

Original Article

Staphylococcus aureus in breast abscess-major culprit besides others

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ABSTRACT

Objective: Breast abscess is a significant cause of morbidity especially in young women of childbearing age. These abscesses are associated with physical, psychological disturbance, and long-term cosmetic consequences.

Materials and Methods: This was a prospective study that involved seventy cases of breast abscesses to identify etiological agents and their susceptibility patterns.

Results: Lactation was a risk factor in almost two-third of all cases. Others were diabetes mellitus, extremes of age, immunocompromised conditions, and tuberculosis. The most common bacterial isolate was *Staphylococcus aureus* (83.3%), almost half being methicillin-resistant *S. aureus* (MRSA). Others included coagulase-negative *Staphylococcus*, *Enterococcus* spp., *Streptococcus* spp., *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Candida* spp., and acid-fast bacilli.

Conclusions: The treatment of all such microorganisms is different, signifying that microbial diagnosis plays a pivotal role in management of such abscesses.

Keywords: Antimicrobial susceptibility, Methicillin-resistant *Staphylococcus aureus*, Pus aspirate, Lactational

INTRODUCTION

Abscess formation in the breast can occur at any age, from lactational or non-lactational causes. It is an extremely painful condition for which immediate relief is sought. In lactating females, milk stasis may further worsen the situation. Incision and drainage is the treatment of choice though it may deter breast feeding by the mother; manual expression of milk and continued lactation may help relieve pain and discomfort. Adequate psychological support to the mother may also be required. The present article addresses the microbiological profile of breast abscess and elucidates antimicrobial susceptibility of isolates, with main focus on methicillin-susceptible and methicillin-resistant *Staphylococcus aureus* (MRSA and MSSA).

MATERIALS AND METHODS

This was a prospective study done over a span of 3 years (May 2014–May 2017). Pus aspirates received in the department of microbiology from patients presenting with breast abscesses were taken and empiric antibiotic treatment was initiated. The samples were cultured aerobically as per standard microbiological procedures. Antimicrobial susceptibility testing of bacterial isolates was performed as per the current CLSI guidelines.

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RESULTS

A total of 70 pus aspirates from patients with clinically suspected breast abscesses were received. All patients were females, 44 (67.7%) were lactating and 24 (32.3%) were non-lactating. Age at presentation ranged from 12 days to 70 years and mean age 25 years. There were almost equal numbers of abscess of the left or right breast, a single case of bilateral abscess was recorded. The highest number of cases was reported in August every year [Figure 1]. The spectrum of microbial pathogens ranged from bacterial to fungal isolates. Of 70 pus samples, 57 (81.4%) samples yielded positive results on culture or microscopy. Fifty-four (94.7%) samples yielded growth of bacteria and one sample yielded growth of *Candida non-albicans*. Another sample grew *Aspergillus flavus*, but it was not isolated from repeat sample taken 4 days later; hence possibility of contamination could not be ruled out. In one case, acid-fast bacilli were seen on Ziehl-Neelsen staining. Thirteen samples (18.6%) were reported

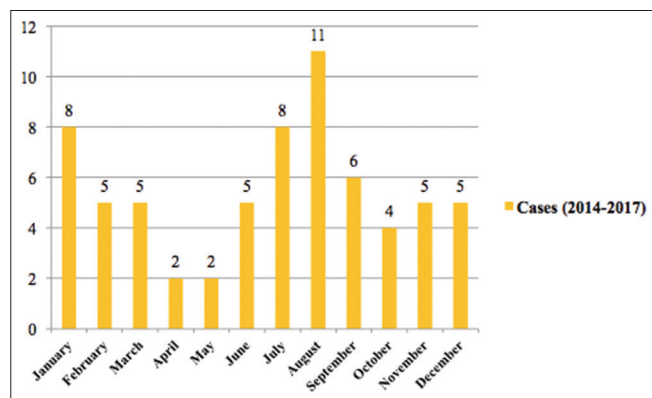


Figure 1: Month-wise distribution of cases during the study period.

as negative by culture and microscopy [Figure 2]. All smears showed presence of many pus cells. Direct smears of samples growing *S. aureus* showed $\geq 5\%$ intracellular Gram-positive cocci in pairs and clusters. Findings of Gram stain of samples coincided with the culture findings.

