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Ahmed Abd-Elrahman El-Shaboury

*Department of Plastic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt,*  
ahmedelshaboury621@gmail.com

Mohammed Ibrahim Zidan

*Department of Plastic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt*

Al-Sayed Hussein El-Sharkawy

*Department of Plastic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt*

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## META ANALYSIS

# Inferior Pedicle Breast Reduction in Egyptian Research: A meta-Analysis Study

Ahmed Abd El-Rahman Elshaboury\*,  
Mohamed Ibrahim Zidan, Al-Sayed Hussein El-Sharkawy

Department of Plastic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

### Abstract

**Background:** Macromastia or breast hypertrophy is a common problem in the general female population, leading to debilitating symptoms and poor quality of life. Breast reduction surgery relieves disabling symptoms with great satisfaction, even though postoperative complications regularly occur.

**Objective:** The present study aimed to examine the inferior pedicle technique's reliability, safety, and effectiveness in breast reduction for Egyptian female patients with macromastia.

**Patients and methods:** The authors performed a systematic literature search on MEDLINE, Scopus, and Google Scholar for prospective and retrospective studies evaluating the inferior pedicle technique for breast reduction in Egypt.

**Results:** A total of 431 patients from 14 articles were included in our systematic review and meta-analysis. The group that received inferior pedicle reduction mammoplasty had a higher likelihood of improvement than other techniques (risk ratio = 1.2) even though this relative superiority was not statistically significant ( $P = 0.5$ ). The overall prevalence of postoperative complications was 10% [95% confidence interval (CI): 7–15%]. The lowest reported problem was nipple necrosis, as seen in 4% (95% CI: 1–12%), whereas the most described complication was hypertrophic scars, as seen in 33% (95% CI: 17–62%). However, the rate of patient satisfaction was considerably significant in 94% (95% CI: 90–98%).

**Conclusion:** Current evidence affirms the safety, reliability, and comparative efficacy of the inferior pedicle reduction mammoplasty for patients with macromastia. The study highlighted the need for more robust postoperative follow-ups. It recommended a future investigation on revision mammoplasty rates and the long-term functional outcomes in younger and older populations.

**Keywords:** Breast reduction, Egypt, Inferior pedicle, Mammoplasty, Meta-analysis

## 1. Introduction

Macromastia or breast hypertrophy is a frequent problem in the general female population, leading to disabling symptoms and poor quality of life.<sup>1</sup>

The clinical symptoms reported by patients include chronic head, neck, back, and shoulder pain; inframammary eczema; shoulder grooving; shortness of breath; and low self-esteem owing to unattractive appearance.<sup>2</sup>

Likewise, they encounter psychosocial burdens owing to challenges in performing activities, finding proper clothes, and sustaining their self-image.<sup>3</sup>

Although the definite pathophysiology is still elusive, the condition is generally believed to result from an aberrant estrogen response.<sup>4,5</sup>

The perception of breast enlargement as a morbid disorder has progressed in recent years mainly owing to medical care accessibility, patients' self-awareness, and clinicians' assent to cosmetic procedures.

For instance, thousands of reduction surgeries are performed worldwide, with more than a hundred procedures outlined in the literature.<sup>5</sup>

Reduction surgery effectively relieves disabling symptoms with great satisfaction, even though postoperative complications regularly occur.<sup>6</sup>

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\* Corresponding author at: Department of Plastic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.  
E-mail address: [ahmedelshaboury621@gmail.com](mailto:ahmedelshaboury621@gmail.com) (A.A. El-Rahman Elshaboury).

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Historically, the early de-epithelialized nipple–areolar pedicle method appeared in 1912; the parenchymal pedicle method emerged in 1928, involving broad undermining of cutaneous flaps and wide resection of adjacent quadrants. Although this technique exhibited a high incidence of nipple–areola necrosis, it prevailed as the most convenient reduction method for nearly 30 years.<sup>7</sup>

In general, the literature describes five different approaches, namely, circumcision, amputation, simple grafting, wedge resection, and flaps.<sup>8</sup>

Recently, Cheng and colleagues introduced the top hat principle in which a crescent-shaped skin incision is placed below the new nipple. The parenchymal tissue is trimmed to lessen height and width, and the subcutaneous flaps are sutured locally with base imbrication.<sup>9</sup>

Likewise, this oblique procedure of Dufourmentel and Mouly transformed into an inverted-T. At the same time, the glandular resection is employed in a keel fashion under the areola to create room for long flaps without excessive compression on the underlying circulation.<sup>10</sup>

In 1956, R.J. Wise introduced the keyhole pattern and highlighted the significance of preoperative markings by using brassiere trims to elaborate his incisions. The Wise pattern became the fundamental design for most breast reduction procedures and even proposed variants and modifications to produce a shorter scar.<sup>7</sup>

All reduction methods generally involve a pedicle design to relocate the nipple–areola complex and a resection pattern for parenchyma and skin.<sup>11</sup>

In Egypt and North America, the classic inverted-T inferior pedicle method with Wise pattern cutaneous markings remains the most common technique.<sup>12</sup> In this technique, the desired breast meridian is outlined based on the ideal position of the nipple and areola, irrespective of their actual location.<sup>13</sup>

Medial markings are drawn as symmetrical as possible between both breasts, whereas lateral markings can help balance the degree of lateral parenchymal excision in the highly asymmetric breast.<sup>11</sup>

The new position of the nipple is determined by tracing a horizontal line over the inframammary crease and then marking the breast mound at the breast meridian's boundary. Eventually, in relation to the patient's height, the superior border of the areola is drawn nearly an inch over this marking.<sup>13</sup>

