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Trends in non-lactation breast abscesses in a tertiary hospital setting

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Abstract

Background: The aim of this paper was to retrospectively review non-lactation breast abscesses treated in Princess Alexandra Hospital over a 10-year period and to illustrate the trends in size, risk factors, microbiological profile and management.

Methods: A computerized search of the medical records was undertaken to identify all adult patients with a diagnosis of breast abscesses during June 2005–June 2015. Patients concurrently breastfeeding were excluded. A retrospectively review of the clinical records was performed.

Results: Eighty-five abscesses were identified in 77 patients. The median patient age was 45 years and 93.7% were females. Smoking and diabetes mellitus were associated with a longer inpatient hospital stay. There was a significant difference in microbiology of abscesses in relation to size. Smaller abscesses (≤3.0 cm) predominantly had mixed anaerobes (54%), whereas larger abscesses had a dominance of *Staphylococcus aureus* (29%) and other aerobic microbes (33%) ($P < 0.05$). Seven percent of all abscesses had methicillin-resistant *S. aureus*. Flucloxacillin was prescribed solely in majority of the cases (45%) with addition of suitable mixed anaerobic cover in 12% cases. Of the 85 abscesses, 58.8% were managed non-operatively with antibiotics ± percutaneous drainage. Percutaneous aspiration had a shorter inpatient stay compared with patients who underwent operative management.

Conclusion: This represents the first Australian study solely analysing non-lactation breast abscess. Size was correlated significantly to characteristic bacteriology and empiric therapy should include both aerobic and anaerobic cover. The majority of non-lactation breast abscesses can be managed non-operatively with a combination of antibiotics and percutaneous aspiration.

Introduction

Breast abscesses are defined as localized collections of purulent material within the breast occurring as a result of virulent primary or secondary infections.[1] They usually occur in women during lactation as a complication of trauma and infective mastitis. Non-lactation breast abscesses, however, are relatively uncommon clinicopathological entities and are infrequently described in the literature. Abscesses in non-lactating women tend to occur typically at the end of their reproductive years,[2] are often central or subareolar in site and are reported to have a different underlying pathogenic microbial spectrum to lactation abscesses.

Lactation breast abscesses occur as milk stasis provides a lactose-rich medium for bacteria that are introduced through the terminal ducts of the nipple.[3] The pathology of non-lactation breast abscesses is markedly different and was first described by Zuska *et al*. in 1951 as fistulas of lactiferous ducts that resulted in chronically draining sinus and abscess formation, typically around the areola.[4,5] The role of squamous metaplasia of the lactiferous duct (SMOLD) epithelium, duct obstruction and subareolar duct dilation or duct ectasia has also contributed to the pathogenesis of breast abscesses.[4,6,7] Complications include severe, necrotizing infections and sepsis, and may be prevented by timely treatment.

The traditional treatment for lactation and non-lactation abscesses has been incision and drainage with supportive antibiotic cover. However, more recently non-operative management with percutaneous needle aspiration usually under ultrasound guidance has been shown to be successful and associated with a better cosmetic outcome. Indeed, some recent reports have advocated the use of larger needle techniques such as the use of vacuum-assisted biopsy devices.[8]

Breast abscesses present to a variety of health professionals including general practitioners, emergency department and surgical outpatient clinics. Knowledge of involved organisms, antibiotic therapy and surgical interventions would therefore benefit health professionals of multiple disciplines in the management of these abscesses. In Australia, there are very little data on the occurrence of breast abscesses. One report from the Royal Women's Hospital in Melbourne in 2004 demonstrated that of 1183 breastfeeding women, only five women (0.4%) sustained a breast abscess, all of whom were able to be managed with needle aspiration.[9] However, no data on non-lactation breast abscesses in Australia have been published previously.

The aim of this study is to illustrate the trends in the microbiology, risk factors and management of breast abscesses in non-lactating patients in a large public non-obstetric tertiary hospital in Queensland, Australia.

