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ORIGINAL ARTICLE

The effectiveness of needle aspiration versus traditional incision and drainage in the treatment of breast abscess: a meta-analysis

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ABSTRACT

Background: Breast abscess is a common and intractable clinical condition and the use of needle aspiration (NA) or incision and drainage (ID) in treatment is controversial. This meta-analysis aimed to systematically compare the clinical effectiveness of NA and ID in treating breast abscesses.

Methods: The Web of Science, ScienceDirect, PubMed, Cochrane Library, EMBASE, China National Knowledge Infrastructure, and Wanfang Data were searched for randomized controlled trials (RCTs) published from inception to January 7, 2022. The ROB-2 tool assessed risk of bias; the GRADE methodology rated certainty in outcomes; and Stata 16.0 performed data analyses.

Results: Nine RCTs were included, including 703 patients. The results showed there was no significant difference in cure rate between the two groups (relative risk [RR] = 0.96, 95% confidence interval [CI] [0.86, 1.07]; $p = .469$), and after subgroup analysis, we found that it was not related to the use of ultrasound guidance or not. There was no significant difference in the recurrence rate (RR = 0.68, 95% CI [0.35, 1.30]; $p = .241$). Furthermore, the NA group was associated with shorter healing time (weighted mean differences = −11.02, 95% CI [−15.14, −6.90]; $p < .001$), lower incidence of breast fistula (RR = 0.21, 95% CI [0.06, 0.72]; $p = .013$), lower interrupted breastfeeding rate (RR = 0.28, 95% CI [0.20, 0.39]; $p < .001$), and higher satisfaction rate of appearance (RR = 1.51, 95% CI [1.03–2.21]; $p = .035$).

Conclusion: NA has better advantages in terms of healing time, avoidance of breast fistula, continuous breastfeeding, and patient satisfaction. Although NA and ID have similar cure and recurrence rates, NA, with or without ultrasound guidance, could be used as a first-line treatment for breast abscesses. Patients with large volumes, multicompartmental abscesses, or those who have been ineffective against multiple NA, should be considered for ID.

KEY MESSAGES

- Breast abscess is a common and intractable clinical condition in general surgery.
- Compared with ID for breast abscesses, NA has better advantages in terms of healing time, avoidance of breast fistula, continuous breastfeeding, and patient satisfaction and could be used as a first-line treatment for breast abscesses.
- Patients with large volumes, multicompartmental abscesses, or those who have been ineffective against multiple NA, should be considered for ID.

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Breast abscess; needle aspiration; incision and drainage; meta-analysis

Introduction

Breast abscess refers to inflammation of the breast and is divided into puerperal and non-puerperal breast abscesses. A puerperal breast abscess is an acute inflammation of the breast caused by pregnancy or breastfeeding, which affects 0.4–11% of breastfeeding women [1]. A non-puerperal breast abscess is an inflammation of the breast in non-breastfeeding women. The two main causes of non-puerperal breast abscess are granulomatous lobular mastitis and periductal mastitis, both of which mainly affect young women.

The clinical features and outcomes of breast abscesses in puerperal and non-puerperal women are different, and each has a unique aetiology. Puerperal abscesses are caused by the progression of mastitis, or

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inflammation of the breast during lactation. Bacteria inserted through the terminal ducts of the nipple are given a lactoserum culture media by milk stagnation. *Staphylococcus aureus*, *S. epidermidis*, and *Streptococci* are the main organisms responsible [2]. The aetiology of non-puerperal breast abscesses is not well established, however, various mechanisms, including infection, autoimmunity, and hypersensitivity reactions, have been proposed [3–5].

The patient's clinical presentation includes fever, chills, and malaise and medical history are typically used to make the clinical diagnosis of puerperal mastitis or a breast abscess. Approximately 90% of non-puerperal breast abscesses are sub-areolar and present a chronic course. Zuska's disease is characterized by fistulas on the surface of the areola when it is advanced or chronic/recurrent [6].

Incision and drainage (ID) is an effective treatment for breast abscesses. Massive trauma, a long healing time, a high risk of breastfeeding interruption, potentially unsatisfactory postoperative scarring, and even breast deformation all have a negative impact on their quality of life [7,8]. In recent years, needle aspiration (NA) treatment has been widely used owing to its advantages of minimal trauma and minimal changes in breast appearance. Therefore, some trials suggest that patients with breast abscesses should be advised to undergo NA treatment as much as possible and, if conditions permit, ultrasound guidance is recommended [9–11]. However, a few studies have pointed out that cure rates range from 82% to 100% when using NA alone, and multilocular abscesses cause up to 50% of NA treatment failures ($p < .05$), and these patients require ID for further treatment [12–14].

The use of NA or ID in the treatment of breast abscesses is controversial and lacks a high level of evidence-based medical information. Several randomized controlled trials (RCTs) have demonstrated the advantages and disadvantages of these two treatment options in patients. However, the results of these RCTs have not yet been systematically investigated. The purpose of this meta-analysis was to compare the therapeutic effects of ID and NA in treating breast abscesses.

Materials and methods

Protocol and registration

The protocol of this meta-analysis was registered in PROSPERO (CRD42022294012). This study conducted a meta-analysis based on the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) [15].

Data sources and search strategy

A comprehensive search was conducted for relevant articles published from inception to January 7, 2022 from the following databases: (1) Web of Science; (2) ScienceDirect; (3) PubMed; (4) Cochrane Library; (5) EMBASE; (6) China National Knowledge Infrastructure (CNKI); and (7) Wanfang Data. The following key terms were used: 'breast abscess', 'mammary abscess' and 'randomized controlled trial'. Also, we carefully checked the reference lists of the retrieved articles to identify more relevant trials.

Eligibility criteria

Trials were included if the following criteria were met simultaneously: (1) RCTs with or without allocation concealment, regardless of language; (2) the study population consisted of patients with clinically confirmed puerperal breast abscess or non-puerperal breast abscess; (3) trials involving both NA and ID groups, besides basic treatment, were the same in both groups; (4) for the duplicate trials, the most recently published or largest sample size trials were incorporated; and (5) outcomes, including cure rate, healing time, recurrence rate, the incidence of breast fistula, interrupted breastfeeding rate, and satisfaction rate of appearance. Every trial that was included had at least one outcome. Case reports, reviews, commentary articles, abstracts, and systematic evaluations were excluded.

Data extraction

Two reviewers independently extracted information into a standardized form. For each study, we extracted the following: (1) study characteristics: first author, year of publication, study region, study design, sample size, and duration of follow-up; (2) participant details: mean age, whether the intervention was ultrasound-guided, diameter of the breast abscess, and lactation status; and (3) study outcomes: the primary outcome was the cure rate, and secondary outcomes were healing time, recurrence rate, the incidence of breast fistula, interrupted breast rate, and satisfaction rate of appearance. For this study, cure was defined as complete resolution of abscess and no need for any intervention, and healing time was considered to be the period to cure, defined by days. Appearance satisfaction is evaluated by patients.

In the case of missing data, the authors of the study were contacted. The extracted data were cross-checked by two reviewers.