Currently, inferior pedicle techniques are the most conveniently used, for they offer reproducibly favorable outcomes with a low rate of complications.<sup>14</sup>

However, the most critical drawback of this technique is the shortage of superior pole fullness that is better achieved with the superior pedicle method.<sup>13</sup>

Even though patients undergoing reduction surgery are usually young and healthful, postoperative complications are frequent, ranging from 14 to 53% in the literature.<sup>15,16</sup>

Moreover, there are concerns about the potential impairment of nipple sensibility and breastfeeding.<sup>14</sup>

Unfortunately, all these critical questions received no adequate answers in the current published studies. Likewise, the surgeons' decision to choose a particular technique seems subjective owing to a lack of objective evidence to rely on it.<sup>11</sup>

In addition, the mainstay of research effort in the reduction surgeries has concentrated on developing various techniques rather than evaluating the outcomes associated with these techniques.<sup>12</sup>

As a result, we performed this systematic review and meta-analysis to examine the inferior pedicle technique's reliability, safety, and effectiveness in breast reduction for female patients with macromastia. The study investigates the procedure's functional and esthetic outcomes in the Egyptian literature, aiming to improve clinical practice and guide evidence-based decision making.

## 2. Patients and methods

We prospectively determined the study objectives, search strategy, eligibility criteria, and analytical techniques in the study. We followed the latest version of the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analysis) statement, and the checklist and flow diagram are reported.

### 2.1. Search strategy

We systematically searched MEDLINE, Scopus, and Google Scholar databases for relevant articles from inception until July 2021 using the following search terms: 'macromastia' or 'gigantomastia' or 'breast hypertrophy' or 'breast enlargement' and 'breast reduction' or 'mammoplasty' or 'mammaplasty' or 'breast reconstruction'. References of all retrieved articles were also screened and assessed for additional sources.

### 2.2. Eligibility criteria

The preliminary selection of studies was based on their titles and abstracts. Two researchers independently evaluated the full text of each selected study based on the inclusion criteria as follows: prospective and retrospective designs evaluating the inferior pedicle technique for breast reduction, studies

conducted in Egypt, whether published nationally or internationally, measured complications and effectiveness outcomes, and sufficient data and statistical analysis.

Studies were excluded if any of the following exclusion criteria were met: essay and review articles; studies conducted on congenital anomalies, unilateral reductions, mastopexy, or oncological patients; studies with a follow-up period less than 3 months; case reports; abstracts only; letters, comments, or reviews; and studies on male patients.

### 2.3. Data extraction

Two reviewers conducted independent data extraction, and disagreements were resolved through discussion and consensus. The extracted data covered the general characteristics of each study (authors, year, setting, technique, sample size, age, BMI, operative time, hospital stay, and follow-up) and the outcomes measured (nipple necrosis, wound infection, hematoma and seroma, reduction in sensation, patient dissatisfaction, wound dehiscence, hypertrophic scars, and patient satisfaction).

### 2.4. Risk of bias assessment

The risk of bias within each included study was assessed by two independent authors using the Newcastle–Ottawa scale for cohort studies. The tool consists of eight items with three subscales and a total maximum score of 9, where scores at least 7 imply a high-quality article, and less than 5 indicate low-quality research.<sup>17</sup>

### 2.5. Data analysis

Statistical analyses were conducted using Open Meta Analyst (AHRQ, CEBM; Brown University, Providence, Rhode Island, USA). We ultimately used the random effects model with the DerSimonian–Liard technique. All data were dichotomous (events and no events) and were pooled as weighted proportions and risk ratios (RRs) with 95% confidence intervals (CI).<sup>18</sup> Pooled rates of proportions were calculated through the Freeman–Tukey transformation meta-analysis of proportions using MedCalc (Version 15.0; MedCalc Software, Ostend, Belgium).

Visually and statistically, heterogeneity between studies was examined using  $\chi^2$  and  $I^2$  tests. A  $Q$  statistic with  $P$  less than 0.1 indicated heterogeneity, whereas  $I^2$  values of 0, 25, 50, and 75% represented no, low, moderate, and high heterogeneity, respectively. When significant heterogeneity was

identified, sensitivity analyses were conducted to identify the source of heterogeneity by excluding one study at a time. Publication bias was visually examined through funnel plot symmetry and mathematically through Egger's regression test, Begg's test, and Duval's nonparametric trim-and-fill analysis.<sup>19–21</sup>

## 3. Results

### 3.1. Search results and characteristics of included studies

Our search of electronic databases resulted in the retrieval of 870 unique citations. Following the screening of titles and abstracts, 42 full text articles were retrieved and evaluated for eligibility. Of these, 26 articles ( $n = 431$  patients) were omitted, leaving 16 studies ( $n = 431$  patients) for inclusion in this meta-analysis (Fig. 1).<sup>22–37</sup>

The bibliographies of the included randomized controlled trials were manually searched, but no additional records were identified. All the included studies were conducted between 1999 and 2021. Four studies compared the inferior and superomedial pedicles and one compared liposuction reduction to the inferior pedicle. The average age was 32 years in the included articles, the average BMI was 31.8, and the average follow-up was 9.5 months (Table 1).

### 3.2. The potential sources of bias

Using the Newcastle–Ottawa scale, the included studies ranged from moderate to high quality. The main concern was the absence of control groups in some studies.<sup>23–27,30–32,37</sup> Fig. 2 provides an overview of the quality assessment criteria, whereas Table 2 contains the authors' evaluations with justifications. Funnel plots of the standard errors versus the effect size demonstrated asymmetry (Fig. 3). However, Egger's regression revealed no small study effects. However, Egger's test ( $P = 0.15$ ) and Begg's test ( $P = 0.21$ ) indicated no small study effects. Moreover, we employed the trim-and-fill method to confirm the robustness of the results, which revealed no significant changes to the results when imputing one missing article.

