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# Predictors of Primary Breast Abscesses and Recurrence

**Ankit Bharat**,
Department of Surgery, Washington University School of Medicine, 660 S. Euclid Avenue, Campus Box 8109, St. Louis, MO 63110, USA

**Feng Gao**,
Division of Biostatistics, Washington University School of Medicine, St. Louis, MO, USA

**Rebecca L. Aft**,
Department of Surgery, Washington University School of Medicine, 660 S. Euclid Avenue, Campus Box 8109, St. Louis, MO 63110, USA. Department of Surgery, John Cochran Veterans Hospital, St. Louis, MO, USA

**William E. Gillanders**,
Department of Surgery, Washington University School of Medicine, 660 S. Euclid Avenue, Campus Box 8109, St. Louis, MO 63110, USA

**Timothy J. Eberlein**, and
Department of Surgery, Washington University School of Medicine, 660 S. Euclid Avenue, Campus Box 8109, St. Louis, MO 63110, USA

**Julie A. Margenthaler**
Department of Surgery, Washington University School of Medicine, 660 S. Euclid Avenue, Campus Box 8109, St. Louis, MO 63110, USA

Julie A. Margenthaler: margenthalerj@wudosis.wustl.edu

## Abstract

**Background—**We investigated the patients and microbiological risk factors that predispose to the development of primary breast abscesses and subsequent recurrence.

**Methods—**Patients with a primary breast abscess requiring surgical therapy between January 1, 2000 and December 31, 2006 were reviewed. Recurrent breast abscess was defined by the need for repeated drainage within 6 months. Patient characteristics were compared to the general population and between groups.

**Results—**A total of 89 patients with a primary breast abscess were identified; 12 (14%) were lactational and 77 (86%) were nonlactational. None of the lactational abscesses recurred, whereas 43 (57%) of the nonlactational abscesses did so ($P < 0.01$). Compared to the general population, patients with a primary breast abscess were predominantly African American (64% vs. 12%), had higher rates of obesity (body mass index > 30: 43% vs. 22%), and were tobacco smokers (45% vs, 23%) ($P < 0.01$ for all). The only factor significantly associated with recurrence in the multivariate logistic regression analysis was tobacco smoking ($P = 0.003$). Compared to patients who did not have a recurrence, patients with recurrent breast abscesses had a higher incidence of mixed bacteria (20.5% vs. 8.9%), anaerobes (4.5% vs. 0%), and *Proteus* (9.1% vs. 4.4%) but lower incidence of *Staphylococcus* (4.6% vs. 24.4%) ($P < 0.05$ for each).



Correspondence to: Julie A. Margenthaler, margenthalerj@wudosis.wustl.edu.

**Conclusions—**Risk factors for developing a primary breast abscess include African American race, obesity, and tobacco smoking. Patients with recurrent breast abscesses are more likely to be smokers and have mixed bacterial and anaerobic infections. Broader antibiotic coverage should be considered for the higher risk groups.

## Introduction

Benign breast abscesses remain a cause of significant morbidity due to the patients' underlying disability and high incidence of recurrence [1]. Primary breast abscesses occur both in the puerperal and nonpuerperal settings and affect women of all ages. Surgical drainage remains the gold standard for treating benign breast abscesses [2]. Nevertheless, a significant proportion of breast abscesses recur. Previous retrospective studies have reported that the recurrence rate can be as high as 40% to 50% [2, 3]. Despite this fact, there are few data on the risk factors associated with breast abscess recurrence.

Interestingly, both primary and recurrent breast abscesses seem to be more common in nonpuerperal women [1]. *Staphyloccocus aureus* remains the predominant microbe isolated from breast abscesses, and there has been a recent increase in community-acquired methicillin-resistant *S. aureus* species (MRSA) [4]. Moazzez et al. [4] showed that 50% of staphylococcal species and 19% of all isolates from community-acquired breast abscess were MRSA. Other commonly isolated organisms include coagulase-negative *S. aureus*, diphtheroids, *Pseudomonas aeruginosa*, *Proteus mirabilis*, and anaerobes. However, the characterization of microbial flora associated with recurrent breast abscesses remains incomplete.