Risk-of-bias assessment in individual trials

We used the Cochrane Risk of Bias (ROB)-2 tool independently and in duplicate assessments of the RCTs. The tool assesses the ROB in the following five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. We evaluated each area as 'low', 'some concern' or 'high' based on the information presented in each trial. The overall ROB for each trial was determined based on the highest risk in any domain. We assessed the certainty of the evidence for each outcome indicator using the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) approach [16]. To comply with the GRADE approach, we used terminology consistent with the overall certainty of the evidence. For high certainty of evidence, this involves using stronger language to describe the likelihood of the outcome occurring. For moderate, low, or very low certainty of evidence, this involves using less certain words like 'possible' or 'likely'.

Statistical analysis

Continuous outcomes were expressed as weighted mean differences (WMD) with 95% confidence intervals (CI). Relative risk (RR) and a 95% CI were used to express dichotomous outcomes. Meta-analysis was performed using Stata version 16.0 (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC), with a two-tailed $p < .05$ for statistical significance. The I^2 statistic was used to measure heterogeneity among trials, with I^2 describing the proportion of total variation attributable to inter-study heterogeneity, with I^2 >50% and $p < .1$, defined as significant heterogeneity [17,18]. In the presence of substantial heterogeneity (I^2 >50%), the random effects model was adopted as the pooling method; otherwise, the fixed effects model was used as the pooling method. In addition, if the heterogeneity of the primary outcome was large, a leave-one-out sensitivity analysis was performed by sequentially removing one trial at a time to assess individual trial effects on the overall pooled estimate. This analysis was performed to identify the source of heterogeneity. Publication bias was assessed using a funnel plot, and it was considered absent if the funnel plot was symmetrical. We planned to perform a subgroup analysis of the cure rate according to whether ultrasound guidance was used in the NA group.

Results

Selected trials

The results of the systematic literature search, in accordance with the PRISMA statement, are shown in Figure 1. The literature search identified 1123 articles based on the search terms. Based on the criteria described earlier, nine articles involving 703 patients (354 in the NA group and 349 in the ID group) were eligible for inclusion in this meta-analysis [1,19–26]. All nine trials were conducted in developing countries. The patients in seven trials [1,19,22–26] were puerperal women, and the remaining two trials [20,21] included both puerperal and non-puerperal patients. Ultrasound guidance was used in the NA group in six trials [19–23,25]. Four included trials [1,19,20,23] mentioned the analysis of pathogens causing breast abscesses and found that the predominant pathogen was *Staphylococcus aureus*. In eight trials [1,19–23,25,26] patients were simultaneously treated with antibiotics. The basic characteristics of the included studies are presented in Table 1.

Quality assessment

The ROB-2 tool was used to assess the risk of literature bias in the included trials. Three trials were judged as low risk, and the other six trials were judged as having some concerns. This was mostly because of the non-standard randomization of the allocation process and the reporting of the results.

Five trials [1,19,20,22,24] only mentioned that random grouping was performed, but did not describe whether a random allocation sequence was used for grouping and whether the allocation sequence was hidden before grouping.

Four of the included studies [19,22,24,26] did not indicate whether the outcome data generated by the study were obtained from analyses conducted according to a predetermined analysis plan. Although the surgical management of breast abscesses cannot be blinded, none of the trials were at risk of deviations from the intended interventions. Items assessed for each study are shown in Figure 2.

Table 2 shows the certainty of the evidence for the pooled outcomes evaluated using the GRADE approach.

Primary outcome

Cure rate

The cure rate was the primary outcome of this meta-analysis; eight trials were included in the analysis, with

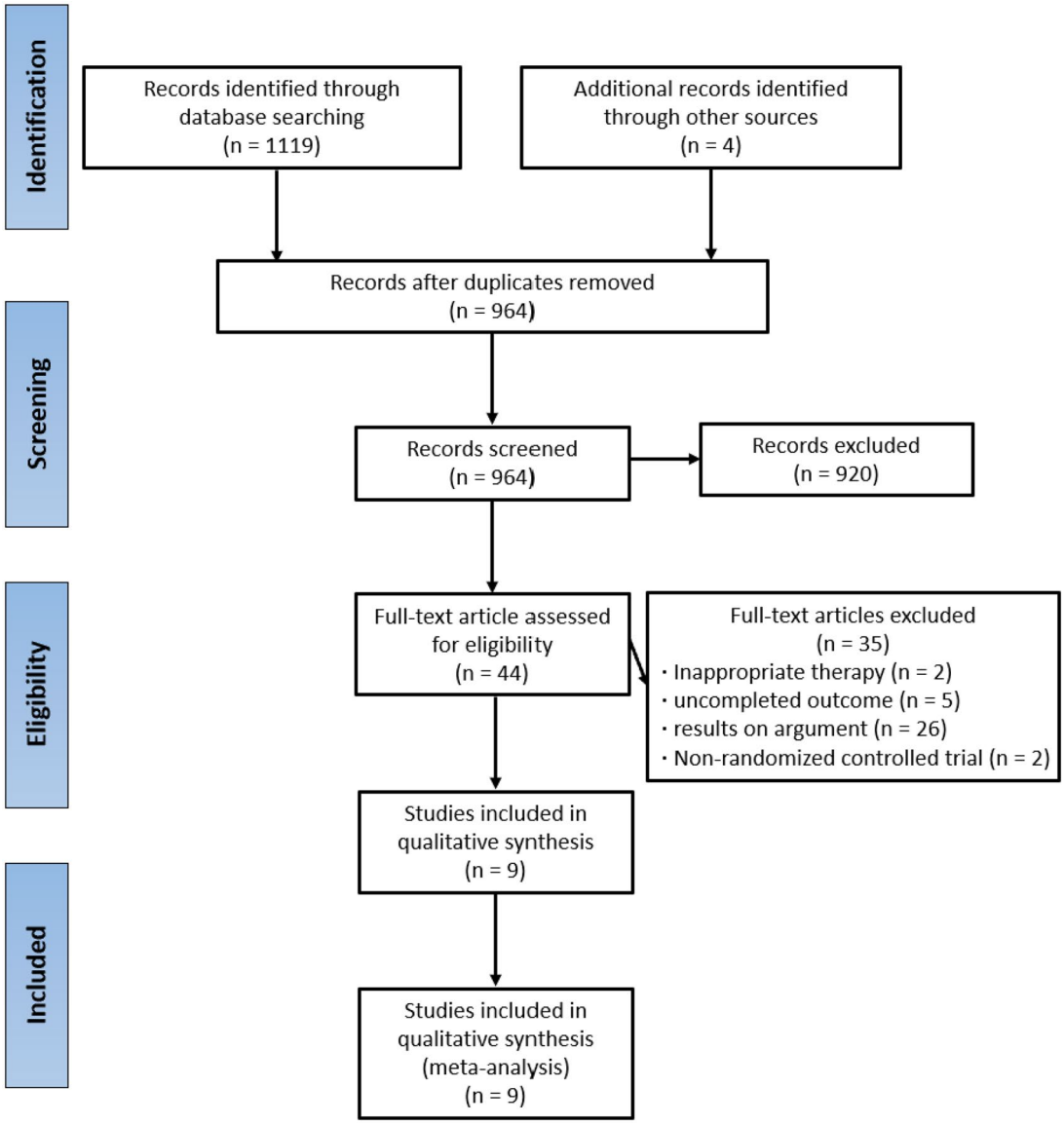

Figure 1. The PRISMA flow chart showing the selection of articles for review.