### 3.3. Outcomes

#### 3.3.1. Safety outcomes

**3.3.1.1. Nipple necrosis.** The overall frequency of nipple necrosis was 4% (95% CI: 0–12%). The

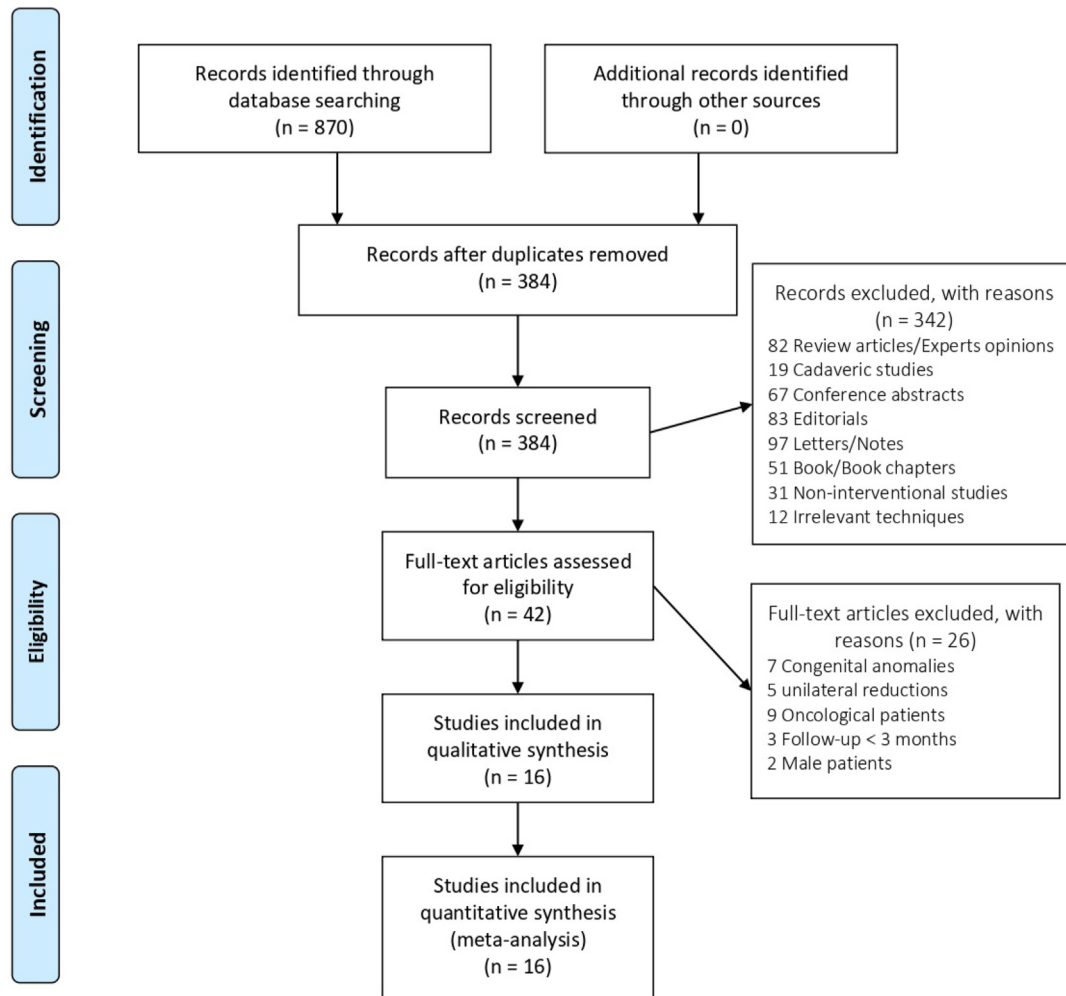


Fig. 1. Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) flow diagram illustrates the search strategy, screening, and the selection process.

pooled analysis was homogeneous ( $I^2 = 0\%$ ,  $P = 0.29$ ) (Fig. 4a). Likewise, the inferior pedicle was comparable to the superomedial pedicle concerning the risk of nipple necrosis, with no statistically significant difference (RR = 1, 95% CI: 0.07–15.7).

**3.3.1.2. Wound infection.** Overall, the incidence of wound infection was 7% (95% CI: 1–14%). The pooled analysis was homogeneous ( $I^2 = 0\%$ ,  $P = 0.87$ ) (Fig. 4b). Furthermore, the inferior pedicle had a lower risk of wound infection than the superomedial pedicle (RR = 0.5, 95% CI: 0.04–6). However, the estimates were not statistically significant.

**3.3.1.3. Hematoma and seroma.** The overall frequency of hematoma and seroma was 8% (95% CI: 2–13%). The pooled analysis was homogeneous ( $I^2 = 0\%$ ,  $P = 0.7$ ) (Fig. 4c). Likewise, the inferior pedicle was

comparable to the superomedial pedicle concerning the risk of hematoma and seroma, with no statistically significant difference (RR = 1.5, 95% CI: 0.5–4.9).

**3.3.1.4. Diminished or loss in sensation.** The frequency of reduction in sensation was 12% (95% CI: 0–19%). The pooled analysis was homogeneous ( $I^2 = 0\%$ ,  $P = 0.96$ ) (Fig. 5b). Besides, the inferior pedicle had a lower risk of reducing sensation than the superomedial pedicle (RR = 0.8, 95% CI: 0.17–3.9). However, the measures were not statistically significant.

