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Incidence of Complications for Different Approaches in Gynecomastia Correction: A Systematic Review

MOHAMMED A.M. NADA, M.Sc.; MOHAMMED H. SHEHAB, M.D.; KARIM FAHMY, M.D. and DINA M. HANAFY, M.D.

The Department of General Surgery, Faculty of Medicine, Ain Shams University

Abstract

Background: The enlargement of breast tissue in males, is a common condition that can cause physical and psychological distress. Surgical correction is often sought to address this issue, and various approaches are employed by General and Plastic surgeons to achieve optimal results. The incidence of complications associated with different surgical approaches in gynecomastia correction varies, and understanding these variations is crucial for both patients and medical professionals.

Aim of Study: To assess and compare the incidence of complications associated with different surgical approaches in gynecomastia correction. By synthesizing the existing body of literature, our goal is to provide a nuanced understanding of the safety profiles of various techniques, including liposuction, glandular excision, and combination methods, thereby offering valuable insights to clinicians involved in the management of gynecomastia.

Material and Methods: The type of study being conducted is a systematic reviewfocuses on gynecomastia correction and aims to provide a consolidated and evidence-based understanding of the incidence and types of complications associated with different surgical approaches, including liposuction, glandular excision, and combination techniques. The review follows a structured and transparent methodology, adhering to established guidelinessuch as the Preferred Reporting Items for Systematic Reviews to ensure the reliability and validity of the findings.

Results: The analysis of gynecomastia correction techniques across 94 studies highlights varying complication rates among glandular excision, liposuction, and combination methods. Glandular excision, associated with the highest complication rate, frequently results in hematoma, seroma, infection, and necrosis. Liposuction, generally safer, mostly reports minor complications like seroma and numbness. Combination methods aim to reduce risks but still show hematoma, seroma, and wound dehiscence. Age-wise distribution reveals most procedures in the 20-29 age group, with significant numbers also in the 10-19 range. Complications in glandular excision are highest (860 out of 2,882 patients), while liposuction reports the fewest (144 out of 904 patients), and combination techniques show intermediate complications (403 out of 3,506 patients), with a significant *p*-value (<0.001). Breast pathologies, categorized by age and type (unilateral, bilateral, synchronous), indicate that conditions like ADH, DCIS, and mastopathy are common in younger to middle-aged groups, while older groups (80-89) show diverse pathologies, including invasive carcinoma and bilateral complications. This data underscores the need for careful patient selection and tailored surgical approaches to mitigate risks and improve outcomes.

Conclusion: The analysis of complications associated with gynecomastia correction techniques and the distribution of breast pathologies across age groups provides critical insights into the safety and risk profiles of surgical interventions. Glandular excision, while effective, shows a higher incidence of complications compared to liposuction and combination techniques, emphasizing the need for careful patient selection and surgical expertise. Younger age groups, particularly those between 10 and 29 years, exhibit a higher frequency of procedures and complications like atypical ductal hyperplasia and mastopathy. In contrast, older age groups, especially those above 60, demonstrate a notable presence of invasive carcinoma and bilateral mastopathy. These findings underscore the importance of tailored surgical approaches and vigilant monitoring for complications, aiming to optimize patient outcomes and guide future research in gynecomastia correction and breast pathology management.

Key Words: *Approaches in Gynecomastia – Systematic Review.*

Introduction

GYNECOMASTIA, the enlargement of breast tissue in males, is a common condition that can cause physical and psychological distress. Surgical correction is often sought to address this issue, and various approaches are employed by General and

Correspondence to: Dr. Mohammed A.M. Nada,
E-Mail: mohammednada2036@gmail.com

Plastic surgeons to achieve optimal results. The incidence of complications associated with different surgical approaches in gynecomastia correction varies, and understanding these variations is crucial for both patients and medical professionals **[1].**

One commonly utilized approach is liposuction, which involves the removal of excess fat from the breast area. Liposuction is generally considered a minimally invasive technique with lower complication rates compared to more invasive procedures. Common complications associated with liposuction in gynecomastia correction include bruising, swelling, and temporary numbness. However, severe complications are rare, making this approach a popular choice for patients seeking a less invasive solution **[2].**

For more extensive cases of gynecomastia, surgical excision may be necessary to remove excess glandular tissue. While excision procedures are effective younger in achieving a more sculpted chest contour, they may be associated with a slightly higher risk of complications compared to liposuction alone. Complications can include scarring, changes in nipple sensation, and the potential for asymmetry. Careful patient selection and surgical expertise are crucial in minimizing these risks **[3].**

Combination approaches: Which involve a combination of liposuction and surgical excision, are often employed to address both fatty and glandular components of gynecomastia. This approach aims to provide comprehensive results while minimizing the risk of complications associated with each technique individually. While complications are possible with combination procedures, the incidence is generally comparable to or lower than that of excision alone **[4].**