Methods

Data collection

The medical records of all patients admitted to the Princess Alexandra Hospital, Queensland, between June 2005 and June 2015 with the diagnosis of breast abscess were retrospectively reviewed. Patients were identified using ICD-10 (International Classification of Diseases, Tenth Revision) hospital coding system for breast abscess. Patients were only included if a breast abscess collection was confirmed by ultrasound imaging. Patient gender, age, lactation status, length of hospital stay (LOS), microbiology, abscess size on ultrasound, recurrence and choice of management were recorded. Concurrent diabetes mellitus and history of smoking and/or intravenous (IV) drug use were also noted. Primary source of data were patient charts which included emergency and inpatient notes and outpatient follow-up.

Statistical analysis

The two main programmes used were Microsoft Excel (Version 15.23 (2016); Microsoft Corp, Redmond, WA, USA) and Microsoft SPSS (Version 21; SPSS Inc., Chicago, IL, USA). Age, LOS and size of abscesses are reported as a median with interquartile range (IQR). Prevalence was calculated according to risk factors (smoking and diabetes). Chi-squared testing was used to calculate the effect of risk factors on choice of management providing odds ratio (OR), 95% confidence interval and statistical significance. Mann–Whitney *U*-testing was used to calculate the effect of risk factors on size of abscess and LOS.

Results

Patient demographics

Eighty-five non-lactation breast abscesses were identified in 77 patients between June 2005 and June 2015 for inclusion in this study, of whom 93.5% (72/77) were females. Age was skewed to the right with a median of 45 years and IQR of 19. LOS was skewed with a median of 4 days and IQR of 4 (Fig. S1). The median abscess size was 3.2 cm, IQR of 3 with majority between 4.1 and 5 cm (Fig. S2). All patients presented with a single abscess at one given time.

Microbiology

Of the 85 breast abscesses, organisms were identified in 71 (83.5%) cases. Of those, in 57 abscesses (80.3%), a single group of organisms was identified and 14 (19.7%) abscesses were polymicrobial. The maximum number of organisms identified in a single abscess was three. Almost half of the abscesses grew mixed anaerobes (42%) followed by almost one-third growing methicillin-sensitive *Staphylococcus aureus* (MSSA, 27%). Methicillin-resistant *S. aureus* was found in six (7%) abscesses.

However, the microbiology varied markedly depending on abscess size (Table 1). Mann–Whitney *U*-analysis showed strong evidence ($P = 0.001$) that smaller abscesses were caused by mixed anaerobic organisms. Larger abscesses (>3.0 cm) tended to be associated with aerobic infections from *S. aureus*, *Streptococcus* spp. and *Pseudomonas aeruginosa*; however, this was not statistically significant ($P > 0.05$). The principal anaerobic organisms involved in mixed anaerobic infections were *Peptococci*, *Peptostreptococci*, *Bacteroides fragilis*, *Prevotella melaninogenica* and *Fusobacterium* sp.

Risk factors influencing onset and outcomes

Of the 77 patients, 37 (48%) were smokers, 18 (23%) had diabetes mellitus and nine (11.6%) were IV drug users. At least one risk factor was present in 74% of our cohort. In our study, the prevalence of breast abscesses in smokers is 51 per 100 patients and 25 per 100 patients in patients with diabetes. IV drug users had a prevalence of 11 per 100 patients. Smokers required a 1.5 times longer stay in hospital than non-smokers and 2.5 times longer in patients with concurrent diabetes mellitus than with no diabetes. Additionally, although there was a trend for large abscesses to be associated with a longer hospital stay (Fig. S1), Mann–Whitney *U*-statistical