#### 3.4. Efficacy outcomes

##### 3.4.1. Hypertrophic scars

The overall incidence of hypertrophic scars was 33% (95% CI: 5–62%). The pooled analysis was

Table 1. The characteristics and summary of included studies.

References	Sitting	Reduction technique	Cases	Age (mean $\pm$ SD)	BMI (mean $\pm$ SD)	Operative time (min)	Hospital stay (days)	Follow-up (months)	Conclusion
Ahmed and Maksoud <sup>22</sup>	Alexandria University	Superior pedicle mammoplasty	3	35.53 $\pm$ 2.06	NA	127.08 $\pm$ 37.5	NA	NA	Mammoplasty techniques in management of idiopathic granulomatous mastitis in moderate to large breasts seems justifiable with good results
Al Mahmoudy Reyad <sup>23</sup>	Ain Shams University	Inferior pedicle mammoplasty	5	25–55 <sup>a</sup>	NA	(120–180) <sup>a</sup>	NA	12	Inferior pedicle mammoplasty combined both the merits of the inferior pedicle reliability and better esthetic results
		Round block	5						
Al-Shahat et al. <sup>24</sup>	Al-Azhar University	Inferior pedicle mammoplasty	30	18–35 <sup>a</sup>	NA	NA	NA	12	Inferior pedicle mammoplasty revealed esthetically pleasing results with few complications
El-Khatib <sup>25</sup>	Cairo University	Inferior pedicle mammoplasty	11	20.8 (19–25) <sup>a</sup>	NA	NA	NA	NA	Inferior pedicle technique is recommended in reduction mammoplasty for breasts with associated postburn deformities
El Sabbagh and Zayed <sup>26</sup>	Mansoura University	Inferior pedicle mammoplasty	21	28 (22–45) <sup>a</sup>	27.5	180	1–3 <sup>a</sup>	6	Inferior pedicle technique with some technical refinements was proven to be an excellent technique for breast reduction of large and ptotic breasts
Elkafrawy et al. <sup>27</sup>	Alexandria University	Inferior pedicle mammoplasty	30	33.35 (24–53) <sup>a</sup>	30.10 $\pm$ 1.64	NA	NA	12	Modification and refining the inverted-T/inferior pedicle technique could give us a better esthetic and functional results with minimization of the problems associated with this technique
Fahmy et al. <sup>28</sup>	Ain Shams University	Superomedial pedicle mammoplasty	12	40.25 $\pm$ 5.56	38.72 $\pm$ 4.19	NA	NA	6	Both superomedial and inferior pedicle techniques in reduction mammoplasty are safe, feasible, and effective; however, boxy breast deformity
		Inferior pedicle mammoplasty	12	38.83 $\pm$ 6.19	36.96 $\pm$ 3.31				

(continued on next page)

Table 1. (continued)

References	Sitting	Reduction technique	Cases	Age (mean $\pm$ SD)	BMI (mean $\pm$ SD)	Operative time (min)	Hospital stay (days)	Follow-up (months)	Conclusion
Aboul Fotouh et al. <sup>29</sup>	Ain Shams University	Superomedial pedicle mammoplasty	10	18–24 <sup>a</sup>	NA	180	NA	24	Medial pedicle technique allowed less amount of breast tissue reduction, longer vertical scar and early over-projecting and inferiorly flattened contour, it provided shorter operative time and more improved long-term shape retention. Inferior pedicle technique allowed more amounts of breast tissue reduction, shorter vertical scar, and early natural breast contour, but it provided longer operative time and inevitable later bottoming out
Ghareeb et al. <sup>30</sup>	Kafir Al-Shaikh General Hospital	Inferior pedicle mammoplasty	10		NA	240	NA		
		Inferior pedicle mammoplasty	20	40.5 $\pm$ 13.5	32.8 $\pm$ 5.7	NA	NA	6	Inferior pedicle technique is a straightforward technique for breast reduction and that affords the advantages of esthetic shape, reduced scar burden, and stability
Ghareeb <sup>31</sup>	Menoufiya University	Inferior pedicle mammoplasty	16	21–43 <sup>a</sup>	NA	NA	NA	NA	
Mahboub et al. <sup>32</sup>	Cairo University	Inferior pedicle mammoplasty	20	39 (28–55) <sup>a</sup>	33.3 (27–35) <sup>a</sup>	48.5 (37–55) <sup>a</sup>	NA	14	Follow-up of the patients revealed that suspension of the breast parenchyma and plication of the dermal flap improved the esthetic results following inferior pedicle breast reduction
Kamel et al. <sup>33</sup>	Assiut University Hospital and Egyptian Military Hospitals	Superomedial pedicle mammoplasty	10	30.6 $\pm$ 3.74	36.62 $\pm$ 5.7	NA	NA	6	The superomedial pedicle has the advantages of better breast shape and contour and higher patient satisfaction
		Inferior pedicle mammoplasty	9	30.11 $\pm$ 5.18	33.08 $\pm$ 6.58				