S. aureus was the most common isolate accounting for 45 (83.3%) of total bacterial cultures. Of these, 23 (51%) were MSSA and 22 (49%) were MRSA. Susceptibility results of other antibiotics in MSSA and MRSA were erythromycin (36% and 50%), fluoroquinolones (74% and 21%), clindamycin (95% and 83%), and gentamicin (100% and 78%), respectively. Intermediate susceptibility to fluoroquinolones was observed in 25% of MRSA isolates. All *S. aureus* isolates were susceptible to vancomycin. D-test was performed to look for inducible clindamycin resistance in staphylococcal isolates. None of the MSSA was D-test positive, however, two MRSA isolates were positive. Three staphylococcal isolates were coagulase-negative (5%) and methicillin-sensitive. Other microbes isolated were *Streptococcus* spp. (one), *Enterococcus* spp. (two), and mixed growth of *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* in one sample. Two cases of breast carcinoma also presented with breast abscesses. In one such case, *Acinetobacter baumannii* grew on repeat culture, which was sensitive to all routine antibiotics tested. In a diabetic patient, initial sample grew *K. pneumoniae* but subsequent sample taken after treatment grew *Candida non-albicans*. All 68 patients underwent treatment with incision and drainage followed by antibiotics.

DISCUSSION

Throughout life, the breast is physiologically subjected to alterations during menses, pregnancy, gestation, and

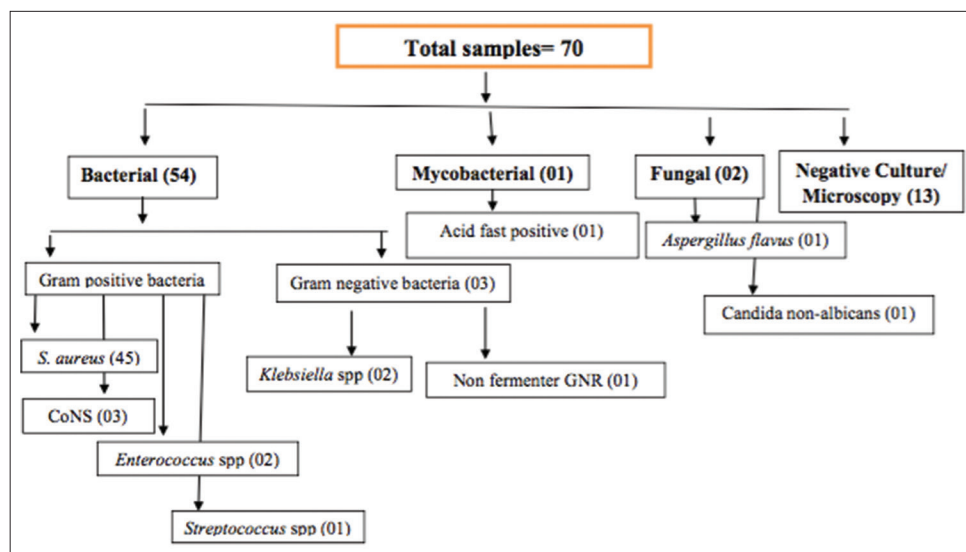


Figure 2: Distribution of culture positive isolates from breast abscess.

menopause. It is uncommon in prepubescent and elderly females. While glandular tissue develops during pregnancy, intralobular ducts develop and form alveoli with parturition.^[1] The breast may become infected by hematogenous, lymphatic, spread from contiguous structures, direct inoculation, and ductal infection through lymphatic route is the most common.^[2] Bacilli infect the ducts and spare the lobules. During lactation, milk provides an ideal culture medium and bacterial dispersion in the vascular distended segment becomes easy. Acute inflammation ensues and infection spreads rapidly within the stroma and through the milk ducts. Incomplete milk drainage may predispose to breast engorgement, and hence to breast abscess development.^[3] In our study, also the majority of patients were lactating females. The age at presentation ranged from 12 days to 70 years with *S. aureus* infection at both extremes. Colonization with staphylococci in full-term babies in first few days of life has been reported. They may acquire it from the nursing staff or from other babies in the ward. An outbreak of breast abscess was recorded in a maternity unit in which 37 cases of *S. aureus* type 80 were recorded in 1 year. Nasal swabs from babies and staff also grew same type of *S. aureus*.^[4] Similarly outbreak of postpartum breast abscess, caused by ST22-MRSA-IV was reported in Mumbai.^[5] Hence, screening for *S. aureus* nasal carriage among staff is highly recommended in such settings.

Risk factors reported for primary breast abscess are primiparity, cracked nipple, increasing maternal age, African American race, obesity, and tobacco smoking. Smoking and mixed bacterial and anaerobic infections may cause recurrent breast abscesses for which broad antibiotic coverage is needed.^[6] In our study, we found diabetes mellitus, extremes of age, breastfeeding, immunocompromised conditions, and tuberculosis as risk factors for breast abscess. Although cracked nipples are considered a risk factor, feeding is still advised at our institute otherwise milk stasis may aggravate the condition. Pregnant and lactating mothers should be trained and counseled about breastfeeding and hygiene of breasts and nipples. Maximum cases were seen during the month of August, which may be due to local climatic conditions such as high humidity and temperature.

