Section: General Surgery

Original Research Article

COMPARATIVE STUDY OF OUTCOMES OF INCISION AND DRAINAGE VERSUS ULTRASOUND-GUIDED NEEDLE ASPIRATION IN FEMALES WITH BREAST ABSCESS

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ABSTRACT

Background: Breast abscess is a common condition affecting women, especially during lactation, and is associated with pain, swelling, fever, and difficulty in breastfeeding. Incision and drainage (I&D) has traditionally been the standard treatment; however, ultrasound-guided needle aspiration (USG-NA) has emerged as a minimally invasive alternative with potentially better clinical outcomes. This study aimed to compare the outcomes of incision and drainage and ultrasound-guided needle aspiration in female patients with breast abscess. **Materials and Methods:** A comparative study was conducted on 126 female patients diagnosed with breast abscess. Patients were equally divided into two groups: incision and drainage (n=63) and ultrasound-guided needle aspiration (n=63). Baseline demographic, clinical, and laboratory parameters were recorded. Outcomes assessed included residual abscess, recurrence, post-procedure pain, complications, hospital stay, recovery time, breastfeeding continuation, and return to routine activities. Statistical analysis was performed using appropriate inferential tests, and a p-value ≤ 0.05 was considered statistically significant. **Results:** Residual abscess on day 3 was significantly higher in the I&D group compared to the USG-NA group (42.9% vs 17.5%; $p < 0.001$). Post-procedure pain was also significantly greater following I&D (49.2% vs 14.3%; $p < 0.001$). USG-NA demonstrated shorter hospital stay (1.86 vs 5.71 days), faster recovery (7.30 vs 12.40 days), and earlier return to routine activities (6.20 vs 10.90 days). Breastfeeding outcomes were significantly better in the USG-NA group, with higher rates of breastfeeding resumption and comfort ($p < 0.001$). Recurrence rates at two weeks were comparable between groups. **Conclusion:** Ultrasound-guided needle aspiration is a safe, effective, minimally invasive, and patient-friendly alternative to incision and drainage for breast abscess management. It offers superior early clinical outcomes, reduced pain, shorter hospitalization, faster recovery, and improved breastfeeding continuation with comparable recurrence rates.

INTRODUCTION

Breast abscess is a common clinical condition affecting women, particularly those in the reproductive age group and during lactation. It is characterized by a localized collection of pus within the breast tissue, most commonly resulting from bacterial infection, especially Staphylococcus aureus, including methicillin-resistant strains. Patients usually present with breast pain, swelling, redness, warmth, fever, and malaise. If not diagnosed and managed appropriately, breast abscess can lead to chronic infection, recurrence, fistula formation, and interruption of breastfeeding, thereby affecting maternal health and infant nutrition. Breast abscesses may also occur in non-lactating women, particularly in association with diabetes mellitus, smoking,

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obesity, and immunocompromised states. Early diagnosis and prompt management are therefore essential to achieve complete recovery and preserve breastfeeding whenever possible.[1,2]

The pathogenesis of breast abscess commonly begins with milk stasis during lactation, which progresses to mastitis and eventually abscess formation. Factors such as poor breastfeeding techniques, nipple trauma, and duct obstruction contribute significantly to the development of infection. In non-lactational abscesses, the etiology is more variable and may involve anaerobic organisms or chronic inflammatory conditions. The primary goals of treatment include adequate drainage of pus, eradication of infection, pain relief, prevention of recurrence, preservation of lactation, and achieving favourable cosmetic outcomes with minimal morbidity.[3]

Traditionally, incision and drainage (I&D) has been considered the standard treatment for breast abscesses. The procedure involves making a surgical incision over the abscess cavity to evacuate pus, followed by placement of a drain or regular wound dressing. Although effective in controlling infection, incision and drainage is associated with several disadvantages. Patients may require hospitalization, local or general anaesthesia, prolonged wound care, and repeated dressings. Furthermore, the procedure can result in postoperative pain, delayed wound healing, scarring, and temporary interruption of breastfeeding. Many patients also experience psychological distress due to cosmetic deformity and prolonged recovery.[4]