Kenawy et al. <sup>34</sup>	Cairo University	Vertical scar	30	20–53 <sup>a</sup>	NA	NA	NA	6–13 <sup>a</sup>	Superior pedicle reduction mammoplasty is reserved for medium and slightly large breasts, with the modifications mentioned for this technique, and it can be used for a variety of breast sizes and shapes
Morsi et al. <sup>35</sup>	Cairo University	Wise pattern Wise pattern reduction mammoplasty	62 15	20–57 <sup>a</sup>	23.9–34.4 <sup>a</sup>	NA	NA	1	The triangular lipodermal flap could be the future preferred technique as a modification to Wise pattern reduction mammoplasty for prevention or reduce the incidence of T junction complications
Nasr et al. <sup>36</sup>	Zagazig University	Wise pattern reduction mammoplasty with triangular lipodermal flap Liposuction reduction	15 26	20–55 <sup>a</sup>	24.6–35.5 <sup>a</sup>	NA	NA	12	Liposuction breast reduction alone is recommended as the first option for breast reduction of medium and even large sized breasts with good skin quality, especially for unmarried young females. The inferior pedicle technique might be chosen for the reduction of giant breasts
Shod <sup>37</sup>	Mansoura Military Hospital	Inferior pedicle mammoplasty Inferior pedicle mammoplasty	26 23	26 ± 9.9 33 ± 4.6	28.31 ± 2 32.9 ± 3.2	156 ± 17.15 240.4 ± 39.7	5.69 ± 1.2 45.9 ± 14.8	3	Inferior pedicle mammoplasty significantly improved women quality of life, esthetic appearance and psychological status. Inferior pedicle with inverted-T mammoplasty is a safe and applicable pattern of mammoplasty, allow significant reduction of breast volume with improved breast measurements and projection and provide satisfactory esthetic outcome

<sup>a</sup> Range.



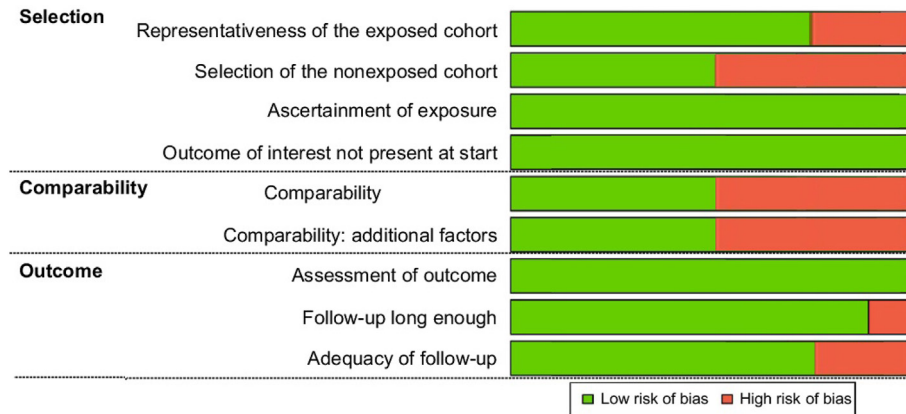


Fig. 2. Risk of bias graph according to the Newcastle–Ottawa Scale.

heterogeneous ( $I^2 = 62.3\%$ ,  $P = 0.02$ ), and heterogeneity did not resolve after further sensitivity analysis; thus, the random effect model was employed (Fig. 4d). Likewise, the inferior pedicle was comparable to the superomedial pedicle concerning the risk of hypertrophic scars, with no statistically significant difference (RR = 3, 95% CI: 0.1–67).

#### 3.4.2. Wound dehiscence

The frequency of wound dehiscence was 12% (95% CI: 4–19%). The pooled analysis was homogeneous ( $I^2 = 0\%$ ,  $P = 0.00$ ) (Fig. 5a). Furthermore, the inferior pedicle was comparable to the superomedial pedicle concerning the risk of wound dehiscence, with no statistically significant difference (RR = 1, 95% CI: 0.2–4.6).

#### 3.4.3. Patient satisfaction

The overall frequency of patients' satisfaction was 94% (95% CI: 90–98%). The pooled analysis was homogeneous ( $I^2 = 29.2\%$ ,  $P = 0.00$ ) (Fig. 5c). Likewise, the inferior pedicle was comparable to the superomedial pedicle concerning the likelihood of patients' satisfaction, with no statistically significant difference (RR = 0.95, 95% CI: 0.8–1.1).

#### 3.4.4. Patient dissatisfaction

Overall, the incidence of patients' dissatisfaction was 10% (95% CI: 4–16%). The pooled analysis was homogeneous ( $I^2 = 0\%$ ,  $P = 0.00$ ) (Fig. 5d). Besides, the inferior pedicle was comparable to the superomedial pedicle concerning the risk of patient dissatisfaction, with no statistically significant difference (RR = 2.7, 95% CI: 0.2–28.3).

## 4. Discussion

In this systematic review and meta-analysis of 16 clinical studies and 431 patients, 11 trials showed that the inferior pedicle was comparable to other techniques. However, three of our included studies reported that different methods were more favorable in their outcomes. Furthermore, to complicate this further, two other trials favored the effect of inferior pedicle over other techniques (Table 1).

As no previous meta-analysis examined the comparative effectiveness of this method in the Egyptian literature, the relatively small sample size of individual trials left the problem unresolved. Whether the inferior pedicle approach is more reliable to perform remains a valid debate. Thus, we performed this meta-analysis to examine the technique's reliability, safety, and effectiveness in breast reduction for female patients with macromastia.

In our analysis, the group that received inferior pedicle reduction mammoplasty had a higher likelihood of improvement than other techniques (RR = 1.2) even though this relative superiority was not statistically significant ( $P = 0.5$ ). The overall prevalence of postoperative complications was 10% (95% CI: 7–15%). The lowest reported problem was nipple necrosis, as seen in 4% (95% CI: 1–12%), whereas the most described complication was hypertrophic scars, as seen in 33% (95% CI: 17–62%). However, the rate of patient satisfaction was considerably significant, as seen in 94% (95% CI: 90–98%).