Table 1 Patterns of microbiology in small and large breast abscesses

Species	Small abscesses (≤3.0 cm) Cases (%)	Large abscesses (>3.0 cm) Cases (%)	*P*-value
Mixed anaerobes	20 (54)	9 (20)	<0.05
Gram-negative anaerobic			
Proteus mirabilis	0 (0)	6 (13)	>0.05
Gram-positive aerobic			
Methicillin-sensitive *Staphylococcus aureus*	6 (16)	13 (29)	>0.05
Methicillin-resistant *S. aureus*	4 (11)	2 (4)	>0.05
Streptococcus spp.	2 (5)	8 (18)	>0.05
Gram-negative aerobic			
Pseudomonas aeruginosa	0 (0)	4 (9)	>0.05
Escherichia coli	0 (0)	2 (4)	>0.05
Propionibacterium	3 (8)	1 (2)	>0.05
Prevotella bivia	1 (3)	0 (0)	>0.05
Total	36	45	>0.05

All microbiology including polymicrobial abscesses included; $n = 71$ (n = abscesses with any growth).

testing between the above-mentioned risk factors, size and LOS did not show a statistical significance ($P > 0.05$).

In the 77 patients, abscesses recurred in five patients. Four of the five recurrences were in smokers, of whom two were concurrent IV drug users. The recurrences were over a minimum of 2 weeks to a maximum of 6 months.

Antibiotic management

Of the 85 breast abscesses, 63 (74.1%) received single and 18 (21.2%) received double antibiotic cover. Flucloxacillin was the choice of antibiotic therapy. It was prescribed alone in 38 (44.7%) and with other agents in six (7%) patients. Metronidazole was the second most commonly prescribed antibiotic in 11 (12.9%) followed by cephalosporins in nine (10.5%) patients. Vancomycin was prescribed in six (7%) patients.

Interventional treatment

Of the 85 breast abscesses, 50 (58.8%) were managed non-operatively and 35 (41.1%) operatively. Of the 50 cases managed without surgery, 24 (28.2% overall) abscesses were managed with antibiotics alone and 26 (30.6% overall) with ultrasound-guided percutaneous needle aspiration in addition to antibiotic cover. The average number of aspirations in our cohort was 1.4 with a range of 1–5 aspirations. The success rate of percutaneous aspiration was 83.6%. Of the 14 remaining unsuccessful aspirations, eight abscesses were aspirated once, five aspirated twice and a single abscess was aspirated five times. All the 14 unsuccessful aspirations lead to operative management. Chi-squared statistical testing showed smokers 2.5 times more likely to have failed percutaneous aspiration (OR: 2.49, 95% confidence interval: 1.48–4.21, $P = 0.001$). Of the 14 patients, 12 were smokers with two having concurrent diabetes and two IV drug users.

Overall, surgical intervention was utilized in 35 patients (41.2%) and was first-line treatment in 21 (24.7%) patients. Incision and drainage was the most commonly performed procedure (31.7%) followed by excision of lesion in six abscesses (7%). Figure 1 demonstrates that whilst overall percutaneous aspirations were preferred over operative management, the only size range where operative frequency started to exceed aspirations was 4.1–5 cm (50% versus 33.3%).

Intervention versus non-intervention

Abscess size was the main distinguishing factor between the intervention groups. Patients managed by antibiotics alone had overall smaller abscesses with a mean size 2.63 ± 1.5 cm. Patients managed with failed or successful percutaneous drainage had similar larger abscess sizes with a mean of 3.37 ± 1.78 and 3.68 ± 2.07 cm, respectively. Comparably, patients managed operatively only also had similar size abscesses with a mean of 3.66 ± 1.72 cm.

Smoking showed no association with the choice of management (Table 2). Diabetes mellitus however showed a significant OR with the need of operative management ($P = 0.03$). Patients managed on antibiotics alone more commonly had pus discharge on initial presentation, with the implication being that these abscesses were self-draining. Twelve out of the 24 abscess (50%) treated with antibiotics alone had discharge on presentation, followed by 12 out of 26 treated with percutaneous drainage and nine out of 35 treated operatively alone.