a total of 609 patients, of which six trials [19–23,25] had ultrasound guidance in the NA group. The pooled results revealed that there was no significant difference between the two groups (eight trials, 609 patients; RR = 0.96, 95% CI [0.86, 1.07]; $p = .469$) (Figure 3), with high heterogeneity (I^2 = 72.9%, $p = .001$). Subgroup analysis showed no significant differences in cure rate between the two groups according to therapy in the NA group with or without ultrasound guidance (with ultrasound guidance: six trials, 511 patients, RR = 1.02, 95% CI [0.89, 1.16]; without ultrasound guidance: two trials, 98 patients, RR = 0.74, 95% CI [0.48, 1.17]. Based on the GRADE assessment, the level of evidence provided for this outcome was low (Table 2).

Secondary outcomes

Healing time

Data on healing time were available for seven included trials [1,19–22,25,26], and we excluded patients who had treatment failure when calculating this outcome indicator. The results showed significant statistical heterogeneity (I^2 = 97.2%, $p = .001$), and a pooled WMD indicated that the healing time of the NA group was significantly shorter than that of the ID group (seven

Table 1. Characteristics of the included trials.

Included studies	Country	Study design	No. of patients		Mean age (years)	Follow up (months)	Ultrasound-guided needle aspiration	Diameter of breast abscess (cm)	Lactation status	Predominant pathogen	Outcomes
			NA	ID							
Eryilmaz et al. [1]	Turkey	RCT	22	23	25.0	N.R.	No	6.3[h]	Lactation	*S. aureus*	a, b, c, f
Saleem et al. [19]	Pakistan	RCT	30	30	30.0	2	Yes	5.5[h]	Lactation	*S. aureus*	a, b, c, d, e, f
Naeem et al. [20]	Pakistan	RCT	32	32	28.4	2	Yes	Max<5[i]	Both[j]	*S. aureus*	a, b
Chandika et al. [21]	Uganda	RCT	33	32	23.1	1	Yes	Max ≤ 5[i]	Both[j]	N.R.	a, b, c
Suthar et al. [22]	India	RCT	35	35	N.R.[g]	N.R.	Yes	5.0[h]	Lactation	N.R.	a, b, c, d, e, f
Saharan et al. [23]	India	RCT	25	25	24.8	1	Yes	3.0[h]	Lactation	*S. aureus*	a, c, d
Hussain et al. [24]	Pakistan	RCT	45	45	28.0	N.R.	No	Max ≤ 3[i]	Lactation	N.R.	e
Shi et al. [25]	China	RCT	103	103	26.3	3	Yes	7.9[h]	Lactation	N.R.	a, b, c, d, e
Liu et al. [26]	China	RCT	29	24	29.9	3	No	4.6[h]	Lactation	N.R.	a, b, c, d, f

[a] Cure rate; [b] Healing time; [c] Recurrence rate; [d] The incidence of breast fistula; [e] Interrupted breastfeeding rate; [f] Satisfaction rate of appearance; [g] Age range was between 16 and 38 years with peak age groups between 24 and 30 years; [h] Mean diameter of breast abscesses in all patients; [i] Max diameter of breast abscesses in both groups; [j] Including lactation and non-lactation.
NA: needle aspiration; ID: incision and drainage; RCT: randomized controlled trial; N.R.: not reported.

trials, 436 patients; WMD = −11.02, 95% CI [−15.14, −6.90]; $p < .001$) (Figure 4). Based on the GRADE assessment, the level of evidence provided for this outcome was low (Table 2).

Recurrence rate

The recurrence rate of breast abscess is equally noteworthy, with seven trials [1,19,21–23,25,26] available to extract data on the recurrence rate. Pooled results indicated that there was no significant difference between the two groups (seven trials, 434 patients; RR = 0.68, 95% CI [0.35, 1.30]; $p = .241$), with no evidence of significant statistical heterogeneity (I^2 = 37.1%, $p = .146$) (Figure 5). Based on the GRADE assessment, the level of evidence provided for this outcome was low (Table 2).

Incidence of breast fistula

Breast fistula was the most frequently reported complication of breast abscess, especially in puerperal patients, and the incidence of breast fistula was extracted from five included trials [19,22,23,25,26]. All patients included in these studies were puerperal abscesses and heterogeneity between the included trials was low (I^2 = 0%, $p = .994$). Pooled results showed that the incidence of breast fistula was significantly lower in the NA group than in the ID group (five trials, 435 patients; RR = 0.21, 95% CI [0.06, 0.72]; $p = .013$) (Figure 6). Based on the GRADE assessment, the level of evidence provided for this outcome was low (Table 2).

Interrupted breastfeeding rate

Four included trials [19,22,24,25] were available to extract relevant data on the interrupted breastfeeding rate. The results showed that the interrupted breastfeeding rate in the NA group was significantly lower than that in the ID group (four trials, 426 patients; RR = 0.28, 95% CI [0.20, 0.39]; $p < .001$) (Figure 7). The heterogeneity between trial estimates was low (I^2 = 0%, $p = .552$). Based on the GRADE assessment, the level of evidence provided for this outcome was low (Table 2).

Satisfaction rate of appearance

Four of the included trials [1,19,22,26] provided data on the satisfaction rate of appearance. The results showed that the satisfaction rate of appearance was significantly higher in the NA group than in the ID group (four trials, 208 patients; RR = 1.51, 95% CI [1.03, 2.21]; $p = .035$), with significant statistical heterogeneity

