Breast Abscesses in Nonlactating Women With Diabetes: Clinical Features and Outcome

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Abstract: *Background:* The association between diabetes and breast abscess in nonlactating women has not been previously reported in the literature. *Methods:* Retrospective analysis of all cases of breast abscess in nonlactating women in a community teaching hospital from 2000 to 2006. We analyzed their clinical characteristics, prevalence of diabetes mellitus (DM), management, and clinical outcome. *Results:* We identified 116 breast abscesses in 98 nonlactating women [age 48 ± 14, (mean ± SD), 89% African Americans]. At presentation, 63 patients (64%) had a known history of DM (duration: 8.5 ± 5 years) and 8 patients (8%) had newly diagnosed DM. Among the remaining 27 women, 7 (26%) developed DM within 5 years of follow-up. The odds ratio of having diabetes in nonlactating women with breast abscess relative to those without breast abscess was estimated as 14.24 (95% confidence interval, 6.72–30.17). Most patients (89%) had a single abscess. Patients with DM had increased length of hospital stay ($P < 0.01$) and a more severe clinical course during follow-up. Most patients (70%) were treated with incision and drainage and antibiotics. Glycemic control was suboptimal with only 46% of subjects receiving insulin therapy during the hospital stay. *Conclusions:* Our study indicates a strong association between DM and breast abscess in nonlactating women. The high prevalence of DM (72%) and their more severe clinical course suggest that breast abscesses in nonlactating women should be considered among the "typical" infections associated with DM. Increased awareness and intensified glycemic control might improve clinical outcome in nonlactating women with breast abscesses.

Key Indexing Terms: Breast abscess; Diabetes; Lactation; Diabetic complications; Infections in diabetics. **[Am J Med Sci 2009;338(2):123–126.]**

Breast abscess, defined as a localized collection of purulent material in the breast, usually occur in women during the lactation period as a complication of trauma and infective mastitis.[1,2] *Staphylococcus aureus* is the most common reported microorganism.[3] Most patients have single abscesses that[2] are treated with conservative measures, including withholding lactation, local drainage, and antibiotic therapy.[1,3] In contrast, breast abscesses occurring in nonlactating women are rare and are poorly described in the literature. In recent years, however, we have treated a large number of nonlactating women presenting with breast abscesses without apparent precipitating cause, except for a history of poorly controlled diabetes mellitus (DM). We performed a computerized search of biomedical journal literature from Medline, PubMed, and Ovid from 1966 to 2006 English-language original and found no citations describing the association between DM and breast abscess in nonlactating women. Accordingly, we conducted a retrospective analysis of a large cohort of all cases of breast abscesses in nonlactating women to determine their clinical presentation, prevalence of diabetes, risk factors, treatment, and clinical outcome.

METHODS

Using the ICD-9 code 611.0 that includes all the inflammatory diseases of the breast, we identified 1687 medical records of women treated at Grady Memorial Hospital from 2000 to 2006. Grady Memorial Hospital is a large public institution in the metropolitan Atlanta area that serves a high proportion of African American women. Breast abscess is defined as the localized collection of purulent material deep in the breast. A total of 1589 cases were excluded for several reasons, including a history of breast feeding within 12 months of presentation, inflammatory breast cancer, male gender, or a history of breast surgery or breast trauma within 3 months of presentation. The remaining 98 nonlactating women who were treated for breast abscess were included in the analysis. Patients were either admitted to the hospital or treated in the emergency department or in the outpatient Avon Comprehensive Breast Center. Breast clinic and hospital records were reviewed to obtain information on demographics, precipitating cause, breast feeding history and duration of lactation, breast symptoms, including breast pain, breast swelling, discharge, breast palpable mass, admission white blood cell count, tobacco use, presence of hypertension history and duration of diabetes, admission blood glucose and Hg A1c, medical and surgical management, length of stay (LOS), recurrence rate, and time to resolution. The time for the abscess to resolve was calculated in days from presentation to clinical resolution documented in the chart.

To determine the association between breast abscess and DM, a control group of 98 patients without breast abscesses and matched for age, gender, and body weight index were randomly selected from the Avon Comprehensive Breast Center during the study period. The study was approved by the Emory University Institutional Review Board.

