

Are Lactational Breast Abscesses caused by Methicillin-resistant Staphylococcus aureus Special?

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Research

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Abstract

Background: This study aimed to identify the differences in clinical characteristics, puncture efficacy, antibiotic use, treatment duration, breastfeeding postillness, and recurrence of patients with breast abscesses caused by methicillin-resistant *Staphylococcus aureus* (MRSA) or methicillin-susceptible *Staphylococcus aureus* (MSSA) infection during lactation.

Methods: The clinical data of patients with breast abscesses during lactation who were treated in our hospital from January 2014 to February 2017 were reviewed. According to bacterial culture results, they were divided into MRSA (n = 260) and MSSA (n = 962) groups. Hospitalization (whether or not the patients were hospitalized), postpartum time, age, location of abscess cavities, number of abscess cavities, amount of pus, frequency of needle aspiration, failure of needle aspiration, antibiotic use, treatment duration, delactation and recurrence were compared between the two groups using a t-test and a chi-squared test.

Results: We noted that only delactation was statistically significantly different between the two groups ($P = 0.018$). Hospitalization, postpartum time, age, location of abscess cavities, number of abscess cavities, amount of pus, frequency of needle aspiration, failure of needle aspiration, antibiotic use, treatment duration and recurrence showed no statistically significant differences ($P = 0.488$, $P = 0.328$, $P = 0.494$, $P = 0.218$, $P = 0.088$, $P = 0.102$, $P = 0.712$, $P = 0.336$, $P = 0.512$, $P = 0.386$ and $P = 0.359$, respectively).

Conclusion: Patients with breast abscesses caused by MRSA infection during lactation presented no significant differences in the clinical manifestations, needle aspiration efficacy, antibiotic use or treatment duration compare with those caused by MSSA infection. However, patients with MRSA infected were more susceptible to delectation.

Background

Breast abscesses are common in lactating women, with an incidence of 0.4–11% during lactation [1]. *Staphylococcus aureus* is the most common pathogenic bacteria among breast abscesses during lactation. As it is gram-positive bacteria, it has strong pathogenicity and can cause skin, soft-tissue, bone, joint, and systemic organ infections [2–5]. In 1961, the world's first case of methicillin-resistant *Staphylococcus aureus* (MRSA) was isolated [6]. MRSA is characterized by high-level drug resistance and a complex drug resistance mechanism, which can increase infection-caused mortality, prolong the length of the hospital stay and increase medical expenses [7]. In recent years, the detection rate of MRSA in the pus of breast abscesses has gradually increased. Whether the condition of patients with breast abscesses combined with MRSA infection is more serious than those infected with methicillin-susceptible *Staphylococcus aureus* (MSSA) or whether MRSA increases the difficulty of breast abscess treatment remains unclear. Presently, there are few studies on these aspects, and the sample sizes are small.

Materials And Methods

Aim, design, and setting

We aimed to determine the clinical manifestations, puncture efficacy, antibiotic use, treatment duration, breastfeeding and recurrence of patients with breast abscesses caused by MRSA or MSSA infection during lactation, using a large sample study, to guide the clinical diagnosis and treatment.

This was a retrospective study. We collected the clinical data on patients with breast abscesses during lactation treated in the Breast Disease Prevention and Treatment Centre of Haidian Maternal and Child Health Hospital, Beijing, from January 2014 to February 2017, using the electronic medical record system and reviewing medical records in the medical record room.

Patient characteristics

A total of 1525 patients with breast abscesses during lactation were treated in the Breast Disease Prevention and Treatment Centre of Haidian Maternal and Child Health Hospital, Beijing, from January 2014 to February 2017, among which 20 patients received no bacterial culture, 24 were lost to follow-up and 259 showed non-MRSA or non-MSSA in the bacterial culture. Thus, a total of 1222 patients met the inclusion criteria.

According to their bacterial culture results, all the patients were assigned to either the MRSA or MSSA group. Hospitalization (whether or not the patients were hospitalized), postpartum time, age, location of abscess cavities, number of abscess cavities, amount of pus, frequency of needle aspiration, treatment method (failure of needle aspiration), antibiotic use, treatment duration, delactation and recurrence were compared between the two groups. We aimed to determine whether the condition of patients with breast abscesses caused by MRSA infection was more serious than of those with MSSA infection and whether MRSA infection would prolong treatment duration or increase the recurrence rate.