Different types of microorganisms have been reported in pus cultures from breast abscesses. *S. aureus* is the predominant

pathogen in breast abscesses, accounting for 32–100% cases as seen in Table 1.^[3,4,7] In our study, the proportion of MSSA: MRSA was 51% and 49% which indicates that methicillin resistance is widespread in the community. MRSA signifies resistance to all β -lactam antibiotics and is mediated by the *mecA* gene encoding penicillin-binding protein 2a.^[8] This may be attributed to availability of over the counter antibiotics and use of beta-lactam beta-lactamase inhibitor combinations which are well tolerated and are easily available oral options. The Indian Network for Surveillance of Antimicrobial Resistance group found 40% of MRSA rates in skin and soft tissue infection in 2009.^[9] In pregnant females, MRSA vaginal-rectal colonization rates of up to 25% have been observed during routine obstetric screening for Group B *Streptococcus*.^[10]

Centre for disease control and prevention (CDC) has defined community-acquired (CA) MRSA as infection due to MRSA in patients who lack risk factors of hospital-acquired (HA) MRSA. The risk factors include recent hospitalization, procedures like hemodialysis or surgery, or presence of indwelling/ other medical devices. HA-MRSA strains carry a relatively large SCCmec (Types I–III), are often resistant to many classes of non- β -lactam antimicrobials while CA-MRSA isolates carry smaller SCCmec, mostly Type IV or V, and may be susceptible to narrow-spectrum non- β -lactams such as clindamycin and trimethoprim-sulfamethoxazole (TMP-SMX).^[11] Furthermore, a high percentage of CA-MRSA strains carry genes for Panton–Valentine leukocidin, which can lyse the cell membranes of human neutrophils, accounting for enhanced pathogenicity of community strains.^[8] In the present study, all samples growing MRSA except one presented as outpatients with no risk factors for acquiring HA-MRSA.

Quinolone resistance can be up to 90% in HA-MRSA and 40% in CA-MRSA isolates, and MIC creep has been observed in patients on quinolone therapy.^[12,13] In the present study, 54% MRSA isolates were fluoroquinolones resistant, 25% were intermediate sensitive, and 21% were sensitive. Macrolide resistance in *S. aureus* could result from a multitude of genes of which *ermC* and *msrA/msrB* have been associated with MSSA isolates.^[13] In our study, erythromycin resistance has been noted more among MSSA isolates.

Table 1: MRSA rate among *S. aureus* isolates from breast abscess cases.

| Author/year | Country | Most common isolate (%) | MRSA rate (%) | Most susceptible antibiotic |
|--|--------------|--------------------------|---------------|--|
| Soltau <i>et al.</i> , 1957 ^[4] | London | <i>S. aureus</i> (100%) | 8 | Erythromycin, tetracycline |
| Moazzez <i>et al.</i> , 2003–2005 ^[7] | Los Angeles | <i>S. aureus</i> (32%) | 58 | Levofloxacin |
| Elliman <i>et al.</i> , 2003–2010 ^[3] | Israel | <i>S. aureus</i> (25%) | 55 | Cotrimoxazole, erythromycin, and clindamycin |
| Present study (2014–2017) | Delhi, India | <i>S. aureus</i> (83.3%) | 49 | Gentamicin, clindamycin, and vancomycin |

S. aureus: *Staphylococcus aureus*, MRSA: Methicillin resistant *S. aureus*

Table 2: List of microorganisms causing breast abscess, other than *Staphylococcus aureus*.