Statistical analysis was performed using the Splus software package. Specifically, 2 sample comparisons were conducted using 2-sample *t* tests (or nonparametric Wilcoxon tests) or 2-sample proportion tests. Odds ratio and the corresponding confidence interval were calculated based on 2 by 2 contingency table and using Woolf's formula based on log transformation.[4] A *P* value less than 0.05 was considered as significant.

RESULTS

We identified 1687 medical records of women with benign inflammatory breast disorders. Of them, 98 (6.8%)

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TABLE 1. Clinical characteristics at presentation

	Control group	All patients with breast abscess	Breast abscess with diabetes	Breast abscess without diabetes	*P*
Number of patients, n (%)	98	98	71 (72)	27 (28)	
Breast abscess, n (%)	None	116	85 (73)	31 (27)	
Age (yr)	47 ± 15	48 ± 14	51 ± 14	40 ± 13	<0.01
African American race, n (%)	87 (89)	87 (89)	61 (86)	26 (97)	0.27
Body weight (lbs)	225 ± 64	227 ± 74	238 ± 63	178 ± 68	0.01
Admission BG (mg/dL)	n/a	205 ± 144	241 ± 152	104 ± 24	0.01
Admission HgA1c (%)	n/a	8.3 ± 2.4	8.3 ± 2.4	—	
DM diagnosis at presentation, n (%)	11 (11)	71 (72)	71 (72)	—	
DM diagnosis during follow-up, n (%)	n/a	7 (7)	—	7 (7)	
DM duration, yrs	5.5 ± 6	7.4 ± 6	7.4 ± 6	—	
Management					
Incision and drainage, n (%) in the OR + antibiotics	—	81 (70)	52 (45)	29 (25)	
Drainage + antibiotics, n (%)	—	2 (1.7)	2 (1.7)	0	
Antibiotics only, n (%)	—	15 (13)	11 (9.5)	4 (3.5)	
Refusal/unknown, n (%)	—	18 (15.3)	18 (15.3)	0	
Length of hospital stay (d)	—	4 ± 7 (N = 68)	5 ± 9 (N = 53)	2 ± 2 (N = 15)	<0.01
Time to resolve (d)	—	47 ± 54	53 ± 70	44 ± 36	0.46

All data are expressed as a mean ± SD or n (%).
The *P* values were derived comparing breast abscess patients with and without DM using a 2-sample *t* test or a 2-sample proportion test.
DM, diabetes mellitus; BG, blood glucose; OR, odds ratio; n/a, not applicable.

nonlactating women had a total of 116 breast abscesses. The clinical characteristics of patients are shown in Table 1. At presentation, a diagnosis of diabetes was established in 71 women (72%). Of them, 63 (64%) subjects had a known history of diabetes before admission (duration: 8.5 ± 5 years) and 8 patients (8%) were newly diagnosed. Among the remaining 27 women without diabetes, 7 (26%) subjects went to develop diabetes within 5 years of follow-up. The odds ratio of having diabetes in women with breast abscess relative to a control group of women without breast abscesses matched for age, race, and body weight was estimated to be 14.24 (95% confidence interval, 6.72–30.17).

The clinical presentation of women with breast abscesses included local induration, erythema, swelling, and pain over the affected area. Diabetic women with breast abscesses were significantly older (51 ± 14 versus 40 ± 13 years, $P < 0.001$), heavier (238 ± 63 versus 178 ± 68 lbs, $P < 0.001$), and presented with higher BG levels (241 ± 152 versus 104 ± 24 mg/dL). Women with DM required a longer length of hospital stay and longer time to resolution of the abscess than patients without DM. Patients with DM had a longer LOS than nondiabetic patients ($P < 0.01$). Six women (8%) were admitted with severe hyperglycemia (BG >500 mg/dL), 2 of them presented with diabetic ketoacidosis.