Multiple studies from Western and Eastern literature support the findings of this meta-analysis. In a recent Canadian meta-analysis, more than a

Table 2. Detailed quality assessment according to Newcastle–Ottawa Scale.

Newcastle–Ottawa quality assessment scale for cohort studies										
References	Selection				Comparability		Outcome			Score
	Representativeness of the exposed cohort population	Selection of the non exposed control from the same community as the exposed cohort	Ascertainment of exposure through secure record (e.g. surgical records)	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis (e.g. comparative statistical analysis of primary outcome)	Comparability for any additional factor (e.g. comparative statistical analysis of secondary outcome)	Assessment of outcome through independent assessment or records	Follow-up long enough for outcomes to occur	Adequacy of follow-up of cohorts with complete follow-up or – small number lost	
Ahmed and Maksoud <sup>22</sup>	0	1	1	1	1	1	1	1	0	7
Al Mahmoudy and Reyad <sup>23</sup>	0	0	1	1	0	0	1	1	1	5
Al-Shahat et al. <sup>24</sup>	1	0	1	1	0	0	1	1	1	6
El-Khatib <sup>25</sup>	0	0	1	1	0	0	1	1	0	4
El Sabbagh and Zayed <sup>26</sup>	1	1	1	1	1	1	1	1	1	9
Elkafrawy et al. <sup>27</sup>	1	0	1	1	0	0	1	1	1	6
Fahmy et al. <sup>28</sup>	1	1	1	1	1	1	1	1	1	9
Aboul Fotouh et al. <sup>29</sup>	1	1	1	1	1	1	1	1	1	9
Ghareeb et al. <sup>30</sup>	0	0	1	1	0	0	1	1	0	4
Ghareeb <sup>31</sup>	1	0	1	1	0	0	1	1	1	6
Mahboub et al. <sup>32</sup>	1	0	1	1	0	0	1	1	1	6
Kamel et al. <sup>33</sup>	1	1	1	1	1	1	1	1	1	9
Kenawy et al. <sup>34</sup>	1	1	1	1	1	1	1	1	1	9
Morsi et al. <sup>35</sup>	1	1	1	1	1	1	1	0	1	8
Nasr et al. <sup>36</sup>	1	1	1	1	1	1	1	1	1	9
Shod <sup>37</sup>	1	0	1	1	0	0	1	0	1	5

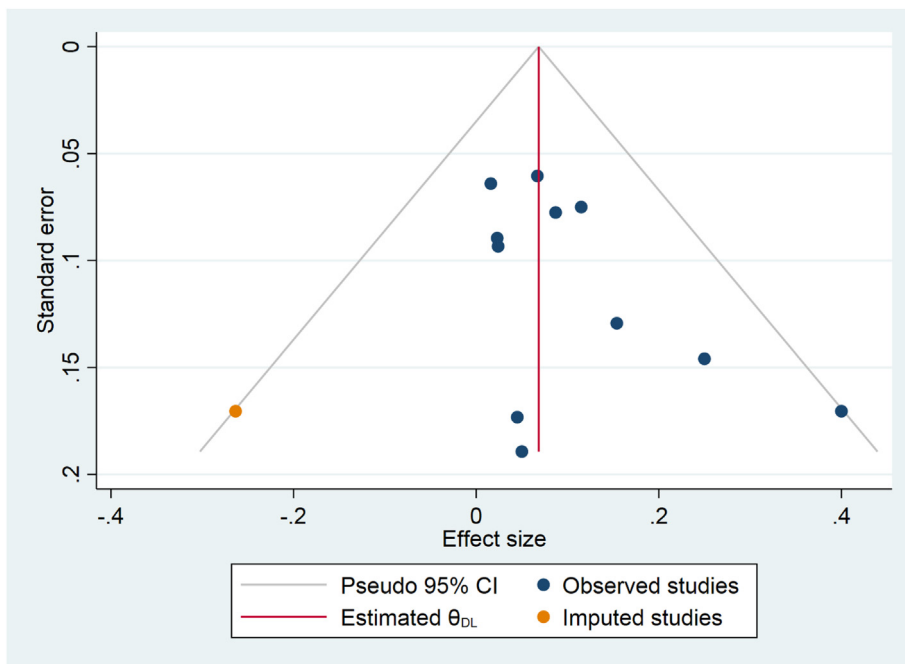


Fig. 3. Funnel plots of the standard errors versus the effect size showing asymmetry.