In the present study, we investigated the risk factors for developing a primary breast abscess and subsequent recurrence. In addition, we characterize the microbial flora associated with recurrent breast abscesses.

## Methods

Institutional review board approval was obtained prior to the commencement of this retrospective study. Written informed consent of patients was not required. The surgical, pathology, and microbiologic databases at Washington University/Barnes Jewish Hospital were queried from January 1, 2000 to December 31, 2006 to identify all patients with a diagnosis of breast abscess. Exclusion criteria included patients with a current or historical diagnosis of breast cancer ± radiation therapy to the breast and recent breast surgery within the prior 12 months. Patients were considered to have a recurrent breast abscess if they required a repeat drainage procedure in the same breast quadrant within 6 months. Breast abscesses were considered lactational if the subject was breast-feeding or immediately postpartum at the time of presentation.

Breast imaging, medical records, and treatment strategies were reviewed and recorded. All data were transferred to a single spreadsheet (Excel; Microsoft, Redmond, WA, USA). Statistical calculations were performed using software (StatView; Abacus Concepts, Berkeley, CA, USA). Patient risk factors were compared to the known distribution of such risk factors in the general population of Missouri. The demographic data for the Missouri population was obtained from the Missouri Department of Health website: www.dhss.mo.gov. For contiguous variables, such as age and body mass index (BMI), values were grouped and the differences between recurrence and nonrecurrence were compared by the chi-squared test. Categorical variables were compared by Fisher's exact test. A multivariate logistic regression was fitted to see the independent risk factors. For all analyses, results were considered statistically significant if the *P* value was 0.05 or less.

## Results

During the study period, 115 patients were surgically treated for a primary breast abscess. Among them, 26 had a history of ipsilateral breast cancer and were excluded from the study. The clinical and demographic profile of the study subjects is shown in Table 1. The entire study population ($n$ = 89) was first compared to the general Missouri population with respect to race, rates of obesity (defined by a BMI of >30), and tobacco usage (general Missouri population results are not depicted in Table 1). Overall, compared to the general Missouri population, patients developing a breast abscess were more likely to be African American (63% vs. 12%), have higher rates of obesity (BMI > 30: 42% vs. 22%), and tobacco smokers (44% vs. 23%) ($P$ < 0.01 for each comparison) (Fig. 1).

Of the 89 patients included in the study, 12 (14%) had lactational abscesses and 77 (86%) had nonlactational abscesses. There were no recurrences in patients with lactational breast abscesses, whereas 43 (57%) patients in the nonlactational group ($n$ = 77) developed a recurrence. The median time to recurrence was 97 days (range 10–146 days). Of the 43 patients who developed a recurrence, 39 (91%) had one recurrence and 4 (9%) had two or more recurrences during the study period.

In a further subgroup analysis, patients with and without recurrence in the nonlactational group were compared (Table 1). There was no significant difference between patients with and without recurrence with regard to age, race, BMI, alcohol consumption, and illicit drug use. Patients with recurrent abscesses had a higher prevalence of at least one other medical co-morbidity, including diabetes, hypertension, asthma, or psychiatric illness (recurrent 56% vs. nonrecurrent 36%, $P$ = 0.0014) as well as prescription drug use for other co-morbid conditions (recurrent 67% vs. nonrecurrent 33%). In addition, we found a significantly increased rate of smoking in patients with recurrent abscesses (77% vs. 29%, $P$ = 0.002) (Fig. 2).

In the multivariate logistic regression analysis, age, sex, race, co-morbid conditions, coexistent formulary drug use, alcohol consumption, and illicit drug use did not significantly predispose to recurrence. The only factor that was significantly associated with recurrence was tobacco smoking (Table 2).