Most abscesses occurred as a single episode, but 11 had more than 1 breast abscess (Table 2). Of the 11 women with multiple breast abscesses, 6 women had 2 abscesses approximately 4 to 13 months between them, 3 women had 3 abscesses approximately 6 to 12 months between them, and 2 women had 4 abscesses approximately 3 to 40 months between them. There were no significant differences in the hospital LOS, hemoglobin A1C at presentation, and time to abscess to resolve between women with single or multiple breast abscesses. Women with multiple breast abscesses were heavier than those with a single abscess (262 ± 52 versus 228 ± 64 lbs, $P = 0.12$). The mean time for the abscess to resolve was 53 ± 70 days for women with DM and 44 ± 36 days for women without DM. Most patients (70%) were treated with surgical incision and drainage and antibiotic therapy.

There was no association between the development of breast abscesses and a previous history of lactation. A total of 84 women (86%) never breast fed and 14 (14%) had a history of breast feeding more than 10 years before presentation. There was no apparent precipitating cause for abscess development such as a history of breast trauma or skin disorder. We also failed to observe an association between breast abscesses and smoking, hypertension, admission white blood cell count on or other chronic disorders.

In-hospital glycemic control was suboptimal in the most of the patients. The mean daily BG was 176 ± 33 mg/dL, and only 46% of subjects received insulin therapy during the hospital stay. Among diabetic subjects, 7% were treated with oral antidiabetic agents, 32% received sliding scale insulin alone, 39% were treated with a multidose insulin regimen, and 22% of patients received no diabetes treatment. Patients treated with multidose insulin regimen, including those admitted with severe hyperglycemia or diabetic ketoacidosis, had significant lower BG levels during the hospital stay and at discharge compared with women treated with oral agents or sliding scale insulin ($P = 0.02$).

DISCUSSION

This study recognizes a strong association between DM and breast abscess in nonlactating women. In this large retrospective cohort, we observed that about 75% of nonlactating women with breast abscesses had diabetes at presentation or went to develop diabetes within 5 years of follow-up. The odds ratio of having diabetes in women with breast abscess relative to those without breast abscess was estimated to be 14.24 (95% confidence interval, 6.72–30.17). Patients with diabetes had an

TABLE 2. Characteristics of patients with single or multiple breast abscesses

	Total	Single breast abscess	Multiple breast abscesses	*P*
Number of patients, n (%)	98	87 (89)	11 (11)	>0.99
Diabetics, n (%)	71	63 (89)	8 (11)	
Nondiabetics, n (%)	27	24 (89)	3 (11)	
Age (yr)				
Diabetics	51 ± 14	54 ± 14	43 ± 10	<0.01
Nondiabetics	40 ± 13	41 ± 13	35 ± 9	0.47
Weight (lbs)				
Diabetics	238 ± 63	228 ± 64	262 ± 52	0.12
Nondiabetics	178 ± 68	179 ± 70	176 ± 69	0.97
Admission BG (mg/dL)	241 ± 152	234 ± 166	243 ± 149	0.95
Admission HgA1c (%)	8.3 ± 2.4	8.1 ± 2.4	9.1 ± 3.0	0.29
LOS (d)				
Diabetic	5 ± 9	4 ± 7	10 ± 19	0.37
Nondiabetic	2 ± 1	2 ± 3	13 ± 27	0.55
Time to resolve (d)				
Diabetic	53 ± 70	43 ± 42	69 ± 90	0.43
Nondiabetic	44 ± 36	40 ± 35	62 ± 40	0.49

All data are expressed as a mean ± SD or n (%).
The *P* values were derived comparing patients with single versus multiple breast abscesses using a 2-sample *t* test or a 2-sample proportion test.
BG, blood glucose; LOS, length of stay.

increased length of hospital stay and a more severe clinical course than women without diabetes.