Inclusion, exclusion, cure, and recurrence criteria

The inclusion criteria were as follows: (1) Patients diagnosed with breast abscesses during lactation who met all of the following criteria: lactating woman; breast lesions with inflammatory manifestations such as redness, swelling, heat and pain or accompanied by fever; physical examination showing touched fluctuation; A diagnostic breast ultrasound will identify a collection of fluid. The collection can often be drained by needle aspiration, which itself can be diagnostic. (2) Bacterial cultures of the patients' pus were sent. (3) The bacterial culture results showed MRSA or MSSA. Patients with no MRSA or MSSA or cases which there was no bacterial growth in the bacterial culture ($n = 259$) and patients were lost to follow-up ($n = 24$) were excluded.

The cure criteria of needle aspiration were that the patients' clinical symptoms disappeared, and the fluid aspirated by the last aspiration was non-purulent. The failure criteria of needle aspiration were skin ulcerations occurring after aspiration, the clinical symptoms not being relieved after aspiration and patients transferred to surgery. The recurrence criteria were all patients followed up for 1 month without

recurrence of clinical symptoms or another aspiration being considered clinically cured. Otherwise, the case was regarded as a recurrence.

Treatment methods

All patients were treated with ultrasound-guided needle aspiration and irrigation for abscesses. If the clinical symptoms were not relieved after aspiration, sensitive antibiotic adjuvant therapy was selected according to the drug sensitivity results of the bacterial culture. If the clinical symptoms were still not relieved, surgical treatment was considered. Surgical methods included Mammotome minimally invasive vacuum-assisted biopsy of the abscess, abscess catheter irrigation and drainage, abscess incision and drainage (Fig. 1).

All patients were followed up for 1 month by regular outpatient treatment and telephone follow-up.

Statistical analysis

Data were statistically analyzed using SPSS 21.0. Hospitalization, postpartum time, location of abscess cavities, number of abscess cavities, failure of needle aspiration, antibiotic use, delactation and recurrence were analyzed using the chi-squared test. Age, amount of pus, frequency of needle aspiration and treatment duration were analyzed using a t-test.

Results

Of the 1525 patients with breast abscesses during lactation who were reviewed, a bacterial culture of pus was collected from 1481 (bacterial culture was not collected from 20 patients and 24 patients were lost to follow-up. So the 44 patients were excluded). The results showed 260 cases of MRSA, 962 cases of MSSA, seven cases of methicillin-resistant *Staphylococcus epidermidis*, 13 cases of *Staphylococcus epidermidis*, and 42 cases of other bacteria, including *Streptococcus tarsus*, *Streptococcus sanguinis* and *Staphylococcus intermedia*. No growth of pathogenic bacteria was detected in the bacterial cultures of the other 197 patients. A total of 1222 patients met the inclusion criteria. According to their bacterial culture results, they were assigned to the MSSA or MRSA group and aged 21–44 (mean age, 30.57) years.

All 1222 patients with breast abscesses during lactation were analyzed using the chi-squared test, revealing a statistically significant difference in delactation between the groups ($\chi^2 = 5.290$, $P = 0.018$). No statistically significant differences were found in hospitalization ($\chi^2 = 0.012$, $P = 0.488$), postpartum time ($\chi^2 = 0.269$, $P = 0.328$), location of abscess cavities ($\chi^2 = 0.738$, $P = 0.218$), number of abscess cavities ($\chi^2 = 2.063$, $P = 0.088$), failure of needle aspiration ($\chi^2 = 0.331$, $P = 0.336$), antibiotic use ($\chi^2 = 0.003$, $P = 0.512$) or recurrence ($\chi^2 = 0.390$, $P = 0.359$) between the groups (Table 1). The t-test demonstrated that the differences in age ($P = 0.494$), amount of pus ($P = 0.102$), frequency of needle aspiration ($P = 0.712$), and treatment duration ($P = 0.386$) were not statistically significant between the groups (Table 1, Table 2).

