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## Inadequate antibiotic therapy results in higher recurrence rate after drainage of complicated peri-rectal abscess

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# Inadequate Antibiotic Therapy Results in Higher Recurrence Rate after Drainage of Complicated Peri-Rectal Abscess

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## Abstract

**Background:** Recommended treatment for complicated peri-rectal abscess is incision and drainage (I&D) in conjunction with antibiotics. However, there is no standard antibiotic regimen for post-operative therapy described in the published literature. Our hypothesis was that appropriate post-operative antibiotic therapy after emergency I&D of complicated peri-rectal abscess will improve patient outcomes.

**Methods:** Data from 58 patients with complicated peri-rectal abscess who underwent emergency I&D were analyzed retrospectively. Demographic, microbiologic, and antibiotic data were abstracted. Adequateness of antibiotics was judged by susceptibility data when available or by comparing the antibiotic spectrum with the type of organisms grown in culture when susceptibility data were not available. The Student *t*-test and  $\chi^2$  test were used to analyze continuous and categorical variables, respectively. Multivariable analysis was used to adjust for confounding variables influencing recurrence rates.

**Results:** Of the 58 patients reviewed, 12 were excluded because there was no culture information available or the culture showed no growth. Of the remaining 46 patients, 33 (72%) were male and 29 (63%) were African American. The mean age was  $39.4 \pm 16.4$  years and the Body Mass Index was  $28.4 \pm 6.6 \text{ kg/m}^2$ . Culture data revealed mixed aerobic/anaerobic organisms in 17 (37%), mixed aerobic organisms in 15 (32.6%), gram-positive organisms in 9 (19.6%), gram-negative organisms in 2 (4.4%), and other organisms in 3 (6.6%). Twenty-five patients (54.4%) received adequate antibiotic coverage with the remainder inadequately covered. The inadequate antibiotic therapy cohort had a higher re-admission rate for abscess recurrence ( $n=6$  [28.6%] versus  $n=1$  [4%];  $p=0.021$ ). More than half were readmitted 30 days or more after the index procedure. There were no differences in length of stay (LOS), intensive care unit LOS, or Charlson Comorbidity Index between the groups.

**Conclusion:** Inadequate antibiotic coverage after I&D of complicated peri-rectal abscess resulted in a six-fold increase in the re-admission rate. A standard oral protocol combining antibiotics covering typical gram-positive, gram-negative, and anaerobic organisms should provide adequate coverage after surgical drainage. Additional prospective studies are needed to elucidate the optimal antibiotic regimen for these patients.

**Keywords:** antibiotic therapy; antibiotics; peri-rectal abscess

**P**ERI-RECTAL ABSCESS is a common surgical emergency in both men and women [1] that generally is treated surgically. It is estimated that there are approximately 100,000 cases of peri-rectal abscesses in the United States annually [2]. The most widely accepted etiology is the cryptoglandular theory, which suggests that the anal glands emptying into the

anal crypts become obstructed with inspissated debris, leading to bacterial overgrowth and development of an abscess. The abscess then collects in the anatomic space between the internal and external sphincters where the gland terminates and may extend along the path of least resistance into the adjacent perianal tissues.

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In the early 1900s, Grace recommended early surgical incision and drainage (I&D) of the peri-rectal abscess [3]. Microbiologic analysis of material obtained during I&D most often yields mixed aerobic and anaerobic organisms [4]. In addition to timely I&D, revised practice recommendations suggest addition of antibiotic therapy if the abscess is considered “complicated” [5]. However, there are no clinical practice guidelines describing specific antibiotic therapy for patients who have undergone peri-rectal abscess drainage. The purpose of this study was to assess whether post-operative antibiotic therapy, judged to be adequate according to microbiologic analysis, improved outcomes in patients with perianal abscesses compared with no antibiotic therapy or therapy judged to be inadequate.

### Patients and Methods

A prospectively collected acute and critical care surgery database was queried for patients admitted from 2008 to 2015 with abscess of the anal and rectal regions (ICD 9 code 566). Patients were included only if they had acute-onset peri-rectal abscess associated with cellulitis (complicated peri-rectal abscess), underwent emergency I&D, and had material sent for culture from the abscess after I&D. A perianal abscess was defined as the presence of a firm or fluctuant tender mass located close to the anus. Patients in whom the abscess extended to the perineum and buttocks were included. The location of the abscess and the presence of cellulitis was based on the findings described in the operative report. Patients were excluded if no material was sent for culture or if the final culture showed no growth.