Majority of the abscesses treated by antibiotics only were appropriately guided by culture microbiology. Of the 24 abscesses, 21 had organisms strongly susceptible to chosen antibiotic.

Discussion

The epidemiology of non-lactation breast abscesses, microbiology and management in Australia has not been documented previously.

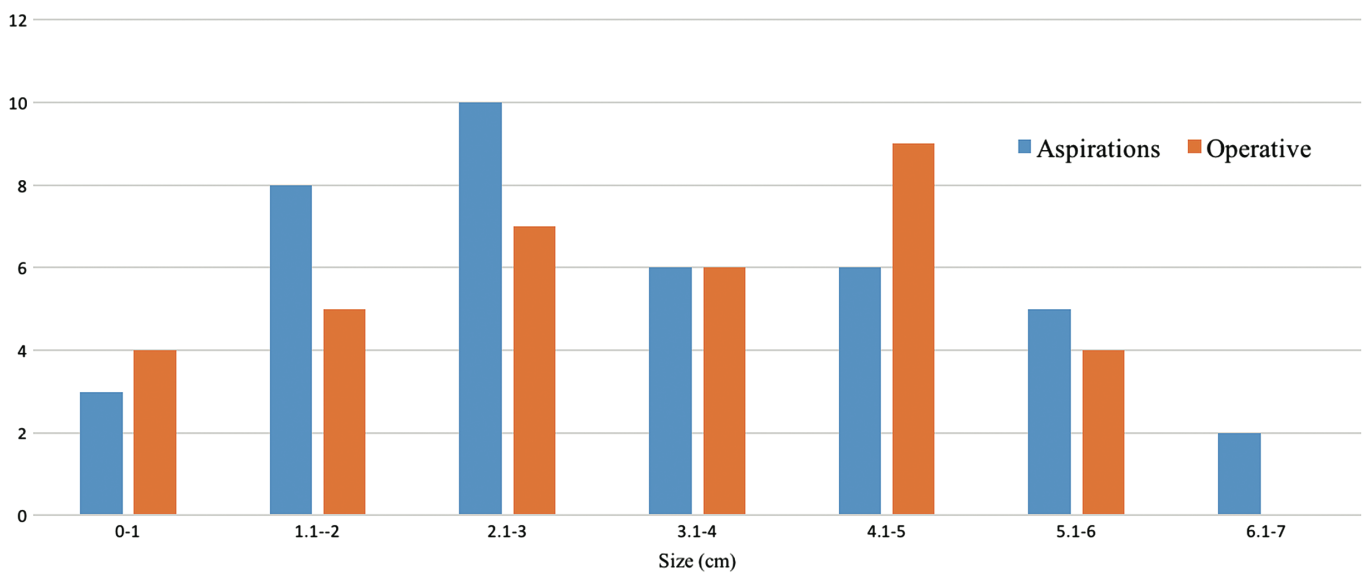

Fig. 1. Percutaneous aspiration (■) versus operative management (■) in non-lactational breast abscesses.

Table 2 OR, 95% CI and significance for smoking and diabetes in the three treatment groups (antibiotics only versus percutaneous drainage only versus operative management)

	Antibiotics only	Percutaneous drainage only	Operative management
Smoking			
OR	1.16	0.77	2.11
95% CI	0.49–2.79	0.23–2.58	0.86–5.15
Significance	No (P = 0.11)	No (P = 0.67)	No (P = 0.1)
Diabetes mellitus			
OR	1.28	2.27	2.10
95% CI	0.44–3.75	0.89–5.82	0.12–0.94
Significance	No (P = 0.21)	No (P = 0.08)	Yes (P = 0.03)

CI, confidence interval; OR, odds ratio.

