valid N (list wise)	110				

Table 1: Epidemiologic characteristic data of patients who didn't receive antibiotic

	N	Minimum	Maximum	Mean	Std. Deviation
Age	110	12.00	57.00	27.6727	10.34905
BMI	110	20.76	27.75	23.2666	1.44823
Gender	110	0.00	1.00	0.3182	0.46790
Valid N (list wise)	110				

Table 2: Epidemiologic characteristic data of patients who received antibiotic

Useful findings were obtained by evaluating clinical symptoms and laboratory findings in both groups.

The most common clinical finding among patients was RLQ tenderness which is been detected in 199 patients (90.5%). The nausea and vomiting in 175 patients (79.5%), and anorexia in 174 patients (79.1%) were found. The lowest frequency of clinical symptoms dedicates to fever, which is been detected only in 61 patients (27.7%). Other information about frequency of clinical symptoms and laboratory findings are listed in Tables 3-8.

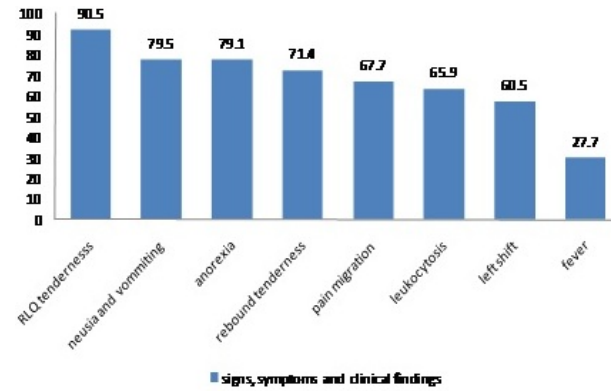

Figure 1: frequency of clinical symptoms and laboratory findings of studied cases

All patients were clinically examined in first, second and fourth week after surgical operation in health centers of Imam Khomeini of sari and Razi of Qaemshahr and by evaluating the recorded data, useful information were found about frequency of superficial and deep infections in these two groups. Among patients who received antibiotic, 2 cases (1.81%) stricken by superficial infection in second week after operation, while there were no similar data recorded in patients who received placebo. None of the patients were stricken by superficial and deep infections in first and fourth week after operation (0%). It is worth to say none of the patients were infected by inter organic infection in first, second and fourth week of postoperative period.

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age * Drug	220	100.0%	0	.0%	220	100.0%

Table 3: evaluation of significance between age and frequency of surgical wound infection in studied patients

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	65.673a	41	.009

Likelihood Ratio	80.763	41	.000
Linear-by-Linear Association	.379	1	.538
N of Valid Cases	220		
a. 72 cells (85.7%) have expected count less than 5. The minimum expected count is .50.			

Table 4: evaluation of significance between age and frequency of surgical wound infection in studied patients

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
BMI * Drug	220	100.0%	0	.0%	220	100.0%

Table 5: evaluation of significance between BMI and frequency of surgical wound infection in studied patients

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	172.295a	106	.000
Likelihood Ratio	236.672	106	.000
Linear-by-Linear Association	3.960	1	.047
N of Valid Cases	220		
a. 214 cells (100.0%) have expected count less than 5. The minimum expected count is .50.			

Table 6: evaluation of significance between BMI and frequency of surgical wound infection in studied patients

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Drug	220	100.0%	0	.0%	220	100.0%

Table 7: evaluation of significance between gender and frequency of surgical wound infection in studied patients

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.314a	1	.038		
Continuity Correction[b]	3.758	1	.053		
Likelihood Ratio	4.331	1	.037		
Fisher's Exact Test				.052	.026
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 42.50.					
b. Computed only for a 2x2 table					

Table 8: evaluation of significance between age and frequency of surgical wound infection in studied patients

Discussion

Acute appendicitis is the most common acute abdomen which requiring surgical intervention. Appendectomy is the specific treatment of appendicitis but a dose of antibiotic should be administrated before appendectomy. Administration of antibiotic after appendectomy is a controversy in non-perforated appendicitis as in some references the administration of antibiotic is been advised in 24 to 48 hours after appendectomy [2] while some other references advised that not to administrate antibiotic after appendectomy [3]. The purpose of study considering this controversy in references is to obtain that if the administration of antibiotic is effective in surgical site infection or not. Also this study contributes that the accurate administration of antibiotics by considering side effects, bacterial resistance and costs of antibiotic application. In this study we chose 220 patients with diagnosis of non-perforated appendicitis during surgical operation and all of them received prophylactic antibiotic before surgical operation as advised in all surgical references. 2 cases of antibiotic received group stricken by superficial infection in second week after surgical operation while no cases stricken by superficial, deep and inter organic infections in placebo received group. As mentioned in Schwartz's principles of surgery, surgical site infections depend on following factors: 1. Bacterial contamination frequency during surgical operation. 2. Duration of surgical operation 3. Patient-related factors such as diabetes mellitus, malnutrition, obesity, immune compromises and etc. Non-perforated appendicitis is categorized in class III of surgical wounds and the frequency of surgical site infection is 3.4% to 12.8% according to surgical references but our study indicates that this frequency is 0% in placebo (distilled water) received group and 1.8% in patients who received postoperative antibiotics. In order to describe this low frequency surgical site infection in our study in comparison to references we indicate to following notes. As in primary definition and patient selection method in our study some of them excluded from our study, such as