With advancements in imaging techniques, ultrasound-guided needle aspiration (USG-NA) has emerged as a less invasive alternative to conventional surgery. In this procedure, ultrasonography is used to accurately localize the abscess cavity, after which pus is aspirated using a wide-bore needle. USG-NA can often be performed on an outpatient basis without the need for general anaesthesia or surgical incision. Repeat aspirations can be carried out if necessary until complete resolution is achieved. Several studies have demonstrated that USG-NA is associated with reduced pain, shorter hospital stay, faster recovery, improved cosmetic results, and better continuation of breastfeeding. It is particularly effective in smaller and unilocular abscesses, although its role in larger or multiloculated abscesses remains controversial.[5]

A number of comparative studies have evaluated incision and drainage versus ultrasound-guided needle aspiration; however, the findings remain inconsistent. Some researchers, including Ali H et al., have reported that USG-NA is equally effective as incision and drainage while offering lower morbidity and greater patient comfort. In contrast, studies such as that by Ali H et al. (2024) suggested that USG-NA may require multiple sittings and may be less effective in abscesses with thick walls or multiple loculations. These differing observations have contributed to ongoing debate regarding the most appropriate treatment modality for breast abscess management.[6]

Current clinical practice varies widely depending on factors such as abscess size, complexity, clinician experience, patient preference, and availability of ultrasonography services. Although many centres are increasingly adopting minimally invasive approaches, incision and drainage continues to be widely practiced because of its familiarity and perceived reliability in achieving complete drainage. Consequently, there is a strong need for well-designed comparative studies assessing the efficacy, safety, recurrence, patient satisfaction, cosmetic outcomes, pain, duration of hospital stay, and continuation of breastfeeding associated with both procedures.[7]

Despite growing global interest in minimally invasive management of breast abscesses, limited local data are available regarding the comparative effectiveness of incision and drainage and ultrasound-guided needle aspiration. Differences in demographic, socioeconomic, and healthcare infrastructure factors may influence treatment outcomes in different populations. Therefore, conducting a comparative study in the local setting is important to generate evidence relevant to the patient population and institutional practices.[8]

The continuation of breastfeeding is an especially important consideration in lactating mothers. Breastfeeding interruption can adversely affect maternal psychological well-being and infant nutrition and immunity. Since USG-NA is less invasive and less painful, it may allow mothers to continue breastfeeding more comfortably than conventional incision and drainage. However, confirmation of these advantages in the local population is essential before broader implementation can be recommended. Patient satisfaction and cosmetic outcomes also play an increasingly important role in modern healthcare. Factors such as postoperative scarring, duration away from work or household activities, and overall quality of life influence treatment acceptance and compliance.[9,10]

Breast abscess remains a significant health problem among women, particularly lactating mothers. Although incision and drainage has long been regarded as the conventional standard treatment, ultrasound-guided needle aspiration has emerged as a promising minimally invasive alternative. Ongoing uncertainty regarding the comparative effectiveness of these modalities highlights the need for focused clinical research. Comparative studies evaluating both procedures are necessary to establish the safest, most effective, and patient-friendly management approach for breast abscesses in different healthcare settings.[11]

The present study aims to compare the outcomes of incision and drainage with ultrasound-guided needle aspiration in female patients with breast abscess. The study seeks to determine which treatment modality provides superior clinical outcomes in terms of

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effectiveness, patient comfort, recurrence, cosmetic satisfaction, duration of recovery, and preservation of breastfeeding. Such evidence may help clinicians adopt evidence-based treatment strategies tailored to individual patient needs and available healthcare resources.[12]

The aim of this study was to compare the outcomes of incision and drainage and ultrasound-guided needle aspiration in females with breast abscess. The objectives were to compare residual abscess following incision and drainage versus ultrasound-guided needle aspiration, to compare recurrence rates between the two procedures, and to compare the clinical outcomes of patients with breast abscess treated with incision and drainage and those treated with ultrasound-guided needle aspiration.

MATERIALS AND METHODS

This randomized controlled trial was conducted at the Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad from 2023 to 2026. Ethical approval was obtained from the Ethical Approval Committee of Teerthanker Mahaveer Medical College and Research Centre, Moradabad.

Study Population

The study population included female patients above 18 years of age diagnosed with breast abscess based on clinical history, examination, and ultrasound confirmation at TMMC & RC, irrespective of abscess size. Patients with breast abscess due to other causes or those who are immunocompromised were excluded from the study. No risks were associated with participation in the study, and confidentiality of all patient-related information was strictly maintained throughout the research process.

