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ORIGINAL ARTICLE

Clinical and microbiological analysis of adult perianal abscess

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Background: In Taiwan, *Klebsiella pneumoniae* is the predominant pathogen causing pyogenic liver abscess in patients with diabetes mellitus (DM). The purpose of our hospital-based study was to determine the predominant bacterial species causing perianal abscess in hospitalized patients with and without DM in Taiwan.
Methods: Data on patients admitted and then operated on for perianal abscess during the period of March 2001 to December 2008 were reviewed. Information extracted from medical records included clinical information and laboratory data as well as culture and antibiotic sensitivity results.
Results: A total of 183 patients underwent surgery for perianal abscess. The most common pathogen causing perianal abscess in non-DM patients was *Escherichia coli* (67.1%), and the most common pathogen isolated in DM patients was *K pneumoniae* (60%; $p = 0.009$). Among the 25 patients with DM, incident DM was diagnosed in 24.0% (6 of 25). In addition, five patients had transient hyperglycemia.
Conclusions: Escherichia coli was the predominant pathogen isolated from perianal abscesses in patients without DM. *Klebsiella pneumoniae*, however, was the predominant pathogen isolated in DM patients. In both DM and non-DM patients, more than 90% of *K pneumoniae* isolates showed *in vitro* sensitivity to first-generation cephalosporins.

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Introduction

Perianal abscess is a common colorectal disorder requiring surgical treatment. Most pathogens cultured from perianal abscesses are mixed aerobic—anaerobic organisms. The most common aerobic organisms are *Escherichia coli*, *Proteus vulgaris*, *Staphylococcus aureus*, and *Streptococcus* species, and the two most common anaerobic organisms are *Bacteroides* and *Peptostreptococcus* species.[1–3]

In the past two decades, *Klebsiella pneumoniae* has been the predominant pathogen causing pyogenic liver abscess in patients with diabetes mellitus (DM) in Taiwan.[4–6] In most of the cases of liver abscess, most causative pathogens are monomicrobial, whereas in perianal abscess, the pathogens responsible are predominantly polymicrobial in nature. The pathogens that cause liver abscess and perianal abscess originate in the gastrointestinal tract. The purposes of this study were to investigate the microbiology of perianal abscess in hospitalized patients, to compare the findings in DM patients with those in patients without DM, and to review our experience in treating perianal abscess in adults.

Materials and methods

Patients and bacterial isolates

This study was conducted at the Mackay Memorial Hospital, an 829-bed tertiary teaching hospital in Tamshui, Taiwan. Data on patients hospitalized and operated on for perianal abscess during the period March 2001 to December 2008 were obtained from the medical records. All patients had been admitted to the Colon and Rectal Surgery Service, Department of Surgery, or the Infectious Disease Service, Department of Medicine. Patients with perianal abscess were admitted to the Colon and Rectal Surgery Service if they had a body temperature greater than 38.0°C and/or abscess larger than 5.0 cm on admission. Patients admitted to the Infectious Disease Service included those with sepsis of unknown origin, who were subsequently diagnosed as having perianal abscess, as well as patients diagnosed as having perianal abscess on initial presentation. All of the bacterial cultures isolated from perianal abscesses in this study were saved in the microbiology laboratory for further analysis. We excluded patients with Crohn's disease or ulcerative colitis—patients known to have a higher risk of perianal abscess than the general population.[7,8] Data extracted from the medical records included patient characteristics; duration of hospital stay; medical and surgical history; and laboratory data, including white blood cell count, biochemistry data, pus and blood culture results, antibiotic sensitivity test results, and measurements of glycosylated hemoglobin (HbA1c). In patients with more than one culture result, only the result obtained from the pus during the operation was included for analysis. Cultures were performed for both aerobic and anaerobic organisms in the hospital's microbiology laboratory. Pathogens were identified on the basis of colonial morphology and standard biochemical tests. All isolates were stored at −70°C in tryptic soy broth (Difco Laboratories, Detroit, MI, USA) supplemented with 20% glycerol.