In our retrospective study, we observed that non-lactation breast abscesses were most prevalent in women at the end of 40th decade, consistent with the end of reproductive cycle for most women. The microbiology of lactation abscess and non-lactation abscesses varies. Lactation breast abscesses are almost always affected by *S. aureus*, whereas non-lactation abscesses demonstrate mixed growth patterns as seen in our study.[10–12] Lactation breast abscesses were also found to be less affected by anaerobic, *Streptococci* spp., *Proteus mirabilis* and *Pseudomonas* spp. than compared with non-lactation abscesses.[13] *S. aureus* remains a common infective organism in non-lactation abscesses, but *P. aeruginosa*, *P. mirabilis* and other less common organisms may be found.[11–13] Our study illustrated a varied microbiology in breast abscesses and its significant relation to size. Larger abscesses (>3.0 cm) tended to be associated with aerobic infections from *S. aureus*, *Streptococcus* spp. and *P. aeruginosa* with some mixed anaerobes. However, statistical significance was found for mixed anaerobes in small abscesses. The principal anaerobic organisms involved in mixed anaerobic infections were *Peptococci*, *Peptostreptococci*, *B. fragilis*, *P. melaninogenica* and *Fusobacterium.*[12]

In the breast, *Propionibacterium acne* and *S. aureus* make up the endogenous anaerobic and aerobic flora, respectively.[14] The widespread presence of exogenous mixed anaerobes in breast abscesses despite its lack in normal flora of the breast is important in understanding the pathogenesis of the abscesses.[15] It highlights that the vulnerability of the breast is far more complex than opportunistic skin and mucosal infections and may involve external infective sources.

There are currently no guidelines for non-lactation breast abscesses in Australia. The guidelines for management of breast abscesses in lactating women recommend flucloxacillin or dicloxacillin for 5 days.[16] In previously published data, MSSA is the most common organism in both lactating and non-lactating breast abscesses, followed by mixed anaerobes.[17] In our data, majority of cultures grew mixed anaerobes followed by MSSA. β-Lactam antibiotics such as flucloxacillin and dicloxacillin have traditionally been the choice for sensitive *Staphylococcus* infections but have weak anaerobe cover. Metronidazole, the carbapenems, combinations of a penicillin and a β-lactamase inhibitor and clindamycin have effective anaerobe cover.[18] Our data showed that flucloxacillin was solely most commonly prescribed for all breast abscesses adhering to the current guidelines for lactating breast abscesses. Metronidazole was less often empirically prescribed. Anaerobic infections, if not appropriately treated, are often complicated by deep-seated tissue necrosis.[19] Morbidity and mortality rates for anaerobic and mixed bacterial sepsis are as high as those for sepsis caused by a single aerobic organism.[19] Of note, in the 24 abscesses treated successfully with antibiotics only, 21 had antibiotics guided by strong culture susceptibility. Therefore, penicillins in combination of metronidazole and/or β-lactamase inhibitors should be in future management guidelines for non-lactation breast abscesses as they could allow for outpatient management in oral forms.

Wound healing occurs as a cellular response to injury and involves activation of keratinocytes, fibroblasts, endothelial cells, macrophages and platelets in addition to angiogenesis and tissue repair. Nicotine prevents optimal blood supply for wound healing, causing vasoconstriction around damaged tissue and delay tissue repair.[20] Patients with diabetes have over 100 physiological deficiencies translating to markedly impaired wound healing such as impaired angiogenic response and growth factor production.[21] Diabetic patients and smokers with lactation breast abscesses have a significantly increased LOS than non-diabetic patients.[22] Although statistically insignificant, smokers and patients with diabetes displayed prolonged inpatient stay. Complications associated with longer hospital stay include respiratory tract infections, urinary tract infections and thromboembolism. The development of chronic fistulae and SMOLDs is likely to be potentiated in smokers due to delayed tissue repair resulting in recurrence of abscess.[6,7] Recurrences yet again worsen chronic inflammation amplifying complications further. Good diabetic control while an inpatient and smoking cessation may be worthwhile in these patients to prevent these complications. Although not statistically significant, the high prevalence of smoking in our cohort provides a starting point for larger studies to further investigate its effects on breast abscesses.