Data Analysis

Data analysis was performed using appropriate statistical methods. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as frequency and percentage. Suitable inferential statistical tests were applied during analysis to compare clinical outcomes in patients with breast abscess treated by incision and drainage and ultrasound-guided needle aspiration. A p-value of ≤0.05 was considered statistically significant for determining the association and differences between the study groups.

RESULTS

A total of 126 patients were included in the study, with 91 lactating and 35 non-lactating women. Among lactating patients, 44 underwent incision and drainage (I&D) and 47 underwent ultrasound-guided aspiration (USG aspiration), while among non-lactating patients, 19 were treated with I&D and 16 with USG aspiration. The distribution of lactational status was comparable between the two groups (p = 0.54), indicating similar baseline characteristics. Pain was the most common presenting symptom, occurring in 58 patients in the I&D group and 60 in the USG aspiration group. Fever was present in 31 and 28 patients, while discharge was observed in 19 and 17 patients, respectively. No statistically significant differences were found in the distribution of presenting symptoms between groups, with p-values of 0.52 for pain, 0.59 for fever, and 0.69 for discharge, confirming comparable clinical presentation at baseline. Diabetes mellitus was the most common risk factor, affecting 14 patients in the I&D group and 13 in the USG aspiration group. Smoking was reported in 6 and 5 patients, respectively, while a previous history of breast abscess was noted in 9 patients in the I&D group and 7 patients in the USG aspiration group. There were no significant differences between the groups regarding diabetes mellitus (p = 0.82), smoking (p = 0.75), or previous breast abscess (p = 0.59), indicating balanced baseline risk factors. Right-sided breast abscess was observed in 28 patients treated with I&D and 30 patients treated with USG aspiration, whereas left-sided involvement was seen in 35 and 33 patients, respectively. The side of breast involvement was similarly distributed between groups (p = 0.72). The upper outer quadrant was the most commonly affected site, involving 29 patients in the I&D group and 31 in the USG aspiration group. The upper inner quadrant was involved in 10 and 8 patients, lower outer quadrant in 13 and 14 patients, and lower inner quadrant in 11 and 10 patients, respectively. The distribution of quadrant involvement showed no significant difference between groups (p = 0.88). Loculation was present in 18 patients treated with I&D and 16 patients treated with USG aspiration, while the majority of patients had non-loculated abscesses. The distribution of loculation status was comparable between groups (p = 0.69), suggesting similar abscess morphology at baseline. Baseline continuous variables were also well matched. The mean age was 35.71 years in the I&D group and 34.94 years in the USG aspiration group (p = 0.68). Mean duration of symptoms was 11.38 and 11.19 days, respectively (p = 0.84). Mean abscess size measured 3.57 cm in the I&D group and 3.38 cm in the USG aspiration group (p = 0.25). Haemoglobin levels, total leucocyte counts, and random blood sugar values were also similar between groups, with no statistically significant differences observed. A significant difference was noted in the type of anaesthesia used. Local anaesthesia was employed in all 63 patients undergoing USG aspiration, whereas 41 patients in the I&D group required general anaesthesia and only 22 underwent the procedure under local anaesthesia. This difference was highly significant (p < 0.001), highlighting the minimally invasive nature of USG aspiration. Repeat procedures were required in 15 patients in the USG aspiration group compared to 7 patients in the I&D group. Although repeat intervention was numerically more common following USG aspiration, the difference did not

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reach statistical significance (p = 0.10). Overall, both treatment modalities demonstrated comparable procedural success rates, with no significant difference in the requirement for additional intervention.

Table 1: Comparison of Residual Abscess Between Incision and Drainage and USG Aspiration on Day 3 and Day 7

Follow-up Day	Residual Abscess	Incision & Drainage (n=63)	USG Aspiration (n=63)	Total (n=126)	p-value
Day 3	Yes	27	11	38	< 0.001
	No	36	52	88	
	Total	**63**	**63**	**126**	
Day 7	Yes	9	5	14	0.40
	No	54	58	112	
	Total	**63**	**63**	**126**	

Residual abscess was significantly lower in the USG aspiration group on day 3 (17.5% vs 42.9%; p < 0.001), while by day 7 both groups showed near-complete resolution with no statistically significant difference (7.9% vs 14.3%; p = 0.40).