Definitions

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; however, these patients were excluded if there was evidence of gangrenous change involving the genitalia and perineum.[9] Sepsis was diagnosed in patients who showed signs of systemic inflammatory response syndrome (including two or more of the following criteria: temperature greater than 38°C or less than 36°C; heart rate greater than 90 beats/min; respiratory rate greater than 20 breaths/min or pCO_2 less than 32 torr; or white blood cell count greater than 12,000 cells/mm^3, less than 4,000 cells/mm^3, or higher than 10% band forms) plus documented infection. Incident DM was diagnosed in patients without a history of DM who presented with a fasting blood glucose level greater than or equal to 126 mg/dL or a random blood glucose level greater than or equal to 200 mg/dL. The fasting blood glucose level was rechecked to confirm DM, and HbA1c was measured to exclude stress hyperglycemia caused by infection. Death was attributed to perianal abscess if the infection was under treatment when death occurred, unless clinical and pathological data clearly suggested a different cause of death.

Management

In patients presenting with anal or perianal pain associated with the abscess, incision and drainage was performed. If an opening of the anal crypt was detected, anal fistulotomy was performed. Patients with septic shock who required observation and treatment in the medical intensive care unit received immediate incision and drainage only. Specimens of pus obtained during initial drainage or fistulotomy were immediately sent to the microbiology laboratory for aerobic and anaerobic cultures. Only topical antibiotic ointment was applied to the wound after a sitz bath. A first-generation oral cephalosporin was given postoperatively to patients with DM but with no systemic signs of sepsis. Sepsis was treated with an intravenous cephalosporin plus an aminoglycoside. Intravenous metronidazole was added to manage the active infection if cultures from the abscesses grew anaerobic bacteria. After discharge, the surgeon who had performed the operation followed the patients weekly during the first postoperative month to monitor the condition of the wound and at 6 months after the operation to look for possible recurrence of the perianal abscess. Data on patients who were lost to follow-up for at least 6 months were excluded from the calculation of the recurrence rate for perianal abscess.

Statistical analysis

Descriptive statistics for continuous variables are reported as the mean ± standard deviation. Categorical variables are described using frequency distributions and are reported as number (%). The *t* test for independent samples was used to detect differences in the means of continuous variables. The Chi-square test or Fisher's exact test was used for categorical comparisons of data. A *p* value less than 0.05

was considered to indicate statistical significance; all tests were two tailed. All statistical analyses were performed on a personal computer with the statistical package SPSS for Windows (Version 12.0; SPSS, Chicago, IL, USA).

Results

Of the 183 patients who met the study criteria, 167 had been admitted to the Division of Colon and Rectal Surgery and 16 had been admitted to the Division of Infectious Diseases. In all but one of the latter cases, the diagnosis of perianal abscess was not apparent on admission. Most of the patients (153; 83.6%) were men. A total of 25 (13.7%) patients had DM, with a mean duration of DM since diagnosis of 7.2 years. The DM patients were significantly older than the patients without DM (53.9 ± 9.9 years *vs.* 41.9 ± 13.2 years; $p < 0.001$) (Table 1). Among the 25 patients with DM, 24.0% (6 of 25) had no past history of diabetes. Additionally, five patients had transient hyperglycemia. Polymicrobial infection was found in 76.0% (19 of 25) of patients with DM and in 87.1% (136 of 158) of patients without DM. On admission, 8.0% (2 of 25) of diabetic patients and 5.7% (9 of 158) of nondiabetic patients had a history of perianal abscess. Fistulotomy was performed in 88.0% (22 of 25) of diabetic patients and 93.7% (148 of 158) nondiabetic patients. Because fistulotomy was performed in all patients with fistula-in-ano, the fistulotomy rate was 88.0% for diabetic patients and 93.7% for nondiabetic patients.

Pathogens cultured from the patients with perianal abscess are shown in Table 2. Among the monomicrobial infections, *K pneumoniae* (9 patients) and *E coli* (8 patients) were the most common. *Escherichia coli* was the most common pathogen overall and remained so throughout the study period. *Klebsiella pneumoniae* (60%; $p = 0.009$), however, was most prevalent among patients with DM, followed by *E coli* (52%) and *Bacteroides fragilis* (28%). Among patients without DM, *E coli* was the most common pathogen (67.1%), followed by *B fragilis* (48.1%) and *K pneumoniae* (32.9%) (Table 2).