Table 1
Factor analysis results by chi-squared test

Factors	MRSA group (n = 260)	MSSA group (n = 962)	χ^2	P value
Hospitalization	44	160	0.012	0.488
Residential treatment	216	802	0.269	0.328
Outpatient treatment	149	534	0.738	0.218
Postpartum time	111	428	2.063	0.088
Puerperium	66	270	0.331	0.336
Non-puerperium	194	692	0.003	0.512
Location of abscess cavities	180	709	5.290	0.018
Central area	80	253	0.390	0.359
Non-central area	17	73		
Number of abscess cavities	243	889		
Single abscess	82	305		
Multiple abscess	178	657		
Failure of aspiration	28	63		
Failed	232	899		
Non-failed	5	25		
Antibiotic use	255	937		
Yes				
No				
Delactation				
Delactation				
Non-delactation				
Recurrence				
Recurrent				
Non-recurrent				

This is the most parts of data of the patients in the study and the factor analysis results by chi-squared test.

Table 2
Factor analysis results by t-test

Factor	MRSA group (n = 260)	MSSA group (n = 962)	P value
Mean age (years)	30.6 (21–44)	30.6(20–48)	0.494
Mean amount of pus (ml)	16.5 (0–143)	17.9 (0–420)	0.102
Mean frequency of aspiration (times)	3.0 (0–12)	2.9 (0–16)	0.712
Mean treatment duration(d)	7.9 (1–90)	7.8 (1–85)	0.386
This is a part of data of the patients in the study and the factor analysis results by t-test			

Discussion

Since the first isolation of MRSA by Jevons in 1961 [6], the infection and isolation rates of MRSA have been increasing worldwide, and it has become one of the primary pathogens of nosocomial and community-acquired infections [8, 9]. Annually, the number of deaths caused by MRSA infection in the United States is equivalent to the deaths caused by AIDS, tuberculosis and viral hepatitis combined [10]. The prevalence of MRSA infection has become a serious clinical and public health problem.

In recent years, the detection rate of MRSA in the breast milk and pus of lactating patients has gradually increased [2, 3]. Stafford I and Moazzez A et al. [2, 3] found that the detection rate of MRSA in patients with breast abscesses and mastitis was 67% and 58%, respectively. In our study, of the 1481 patients from whom a bacterial culture of pus was collected, 260 cases of MRSA were detected, with a detection rate of 17.56%, making our detection rate lower than that of Stafford I and Moazzez A et al. The sample sizes in the studies of Stafford I and Moazzez A et al. were small, at 35 and 44, respectively, which are far smaller than our sample size. This difference could explain our lower detection rate than that of these two studies. Although the MRSA infection rate in lactating patients is increasing, the infection cause remains unclear. Some scholars speculated that patients need hospitalization before and after delivery, which could increase the probability of MRSA infection, but further research is required to confirm this [11–14].

In our study, whether the patients were hospitalized was used as an indicator for evaluating the patients' condition to compare the severity in the two groups. Evaluating the postpartum time (puerperium), patients' age, location of abscess cavities, number of abscess cavities and amount of pus, the clinical manifestations of the patients infected with the two bacteria were compared. Furthermore, the therapeutic effect of the frequency of needle aspiration, needle aspiration efficacy, treatment duration and antibiotic use was evaluated. Additionally, the prognosis of the patients was evaluated according to whether the patients had delactation and recurrence. Therefore, we divided the above factors into three aspects for discussion: clinical manifestations, therapeutic effect and prognosis.

Clinical manifestations

Reddy et al. [15] compared MRSA- and MSSA-infected patients with postpartum mastitis, showing no significant differences in age, pregnancy history, initial symptoms or mode of delivery. Chen CY et al. [16] studied patients with breast abscesses caused by MRSA or MSSA infection, which suggested that MRSA infection did not increase the hospitalization rate of patients with breast abscesses. The results of our study showed no significant differences in hospitalization, postpartum time or age between the MRSA and MSSA groups, which is consistent with the above results.