Differences were also observed in the microbial pattern of infection in patients with and without recurrent non-lactational breast abscesses (Fig. 3). Compared to patients with nonrecurrent abscesses, patients with recurrent breast abscesses were found to have an increased incidence of anaerobic bacteria (5% vs. 0%), mixed microbial infection (21% vs. 9%), and *Proteus* (9% vs. 4%) ($P$ = 0.01). In contrast, recurrent breast abscesses were less likely to be due to methicillin-sensitive *S. aureus* (2% vs. 11%) and methicillin-resistant *S. aureus* (2% vs 13%) ($P$ = 0.01). A predominance of anaerobic and mixed microbial infections were also found to be more common in smokers (data not shown). Both groups were treated similarly with regard to the antibiotic regimen. The standard intraoperative antibiotic administered was cefazolin or, if the patient was penicillin-allergic, vancomycin. The patients were discharged on an antibiotic regimen based on the microbial susceptibility.

## Discussion

Whereas the incidence of lactational breast abscess is declining, nonlactational breast abscesses are still seen frequently and are, in fact, increasing [1]. In addition, non-lactational abscesses are more likely to recur. This is clearly evident from the present study as well as from previous reports [3]. It is noteworthy that there has been an increase in cigarette smoking by women 20 to 40 years of age [5]. Cigarette smoking may have a role in the

development of both primary breast abscesses and recurrence. The exact mechanism is still unclear, but it is possible that the smoke toxins secreted into ductal secretions damage the lactiferous ducts [6–8]. Such damage may lead to scarring and fibrosis in the retroareolar tissues. In addition, after the initial surgical drainage, smoking may impair the immune process, thereby predisposing to recurrence. For example, smoking can suppress interleukin-8 production, which is known to promote neutrophil chemotaxis at the site of inflammation [9].

Periductal mastitis, or Zuska disease, may also play a role in the development of recurrent abscesses [10]. Associated findings include luminal obstruction by entrapped keratinous material, squamous metaplasia on histopathological examination, and secondary bacterial infection. Fistula tract formation and a chronic inflammatory response in the subareolar tissues may result in intermittent eruptions at the nipple–areolar border. Whether these intermittent eruptions represent true recurrent abscesses or simply incompletely excised fistulas is unclear. Although we are unable to clearly make this link in the current retrospective study, most patients with Zuska disease are also smokers, suggesting that this may be a component of the disease process in our patients with recurrent abscesses. A prospective study would be necessary to corroborate this suspicion.

Interestingly, we found that smokers were more likely to develop anaerobic and mixed infections. Previous reports have also demonstrated a strong association between smoking and anaerobic breast infections [7, 8]. Routine cultures are known to underestimate anaerobic bacteria. Walker et al. [11] performed a prospective analysis of the microbial pattern isolated from patients with nonpuerperal breast abscesses. They found a high growth rate of anaerobic and mixed organisms. In fact, the anaerobic recovery outweighed the aerobic recovery by a factor of two. Therefore, it is possible that patients who smoke have an increased likelihood of mixed and anaerobic infections for which they are not adequately treated, which may contribute to the increased recurrence rate found in smokers.

We recognize that there are several limitations of this study. First, the recurrence rates were higher than previously reported, which might be a result of the nature of our tertiary breast health center referral system. For the same reason, we had a high incidence of negative cultures, likely a result of patients receiving antibiotics prior to obtaining surgical care at our institution. We also do not know the antibiotic regimens that were utilized in patients preoperatively. We found it surprising that the patients with recurrent breast abscesses were less likely to have MRSA as one would expect that they were treated with some type of antibiotic regimen at the time of initial diagnosis. Why this presumption did not translate to more antibiotic-resistant strains in the recurrence group is unclear.

An additional limitation to our study is the inability to account for patients who may be undergoing nonoperative treatment for their breast abscesses. Recent studies have suggested that ultrasound (US)-guided percutaneous aspiration is an effective alternative to open surgical incision and drainage [12, 13]. Christensen et al. [12] demonstrated that 97% of lactational abscesses and 81% of nonlactational abscesses recovered after a single US-guided aspiration with appropriate antibiotic coverage. Percutaneous aspiration has become more common at our institution, although open surgical drainage remains the first-line therapy for most patients. Furthermore, definitive surgical therapy remains the treatment of choice for recurrent abscesses and in those patients who fail percutaneous interventions. We do not currently record percutaneous procedures in our surgical database and cannot comment on the effectiveness in comparison to open drainage.