Table 2: Comparison of Post-procedure Pain and Complications Between Incision & Drainage and USG Aspiration

Outcome	Category	Incision & Drainage (n=63)	USG Aspiration (n=63)	Total	p-value
Post-procedure Pain	Yes	31	9	40	<0.001
	No	32	54	86	
	Total	**63**	**63**	**126**	
Surgical Site Infection	Present	7	4	11	0.53
Haematoma	Present	6	2	8	0.27

Post-procedure pain was significantly higher following incision and drainage compared to USG aspiration (49.2% vs 14.3%; p < 0.001). Although surgical site infection and haematoma were more frequent in the incision and drainage group, the differences were not statistically significant, indicating comparable overall complication rates between the two treatment modalities.

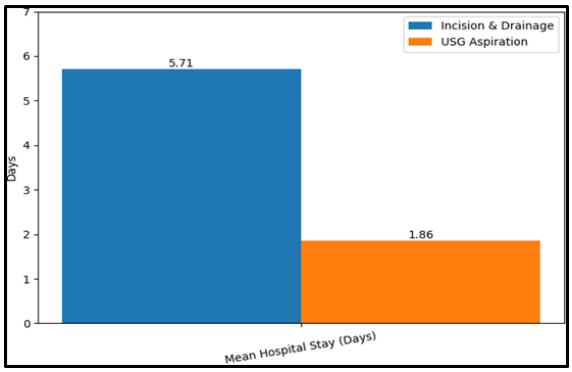

Figure 1: Hospital Stay Comparison

Patients in the Incision & Drainage group had a significantly longer mean hospital stay (5.71 days) than those treated with USG-guided aspiration (1.86 days). This difference was highly statistically significant (p < 0.001), indicating that USG-guided aspiration was associated with a markedly shorter duration of hospitalization.

Table 3: Late Clinical Outcomes at 2 Weeks

Outcome	Incision & Drainage	USG Aspiration	Total Positive Cases	p-value
Residual Lump	11	6	17	0.30
Persistent Discharge	5	11	16	0.18
Persistent Pain	11	9	20	0.81
Recurrence	6	4	10	0.74

At the 2-week follow-up, rates of residual lump, persistent discharge, persistent pain, and recurrence were comparable between the Incision & Drainage and USG Aspiration groups. None of the observed differences were statistically significant (p > 0.05), indicating similar late clinical outcomes with both treatment modalities.

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Table 4: Breastfeeding Outcomes

Outcome	Incision & Drainage	USG Aspiration	Total Positive	p-value
Breastfeeding Resumed	49	61	110	<0.001
Comfortable Breastfeeding	42	59	101	<0.001

Breastfeeding outcomes were significantly better in the USG Aspiration group, with more patients resuming breastfeeding (61 vs 49) and reporting comfortable breastfeeding (59 vs 42) compared to the Incision & Drainage group. Both differences were highly statistically significant ($p < 0.001$), suggesting that USG-guided aspiration facilitates earlier and more comfortable breastfeeding.

Table 5: ROC Curve Analysis for Predicting Residual Abscess on Day 3

Predictor Variable	AUC	95% CI	Cut-off	Sensitivity	Specificity	p-value
Abscess Size (cm)	0.72	0.63–0.81	3.50	73.68	65.91	<0.001
TLC (cells)	0.61	0.51–0.71	12800	60.53	57.95	0.04
Duration of Symptoms	0.58	0.48–0.68	10.50	55.26	56.82	0.09

ROC analysis showed that abscess size was the strongest predictor of residual abscess on day 3 (AUC = 0.72, $p < 0.001$), with a cut-off value of 3.5 cm providing 73.68% sensitivity and 65.91% specificity. Total leucocyte count had modest predictive value (AUC = 0.61, $p = 0.04$), while duration of symptoms demonstrated poor and non-significant predictive ability (AUC = 0.58, $p = 0.09$).

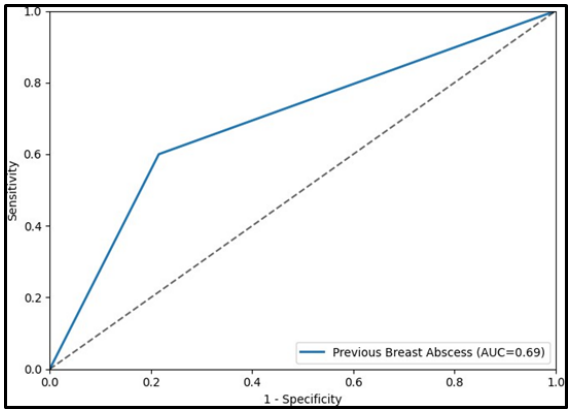

Figure 2: ROC Curve Analysis for Recurrence

ROC curve analysis identified previous breast abscess as the strongest predictor of recurrence, with fair discriminatory ability (AUC = 0.69, $p = 0.01$), sensitivity of 60.0%, and specificity of 78.45%. Diabetes mellitus showed lower predictive performance (AUC = 0.62, $p = 0.05$), indicating that a history of previous breast abscess was the most important factor associated with recurrence in this study.