1. Immune compromised patients like leukemia and hematologic diseases, AIDS, and longtime corticosteroid application.

2. Surgical operations take more than one hour

3. Diabetes mellitus

4. Patients with diagnosis of perforated appendicitis during operation.

The average age of our study is 27.23 years old while this amount is 31.3 years old in Schwartz's principles of surgery textbook [1]. This smaller average in our study in comparison with valid surgical

references is due to our exclusions criteria like patients who should have receive antibiotic after appendectomy, including diabetic cases, immune compromised patients and etc. Patients with these underlying diseases are older than other cases and because of it, so as a result average age of our study is smaller than what we can find in references. RLQ tenderness is the most common clinical symptom found in our study patients while fever has the lowest prevalence between them.

In 2009 dr. Dinhkim et al from university of Utah by a retrospective study evaluated patients underwent appendectomy with diagnosis of non-perforated appendicitis from January 1997 till December 2007. They divided cases into two groups; a group of 321 patients who received postoperative antibiotic and a group of 186 patients who didn't receive postoperative antibiotic. Then these two groups were evaluated for surgical site infections. As a result no significant difference was reported between these two groups (12.4% vs. 9%) [4]. In comparison with our study (1.8% infected in antibiotic received group) it's a greater percent. It seems that this greater amount would be explained by inclusion of patients who must receive antibiotic, in above study like immune compromised cases and patients who receive immune suppressive drugs. Also it should be said that our findings indicate the same result as we couldn't prove any significant difference between these two groups in our study for surgical site infections ($P<0.05$).

In 2005 another study done by Dr. Anders et al from university of Hong Kong, China; patients between 15 to 70 years old from July 1995 till December 2000 were selected with diagnosis of non-perforated appendicitis and divided in 3 groups. First group including 94 patients received a single dose of preoperative cefuroxime and metronidazole, second group including 94 patients received same medication as first group (cefuroxime and metronidazole) and addition of 3 more doses before appendectomy. Third group including 83 patients received same preoperative medication and was continued 5 days after appendectomy. In this study, there is no significant difference between these 3 groups about surgical site infections (first group 6.5%, second group 6.4% and third group 3.6%) [5]. In comparison with our study the frequency of surgical site infections is greater in above study which excluded just perforated appendicitis and included other cases with any underlying diseases while we excluded perforated appendicitis, in addition, diabetic and immune compromised patients, cases with long time corticosteroid application and BMI greater than 30 and lesser than 19 and also surgical operations took more than one hour. The reason for our exclusions criteria is the essential postoperative antibiotic therapy in these cases with underlying diseases.

In 1995 another study done by Lieberman et al from university of San Diego, USA; 179 patients with diagnosis of acute non-perforated appendicitis divided in 3 groups. First group received just 2gr preoperative cefotetan, second group received just 2gr preoperative cefoxitin and third group received 2gr preoperative cefoxitin and three more doses of same medication after appendectomy. Then they have been evaluated for surgical site infections and following results reported: 0% in first, 11.1% in second and 1.9% in third group [6] and these findings had no significant differences for surgical site infections the same as what we found in our current study, which 2 cases in antibiotic received group stricken surgical site infection and none cases of placebo received group stricken it. Of course these results are not significant in statistical point of view either. As mentioned in Sabistom textbook of surgery, a single dose of preoperative antibiotic would reduce the risk of wound infection and intra-abdominal abscesses in acute non-perforated appendicitis but continuing this medication after appendectomy in these patients would not help to reduce side effects and risk of infections [3]. This is as same as our results in current study. In Maingot's textbook of abdominal operations it has been mentioned that a single dose of preoperative antibiotic (cefoxitin) is adequate for non-perforated appendicitis but this medication should be continued for 5 days after appendectomy in perforated appendicitis [7]. Considering that current study is evaluated non-perforated appendicitis the findings are close to textbooks. Although a study based on evaluating the effect of antibiotic on surgical site infection in perforated appendicitis patients would be recommended. In addition, as current studies do not evaluate different antibiotics, studies designed for specific antibiotics would be suggested.

Finally according to our findings we are going to report some results about application of postoperative antibiotic in non-perforated appendicitis: administration of antibiotic has no effect on surgical site infections so it should be accurately administrated due to costs, bacterial resistance and side effects.

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