Despite these limitations, the data from the present study demonstrate several significant risk factors for developing a primary breast abscess, including African American race, obesity,

and tobacco smoking. Furthermore, of all the risk factors studied, tobacco use is the only factor that also predisposes to the risk of recurrent abscesses, requiring repeated surgical drainage. Patients with recurrent abscesses and patients who smoke have a higher incidence of mixed bacterial and anaerobic infections. Therefore, patients who present with a primary breast abscess and who also smoke may benefit from broader antibiotic coverage in an attempt to prevent recurrence.

## References


1. Maier WP, Au FC, Tang CK. Nonlactational breast infection. Am Surg. 1994; 60:247–250. [PubMed: 8129243]
2. Meguid MM, Oler A, Numann PJ, et al. Pathogenesis-based treatment of recurring subareolar breast abscesses. Surgery. 1995; 118:775–782. [PubMed: 7570336]
3. Watt-Boolsen S, Rasmussen NR, Blichert-Toft M. Primary periareolar abscess in the nonlactating breast: risk of recurrence. Am J Surg. 1987; 153:571–573. [PubMed: 3592073]
4. Moazzez A, Kelso RL, Towfigh S, et al. Breast abscess bacteriologic features in the era of community-acquired methicillin-resistant Staphylococcus aureus epidemics. Arch Surg. 2007; 142:881–884. [PubMed: 17891866]
5. Lantz PM. Smoking on the rise among young adults: implications for research and policy. Tob Control. 2003; 12(Suppl 1):i60–i70. [PubMed: 12773786]
6. Furlong AJ, al-Nakib L, Knox WF, et al. Periductal inflammation and cigarette smoke. J Am Coll Surg. 1994; 179:417–420. [PubMed: 7921391]
7. Bundred NJ, Dover MS, Coley S, et al. Breast abscesses and cigarette smoking. Br J Surg. 1992; 79:58–59. [PubMed: 1737279]
8. Schafer P, Furrer C, Mermillod B. An association of cigarette smoking with recurrent subareolar breast abscess. Int J Epidemiol. 1988; 17:810–813. [PubMed: 3225089]
9. Ohta T, Yamashita N, Maruyama M, et al. Cigarette smoking decreases interleukin-8 secretion by human alveolar macrophages. Respir Med. 1998; 92:922–927. [PubMed: 10070565]
10. Wang Z, Leonard MH, Khamapirad T, et al. Bilateral extensive ductitis obliterans manifested by bloody nipple discharge in a patient with long-term diabetes mellitus. Breast J. 2007; 13:599–602. [PubMed: 17983403]
11. Walker AP, Edmiston CE Jr, Krepel CJ, et al. A prospective study of the microflora of nonpuerperal breast abscess. Arch Surg. 1988; 123:908–911. [PubMed: 3382358]
12. Christensen AF, Al-Suliman N, Nielsen KR, et al. Ultrasound-guided drainage of breast abscesses: results in 151 patients. Br J Radiol. 2005; 78:186–188. [PubMed: 15730981]
13. Berna-Serna JD, Madrigal M, Berna-Serna JD. Percutaneous management of breast abscesses: an experience of 39 cases. Ultrasound Med Biol. 2004; 30:1–6. [PubMed: 14962601]