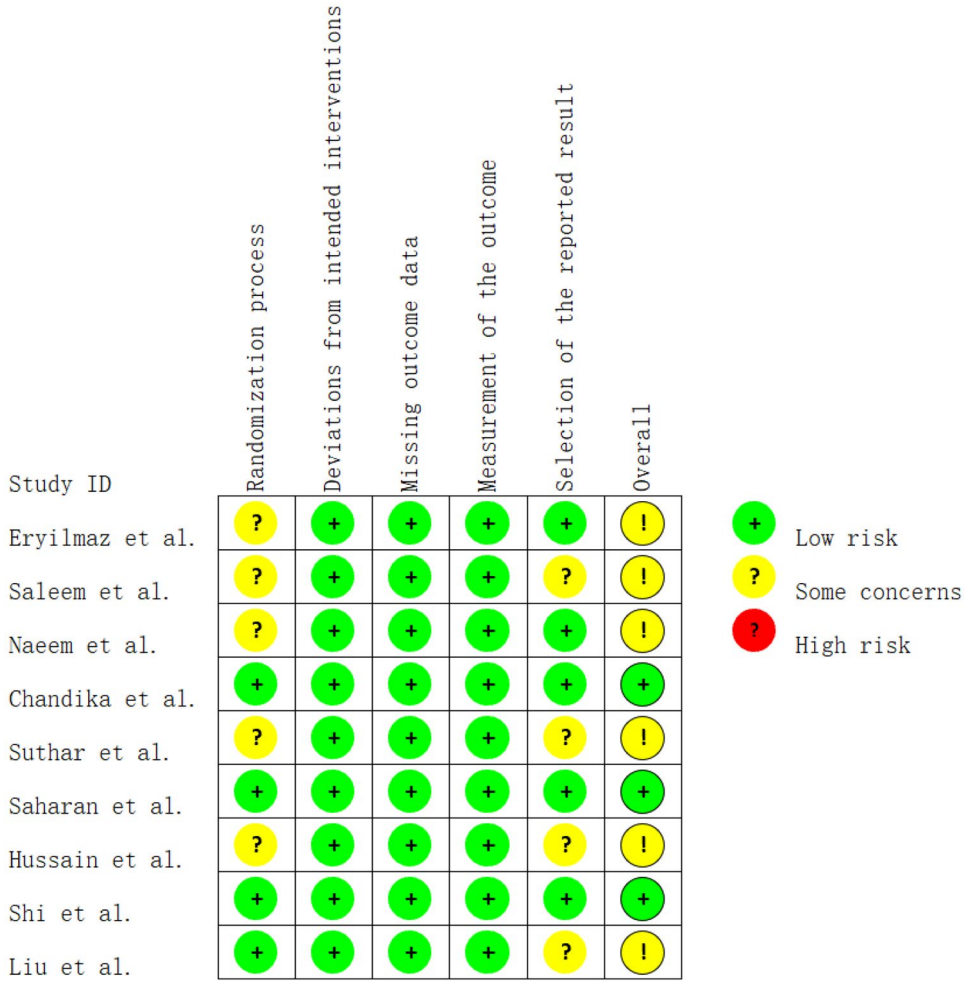

Figure 2. Risk of bias assessment according to review authors' judgements.

(I^2 = 90.4%, $p < .001$) (Figure 8). Based on the GRADE assessment, the level of evidence provided for this outcome was very low (Table 2).

Sensitivity analysis

Because analysis of the pooled primary outcome revealed high heterogeneity in the included trials, we used sensitivity analysis to analyse the sources of heterogeneity. The results showed that the primary outcome was based on eight trials, excluding one trial, and none of the remaining seven trials were statistically significant. This suggests that the pooled estimates were not based on any single trial and confirms the robustness of the findings (Figure 9).

Publication bias

Through analysis of the funnel plot, we found no significant publication bias for the primary outcome (Figure 10).

Discussion

Breast abscess is a common clinical condition in general surgery. It most commonly occurs in women of childbearing age, especially primiparous women. The incidence of breast abscess is estimated to be as high as 11% in puerperal mastitis [27–30]. Every year, the incidence of non-puerperal breast abscesses is increasing. However, there are relatively few studies on the subject, its aetiology is not well established, and the disease is often regarded as idiopathic.

The standard treatment for treating breast abscesses has been surgical ID performed under general anaesthesia. In the medical literature, various surgical treatments for breast abscesses have been reported. These include an incision, draining, and either closing the abscess cavity or leaving the wound open for drainage [31]. There are currently no RCTs that compare various surgical methods for breast abscess drainage. Postoperative complications are inevitable and include delayed incision healing, poor cosmetic outcomes,

Table 2. Summary of findings for the main comparison.

Certainty assessment							No. of patients		Effect		
No. of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Needle aspiration	incision and drainage	Relative (95% CI)	Absolute (95% CI)	Certainty
Cure rate											
8	Randomized trials	Serious[a]	Serious[b]	Not serious[c]	Not serious	None	245/307 (79.8%)	240/302 (79.5%)	RR 0.96 (0.86–1.07)	32 fewer per 1,000 (from 111 fewer to 56 more)	⊕⊕◯◯ Low
Healing time											
7	Randomized trials	Serious[d]	Serious[b]	Not serious[c]	Not serious	None	221	215	–	MD 11.02 lower (15.14 lower to 6.9 lower)	⊕⊕◯◯ Low
Recurrence rate											
7	Randomized trials	Serious[e]	Not serious	Not serious[c]	Serious[f]	None	11/217 (5.1%)	16/217 (7.4%)	RR 0.68 (0.35–1.30)	24 fewer per 1,000 (from 48 fewer to 22 more)	⊕⊕◯◯ Low
The incidence of breast fistula											
5	Randomized trials	Serious[g]	Not serious	Not serious[c]	Serious[f]	None	1/218 (0.5%)	12/217 (5.5%)	RR 0.21 (0.06–0.72)	44 fewer per 1,000 (from 52 fewer to 15 fewer)	⊕⊕◯◯ Low
Interrupted breastfeeding rate											
4	Randomized trials	Serious[h]	Not serious	Not serious[c]	Serious[f]	None	33/213 (15.5%)	119/213 (55.9%)	RR 0.28 (0.20–0.39)	402 fewer per 1,000 (from 447 fewer to 341 fewer)	⊕⊕◯◯ Low
Satisfaction rate of appearance											
4	Randomized trials	Serious[i]	Serious[b]	Not serious[c]	Serious[f]	None	96/96 (100.0%)	76/112 (67.9%)	RR 1.51 (1.03–2.21)	346 more per 1,000 (from 20 more to 821 more)	⊕◯◯◯ Very low

CI: confidence interval; MD: mean difference; RR: risk ratio.
[a]Of the eight included studies, five studies have some concerns (Eryilmaz et al. [1], Saleem et al. [19], Naeem et al. [20], Suthar et al. [22], Liu et al. [26]).
[b]The I^2 value was relatively large ($I^2 > 50\%$) and the p value was relatively small ($p < .1$). The heterogeneity was still relatively large after the subgroup analysis, which may be related to the diameter of the abscess.
[c]Direct comparison.
[d]Of the seven included studies, five studies have some concerns (Eryilmaz et al. [1], Saleem et al. [19], Naeem et al. [20], Suthar et al. [22], Liu et al. [26]).
[e]Of the seven included studies, four studies have some concerns (Eryilmaz et al. [1], Saleem et al. [19], Suthar et al. [22], Liu et al. [26]).
[f]Too few events occurred in this indicator (number of events <300).
[g]Of the five included studies, three studies have some concerns (Saleem et al. [19], Suthar et al. [22], Liu et al. [26]).
[h]Of the four included studies, three studies have some concerns (Saleem et al. [19], Suthar et al. [22], Hussain et al. [24]).
[i]All four of the included studies have some concerns (Eryilmaz et al. [1], Saleem et al. [19], Suthar et al. [22], Liu et al. [26]).