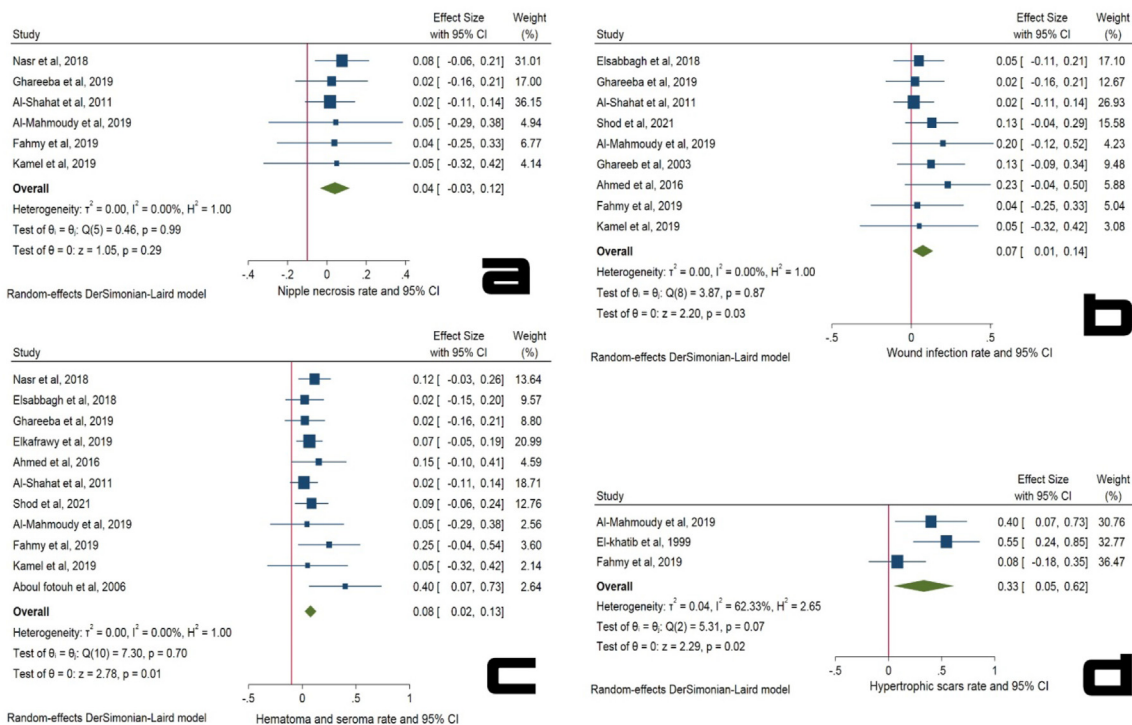


Fig. 4. Forest plots showing the pooled frequency and relative risk in each outcome along with the associated 95% confidence interval. (a) Nipple necrosis, (b) wound infection, (c) hematoma and seroma, and (d) hypertrophic scars.

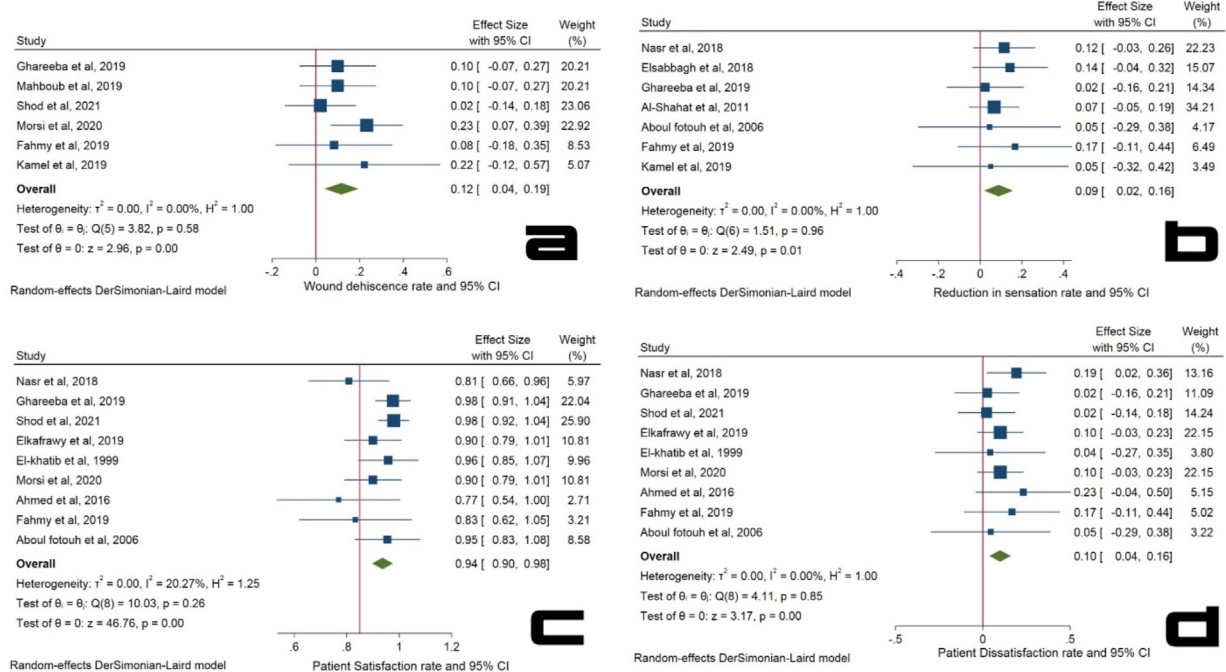


Fig. 5. Forest plots showing the pooled frequency and relative risk in each outcome along with the associated 95% confidence interval. (a) Wound dehiscence, (b) reduction in sensation, (c) patient satisfaction, and (d) patient dissatisfaction.

quarter of patients encountered a postsurgical complication.<sup>14</sup>

However, in the American literature, the reported complication rates fluctuate between 6.5 and 22%.<sup>7</sup>

On the contrary, a recent Chinese meta-analysis pointed out that complications after surgery would be as high as 50%.<sup>15</sup> Furthermore, they reported a patient satisfaction rate between 80 and 90%, a reduction in nipple sensation of 22%, and a delayed wound healing of 20%.<sup>7,14,38</sup> Our results from the Egyptian literature showed comparable improvements and even better rates of postoperative complications.

