Original Article

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A Comparative Study of Drainage of Breast Abscesses by Conventional Incision and Drainage vs Ultrasound-Guided Needle Aspiration/Re-Aspiration in A Tertiary Health Care Centre

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ABSTRACT

Objective: Breast abscesses are localized purulent collections, often arising from bacterial mastitis, and pose significant health risks, especially for lactating women. The aim of this study was to compare the efficacy and outcomes of two different treatment approaches: Traditional incision and drainage (I&D) versus ultrasound (USG)-guided aspiration in breast abscess management.

Materials and Methods: Fifty female patients with breast abscesses were enrolled and divided into two groups: Group A (n = 25, I&D) and group B (n = 25, USG-guided aspiration). Group A underwent I&D under general anaesthesia and group B underwent USG-guided aspiration under local anaesthesia. The patients were followed up for two weeks after the procedure. Patient demographics, abscess characteristics, treatment outcomes, and complications were analyzed.

Results: The mean age of patients was 36.4 and 31.8 in group A and B, respectively and the mean abscess size was 5.7 cm. The study found that USG-guided aspiration was associated with several advantages over I&D. Patients in group B experienced shorter healing times (5 days vs. 13 days, $p = 0.001$), lower rates of residual abscesses (12% *vs.* 36%, $p = 0.047$), and no recurrence after two weeks vs. 28% in group A ($p = 0.012$). Notably, the resumption of lactation was significantly greater in group B (91.67% *vs.* 20%). Importantly, patients in group B had no scarring, while 37% in group A healed with scars.

Conclusion: These results highlight that USG-guided aspiration offers a minimally invasive and effective method for managing breast abscesses, leading to quicker recovery, better cosmetic outcomes, and higher patient satisfaction compared to the traditional I&D approach. Early diagnosis and intervention with USG-guided aspiration can prevent complications and reduce the need for open surgery. Based on these findings, USG-guided aspiration is a safer and more efficient method for treating breast abscesses, particularly when initiated promptly after diagnosis.

Keywords: Abscess; benign; breast; needle aspiration; ultrasound-guided

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Key Points

- Advantages of ultrasound-guided aspiration: The results indicate several advantages associated with ultrasound-guided aspiration, including shorter healing times, lower rates of residual abscesses, no recurrence after two weeks, higher rates of lactation resumption, and minimal scarring. These findings suggest that ultrasound-guided aspiration may offer superior outcomes compared to the traditional incision and drainage approach.
- Clinical implications: The study underscores the clinical implications of adopting ultrasound-guided aspiration as a minimally invasive and effective method for managing breast abscesses.

Introduction

A breast abscess is defined as a localized collection of purulent material in the breast surrounded by a pyogenic membrane (1). Typically, breast abscesses originate from bacterial mastitis, most commonly caused by *Staphylococcus aureus*. Abscess formation is the most feared complication of parenchymal infection, predominantly observed in lactating women, and often originating from a sore or cracked nipple. The reported incidence of abscesses in lactation-related mastitis ranges from 4.8% to 11% (2). Complications may include severe necrotizing infections and sepsis (3).

The conventional approach to treating breast abscesses has been incision and drainage (I&D) with antibiotic coverage, primarily after initial unsuccessful needle aspiration. However, non-operative techniques such as percutaneous drainage using ultrasound (USG) have

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gained popularity, even in large abscesses that were once considered indications for I&D. The conventional method has major drawbacks, such as extended healing time, unfavorable cosmetic outcomes, and a higher risk of recurrence, leading to a significant shift in management protocols (4, 5).

In cases where image-guided aspiration, performed under antibiotic cover, fails to resolve the abscess or results in recurrence or increased size, surgical drainage under general anesthesia may still be necessary. I&D, along with wound debridement, may be required in cases of superficial abscesses with skin necrosis, and surgery may also be necessary when malignancy is suspected (4). The aim of this study was to compare the traditional I&D technique versus percutaneous USG-guided needle aspiration in terms of efficacy, healing time, cosmetic outcome and resumption of breast feeding. A preliminary preprint version of this article was previously posted in The Tamil Nadu Dr.M.G.R University repository on February 9, 2021.