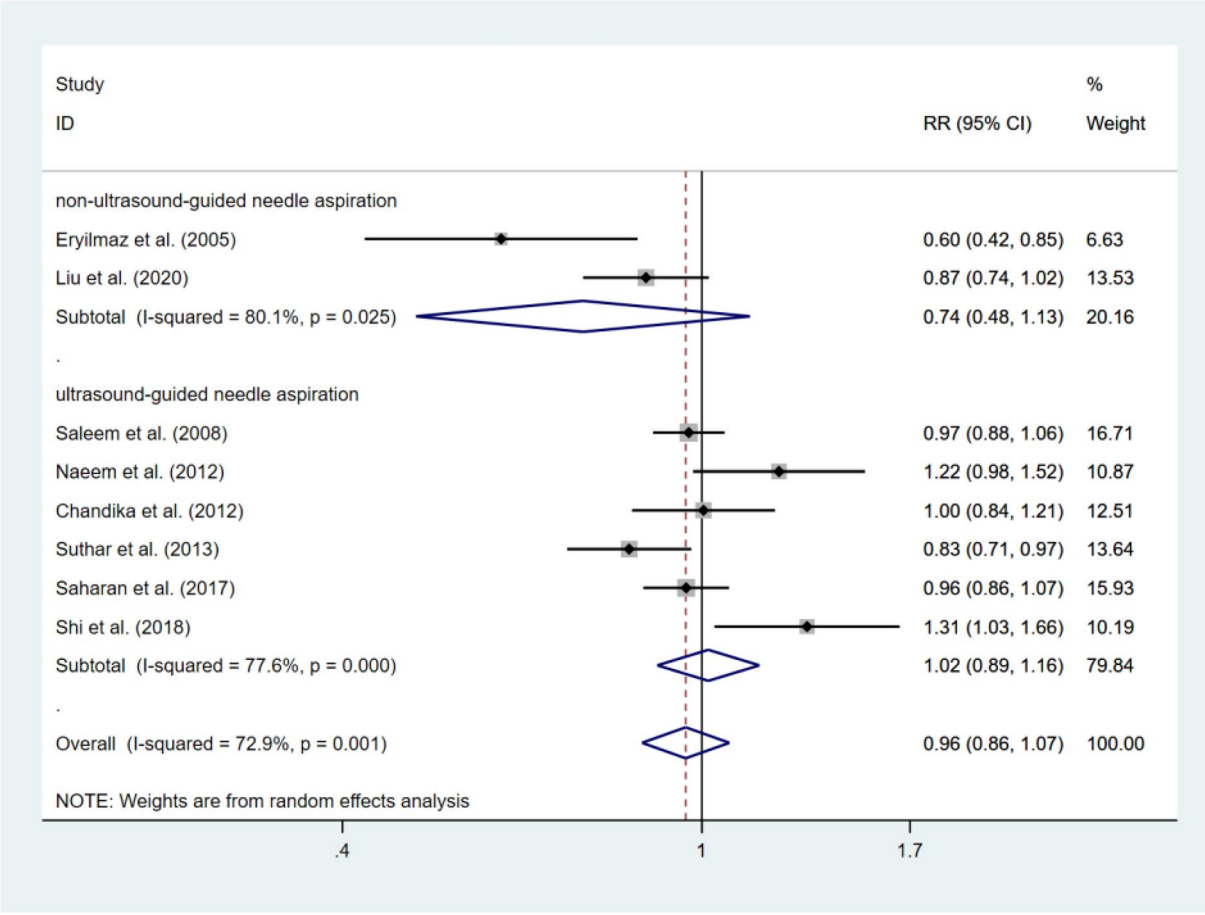

Figure 3. Forest plots comparing the cure rates of the NA and ID groups. RR: relative risk; CI: confidence interval; NA: needle aspiration; ID: incision and drainage.

breast fistula formation, nipple retraction, skin flap necrosis, haematoma, persistent infection, and pain.

With the continuous advancement in the concept of minimally invasive treatment in surgery and in the treatment tools, studies on the minimally invasive treatment of breast abscess through NA or the insertion of a fine drainage tube have been carried out in recent years. In the literature, cure rates from uncontrolled trials using NA alone have reported cure rates ranging from 82% to 100% [13]. An RCT study comparing the cure rates of ID and NA without ultrasound guidance for puerperal breast abscesses found that ID had a considerably higher cure rate (100%) than NA (59%) [1]. Another RCT comparing ultrasound-guided NA with ID for abscesses <5 cm was published in 2011 by Naeem, and it discovered that while both groups had similar cure rates, NA would be less expensive for patients [20]. However, these trials were small and could not clarify consistency in the surgical treatment approach of these studies; therefore, the evidence may not be sufficient. In our meta-analysis, we included eight studies, including 609 patients, and the pooled results revealed a similar cure rate between the ID and NA groups.

Complete remission may require multiple aspirations (range 1–5) within a certain period of time. Multilocular abscesses, abscesses >5 cm, and persistent symptoms are risk factors for NA failure. Ultrasound is a useful diagnostic tool for an initial assessment. As ultrasound equipment becomes more widely available, studies on the use of ultrasound-guided minimally invasive treatment of abscesses have been published, with success rates as high as 91% [12,32]. According to the findings of two non-RCT trials, breast abscesses <3 cm in diameter are extremely likely to heal with just one aspiration, whereas larger breast abscesses are more likely to need further ID therapy even after receiving NA [32,33]. The subgroup analysis of this meta-analysis showed similar cure rates for NA and ID, with or without ultrasound guidance. But due to limited data, we were unable to perform a stratified analysis based on abscess size.

Intervention with antibiotics is an important factor affecting the outcome of abscess treatment, including