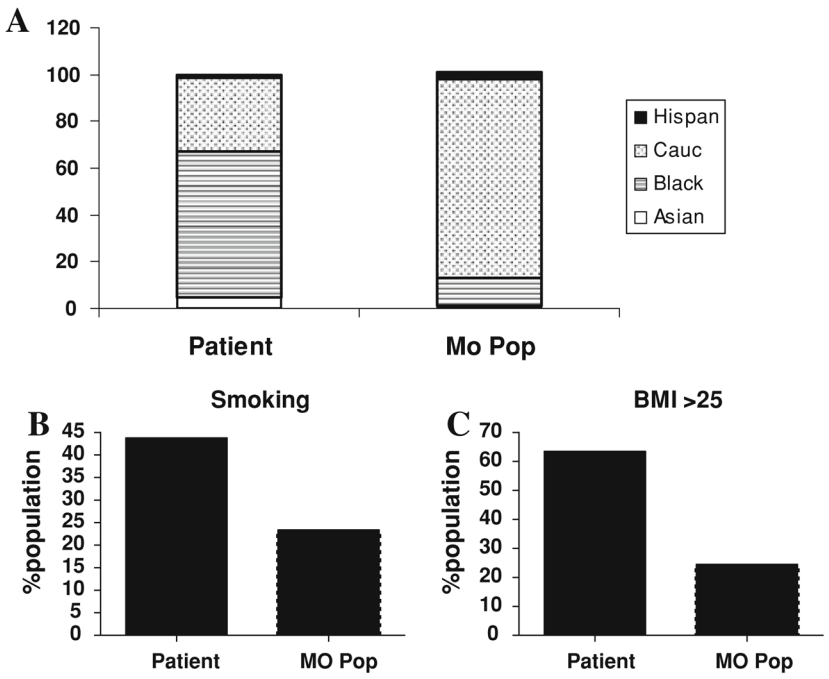


**Fig. 1.**

Comparison of the study population (*Patient*) versus the general Missouri population (*Mo Pop*) with respect to demographic and patient risk factors predisposing to the development of primary breast abscesses. These factors include race (**a**), tobacco smoking (**b**), and body mass index (BMI) > 25 (**c**)

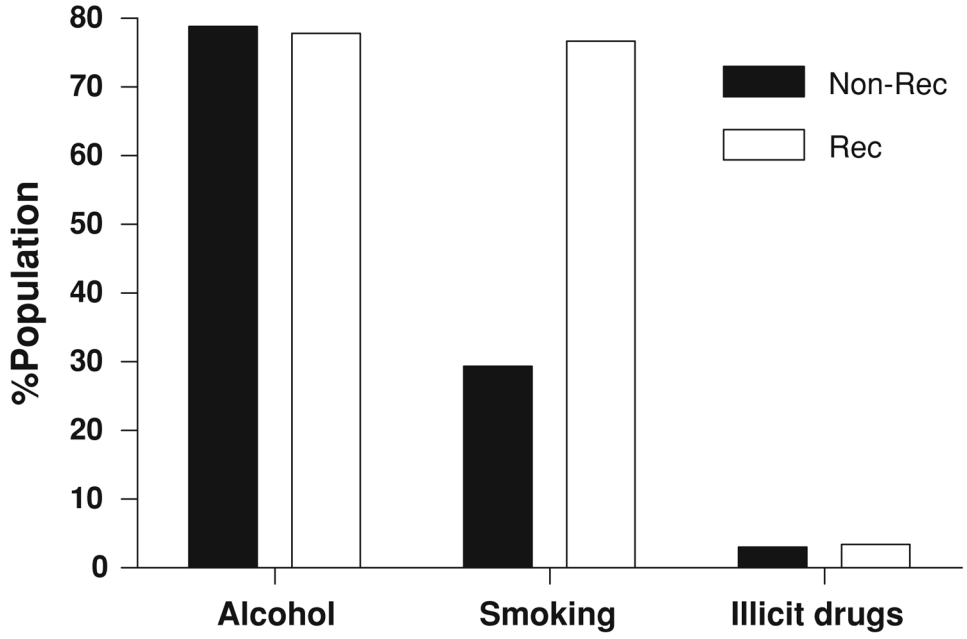


**Fig. 2.**

Tobacco smoking is a strong predictor of breast abscess recurrence. Usage of alcohol, tobacco, and/or illicit drugs is recorded at the time of abscess diagnosis. Alcohol consumption includes any type of consumption (social, daily, or abuse). *Non-Rec*: nonrecurrent; *Rec*: recurrent