Materials and Methods

Study Design

This was a randomized, controlled trial.

Sample Size

A total of 105 patients were referred to the Department of General Surgery at Stanley Hospital, Chennai, India, for the treatment of tender breast lumps between 2018 and 2019. All female patients underwent an initial USG examination using a commercially available portable ultrasound machine. The presumptive diagnosis of abscess was made when a homogenous or non-homogenous liquid collection was observed, often with some acoustic enhancement.

Study Criteria

All patients above the age of 12 years, diagnosed with an abscess in either breast (lactating or non-lactating), and not undergoing treatment for any other breast pathology were included in the study. Women with recurrent abscesses, a diagnosis of malignancy, or those unwilling to participate were excluded from the study.

Statistical Analysis

A data sheet was formulated to collect the data. The collected data were analysed using IBM SPSS Statistics for Windows, Version 23.0 (Armonk, NY: IBM Corp). Frequency and percentage analysis were used for categorical variables (presence of residual abscess, recurrence rates, lactation resumption). Mean and standard deviation were used for continuous variables (patient age, abscess size, healing time). Chi-square analysis was used for categorical variables, and the independent sample t-test was used for the comparison of healing times.

Ethical Considerations

Prior to the commencement of the study, informed consent was obtained from all the participants, explaining the purpose, procedures, potential risks and benefits. Data collected, including personal details and medical records were anonymized and access was restricted to the research team. Participation was voluntary and patients were informed that their decision to participate or withdraw would not impact their medical care. The study protocol, including the research design, procedures and consent forms received approval from the Institutional Ethics Committee, Stanley Medical College, Chennai to ensure compliance with ethical guidance and standards (approval number: EC/NEW/INST/2018/461; date: 07.12.2018). The participants were also debriefed at the conclusion of the study, providing them with an understanding of the research goals and outcomes. All queries and concerns were addressed and participants were informed how their data would be used.

Procedure

Fifty-seven patients met the inclusion criteria after detailed history and examination, as well as USG. Seven patients refused to take part in the study and the remaining fifty were randomized into twenty-five patients each in groups A (I&D) and B (USG-guided aspiration). The patients were randomized using a computer generated randomization table. Written informed consent was obtained from the patients included in the study. Patients in the I&D arm were admitted and prepared for surgery under general anaesthesia in casualty theatre by the Principal Investigator. Hilton's method was used for I&D. Initial pus drained was sent for culture and sensitivity. The pus was then evacuated and loculi broken down digitally, the wound was packed with sterile gauze. Post-operatively the patient was on analgesics and appropriate antibiotics. The patient was discharged home after two days to undergo daily wound dressing at a nearby clinic until the wound healed.

Patients under the needle aspiration arm were managed in the department of interventional radiology as outpatient cases. Under aseptic condition, a small area of skin adjacent to the abscess was anaesthetized by 1% lignocaine through a 23 G needle. Aspiration was done under USG guidance using a 16 G needle and a 20 mL syringe. Initial aspirated pus was sent for culture and sensitivity against antibiotics. Aspiration was done until there was no significant residual pus. After the procedure the patient was discharged on antibiotics and analgesics. In both arms, lactating patients were advised to resume breast-feeding on both breasts as soon as they could tolerate the pain as the baby breastfeeds.

All patients were treated with appropriate empiric antibiotics and analgesics initially and were subsequently tailored according to pus culture and sensitivity results. Ultrasonogram of the breast was done on days 3.7 and 14 post operatively/post drainage to rule out residual abscess. Each patient was analyzed on the basis of residual abscess, recovery duration, recurrence of abscess and resumption of functionality for lactating mothers and the patients were followed up for a period of two weeks.