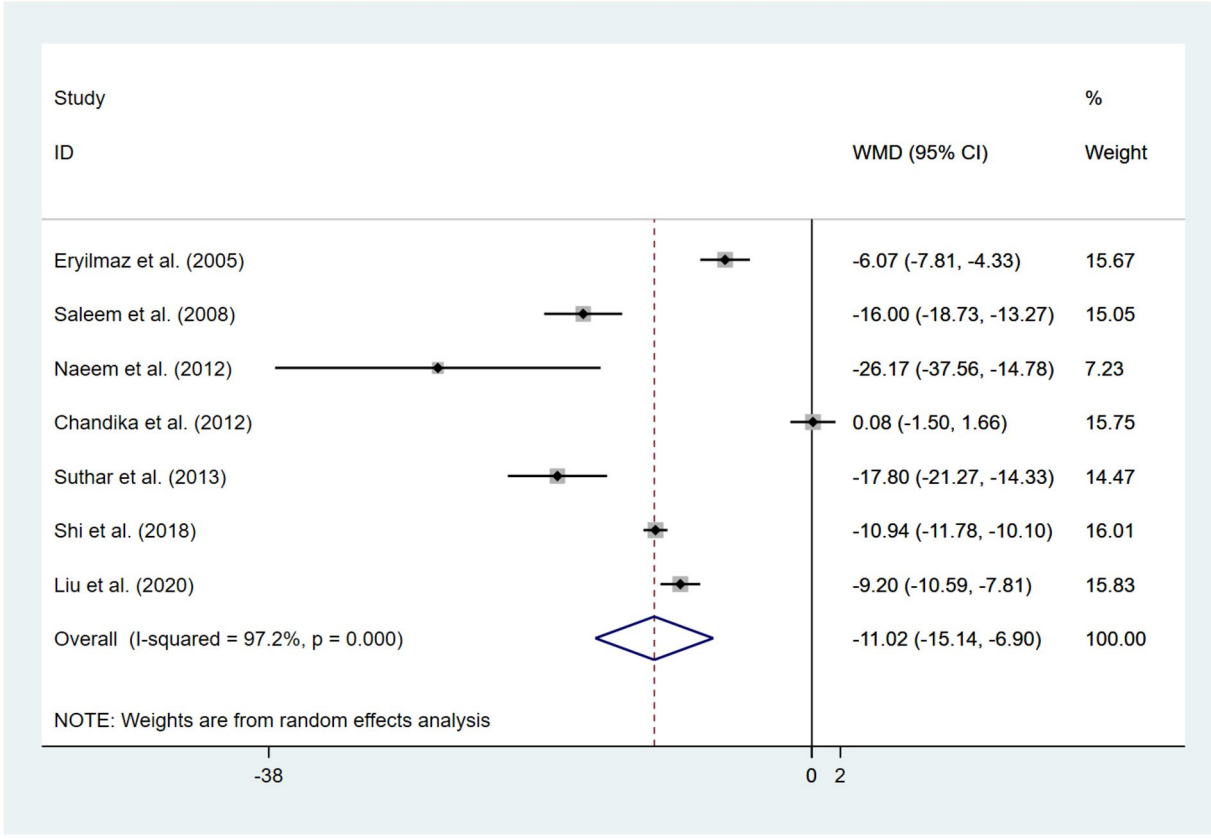

Figure 4. Forest plots comparing the healing times of the NA and ID groups. WMD: weighted mean differences; CI: confidence interval; NA: needle aspiration; ID: incision and drainage.

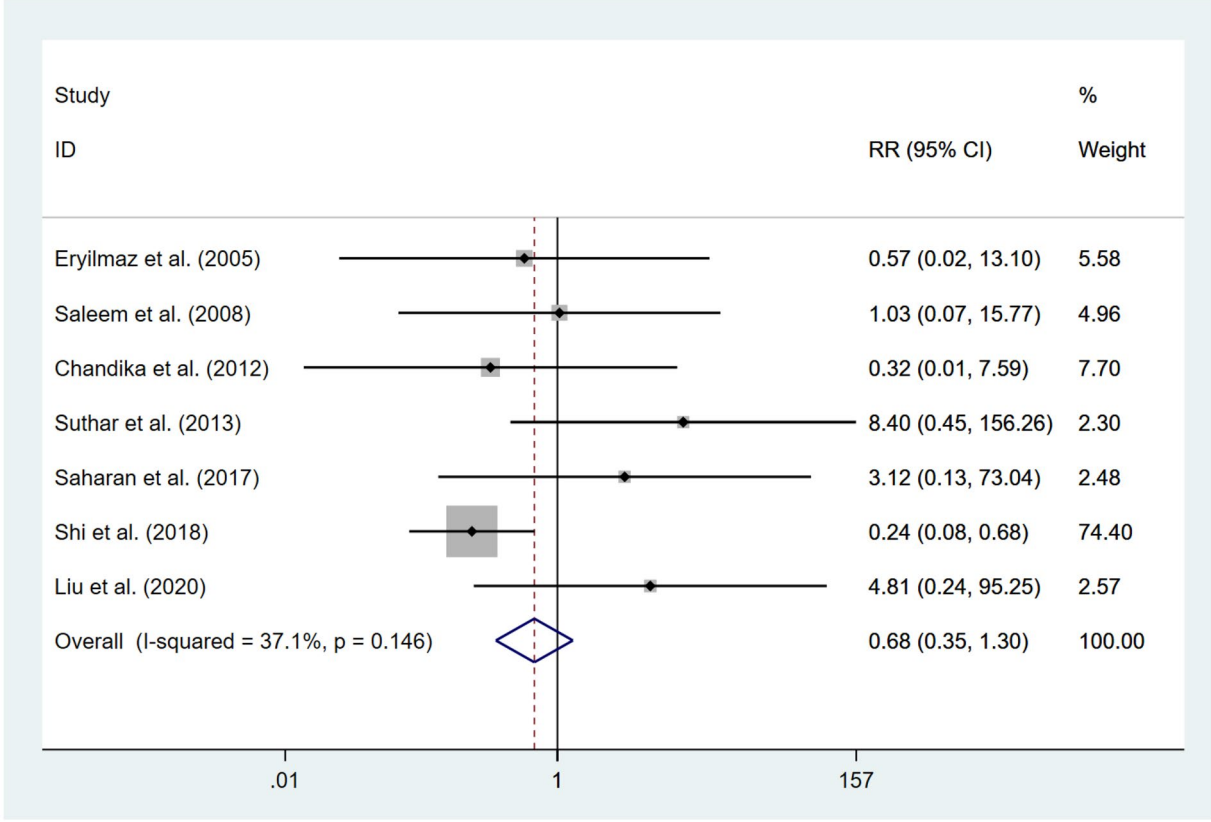

Figure 5. Forest plots comparing the recurrence rates of NA and ID groups. RR: relative risk; CI: confidence interval; NA: needle aspiration; ID: incision and drainage.