Studies have shown that central breast abscesses, multiple abscesses and abscesses measuring > 5 cm are complex and refractory abscesses [17-19], which increase the difficulty of treatment. In our study, no significant differences were found in the location of the abscess, the number of abscess cavities or the amount of pus between patients with breast abscesses caused by MRSA infection or MSSA infection during lactation, which did not increase the difficulty of treatment. Although the results of our study were inconsistent with the above results, the sample size of the above studies was smaller than that of our samples and included some nonlactating breast abscess cases [19], which could have led to inconsistent results.

Therefore, based on our study, the clinical manifestations of patients with breast abscesses caused by MRSA infection during lactation were not different from those caused by MSSA infection, and MRSA infection did not increase the hospitalization rate, indicating that MRSA infection did not increase the severity of the breast abscess or the difficulty of treatment.

Therapeutic effect

With the development of minimally invasive treatment technology, ultrasound-guided needle aspiration and irrigation has become the preferred treatment method for breast abscesses and is widely used in clinical practice [20, 21]. Chen CY et al. [16] showed that MRSA infection did not reduce the therapeutic effect of ultrasound-guided percutaneous drainage or prolong the duration of treatment and antibiotic use compared with MSSA infection in postpartum breast abscess. In our study, 1222 patients were treated with ultrasound-guided needle aspiration and irrigation. Of these, 90 failed in the aspiration, including abscess ulceration after aspiration or ineffective aspiration; then, they underwent Mammotome minimally invasive vacuum-assisted biopsy, abscess catheter irrigation and drainage or abscess incision and drainage. However, the statistical analysis showed no difference in the therapeutic effect of needle aspiration between the MRSA and MSSA groups, and MRSA infection did not increase the failure rate of needle aspiration. The mean frequency of needle aspiration in the MRSA and MSSA groups was 3.0 and 2.9, respectively, without statistical significance, which also indicated that MRSA did not increase the frequency of needle aspiration. Among the 1222 patients, the treatment duration was 2–82 (mean, 8) days. The treatment duration was 7.9 days in the MRSA group and 8 days in the MSSA group, without statistically significant differences, indicating that MRSA infection did not prolong the treatment duration of patients with lactational breast abscesses. The above results are consistent with those of Chen CY et

al [6]. Therefore, when clinicians treat MRSA-infected patients with breast abscesses during lactation, ultrasound-guided needle aspiration remains the first choice.

According to Jiayue Luo et al. [22], antibiotics were not routinely used for the treatment of breast abscesses during lactation, but the success rate was similar to that of routine antibiotic use. Thus, they are conducting a prospective randomized controlled study on whether breast abscesses during lactation should be treated with antibiotics during drainage. The participants were randomly divided into two groups: an antibiotic group (antibiotic use 5 days postoperatively) and a nonantibiotic group (no antibiotic use postoperatively). The authors will observe the treatment duration and recurrence rate of breast abscess. Their expected conclusion is that for the treatment of breast abscesses, the effect of drainage without antibiotics is not poorer than that of drainage combined with antibiotics. However, the study has not yet been completed, and the expected conclusion has not yet been confirmed. In our study, the symptoms were significantly relieved after needle aspiration or drainage, without antibiotic use. However, for the patients with severe systemic symptoms or poor effects of the puncture, antibiotics were administered. Among the 260 patients with MRSA infection, 82 were treated with antibiotics and the remaining 178 were not. Among the 82 patients receiving antibiotics, two were treated with vancomycin and the rest with levofloxacin. Of the 962 patients with MSSA infection, 305 were treated with antibiotics and 657 were not. The statistical analysis demonstrated no difference between the two groups, suggesting that MRSA infection in breast abscesses during lactation did not increase the use of antibiotics. All patients without antibiotic treatment were cured. Therefore, for the treatment of breast abscesses during lactation, effective drainage of pus might be necessary. Without drainage of infected fluid, the use of antibiotics is ineffective [23].