Results

The average age of the patients in group A was 36.4±10.21 years and group B was 31.8±8.01, ranging from 12 to 60 years, of whom a total of 47% were lactating mothers. Table 1 provides the age distribution of the patients.

The mean ± standard deviation abscess size was 5.7±3.4 cm (95% confidence interval, 2.8 to 8.1). Just over half (53%) of abscesses were noted in the left breast whilst the remainder were noted in the right. However, there was no significance in the size range of the abscess with respect to either breast or lactation status. There was no significant difference between group A and group B regarding age and side of breast involved. Table 2 shows the distribution of lactating mothers in each group.

Nearly all patients (94%) had a palpable breast mass. The abscess was localized to the left upper outer quadrant in 34% (n = 17), whereas whole breast involvement was present 8.6% (n = 6). Right (47%; n

= 23) and left (53%; *n* = 27) breasts were almost equally affected. Out of the 25 patients in group B, 52% (*n* = 13) were found to have undergone aspiration just once for resolution of the abscess. Table 3 shows the quadrants involved and Table 4 shows size of the abscess.

As far as symptoms were concerned, pain was present in 92% (*n* = 46) and fever in 58% (*n* = 29). On the third day after the procedure, out of 25 patients in group A, only one was normal (4%) while the rest (*n* = 24, 96%) had residual abscess, edema, minimal collection, subcutaneous edema or persistent loculations.

In comparison, in group B on the third day after the procedure, 44% (*n* = 11) returned to normal while the remaining 56% (*n* = 14) had had residual abscess, edema, minimal collection, and/or subcutaneous edema. Thirteen patients (26%) needed only a single aspiration and one week of antibiotics. Eight patients (16%) underwent aspiration twice, whereas four (8%) required three aspirations and more than one week of antibiotics.

In terms of duration of symptoms or residual abscess until the seventh post-operative day, 36% (*n* = 9) of group A patients were found to remain symptomatic while only 12% (*n* = 3) of those from group B had residual abscess <2x2 cm in size with no complaints ($p = 0.047$). Table 5 show the number of residual abscess on 7th post-operative day.

The mean healing time was 13±5.01 days in group A and 5±2.54 days in group B. The mean difference was significant ($p = 0.001$). Out of 25 patients in group B, none had recurrence after two weeks while around 28% (*n* = 7) of patients from group A returned with recurrence ($p = 0.012$). The Table 6 shows the recurrence in the two groups.

Table 1. Age distribution

Age distribution, years	I and D	USG guided aspiration
	25	25
Mean	36.4	31.8
Median	35	30
Mode	34	30
Standard deviation	10.27132	8.03119
Minimum	21	19
Maximum	56	48

I and D: Incision and drainage; USG: Ultrasonography

Table 2. Lactating patients for each group

Lactating	Management (method)		Total	Chi-square test *p*-value
	I and D	USG guided aspiration		
No	15	13	28	0.325, $p = 0.776$
Yes	10	12	22	
Total	**25**	**25**	**50**	

I and D: Incision and drainage; USG: Ultrasonography

Table 3. Quadrants involved

	Management (method)		Total
Quadrant	**I and D**	**USG guided aspiration**	
Two separate loculi	0	1	1
Diffuse	0	1	1
Diffuse, multiloculated	1	0	1
Diffuse, multiloculated with edema	1	0	1
Multiloculated	2	2	4
LLIQ (left lower inferior)	4	3	7
LLOQ (left lower outer)	3	2	5
LUIQ (left upper inferior)	2	4	6
LUOQ (left upper outer)	3	1	4
RLIQ (right lower inferior)	0	2	2
RLOQ (right lower outer)	3	4	7
RUIQ (right upper inner)	5	1	6
RUOQ (right upper outer)	1	4	5
Total	**25**	**25**	**50**