Diabetes has long been recognized to be a risk factor for infection complications.[5,6] Data from the Second Dutch National Survey of General Practice, a 12-month prospective cohort study, revealed that patients with DM type 1 and DM type 2 are at increased risk for infection complications.[6] Diabetes increases the risk of some common infections, such as urinary tract infections, bacterial and fungal infections, soft tissue infection, including necrotizing fasciitis and Fournier's necrosis, gangrene, and nonclostridial anaerobic cellulitis.[7] In addition, there are a group of unusual infections typical for the diabetic population, including mucormycosis, malignant external otitis, emphysematous pyelonephritis, and emphysematous cholecystitis.[7,8] Rhinocerebral mucormycosis is an acutely fatal fungal infection that predominantly affects immunocompromised and patients with poorly controlled diabetes. Approximately 60% to 80% of patients with rhinocerebral mucormycosis have a concomitant diagnosis of diabetes.[9,10] Malignant otitis externa is another uncommon but potentially life-threatening infection in patients with diabetes, affecting the external auditory canal and skull. Of all the cases of malignant otitis externa, 86% to 90% have been reported in the diabetic population.[11] Acute emphysematous cholecystitis predominantly affects elderly diabetic men.[12,13] Emphysematous cystitis is a rare complication of lower urinary track infection resulting from infection of the urinary bladder with gas-producing bacteria. In a recent review of 135 cases of emphysematous cystitis, 64% of the cases had diabetes.[14] Our results indicate that breast abscesses in nonlactating women should also be considered as one of the "typical" infections that occurred in 72% of patients with diabetes.

Several immunologic pathways have been identified by which hyperglycemia and diabetes affect the host immune system, increasing its susceptibility to infection.[5,13,15] There is substantial *in vitro* and *in vivo* evidence that short-term hyperglycemia impairs immune function through the following pathways/mechanisms: abnormalities in neutrophil activity,[15,16] increased expression of intercellular adhesion molecules and E-selectin,[17] the inflammatory cytokine cascade with increasing levels of early proinflammatory cytokines, such as interleukin-6 and tumor necrosis factor-α,[18] impairment of the microvasculature's ability to relax in the presence of vasodilating stimuli, such as nitric oxide radicals,[19] and promotion of adherence and sequestration of neutrophils and monocytes into peripheral tissues.[8,15,16] Acute hyperglycemia also inhibits specific cellular functions such as the production of reactive oxygen species and phagocytosis.[12] Antioxidant systems involved in bactericidal activity, including superoxide dismutase activity, glutathione peroxidase and glutathione reductase activities, has been reported to be significantly impaired in diabetics compared with nondiabetic controls.[20]

A large body of evidence suggests that in hospitalized patients with and without diabetes, the presence of hyperglycemia is associated with increased risk of complications and death.[21–30] Prospective randomized trials in hospitalized patients have shown that aggressive glycemic control reduces short- and long-term mortality, multiorgan failure and systemic infections, length of hospital and intensive care unit stay,[1,2,7,9–11] and to lower total hospitalization cost.[31] In general surgical patients, a serum glucose >220 mg/dL on postoperative day 1 has been shown to be a sensitive (87.5%) but relatively nonspecific (33.3%) predictor of the later development of postoperative nosocomial infection.[24] In patients with hyperglycemia (>220 mg/dL) on postoperative day 1, the infection rate was 2.7 times that observed (31.3% versus 11.5%) in diabetic patients with all serum glucose values <220 mg/dL. When minor infection of the urinary tract was excluded, the relative risk for "serious" postoperative infection (sepsis, pneumonia, and wound infection) increased to 5.7 when any postoperative day 1 BG level was >220 mg/dL. In our study, diabetic women had a longer length of hospital stay, had a longer and more severe clinical course until resolution of the abscess, and their diabetes was poorly managed with less

than half of the patients receiving insulin therapy. These results indicate that a randomized controlled trial is needed to determine whether intensified insulin treatment with multidose insulin regimens can improve the clinical outcome and prevent abscess recurrence in women with DM.

We acknowledge the following limitations in this study. The main limitation is its retrospective nature. In addition, the study was conducted in a single institution in Atlanta in a predominantly inner city and African American population, thus, our results may not apply to other ethnic groups or other institutions. In addition, our study did not address the question of whether treatment of hyperglycemia may improve outcome of length of hospital stay in patients with hyperglycemia. A prospective, randomized trial of strict glycemic control is certainly needed to address these issues.

In conclusion, we found a strong association between breast abscesses in nonlactating women and DM. We found a high prevalence of DM (72%) in nonlactating women with breast abscess, and that diabetic women had an increased length of hospital stay and a more severe clinical course than women without DM. Our results indicate that breast abscesses in nonlactating women should be considered as one of the typical infections that occurred in subjects with diabetes. Increased awareness and intensified glycemic control might improve clinical outcome in nonlactating women with breast abscesses.

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