Patient charts were reviewed for demographic data, including age, gender, race, and Body Mass Index (BMI), socioeconomic status based on zip code, medical and surgical history including diabetes, human immunodeficiency virus (HIV) status, alcohol consumption, smoking history, illicit drug use, Charlson Comorbidity Index, hospital and intensive care unit (ICU) length of stay (LOS), and re-admission for recurrent peri-rectal abscess. Culture data, including specific organisms and their susceptibilities when available, were collected for all the patients. If patients had more than one culture report, only the data from the first operation were included. All antibiotics given to the patient on discharge were recorded.

Adequacy of discharge antibiotic therapy was determined by comparing the profile of the prescribed antibiotics with the culture report. If susceptibility data for specific microorganisms were available, the discharge antibiotic regimen was considered adequate if all the isolated organisms were susceptible to the agent or agents prescribed. If specific organisms were not fully isolated and characterized with regard to susceptibilities, the appropriateness of the antibiotic regimen was characterized according to its generally recognized activity against gram-positive, gram-negative, and anaerobic organisms, as shown in Table 4 below. Based on the discharge antibiotics prescribed, patients were divided into two cohorts: Those who were prescribed adequate and those who were prescribed inadequate antibiotic regimens. The primary outcome, re-admission for recurrent peri-rectal abscess, was compared in the two cohorts.

The  $\chi^2$  test was used for evaluating the association between qualitative variables and outcomes, and the Student

TABLE 1. PROFILES OF PATIENTS IN RELATION TO ANTIBIOTIC ADEQUACY AT DISCHARGE

	Total	Adequate therapy	Inadequate therapy	<i>p</i>
N	46	25 (54.35%)	21 (45.65)	
Age	39.4 (±16.4)	40.1 (±17.3)	38.5 (±15.7)	0.658
Gender (%)				0.967
Male	33 (71.7)	18 (72.0)	15 (71.4)	
Female	13 (28.3)	7 (28.0)	6 (28.6)	
Race (%)				0.196
African American	29 (63.0)	16 (64.0)	13 (61.9)	
Caucasian	13 (28.3)	5 (20.0)	8 (38.1)	
Other	2 (4.4)	2 (8.0)	0	
Asian	2 (4.4)	2 (8.0)	0	
Body mass index (SD)	28.4 (± 6.6)	28.8 (± 6.9)	27.9 (± 6.4)	0.795
Co-morbidities (%)				
Myocardial infraction	2 (4.4)	1 (4.0)	1 (4.8)	0.899
Congestive heart failure	1 (2.2)	0	1 (4.8)	0.270
Peripheral vascular disease	0	0	0	
Cerebrovascular disease	0	0	0	
Chronic pulmonary disease	6 (13.0)	5 (20.0)	1 (4.8)	0.126
Mild liver disease	1 (2.2)	1 (4.0)	0	0.354
Severe liver disease	1 (2.2)	1 (4.0)	0	0.354
Diabetes mellitus	7 (15.2)	4 (16.0)	3 (14.3)	0.872
Diabetes mellitus + complications	1 (2.2)	0	1 (4.8)	0.270
HIV	3 (6.5)	1 (4.0)	2 (9.5)	0.449
Average socioeconomic status				0.292
Below	30 (65.2)	18 (72.0)	12 (57.1)	
Above	16 (34.8)	7 (28.0)	9 (42.9)	
Age-adjusted Charlson Comorbidity Index	1.7 (± 2.4)	1.7 (± 2.5)	1.8 (± 2.5)	0.989
LOS	2.4 (± 1.4)	2.1 (± 1.0)	2.8 (± 1.7)	0.105

HIV = human immunodeficiency virus; LOS = length of stay.

TABLE 2. ORGANISMS CULTURED FROM SITES

Organism	Number (%)
Gram-positive organisms	
Unspecified organisms only	3 ( 6.5)
<i>Staphylococcus aureus</i> (MSSA)	4 ( 8.7)
<i>Staphylococcus aureus</i> (MRSA)	2 ( 4.4)
Gram-negative organisms	
Unspecified organisms only	2 ( 4.4)
Mixed organisms	
Aerobic	15 (32.6)
Anaerobic	1 ( 2.2)
Aerobic and anaerobic	17 (37.0)
<i>Candida albicans</i>	2 ( 4.4)

MRSA = methicillin-resistant *S. aureus*; MSSA = methicillin-sensitive *S. aureus*.

*t*-test test was used for quantitative variables. Logistic regression was performed to identify possible covariates as significant predictors of recurrent peri-rectal abscess, including age, gender, history of diabetes, HIV status, Charlson Comorbidity Index, and adequacy of the discharge antibiotic regimen. In all the analyses, a two-sided *p* value of <0.05 was regarded as significant. The SPSS V. 23.0 program was used for data analysis.