In vitro antibiotic sensitivity of the common bacteria isolated from perianal abscess revealed that *E coli* isolates were highly sensitive to first-generation cephalosporins in DM patients (11 of 13; 84.6%), but less sensitive in non-DM patients (69 of 106; 65.1%). In both DM and non-DM patients, more than 90% of *K pneumoniae* isolates were sensitive to first-generation cephalosporins [14 of 15 (93.3%) and 51 of 52 (98.1%), respectively].

Three of the 183 patients had bacteremia. One DM patient had *K pneumoniae* bacteremia and died because of septic shock, despite administration of antibiotics to which the organism was sensitive. Of the other two non-DM patients, one had chronic schizophrenia and *B fragilis* bacteremia, and the other had AIDS (CD4 count, 4 cells/mm^3) and Group C1 *Salmonella* bacteremia. The patient with AIDS also had liver abscess and was treated with antibiotics. Both patients were treated with surgery and antibiotics and recovered completely. After discharge, 6 of the 166 patients (3.6%) who were followed for 6 months had a recurrent perianal abscess, whereas 17 patients were lost to follow-up. One patient had active postoperative anal bleeding that responded well to conservative treatment.

Discussion

The cryptoglandular theory of perianal abscess formation is now widely accepted. Most perianal abscesses result from infection that originates in the anal crypts and then extends into the anal glands in the intersphincteric plane.[10,11] If it tracks downward into the intersphincteric plane, a perianal abscess forms. Pus culture is usually not performed because antibiotics are infrequently used. Some authors have shown, however, that the likelihood of a fistula is much greater in the presence of gut-derived organisms (*E coli* and *B fragilis*) and, therefore, recommend culture and reexamination for fistula only if gut-derived organisms have been cultured.[12,13]

In our series of patients with perianal abscess, *K pneumoniae* (60%) was the most common pathogen in DM patients, although the most frequently isolated pathogen overall was *E coli* (67.1%). *Klebsiella pneumoniae* has also been reported to be the most common organism isolated from pyogenic liver abscess in Taiwanese patients with DM.[4,5] Individuals with DM are at greater risk of infection because of abnormalities in cell-mediated immunity and phagocyte function associated with poor glycemic control, as well as reduced vascularization associated with complications because of long-standing DM. Defective neutrophil bactericidal activity is thought to contribute to the increased susceptibility to bacterial infection in DM patients.[14] It has been demonstrated that overuse of antibiotics results in the elimination of susceptible microorganisms, thereby encouraging the colonization of *K pneumoniae* in both humans and animals.[15] Whether a special *K pneumoniae* strain has a survival advantage

Table 1 Clinical features of patients with perianal abscess

Variable	DM ($n = 25$)	Non-DM ($n = 158$)	p
Male/female	22/3	131/27	0.772
Mean age (yr)	53.9 ± 9.9	41.9 ± 13.2	<0.001
Range (yr)	36–77	16–84	
Length of stay >7 d, *n* (%)	2 (8.0)	13 (8.2)	0.999
Polymicrobial, *n* (%)	19 (76.0)	136 (87.1)	0.229
Past history of abscess, *n* (%)	2 (8.0)	9 (5.7)	0.649
Fistula-in-ano, *n* (%)	22 (88.0)	148 (93.7)	0.392
Mortality, *n* (%)	1 (4.0)	0 (0)	0.137

DM = diabetes mellitus.

Table 2 Pathogens cultured from perianal abscess

Pathogens	DM ($n = 25$)	Non-DM ($n = 158$)	p
	n (%)	n (%)	
Bacteroides fragilis group	7 (28)	76 (48.1)	0.061
Escherichia coli	13 (52)	106 (67.1)	0.142
Klebsiella pneumoniae	15 (60)	52 (32.9)	0.009
Enterococcus	4 (16)	25 (15.8)	0.999
β-Hemolytic *Streptococcus* Group B	4 (16)	7 (4.4)	0.046
β-Hemolytic *Streptococcus* non-Group A, B, and D	1 (4)	9 (5.7)	0.999
α-Hemolytic *Streptococcus* Group D	0 (0)	9 (5.7)	0.613
Bacteroides ovatus	0 (0)	2 (1.3)	0.999
Salmonella Group C1 (non-typhi) and *Salmonella arizona*	0 (0)	2 (1.3)	0.999
α-Hemolytic *Streptococcus* species	2 (8)	18 (11.4)	0.999