Table 6: Subgroup Analysis in Lactating Females

Outcome	I&D (n=44)	USG (n=47)	p-value
Breastfeeding Resumed	38	46	0.01
Comfortable Feeding	33	45	<0.001
Recurrence	4	2	0.41

Among lactating females, the USG aspiration group demonstrated significantly better breastfeeding outcomes, with higher rates of breastfeeding resumption (46 vs 38; $p = 0.01$) and comfortable feeding (45 vs 33; $p < 0.001$) compared to the Incision & Drainage group. Recurrence rates were lower in the USG group (2 vs 4), but the difference was not statistically significant ($p = 0.41$).

Table 7: Recovery Outcome Comparison

Variable	Incision & Drainage	USG Aspiration	p- value
Mean Recovery Days	12.40	7.30	<0.001
Return to Routine Activity (days)	10.90	6.20	<0.001

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Patients treated with USG-guided aspiration experienced significantly faster recovery, with a shorter mean recovery time (7.30 vs 12.40 days) and earlier return to routine activities (6.20 vs 10.90 days) compared to those undergoing Incision & Drainage. Both differences were highly statistically significant ($p < 0.001$), highlighting the advantage of USG aspiration in promoting quicker functional recovery.

Table 8: Predictors of Residual Abscess (Logistic Regression)

Variable	Odds Ratio	95% CI	p-value
Treatment (USG vs I&D)	0.38	0.18–0.77	0.01
Abscess Size >3.5 cm	2.41	1.22–4.76	0.01
Presence of Loculation	1.89	0.91–3.95	0.08
Diabetes Mellitus	1.56	0.73–3.34	0.25

Logistic regression analysis showed that USG-guided aspiration significantly reduced the odds of residual abscess compared to Incision & Drainage (OR = 0.38, 95% CI: 0.18–0.77; p = 0.01), while abscess size >3.5 cm was an independent predictor of residual abscess (OR = 2.41, 95% CI: 1.22–4.76; p = 0.01). Although loculation and diabetes mellitus were associated with increased odds, neither reached statistical significance (p = 0.08 and p = 0.25, respectively).

DISCUSSION

Breast abscess is a localized collection of pus within the breast tissue, most commonly affecting lactating women, although non-lactational cases are also frequently encountered. The condition usually develops as a complication of untreated or severe mastitis and presents with pain, swelling, redness, fever, and localized tenderness. Prompt and effective management is essential not only for relief of symptoms but also for prevention of complications such as recurrence, fistula formation, prolonged infection, and interruption of breastfeeding. Traditionally, incision and drainage (I&D) has been considered the standard treatment for breast abscess. The procedure involves surgical opening of the abscess cavity to evacuate pus, usually under local or general anaesthesia, followed by wound dressing and postoperative care. Although effective, I&D is associated with prolonged healing, postoperative discomfort, cosmetic scarring, and temporary discontinuation of breastfeeding.[13,14]

In recent years, ultrasound-guided needle aspiration (USG aspiration) has emerged as a minimally invasive alternative. This technique uses ultrasonography to accurately identify the abscess cavity and aspirate pus using a needle, often on an outpatient basis. The method offers advantages such as reduced tissue trauma, less postoperative pain, shorter recovery duration, improved cosmetic outcomes, and preservation of breastfeeding. Repeated aspirations can be performed whenever necessary, thereby avoiding surgery in many patients. Due to advancements in imaging and minimally invasive techniques, there has been increasing interest in shifting from conventional surgical management toward more conservative treatment approaches. Comparative evaluation of I&D and USG aspiration is therefore important to identify the most effective, safe, and patient-friendly management option.[15,16]