**Results**

In all, 58 patients with acute complicated peri-rectal abscess underwent emergency surgical drainage in the operating room during the study period. Twelve patients were excluded because no culture data were available or because no microorganisms were isolated. Of the 46 patients included in the study, 72% were male, with a mean age of 39.37 (±16.42) years. The majority of the patients (63%) were African American. There were no significant differences in any of the demographic, medical history, or laboratory variables collected for these patients. Of the total 46 patients, 25 (54%) received adequate antimicrobial therapy on discharge, whereas the remaining 21 did not (Table 1).

Most cultures revealed mixed flora without further specification. The most common specific organisms isolated were methicillin-sensitive *Staphylococcus aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA). Overall, the most frequent findings from cultures were mixed aerobic and anaerobic organisms (37.0%) and mixed organisms not

otherwise specified (32.6%). Other gram-positive organisms only were recovered from 6.5%, gram-negative organisms only from 4.4%, mixed anaerobic bacteria from 2.2%, and *Candida* from 4.4% (Table 2).

The most common antibiotics prescribed on discharge were amoxicillin/clavulanic acid (28.3%), sulfamethoxazole/trimethoprim (23.9%), ciprofloxacin plus metronidazole (15.2%), clindamycin alone (4.4%), and other combinations (10.9%). Eight patients (17.4%) did not receive any antibiotic on discharge (Table 3). Among the antibiotics given on discharge, sulfamethoxazole/trimethoprim and cephalexin were considered to have inadequate anaerobic coverage, and clindamycin does not control gram-negative organisms (Table 4). The adequacy or inadequacy of the antibiotics used was not impacted by the average socioeconomic status of the patient. (*p*=0.292) (see Table 1).

Overall, there was a significantly higher rate of re-admission for peri-rectal abscess in patients who received inadequate antibiotic coverage (6 of 21 (29%) versus 1 of 25 (4%); *p*=0.021) (Table 5). Interestingly, of the patients who were re-admitted, more than 50% of the recurrences happened later than 30 days after discharge (see Table 3).

A multivariable analysis was performed to account for potential confounders. After adjusting for age, gender, diabetes, HIV status, and Charlson comorbidity index, inadequate antibiotic coverage on discharge was still found to be an independent predictor of recurrence (odds ratio 15.38; 95% confidence interval 1.07 to 200; *p*=0.044) (Table 6).

Patients who received sulfamethoxazole/trimethoprim had a 42.9% chance of having a recurrence whereas those discharged with no medication had a 28.6% chance followed by clindamycin (14.3%) and amoxicillin/clavulanic acid (14.3%). On the other hand, prescription of antibiotics that had activity against typical gram-positive, gram-negative, and anaerobic bacteria resulted in no recurrences of peri-rectal abscess (see Table 3).

**Discussion**

Peri-rectal abscess is a relatively common anorectal condition managed by surgical intervention, primarily I&D. The peak incidence is in men in their third to fourth decade of life [6]. These demographic data were reflected in this study cohort. Brook and Frazier [14] found that the most common isolates from peri-rectal abscess were mixed aerobes and anaerobes. In that study, abscess anaerobes outnumbered aerobes by a ratio of 2.8:1. In this study, the predominant

TABLE 3. ANTIBIOTICS PRESCRIBED AT DISCHARGE AND ABSCESS RECURRENCE

Antimicrobial regimen	Total patients (%)	Recurrence <30 d (%)	Recurrence 30–90 d (%)	Recurrence >90 d (%)	Total recurrence (%)
Amoxicillin/clavulanic acid	13 (28.3)	1 (14.3)	0	0	1 (14.3)
Sulfamethoxazole/trimethoprim	11 (23.9)	1 (14.3)	1 (14.3)	1 (14.3)	3 (42.9)
No medication	8 (17.4)	0	1 (14.3)	1 (14.3)	2 (28.6)
Ciprofloxacin + metronidazole	7 (15.2)	0	0	0	0
Clindamycin	2 ( 4.4)	1 (14.3)	0	0	1 (14.3)
Amoxicillin/clavulanic acid + metronidazole	2 ( 4.35)	0	0	0	0
Ciprofloxacin + clindamycin	1 ( 2.2)	0	0	0	0
Sulfamethoxazole/trimethoprim +cephalexin	1 ( 2.2)	0	0	0	0
Sulfamethoxazole/trimethoprim + metronidazole	1 ( 2.2)	0	0	0	0
Total	46				7 (100%)

TABLE 4. DISCHARGE ANTIBIOTIC COVERAGE

Antibiotic	Gram positive	Gram negative	Anaerobes
Amoxicillin/clavulanic acid	Y	Y	Y
Sulfamethoxazole/trimethoprim	Y	Y	N
Ciprofloxacin + metronidazole	Y	Y	Y
Clindamycin	Y	N	Y
Amoxicillin/clavulanic acid + metronidazole	Y	Y	Y
Ciprofloxacin + clindamycin	Y	Y	Y
Sulfamethoxazole/trimethoprim + cephalexin	Y	Y	N
Sulfamethoxazole/trimethoprim + metronidazole	Y	Y	Y

isolates were mixed aerobic and anaerobic organisms. Another report [15] identified occasional instances in which yeast were isolated from peri-rectal abscess cultures. In this sample, two cultures were positive for *Candida* spp. Historical studies have demonstrated recurrence rates for anorectal abscess range from 11% and 44%. The recurrence rate in our study was almost 15%, similar to that reported in previous studies [23, 24].