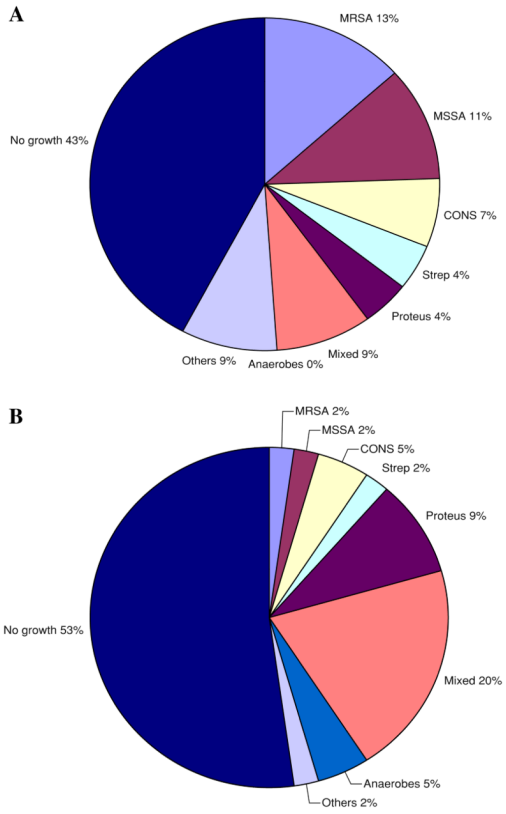


**Fig. 3.**

Microbial pattern in patients with nonlactational/nonrecurrent (**a**) and recurrent (**b**) primary breast abscesses. *MSSA*: methicillin-sensitive *Staphylococcus aureus; MRSA*: methicillin-resistant *S. aureus. CONS*: coagulase-negative *Staphylococcus; Strep.: Streptococcus*

**Table 1**

Clinical and demographic profile of study subjects

| Parameter | All subjects | Nonrecurrent | | | Recurrent | *P** |
|---|---|---|---|---|---|---|
| | | All nonrecurrent | Lactational | Nonlactational | | |
| No. of subjects | 89 | 46 | 12 | 34 | 43 | |
| Age (years) | 40.2 | 37.3 | 29.4 | 40.3 | 43.1 | 0.07 |
| BMI | | | | | | |
| < 25 | 9 (10.1%) | 5 (10.9%) | 2 (16.7%) | 3 (8.8%) | 4 (9.3%) | 0.92 |
| 25–30 | 18 (20.2%) | 11 (23.9%) | 4 (33.3%) | 7 (20.6%) | 7 (16.3%) | |
| > 30 | 37 (41.6%) | 22 (47.8%) | 5 (41.7%) | 17 (50%) | 20 (46.5%) | |
| NA | 25 (28.1%) | 8 (17.4%) | 1 (8.3%) | 7 (20.6%) | 12 (27.9%) | |
| Race | | | | | | |
| Asian | 4 (4.4%) | 3 (6.5%) | 1 (8.3%) | 2 (5.9%) | 1 (2.3%) | 0.47 |
| African American | 56 (62.9%) | 27 (58.7%) | 9 (58.7%) | 18 (52.9%) | 30 (69.8%) | |
| Caucasian | 28 (31.5%) | 15 (32.6%) | 2 (32.6%) | 13 (38.2%) | 12 (27.9%) | |
| Hispanic | 1 (1.1%) | 1 (2.2%) | 0 | 1 (2.9%) | 0 | |
| Smoking | 39 (43.8%) | 12 (20.1%) | 2 (16.7%) | 10 (29.4%) | 33 (76.7%) | < 0.001 |
| Alcohol use | 61 (68.5%) | 27 (58.7%) | 0 | 27 (79.4%) | 34 (79.1%) | 0.19 |

* The *P* values compared between nonlactational/nonrecurrent and nonlactational/recurrent

## Table 2

Analysis of maximum likelihood estimates in multivariate logistic analysis

| Variable | Point estimate | 95% CI |
|---|---|---|
| Age (per 1-year increase) | 1.055 | 0.98–1.12 |
| BMI (per 1-unit increase) | 1.026 | 0.96–1.10 |
| Co-morbidities (no vs. yes)* | 0.384 | 0.07–2.24 |
| Prescription (no vs. yes)* | 0.497 | 0.073–3.41 |
| Alcohol (no vs. yes)* | 0.399 | 0.029–2.3 |
| Illicit drugs (no vs. yes)* | 0.677 | 0.76–1.34 |
| Smoking (no vs. yes)* | 0.129 | 0.03–0.51 |

*CI* confidence interval

* "Yes" is the reference level for the categorical variables