Prognosis

The study by Reddy et al. [15] showed that the delactation rate after mastitis in the MRSA group was 16% and that in the MSSA group was 22%, without statistical significance. However, our results showed that only delactation was significantly different between patients with breast abscesses during lactation in MRSA and MSSA groups. Among the 1222 patients, 28 in the MRSA group presented delactation, with a rate of 10.7% (28/260), whereas 63 (6.5%, 63/962) patients in the MSSA group showed delactation. The delactation rate in MRSA group was higher than that in MSSA group, which indicated that patients with breast abscesses infected with MRSA during lactation were more susceptible to delactation than those infected with MSSA. The authors think that this is related to the patients' concern that MRSA infection would prolong the recovery time and their desire to prevent the recurrence of the abscess by delactation. Furthermore, delactation is also related to the mothers' concern that MRSA could be transmitted to the child through her milk, leading to adverse effects for the child. These concerns increase the delactation rate of patients with breast abscesses infected with MRSA during lactation. A study in Taiwan [24] reported that the colonization rate of MRSA in the nasal cavity of healthy children was 8.1%, and breastfeeding could prevent the colonization of MRSA and MSSA in healthy children, which might be related to improvements in children's immunity by breastfeeding. Therefore, breastfeeding can still be continued in patients with breast abscesses infected with MRSA during lactation. Acute mastitis and

breast abscesses during lactation do not affect breastfeeding. The Academy of Breastfeeding Medicine [25] suggests that the first step in the treatment of mastitis during lactation is to effectively remove the milk, that is, encourage the mothers to breastfeed frequently and start from the affected side. After surgical drainage, breastfeeding on the affected breast should continue, even if a drain is present, with the proviso that the infant's mouth does not come into direct contact with purulent drainage or infected tissue. Our results showed that patients in the MRSA group were more susceptible to delactation than those in the MSSA group, which differs from the findings of Reddy et al. [15]. This result might indicate the lack of adequate physician training in our department; that is, the proper education of patients about the condition is insufficient. Patients had a poor understanding of the disease and MRSA and had a fear of MRSA, thus leading to an increased delactation rate in the MRSA group. Therefore, we should also consider the psychological burden on the patients while undergoing treatment, so that the patients can correctly understand the disease and MRSA and eliminate their concerns, which might change the outcome.

In our study, 30 patients had abscess recurrence, including five in the MRSA group and 25 in the MSSA group, without a significant difference, which is consistent with the results of Chen CY et al. [16]. Their study showed that MRSA infection did not increase the hospitalization rate, frequency of outpatient follow-up, or recurrence rate compared with MSSA infection in postpartum breast abscess.

In conclusion, the infection and isolation rates of MRSA are increasing globally. Given the multiple drug resistance mechanism of MRSA, clinicians are more alert to these bacteria. Therefore, many doctors might believe that patients with breast abscesses infected by MRSA during lactation have a more serious condition and are difficult to treat. In terms of treatment options, they will intervene more actively for MRSA than for an MSSA infection. However, our study showed that age, postpartum time, location of abscess cavities, number of abscess cavities, frequency of needle aspiration, needle aspiration efficacy, treatment duration and recurrence were not significantly different between patients with breast abscesses that were infected by MRSA during lactation and those infected by MSSA, suggesting that MRSA infection does not increase the severity of breast abscess or the difficulty of treatment. For breastfeeding patients with breast abscesses, whether infected with MRSA or not, ultrasound-guided needle aspiration and irrigation should be the first-choice treatment [16]. For antibiotic use, if ultrasound-guided needle aspiration has a good effect in the patients with breast abscesses infected by MRSA during lactation, antibiotics are not necessary. If the treatment effect is not good, it can be combined with antibiotic use. According to the results of the bacterial culture, drugs sensitive to MRSA can be used.

Conclusion

This study has shown that the condition and prognosis of patients with breast abscesses caused by MRSA infection during lactation were not poorer than those with MSSA infection, and no special treatment was required. However, to avoid the spread of MRSA, we suggest that the inpatients with MRSA infection should be placed in isolation wards, outpatient clinics should be disinfected routinely and doctors should wash and disinfect hands strictly according to the principle of nosocomial infection

prevention and control. Furthermore, although the sample size in this study was large, it was a retrospective study and has some limitations. Therefore, the results should be further confirmed by large sample prospective studies.

Abbreviations

MRSA: Methicillin-resistant *Staphylococcus aureus*

MSSA: Methicillin-susceptible *Staphylococcus aureus*

Declarations

• Ethics approval and consent to participate

Neither medical nor ethical approval was required. Our study was a retrospective study. All data are derived from the medical records of patients who have been treated. And all data were processed anonymously.