| Author and year | Organism | Comorbid condition/underlying condition |
|---|--|--|
| Deborah et al., 2003 ^[16] | <i>Staphylococcus lugdunensis</i> | Non mentioned |
| Tewari and Shukla, 2005 ^[14] | <i>Mycobacterium tuberculosis</i> | Pulmonary tuberculosis |
| Anandi et al., 2005 ^[17] | <i>Fusarium solani</i> | Diabetes |
| Ang et al., 2007 ^[18] | <i>Corynebacterium</i> spp. | Not known |
| Mahajan et al., 2007 ^[19] | <i>Salmonella</i> Typhi | None |
| Bing et al. (2005–2013) ^[20] | <i>Actinomyces</i> | Diabetes, smoking |
| Appalaraju et al., 2011 ^[21] | Penicillin resistant pneumococci | Not known |
| Sood, 2014 ^[22] | <i>Salmonella</i> Paratyphi A | Diabetes mellitus type 2, hypothyroidism |
| Baran et al., 2016 ^[23] | <i>Salmonella</i> Typhimurium | Rheumatoid arthritis/T. cell defect |
| Fernandes et al., 2016 ^[24] | Adult filarial worm | Not available |
| Wang et al., 2017 ^[15] | <i>Mycobacterium abscessus</i> | Not known |
| Kandi, 2017 ^[25] | <i>Listeria</i> spp. | No underlying condition, dairy farm worker |
| Present study (2014–2017) | <i>Mycobacterium</i> spp., <i>Klebsiella</i> spp., <i>Candida</i> spp., <i>Enterococcus</i> spp., and coagulase-negative staphylococci | Tuberculosis and diabetes |

Breast tuberculosis is a rare entity as breast is relatively resistant to tuberculosis. Infection usually occurs as an extension of infection through contiguous structures such as chest wall, tubercular pleurisy, or through skin abrasions. Only one sample was positive for acid-fast bacilli (in clumps) on Ziehl–Neelsen staining during the study period. The patient was 20 years old, non-lactating and pyogenic culture were sterile. She was a known case of pulmonary tuberculosis but had not taken anti-tubercular medication adequately. Tewari and Shukla reported 30 cases of breast tuberculosis in the past 20 years giving an overall incidence of 2.5%.^[14] Cases of breast abscess due to atypical mycobacteria such as *Mycobacterium fortuitum*, *Mycobacterium holsaticum*, *Mycobacterium agricund*, and *Mycobacterium bruna* have been reported.^[15] In one patient, where *K. pneumoniae* was isolated and *Candida* non-albicans was isolated in the subsequent culture. This patient was a non-lactating female having a breast abscess, and uncontrolled hyperglycemia. Breast abscesses due to other bacteria such as *Salmonella* spp. and *Corynebacterium* spp. have also been described in Table 2.^[14–25] Of our 68 cases, only three required hospitalization, indicating that breast abscesses can be managed on outpatient basis.

Oral empirical initial antibiotics for MRSA isolates with standard adult doses are dicloxacillin 500 mg orally 4 times daily, TMP-SMX (2 double-strength tablets orally twice daily), clindamycin (300–450 mg/kg orally 4 times daily), and linezolid (400–600 mg orally twice daily). In severe infections requiring admission, intravenous antibiotic therapy like vancomycin (1 g intravenously every 12 h) may be used.^[26] Oral therapy is more cost-effective than parenteral therapy. The treatment of MSSA with oral antibiotics like cloxacillin is cheaper compared to MRSA therapy in which injectable vancomycin is given. Linezolid is a cheaper oral alternative but should be treated as a reserve drug. Toxic shock syndrome caused by *S. aureus* breast abscess producing enterotoxin A

and F was reported in 1982 from London.^[27] Clindamycin is the best oral option for the treatment of MRSA, as in addition to bacteriostatic effect, it also inhibits toxin production. However, clindamycin has been associated with inducible or constitutive resistance in about 50% of MRSA isolates. Specific antimicrobial treatment together with surgical management helps in alleviating the pain in these patients. Some centers, practice needle aspiration followed by suitable antibiotic therapy because there is no requirement for postoperative dressings, post aspiration discomfort is little; it is cosmetically more acceptable and is associated with less complications. However, repeated aspiration may be needed due to incomplete evacuation and multiloculated abscesses. In our set up, incision and drainage are preferred and oral antibiotic treatment of breast abscesses is provided. Empiric therapy with an orally acceptable beta lactam is provided, pending microbiological results, and then may be changed accordingly.

CONCLUSIONS

As is evident from our study, breast abscess may present in women in any age group. Although the spectrum of microbial pathogens varies from bacterial to fungal isolates, *S. aureus* is predominant with an almost equal proportion of MSSA and MRSA. Appropriate treatment requires a combination of surgical and medical therapy. Since the microbiological and susceptibility profiles for isolates vary by region, antimicrobial susceptibility testing should be performed for all isolates. Infection control practices in nursery and maternity wards may help prevent breast abscess formation. In the long-term an effective multicomponent vaccine against *S. aureus* would prove very useful, considering the widespread prevalence of this pathogen in community.

Limitations

Some patients were lost to follow-up and risk factors could not be analyzed in all patients.

Declaration of patient consent

The authors certify that they have obtained informed written consent was obtained from the participants prior enrollment to the study.

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Conflicts of interest

There are no conflicts of interest.

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