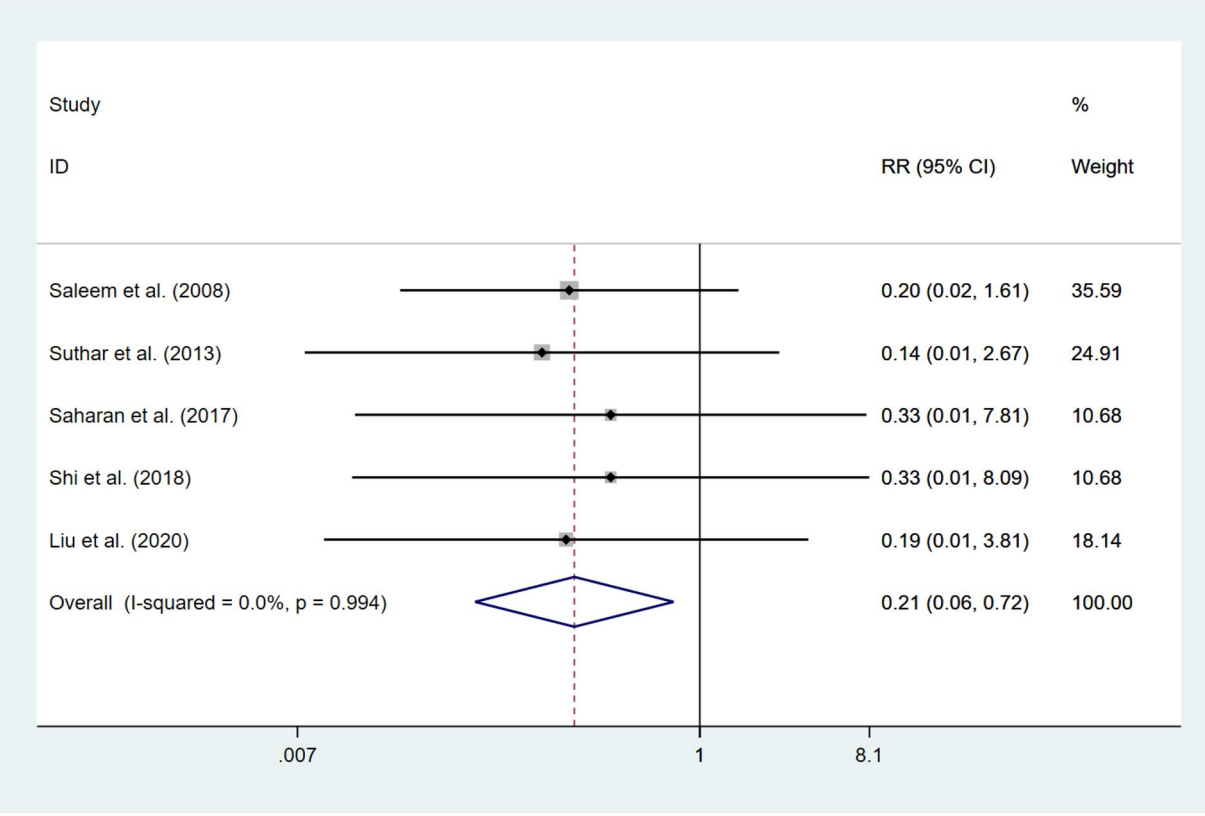

Figure 6. Forest plots comparing the incidences of breast fistula of the NA and ID groups. RR: relative risk; CI: confidence interval; NA: needle aspiration; ID: incision and drainage.

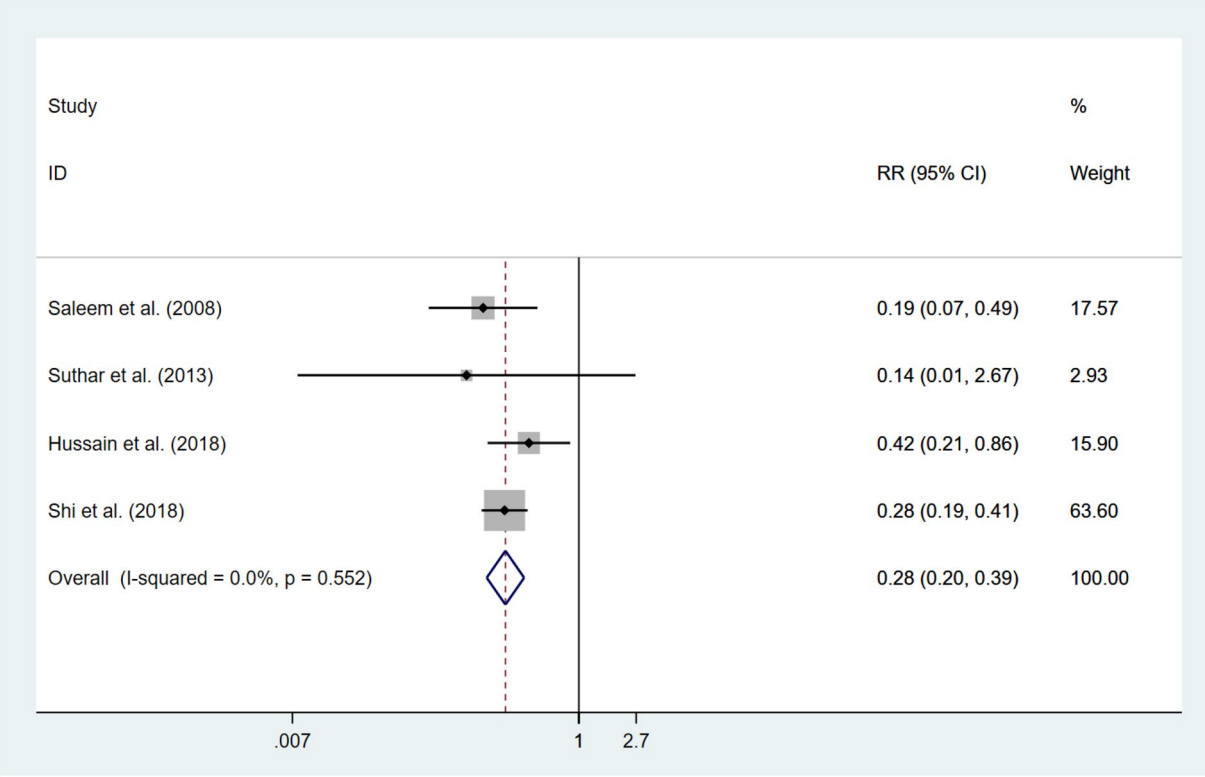

Figure 7. Forest plots comparing the interrupted breastfeeding rates of the NA and ID groups. RR: relative risk; CI: confidence interval; NA: needle aspiration; ID: incision and drainage.

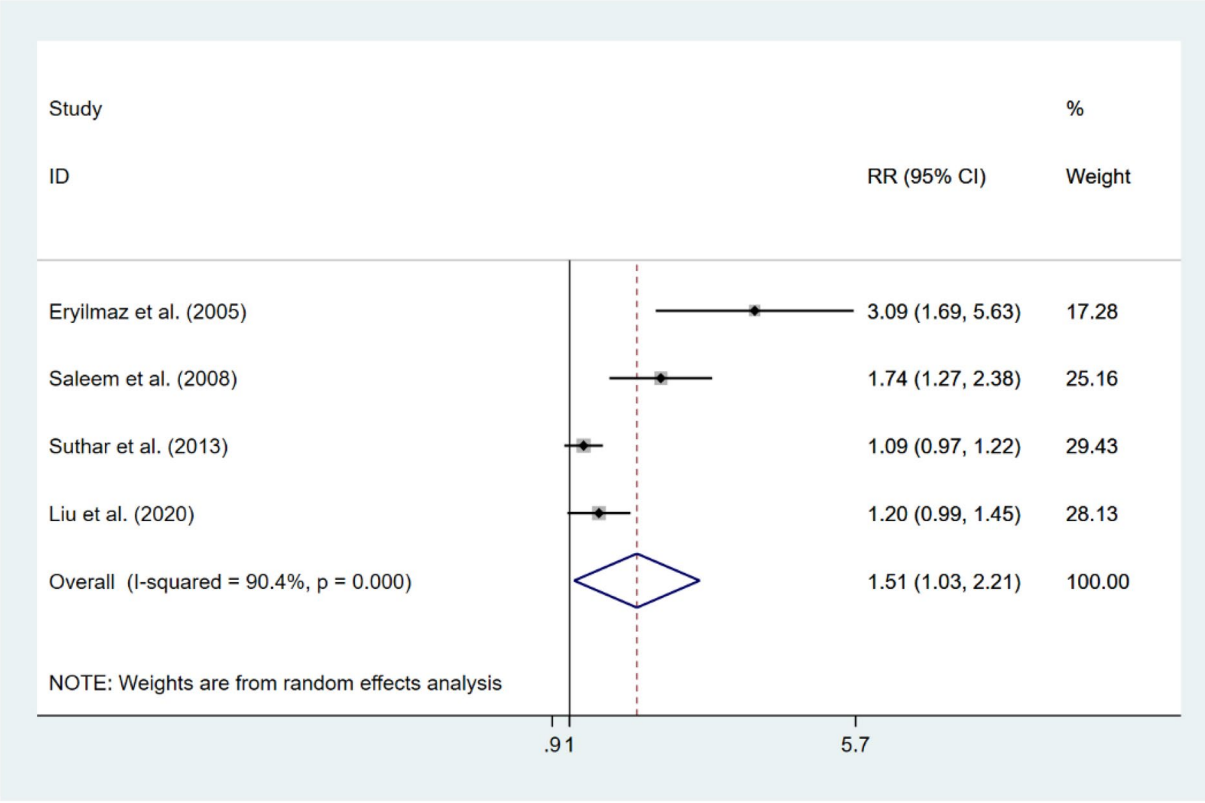

Figure 8. Forest plots comparing the satisfaction rate of appearances of the NA and ID groups. RR: relative risk; CI: confidence interval; NA: needle aspiration; ID: incision and drainage.