A small number of randomized controlled trials and retrospective reviews have compared percutaneous drainage to surgical management. Previous studies have suggested an abscess size <3 cm as a guideline for attempting aspiration.[13,23–26] Others have reported an abscess size >5 cm to be a risk factor for failure to treat successfully via aspiration.[27] In our study, size appeared to be the main differentiating factor between the intervention groups. Patients managed by antibiotics alone had overall smaller abscesses with a mean size 2.63 ± 1.5 cm. In contrast, both percutaneous drainage and operative management had similarly sized larger abscesses, 3.68 ± 2.07 and 3.66 ± 1.72 cm, respectively. With the absence of clear size indication, operative management should ideally occur in cases of failed percutaneous drainage only. Non-operative management should be first-line as it can be done at the bedside, is less invasive with better cosmetic result and prevents post-operative complications, particularly from the likely use of general anaesthesia. Abscesses managed only by percutaneous aspiration had a shorter inpatient stay compared with operative management (4.89 days versus 5.79 days).

Incidentally, smoking was found to be a statistically significant feature ($P > 0.05$) for failed percutaneous management and therefore may assist in individualizing risk of percutaneous drainage failure for some patients. There is strong evidence to suggest that

diabetic patients may require operative management ($P = 0.03$); therefore patients with diabetes, particularly insulin-dependent, may need to have a lower threshold for needing operative intervention.

Whilst surgical incision and drainage has been the traditional method for treating breast abscesses, it does however have several potential disadvantages including scarring, lengthened hospital stay and poor cosmetic outcome. A randomized control involving lactation abscesses showed significantly longer healing time and patient dissatisfaction with incision and drainage compared with percutaneous drainage.[27] With the recent advances in medical imaging, percutaneous drainage can be optimized with ultrasound guidance, lowering the need for surgical intervention.

Limitations in our study include the long 10-year timeline over which our data needed to be collected; however, breast abscesses, particularly in non-lactating women, are rare and this extended time frame is required to acquire sufficient number of patients. The Princess Alexandra Hospital does not provide onsite obstetric services as these are offered at a nearby district hospital; however, it is a tertiary referral public hospital offering breast specialty services. Our study only includes breast abscesses admitted as an inpatient and does not analyse cases presenting to the outpatient clinic or emergency department within the studied 10-year period. Recurrence, particularly in a largely smoking population as in our study has the potential to culminate in persistently discharging fistula and SMOLD. Due to lack of follow-up or patients choosing to represent with general practitioners or other hospitals, recurrence and above-mentioned complications may be underestimated in this study. This can be improved by ensuring clinic or phone follow-up of breast abscesses to assess therapeutic modalities and delineate lesser known complications.

In conclusion, non-lactation breast abscesses are much less common that lactation abscesses and although not causally statistically significant on a multivariate analysis, our cohort of patients included appreciable numbers of patients who smoked, were diabetic or were IV drug users.

We observed that breast abscess size substantially influenced the microbiological profile, the type of management required and therefore indirectly the duration of inpatient stay. It is essential that antibiotic therapy for non-lactational breast abscesses be inclusive of anaerobic cover and further antibiotic choice should be dictated by culture and sensitivity testing of the specific infecting organisms. Although surgical incision and drainage has traditionally been the choice of management, our data show that a large proportion of breast abscesses can be successfully treated by percutaneous drainage under ultrasound guidance. Percutaneous aspiration should be attempted prior to operative management wherever possible in view of its better outcomes and success, particularly in smaller abscesses. As breast abscesses are largely managed by surgeons and surgical units, training in breast ultrasound may be advantageous and facilitate earlier interventional treatment of patients with breast abscesses.

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Conflicts of interest

None declared.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Figure S1. Length of hospital stay in non-lactational breast abscesses.
Figure S2. Size distribution of non-lactational breast abscesses.