I and D: Incision and drainage; USG: Ultrasonography

Table 4. Size of the abscess in the two groups

USG finding (size)	I and D	USG guided aspiration	Total
10X8CM	1	0	1
11X10CM	0	1	1
12X13CM	1	0	1
2X2CM	0	1	1
2X3CM	0	1	1
3X2CM	0	2	2
3X4CM	1	0	1
4X2CM	1	2	3
4X3CM	3	2	5
4X4CM	4	2	6
4X5CM	2	1	3
4X6CM	1	0	1
5X2CM	1	0	1
5X3CM	3	2	5
5X4CM	1	3	4
5X5CM	2	2	4
5X6CM	1	0	1
6X3CM	0	3	3
6X5CM	1	1	2
6X6CM	1	0	1
7X3CM	0	1	1
7X4CM	1	1	2
Total	**25**	**25**	**50**

I and D: Incision and drainage, USG: Ultrasonography

There was a significant difference (p = 0.003) in the duration to resumption of lactation and comfort of re-initiating feeds which was noted to be better in group B with 91.67% resuming lactation while only 20% in group A resumed lactation. There was complete healing with no scar formation in group B compared to 37% patients in group A who healed with scarring.

Patients from group A needed hospital admission (1 to 3 days); the procedure was done under general anesthesia. Daily dressings were required for two weeks on a regular basis and most of the patients were unable to feed from the affected breast during this period, so milk was discarded by pumping.

In group B, patients continued to breastfeed, and the procedure did not require any form of general anesthesia or sedation and was carried out on an outpatient basis.

All fifty patients yielded seven aerobic and polymicrobial (14%) cultures. The isolates in decreasing order of frequency were *Staphylococcus aureus* (20 samples, 40%), *Escherichia coli* (12 samples, 24%), multiple mixed anaerobic-aerobic (7 samples, 14%), *Klebsiella pneumoniae* (5 samples, 10%) Methicillin-resistant *Staphylococcus aureus* (MRSA) (3 samples, 6%), and *Proteus* spp. (3 samples 6%).

Discussion and Conclusion

Breast abscesses, both lactational and non-lactational, are a very common clinical entity identified in daily practice. At an early stage and on initial presentation, acute mastitis may be treated conservatively with antibiotics. Once an abscess is formed, management conventionally involves I&D, but this is associated with a requirement for daily dressing, a prolonged healing time, patient apprehension regarding continuing breastfeeding, an unsatisfactory cosmetic outcome, and recurrence of breast abscess.

Table 5. Residual abscess on 7th post-treatment day

Residual abscess on 7th post–treatment day	Management (method)		Total	Chi-square test *p*-value
	I and D	USG guided aspiration		
No	16 (64%)	22 (88%)	38	3.947, p = 0.047
Yes	9 (36%)	3 (12%)	12	
Total	25	25	50	

I and D: Incision and drainage, USG: Ultrasonography

Table 6. Recurrence after two weeks

Recurrence after two weeks	Management (method)		Total	Chi-square test *p*-value
	I and D	USG guided aspiration		
No	18 (72%)	25 (100%)	43	8.857, p = 0.012
Yes	7 (28%)	0	7	
Total	25	25	50	

I and D: Incision and drainage, USG: Ultrasonography

Traditionally, this was the main modality of management but over time with further analysis, research, and trials, it has emerged that minimally invasive methods provide better results and are a more acceptable method of management. USG-guided needle aspiration under antibiotic coverage has become the latest management protocol in many institutions due to its ease and outcome.

Needle aspiration is performed with a large needle, and as much pus as possible is aspirated at each attempt at aspiration; antibiotics are also administered (2, 6, 7, 8).

Breast abscesses are most frequently located in the upper outer quadrant, which is probably because most of the breast parenchyma is found in this area (2). In the present study, 34% of the patients had abscesses in the upper outer quadrant, and 58% of the abscesses were in the left breast. The highest incidence of breast abscess during lactation has been reported within the first 12 weeks of the postpartum period (2, 9). In the present study, the mean duration of lactation before abscess formation was two months. The most common pathogen identified was *Staphylococcus aureus* (2, 10-12), which was isolated from the pus culture in 40% of cases. It is recommended that when a diagnosis of mastitis or abscess is made, antibiotics that target gram-positive bacteria should be used and milk should be drained via frequent pumping or regular nursing.