#### 4.1. Functional outcomes

Regarding the functional outcomes after surgery, Onuk et al.<sup>39</sup> and Ceber et al.<sup>40</sup> reported significant changes in patients' respiratory functions, including statistically significant increases in peak expiratory and inspiratory flow rates and lung capacity. Other studies compared the physical activity of patients with macromastia before and after surgery with a control group of other women with smaller breasts. Surprisingly, their physical capacity and body posture were statistically equivalent after surgery or even better than the control group.<sup>41-43</sup>

Breastfeeding is another vital outcome as it is critical to both infant and maternal health. The WHO advocates for exclusive breastfeeding during the first 6 months of an infant's life.<sup>44</sup> The likelihood of breastfeeding impairment after surgery remains a prime concern. However, several studies on reproductive-age females displayed no significant differences in breastfeeding after mastoplasmy regardless of the surgical technique. Future investigations should approach these discrepancies.<sup>45,46</sup>

In a recent meta-analysis, the success rates among women who tried breastfeeding were high; however, those who attempted were considerably low.<sup>14</sup> Thus, relevant patient education preoperatively and postoperatively are eminent. Interestingly, another systematic review concluded that subareolar parenchymal column preservation is decisive in the breastfeeding outcome. In this review, the breastfeeding success rate was only 4% for techniques with no preservation, compared with 75 and 100% for partial and complete preservation techniques, respectively.<sup>47</sup> Accordingly, the inferior pedicle method grants a higher potential for breastfeeding success when compared with opposite pedicle locations. Another important finding is that the amount of removed breast tissue does not affect the

breastfeeding outcome, as long as the subareolar column is preserved.<sup>47</sup>

#### 4.2. Nipple–areolar complex (NAC) survival

The NAC necrosis risk significantly increases when the dermal blood supply is eliminated, or the glandular tissue is segregated from the cutaneous vasculature. Literature classified NAC circulation into three types: 70% circular, 20 loops (%), and 6% radial.<sup>48</sup> The radial subtype would have the lowest survival, even if the operation were delivered technically very well, as a reliable anastomosis is lacking in those patients.<sup>49</sup>

#### 4.3. Nipple sensation

Most breast reductions yield a reduction in nipple sensation that is usually regained within 2 years after surgery. Nipples acquire sensations mainly from the fourth intercostal nerve lateral branch, where branches assemble primarily between the deep fascia of the pectoralis major muscle and the breast base.<sup>50</sup> During inferior pedicle reduction, surgeons should aim to dissect above this layer, even though it might not be the dominant nerve supply to the nipple. Nonetheless, a full sensation often returns with practically any technique variant; even patients who reported reduced nipple sensations had a higher degree of sensitivity in their breasts.<sup>42,51</sup>

#### 4.4. Hypertrophic scars

Although the inferior pedicle technique has a relatively lower rate of hypertrophic scars, being the most reported complication requires careful addressing. The hypertrophic suture marks in the Wise incision are preventable by laying everting mattress sutures intradermally instead of subcutaneously on the side of the incision. Moreover, steroid injections every 4–6 weeks, silicone gel, and laser therapy proved effective; otherwise, scar revision is a valid option after 1 year of surgery.<sup>52</sup>

#### 4.5. Bottoming out

Eventually, bottoming out usually resides owing to stretching the inframammary skin, leaving the nipples too high, while the boxy breast occurs with tight midline closure and unwise resection of the central breast parenchyma.<sup>7</sup> As a solution, the horizontal lazy-S incision potentially tightens the breast skin medially and laterally while preserving a

relative skin excess at the center, thus, shaping a desired conical contour.<sup>53</sup>

#### 4.6. Breast contour and projection

Another resolution to prevent the flat breast appearance is tacking sutures to suspend the inferior pedicle to the chest wall. Surgeons can further enhance the breast projection by widening the angle of the drawn limbs of the Wise incision over 90° or by placing figure-of-eight sutures after raising the skin flaps to imbricate the breast tissue, narrowing the breast while adding projection.<sup>54,55</sup>

Meanwhile, several studies detected a group of risk factors that affect complication rates, including BMI, age, smoking, and size of resected tissue. However, recent investigations revealed that reduction techniques are equally effective and reliable in adolescents and elderly patients.<sup>56</sup> Likewise, no significant association seemed to exist between postoperative complications and the size of resected breast parenchyma, even with substantially removed masses over 1000 g.<sup>12,57</sup> In contrast, a recent meta-analysis revealed that obese patients with BMI greater than 40 kg/m<sup>2</sup> have a relatively twofold higher risk of postoperative skin and fat necrosis.<sup>58</sup> Ultimately, the patient's breast size relative to their body proportion has a more notable effect on physical symptoms. Accordingly, BMI may not adequately predict improved outcomes following surgery.<sup>2</sup> Smoking also carried a relatively higher risk for postoperative complications, particularly wound dehiscence, explained by aberrant thrombogenic state, endothelial wall injury, and repressed capillary circulation.<sup>15,59</sup>

### 5. Conclusion

This meta-analysis has multiple vital strengths. So far, this is the first study to comprehensively review and analyze the inferior pedicle reduction mammoplasty in the Egyptian literature. Even so, we acknowledge several limitations in our study judged by the quality of studies. First, none of the included studies were randomized controlled trials and not all of them had a control group. In addition, the number of patients with lost follow-up was considerable and could bias the reported results in favor of the intervention, given that patients with unfavorable outcomes are less likely to maintain contact and provide information.

Overall, the current evidence affirms the safety, reliability, and comparative efficacy of the inferior pedicle reduction mammoplasty for patients with macromastia. Future research should also examine

the rates of revision mammoplasty and the long-term functional and esthetic outcomes in younger and older populations.

### Author contribution

All authors have contributed equally to the article.

### Conflict of interest

Authors declare that there is no conflict of interest, no financial issues to be declared.

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