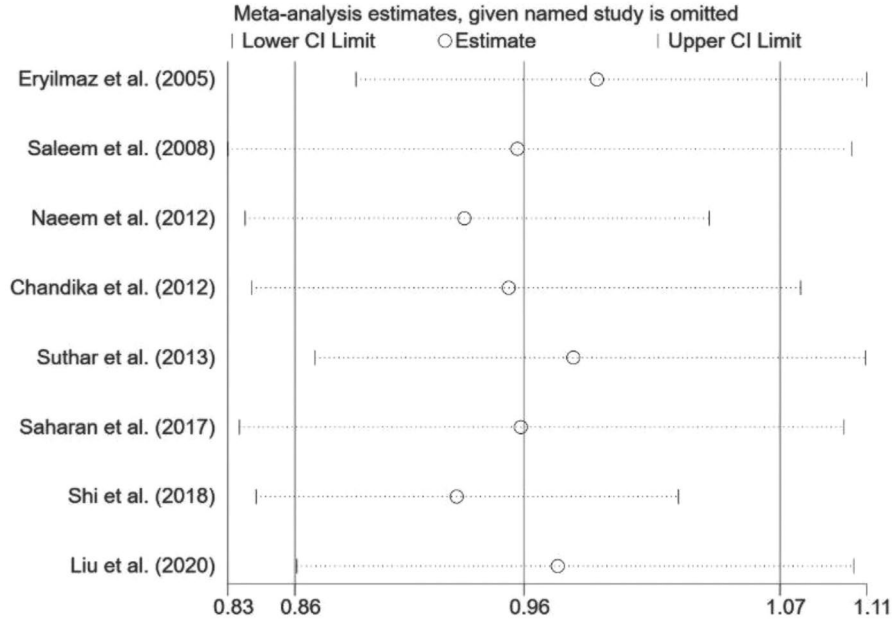

Figure 9. The sensitivity analysis of the cure rate.

cloxacillin, clindamycin, co-amoxiclav, and erythromycin have been usually utilized for breast abscess treatment. However, Singla et al. [34] compared different antibiotic regimens with those without antibiotics in patients with ID, and found that treatment failure rates were similar between the groups with low-quality evidence. In our included studies, all patients were prescribed antibiotics following either a NA or ID, except

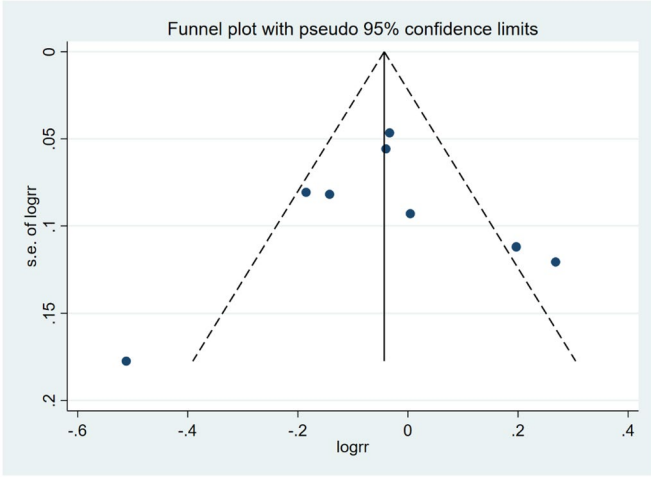

Figure 10. The results of the funnel plot for the primary outcome.

in one study that reported no information on anti-infective treatment, therefor we have insufficient evidence to determine whether antibiotics should be routinely added for patients with breast abscess.

The objectives of treating breast abscess are to drain the abscess completely, reduce pain and discomfort, and enable the patient to continue breastfeeding. With improved standards of living, the demand for maintaining breast integrity is also increasing. According to an RCT published by Naeem, ID required a mean healing period of 45 days while NA only required 20 days, a 25-day difference [20]. Similar to this, our meta-analysis found that the healing time was significantly shorter with NA than with ID, but excluded patients who failed treatment, which may bias the results and reduce the quality of the evidence. Eryilmaz et al. stated that in the ID group, 70% of the patients were dissatisfied with the cosmetic results [1]. Four included trials reported satisfaction outcomes, but none of them used standardized scales, very low evidence suggests that the majority of women indicated satisfaction with the appearance after NA therapy. Even if the causative agent is *S. aureus*, several studies have demonstrated that infants can continue to feed from affected breasts [35]. The meta-analysis found that NA treatment of puerperal breast abscesses is more conducive to continued breastfeeding than ID treatment. Mammary fistula is a chronic condition caused by the rupture of an abscess in which more radical surgical treatment, even mastectomy, is required [36]. This meta-analysis analysed the incidence of breast fistulae in the puerperal abscess and found that it was significantly lower in the NA group than in the ID group, evidence of non-puerperal breast abscesses warrants further validation.

The limitations of our study are as follows: (1) We were not able to analyse non-puerperal breast abscesses separately because the majority of the included studies were from patients with puerperal mastitis. (2) Although all included were RCTs, six trials had a literature quality rating of 'some concern' and the quality of evidence for all outcome indicators was low, explaining to some extent the instability of our results. Therefore, these results should be cautiously interpreted. (3) It was difficult to implement blinding and assign concealment because this study belongs to the surgical field. (4) This meta-analysis did not include outcome indicators in the cost-effectiveness analysis.

Conclusion

Percutaneous drainage performed with or without ultrasound guidance should be the first-line treatment for breast abscesses. This approach has shown advantages over ID in terms of healing time, avoidance of breast fistulas, continued breastfeeding, and patient satisfaction. A surgical ID is required if needle drainage is unsuccessful. In addition, surgical ID should be considered the first-line treatment for large (>5 cm), multiple, or prolonged abscesses.

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Data availability statement

The data sets in the study are presented in the article or supplementary material, and further information can be directed to the authors.

Author contributions

Fei Zhou: conceptualization; data curation; writing – original draft. Zhaohui Li: writing – original draft; methodology; visualization. Liyuan Liu: methodology; software. Fei Wang: data curation; investigation. Lixiang Yu: project administration; investigation. Yujuan Xiang: writing – review and editing; software. Chao Zheng: data curation; methodology. Shuya Huang: writing – review and editing; formal analysis. Zhigang Yu: validation; project administration; supervision.

Disclosure statement

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