The recommended duration of antibiotic therapy is ten days for oral or intravenous antibiotics (1, 2, 7, 8, 13). A break in the skin of the nipple-areola complex may prove to be a source of infection for pathogenic organisms. This, followed by infrequent nursing due to the pain of a cracked nipple, may result in milk stasis which may further contribute to the colonisation of bacteria (14, 15). Fifty-six percent of the patients in group A were unhappy with the residual symptoms they experienced and 37% of them developed a scar.

In group B, none of the patients failed to respond to needle aspiration. The mean healing time was significantly longer in group A than in group B and fewer patients in group A were able to resume lactation following open surgery.

There are multiple advantages of using diagnostic ultrasound in the treatment protocol: The ability to differentiate simple mastitis from abscess, assessing the size of the abscess, and detecting the presence of multiple loculi. Most importantly, it helps in assessing the adequacy of drainage (15-19). Eryilmaz et al. (20) reported that breast abscesses smaller than 5 cm in diameter on physical examination can be treated with repeated needle aspirations with good cosmetic results while I&D can be reserved for patients with larger abscesses. While needle aspiration is a currently accepted minimally invasive procedure for the treatment of uncomplicated abscesses, in case of residual collections that last longer than two weeks, a surgical approach may still be considered for definitive management.

A meta-analysis of existing data and further randomized clinical studies are necessary to evaluate the benefit of USG guidance during needle aspiration in different categories of patients with breast abscesses in relation to puerperium and lactation.

There was a significant difference between group A and group B in terms of post-operative outcome and patient satisfaction, favoring group B. USG-guided guided aspiration/re-aspiration is a technically feasible and easy method of management when done under aseptic precautions and under antibiotic cover with good cosmetic and

functional results for the patient and quick recovery. We concur that I&D should be reserved for patients with skin involvement and large abscesses.

Limitations of this study include the small sample size which was taken for convenience and it was a single centre study, which may limit the generalizability of the study. Lack of blinding may introduce bias. Finally, the two week follow-up was inadequate in terms of long-term complications.

Breast abscess is a basic clinical entity that every physician or surgeon must learn to diagnose, especially in developing countries due to its common occurrence. Once diagnosed it is important to treat at the earliest, as it is a rapidly spreading condition which can involve the entire breast, skin and become multiloculated.

Our findings unequivocally support the superiority of percutaneous USG-guided aspiration over conventional I&D. The USG-guided approach demonstrated notable advantages, including faster healing times, improved cosmetic outcomes, and quicker resumption of lactation. Furthermore, it significantly reduced hospital stays, underscoring its efficiency in providing a patient-friendly and resource-effective solution. The present study also suggested that, when appropriate, multiple USG-guided aspirations can be considered before resorting to I&D, in order to optimize outcomes. Our results affirm the safety and efficacy of percutaneous USG-guided aspiration as a preferred approach for managing breast abscesses. Physicians and surgeons, particularly in resource-constrained settings, should consider the adoption of this minimally invasive technique for optimal patient outcomes.

Ethics Committee Approval: The study protocol, including the research design, procedures and consent forms received approval from the Institutional Ethics Committee, Stanley Medical College, Chennai to ensure compliance with ethical guidance and standards (approval number: EC/NEW/INST/2018/461; date: 07.12.2018).

Informed Consent: Prior to the commencement of the study, informed consent was obtained from all the participants, explaining the purpose, procedures, potential risks and benefits.

Authorship Contributions

Surgical and Medical Practices: V.M.T., R.V., S.S.; Concept: V.M.T., R.V., S.S.; Design: V.M.T., R.V., S.S.; Data Collection and/or Processing: V.M.T., R.V., S.S.; Analysis and/or Interpretation: V.M.T., R.V., S.S.; Literature Search: V.M.T., R.V., S.S.; Writing: V.M.T., R.V., S.S.

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