• Consent for publication

Not applicable.

• Availability of data and materials

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

• Competing interests

The authors declare that they have no competing interests.

• Funding

None.

• Authors' contributions

YL drafted the manuscript with the help of XJM and XPH. XJM critically revised and supervised the study. All authors read and approved the final manuscript.

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Not applicable

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Figures

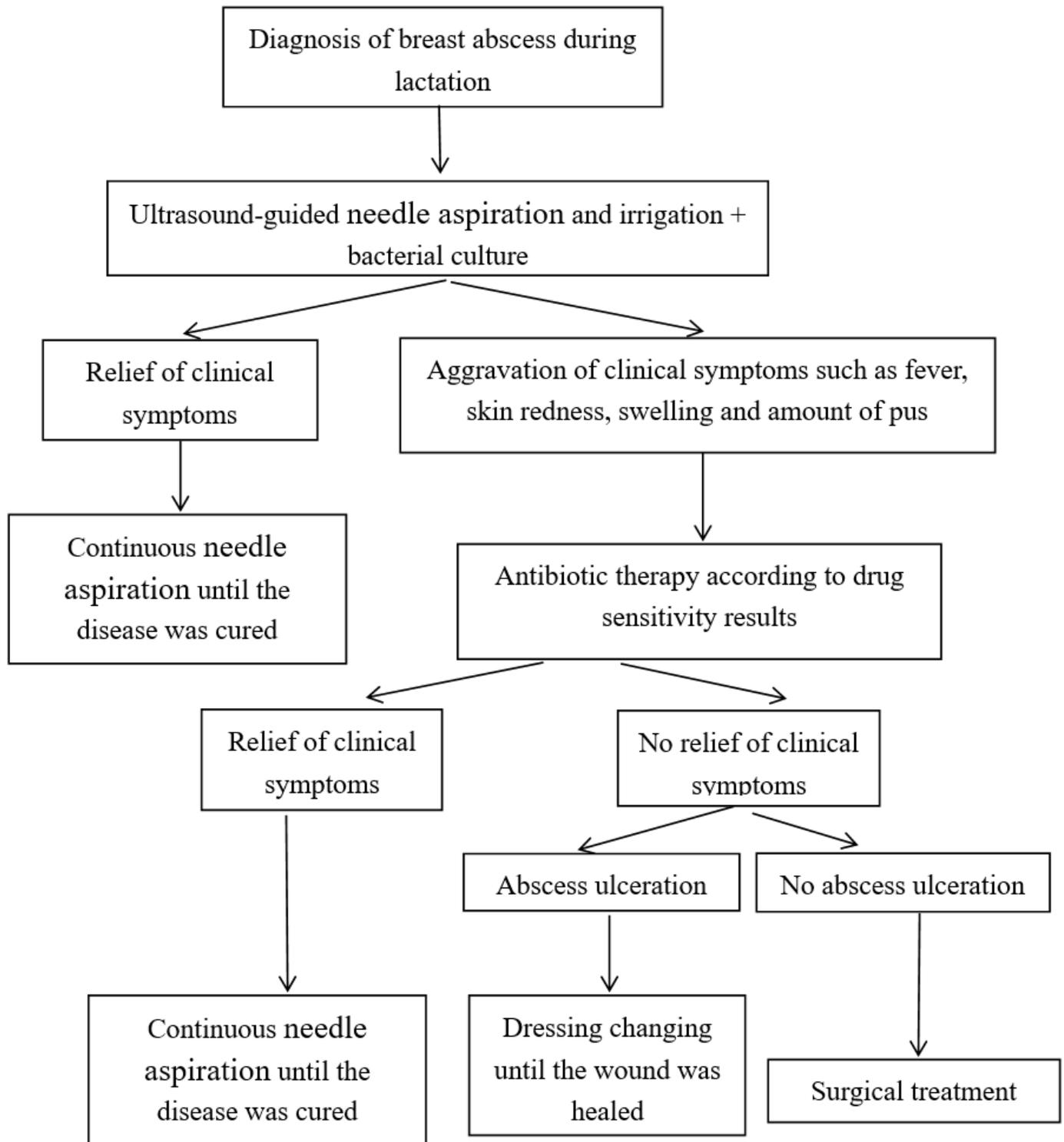


Figure 1

Flow chart of treatment of breast abscess during lactation

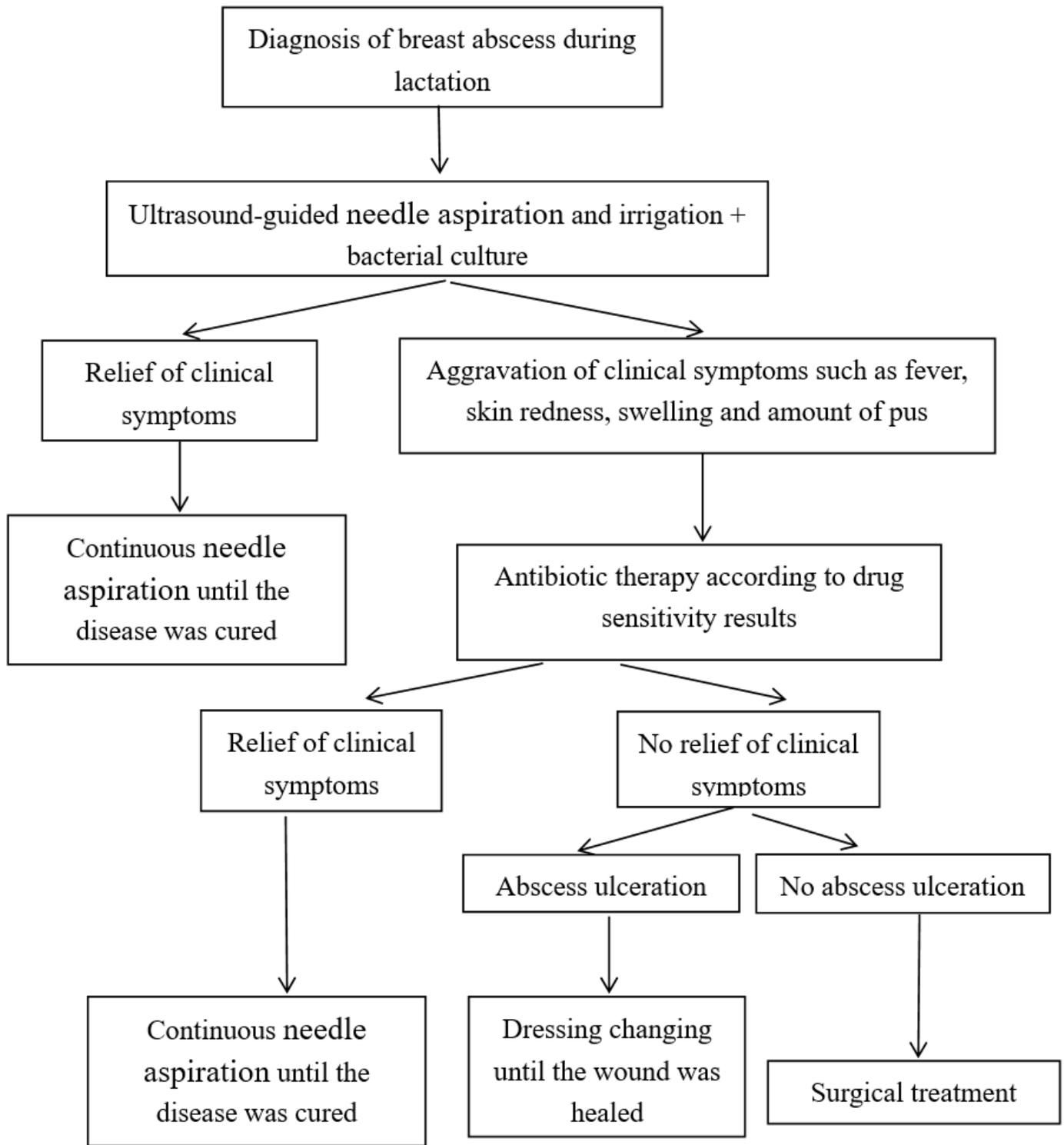


Figure 1

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