The present study demonstrated that baseline characteristics were comparable between the two treatment groups. Lactating women constituted the majority of patients in both groups, with no statistically significant difference in lactational status between I&D and USG aspiration. Totadri VM et al. (2024) and Ubaid M et al. (2023) confirmed that lactation status does not influence treatment selection. Baseline presenting symptoms including pain, fever, and discharge were also similarly distributed between groups, indicating uniformity of disease severity prior to intervention. Similar findings were reported by Totadri VM et al. (2024) and Ubaid M et al. (2023), where pre-treatment characteristics showed no significant difference.[15,17]

Risk factors such as diabetes mellitus, smoking, and previous breast abscess were evenly distributed between both groups in the current study. Voruganti MR et al. (2022) and Chandika AB et al. (2012) indicated that pre-existing risk factors do not significantly affect allocation of treatment modality. Likewise, breast side involvement and quadrant distribution showed no significant variation between groups. The upper outer quadrant was the most commonly involved site, consistent with observations by Voruganti MR et al. (2022) and Chandika AB et al. (2012). Loculation status and baseline continuous variables, including age, abscess size, duration of symptoms, haemoglobin, total leucocyte count, and blood sugar levels were also statistically comparable between groups, confirming well-matched study populations.[18,19]

A major procedural difference observed was the type of anaesthesia used. Most patients undergoing I&D required general anaesthesia, whereas all patients in the USG aspiration group were managed under local anaesthesia. Totadri VM et al. (2024) and Chandika AB et al. (2012) highlighted the minimally invasive nature of USG aspiration and its reduced procedural burden. Although repeat procedures were more common in the aspiration group, the difference was not statistically significant. Totadri VM et al. (2024) and Chandika AB et al. (2012) reported variable findings regarding recurrence and repeat interventions, indicating that multiple aspirations may occasionally be necessary in selected patients.[15,19]

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The study demonstrated significantly better early postoperative outcomes with USG aspiration. Residual abscess on day 3 was significantly lower in the aspiration group compared to I&D, indicating faster abscess resolution. Post-procedure pain was also significantly lower in the USG aspiration group, consistent with previous studies that reported lower pain scores and improved patient tolerance with minimally invasive treatment. Although complication rates such as surgical site infection and haematoma were slightly higher in the I&D group, the differences were not statistically significant. Totadri VM et al. (2024) and Dayal P and Lal M. (2019) also demonstrated fewer postoperative complications and better tolerance with aspiration.[15,19,20]

One of the most important findings of the present study was the significantly shorter hospital stay associated with USG aspiration. Patients treated with aspiration had earlier discharge and faster recovery compared to those undergoing incision and drainage. Recovery outcomes further favoured USG aspiration, with significantly shorter duration for wound healing and earlier return to routine activities. Comparable findings have been reported by Totadri VM et al. (2024), Ubaid M et al. (2023), and Baig A et al. (2024).[15,21,17]

Late clinical outcomes at two weeks, including residual lump, discharge, pain, and recurrence, were comparable between the two groups. This suggested that although USG aspiration provides superior early recovery, both modalities achieve similar long-term resolution. Breastfeeding outcomes, however, were significantly better in the aspiration group. A much higher proportion of lactating women resumed comfortable breastfeeding after USG aspiration compared to I&D. Totadri VM et al. (2024) and Kumar AK et al. (2023) supported the role of aspiration in preserving lactation and improving maternal satisfaction.[15,22]

Predictive analyses in the present study demonstrated that abscess size was the strongest predictor of residual abscess formation, with lesions larger than 3.5 cm associated with poorer outcomes. A previous history of breast abscess and diabetes mellitus showed moderate association with recurrence. Logistic regression analysis further demonstrated that USG aspiration significantly reduced the risk of residual abscess compared to I&D. These findings emphasized that treatment modality and abscess size are important determinants of clinical outcomes. Overall, the study supported the growing evidence that ultrasound-guided needle aspiration is an effective, minimally invasive, and patient-friendly alternative to conventional incision and drainage in the management of breast abscesses.[23,24]

CONCLUSION

Ultrasound-guided needle aspiration was found to be superior to incision and drainage in the management of breast abscess in women. It showed lower residual abscess rates, reduced pain, shorter hospital stay, faster recovery, and earlier return to routine activities. Lactating mothers treated with ultrasound-guided aspiration were more likely to resume comfortable breastfeeding. Recurrence rates between both procedures were comparable, indicating similar effectiveness in definitive treatment. Ultrasound-guided aspiration also demonstrated fewer complications and avoided the need for general anaesthesia. Larger abscess size and previous breast abscess history were identified as important predictors of residual abscess and recurrence.

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