The impact of post-operative antibiotic use on peri-rectal abscess remains uncertain. There is little consensus about whether to obtain cultures, whether to use antibiotics after I&D, and if antibiotics are used, what type should be prescribed and for how long. One study suggested that routine cultures were unnecessary, as they did not affect treatment outcomes [7]. Some studies concluded that simple I&D should suffice for uncomplicated abscesses and that antibiotics were unnecessary [8–10]. However, other studies found that antibiotics given after the I&D decreased the long-term risk of fistula formation and abscess recurrence [11,12]. The latest practice recommendations for treatment of peri-rectal abscess suggest use of antibiotics for abscesses associated with extensive cellulitis, systemic symptoms, or failure to improve with drainage alone [13].

There are a number of studies that address which antibiotics to use, although none is definitive. Cheng and Tsai showed in 2010 that the most common aerobic bacterium was *Escherichia coli* and the most common anaerobic bacterium was *Bacteroides fragilis*. The *E. coli* were susceptible to amoxicillin/clavulanic acid and cefazolin 85% of the time, but success decreased to 69% for ciprofloxacin. For anaerobic bacteria, 100% were susceptible to metronidazole [22]. Several studies have documented increasing resistance of

TABLE 5. ADEQUACY OF ANTIBIOTIC COVERAGE AT DISCHARGE AND RE-ADMISSION FOR PERI-RECTAL ABSCESS

	Total (%)	Adequate therapy (%)	Inadequate therapy (%)	p
N	46	25 (54.4)	21 (45.7)	
Re-admission	7 (15.2)	1 ( 4.0)	6 (28.6)	0.021

TABLE 6. MULTIVARIABLE ANALYSIS FINDINGS

Variable	Odds ratio	95% Confidence interval	p
Inadequate coverage	15.38	1.07– 200	0.044
Age	0.95	0.85– 1.05	0.276
Gender	2.16	0.13– 36.71	0.594
Diabetes	10.04	0.06–1587.1	0.372
HIV	1.79	0.01– 629.4	0.846
Charlson Comorbidity Index	1.94	0.71– 5.35	0.199

HIV = human immunodeficiency virus.

various bacterial species, including *E. coli*, to sulfamethoxazole/trimethoprim, which would indicate a decrease in the utility of this agent [16–19]. In a randomized trial conducted in three hospitals in Turkey, patients with peri-rectal abscess who received amoxicillin/clavulanic acid developed more fistulas than a placebo-treated group [20]. However, in another trial, patients who received ciprofloxacin plus metronidazole developed fewer fistulas than control patients [21].

Our study findings suggested adequate post-operative antibiotic therapy helps prevent recurrence in patients with complicated peri-rectal abscesses. These findings also suggested a higher rate of recurrence in patients discharged on sulfamethoxazole/trimethoprim, amoxicillin/clavulanic acid, or no antibiotics; however, addition of metronidazole appeared to help prevent recurrence. Reviewing our microbiologic data, an oral regimen that would cover the typical gram-positive, gram-negative, and anaerobic organisms involved in these infections could include regimens such as cephalexin plus metronidazole or ciprofloxacin plus metronidazole.

These conclusions should be tempered by the limitations of this study. It was a retrospective design and confined to a single center. The severity of the infection, whether cultures of the abscess were done, and initial antibiotic selection were determined by the preference of the treating surgeons. The study also is limited by the relatively small number of patients sustaining a recurrence and the lack of a uniform program for long-term follow-up to detect recurrence.

## Conclusion

In this study, inadequate antibiotic therapy after I&D of complicated peri-rectal abscess resulted in a higher rate of re-admission for recurrence. A standard oral protocol combining antibiotics covering typical gram-positive, gram-negative, and anaerobic organisms should provide adequate coverage of the usual organisms found in complicated peri-rectal abscess after surgical drainage. Surgeons should develop standardized antibiotic regimens based on local resistance and microbiologic data to use for cases of complicated peri-rectal abscesses. Additional prospective studies are needed to elucidate better the role of antibiotic coverage in treating patients with peri-rectal abscess who have undergone drainage procedures.

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