because of antibiotic resistance or whether they simply acquire their unique virulence genes from other bacteria is not known. Septic metastatic complications in patients with liver abscess are particularly associated with *K pneumoniae* serotype K1 and with *Klebsiella* that carry a *mag*A-containing plasmid, an important virulence gene.[15,16] However, poor glycemic control impairs phagocytosis of capsular serotypes K1 and K2 in *K pneumoniae*.[17] The only death that occurred in our study was that of a DM patient with perianal abscess, *K pneumoniae* bacteremia, and septic shock, who died the day after surgery despite administration of antibiotics to which the organism was sensitive. Interestingly, *K pneumoniae* is usually the only microorganism isolated in DM patients with liver abscess.[4–6] In contrast, most of the cases of perianal abscess infection caused by *K pneumoniae* in our series were polymicrobial in nature. Polymicrobial perianal abscess is caused by gut-derived organisms that can easily colonize in the anus without any barriers.

In our study, DM patients were older and had more comorbidities than those without DM. This could be because Type 2 DM, the most common type of DM, is more frequent in the elderly, and because DM is associated with comorbidities commonly seen in that population, such as hypertension, coronary artery disease, and stroke. A substantial percent (24.0%) of the diabetic patients had newly diagnosed diabetes.

Perianal abscess in children is found almost exclusively in boys and is infrequently associated with systemic signs of sepsis.[18,19] Sepsis is more commonly encountered in adults.[20] Antibiotics are not needed after operation, unless marked cellulitis, immunosuppression, valvular heart disease, signs of systemic infection, or DM exist.[2,3,21] *In vitro* antibiotic sensitivity studies showed that *E coli* isolates were highly sensitive to first-generation cephalosporins in DM patients but less sensitive in non-DM patients. Overall, more than 90% of *K pneumoniae* isolates were sensitive to first-generation cephalosporins *in vitro*.

Diagnosis of perianal abscess was delayed in 15 of the 16 patients admitted to the Infectious Disease Service, primarily because of difficulties in taking the medical history on admission and lapses in physical examination. Although perianal or perirectal pain is the most common presenting symptom in abscesses in this area,[3] the complaint was not clearly reported by patients in our series because of clouded sensorium due to a previous stroke, metabolic encephalopathy, or chronic schizophrenia. Lapses by the admitting physicians included not considering the possibility of perianal abscess and not performing a routine digital examination in all patients with sepsis. Two patients had to be transferred to the medical intensive care unit because of septic shock. Thus, perianal abscess should be considered in the differential diagnosis of sepsis when the origin is unclear. Only one patient admitted to the Infectious Disease Service was correctly diagnosed as having perianal abscess on initial examination. The patient was a young man who had had a hemorrhoidectomy elsewhere 1 week before admission. He presented to our emergency department with a 5-day history of high fever accompanied by right upper abdominal discomfort. Abdominal sonography revealed a heterogeneously echoic mass in the X hepatic lobe, indicative of a liver abscess. He was subsequently found to be HIV positive. His blood culture grew *Salmonella enterica* Group O7 (Group C1). Both the perianal and liver abscesses resolved completely after a 4-week regimen of intravenous ciprofloxacin and a 2-week regimen of metronidazole.

There appears to be a slight advantage in terms of decreased recurrence when perianal abscess is treated with fistulotomy versus drainage alone.[22,23] This is why we performed fistulotomy when the internal opening of the fistula tract was identified. Our low rate of recurrence (3.6%) is in line with the 5% recurrence rate found by Oliver et al.[22] in the patients they treated with fistulotomy. Such results contrast with the 29% recurrence rate in patients treated with drainage alone.

In our patients with perianal abscess, *E coli* was the predominant pathogen isolated in patients without DM. However, *K pneumoniae* was the predominant pathogen in DM patients. *Escherichia coli* isolates were highly sensitive to first-generation cephalosporins in DM patients but less sensitive in non-DM patients. Overall, most of the *K pneumoniae* isolates were sensitive to first-generation cephalosporins. Incident DM was diagnosed in 24.0% of the patients with perianal abscess. The only death that occurred involved a patient with diabetes and *K pneumoniae* bacteremia, who died despite the administration of sensitive antibiotics. Correct and prompt diagnosis of perianal abscess is paramount as it is generally amenable to surgery and appropriate antibiotics.

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