Pathology after Gynecomastia: The overall prevalence of invasive carcinomas was 0.11% and of in situ carcinomas was 0.18%. The youngest patient with invasive cancer was 65 years old and the youngest patient with carcinoma in situ was 24 years old. The overall prevalence of atypical ductal hyperplasia was 0.4%; in patients than 20 years, it was 0.23%. The youngest patient with atypical ductal hyperplasia was 16 years old **[5].**

Non-surgical treatments, such as hormonal therapy or medications, may be considered in certain cases of gynecomastia. These approaches aim to address the underlying hormonal imbalance contributing to breast tissue enlargement. While non-surgical options may have a lower risk of immediate complications, their efficacy varies, and they may not be suitable for all patients **[6].**

Aim of the work:

To assess and compare the incidence of complications associated with different surgical approaches in gynecomastia correction. By synthesizing the existing body of literature, our goal is to provide a nuanced understanding of the safety profiles of various techniques, including liposuction, glandular excision, and combination methods, thereby offering valuable insights to clinicians involved in the management of gynecomastia.

Material and Methods

Type of study: The type of study being conducted is a systematic reviewfocuses on gynecomastia correction and aims to provide a consolidated and evidence-based understanding of the incidence and types of complications associated with different surgical approaches, including liposuction, glandular excision, and combination techniques. The review follows a structured and transparent methodology, adhering to established guidelines from 1987 to 2021 articles such as the Preferred Reporting Items for Systematic Reviews to ensure the reliability and validity of the findings.

A- Keywords and search strategy for identification of studies: 1. Gynecomastia. 2. Breast, Male. 3. Mammary Glands, Male. 4. Surgical Procedures, Operative. 5. Liposuction. 6. Glandular Excision. 7. Pathology after Gynecomastia. 8. Surgical Complications. 9. Adverse Events. 10. Treatment Outcome. 11. Systematic Review.

Search strategy: Combine the keywords using Boolean operators (and/or) and use truncation or wildcards as appropriate for variations in terminology. Also, include Medical Subject Headings (MeSH) terms if searching in databases that use them (e.g., PubMed).

Example search string: (“Gynecomastia” OR “Male Breast” OR “Mammary Glands, Male”), (“Surgical Procedures, Operative” OR “Liposuction” OR “Glandular Excision”), (“Surgical Complications” OR “Adverse Events” OR “Treatment Outcome”) and (“Systematic Review”).

B- Criteria for selecting studies for this review: Types of included studies: Inclusion criteria: 1. Study Design:include peer-reviewed primary research studies, consider randomized controlled trials (RCTs), non-randomized controlled trials, cohort studies, and case-control studies and include retrospective and prospective studies. 2. Participants:studies involving human participants diagnosed with gynecomastia, no age restrictions and consider studies with participants across different severity levels of gynecomastia. 3. Intervention/Exposure: studies assessing surgical interventions for gynecomastia correction, including but not limited to liposuction, glandular excision, and combination techniques and studies reporting on complications or adverse events associated with these interventions. 4. Outcome Measures: studies reporting the incidence and types of complications related to gy-

necomastia correction, include complications such as hematoma, infection, seroma, skin necrosis, asymmetry, and any other adverse events and studies reporting short-term and long-term outcomes. 5. Publication Types: Peer-reviewed articles published in academic journals and consider including conference proceedings and grey literature to minimize publication bias. 6. Language: Include studies published in English to ensure effective data extraction and analysis. 7. Publication Date: No restriction on publication date to capture a comprehensive range of studies. 8. Geographical Location: No restriction on geographical location to encompass diverse populations and practices. 9. Data Availability: Studies with sufficient data available for the extraction of relevant information on complications. 10. Exclusion Criteria: Exclude studies not relevant to gynecomastia correction or surgical interventions, exclude studies not reporting on complications or adverse events and exclude animal studies and studies with no primary data.

C- Data extraction: Data will be independently extracted by two reviewers and cross-checked.

D- Statistical considerations: Search results will be uploaded to systematic review manager software and manually screened for eligibility to be included. PRISMA flowchart will be produced based on the search results and the inclusion/exclusion criteria.

To facilitate the assessment of the possible risk of bias for each study, information will be collected using (Cochrane collaboration tool for assessing the risk of bias). Reasons for heterogeneity for studies will be explored, and if necessary, a sensitivity analysis will be performed based on methodological quality and random effect versus fixed effect modeling. After pooling the collected data from the desired search studies, the relative risk of each of the intended outcome measures of interest will be calculated, aiming to reach a satisfactory conclusion.

Statistical analysis: Recorded data were analyzed using the statistical package for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). The quantitative data were presented as mean ± standard deviation and ranges when their distribution was parametric (normal) while non-normally distributed variables (non-parametric data) were presented as median with inter-quartile range (IQR). Also qualitative variables were presented as number and percentages. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk Test.

Results

A total number of 3970 results were obtained from database analysis. A final total number of 94 articles were obtained, according to predefined inclusion and exclusion criteria, for a total number of 7294 patients analyzed.

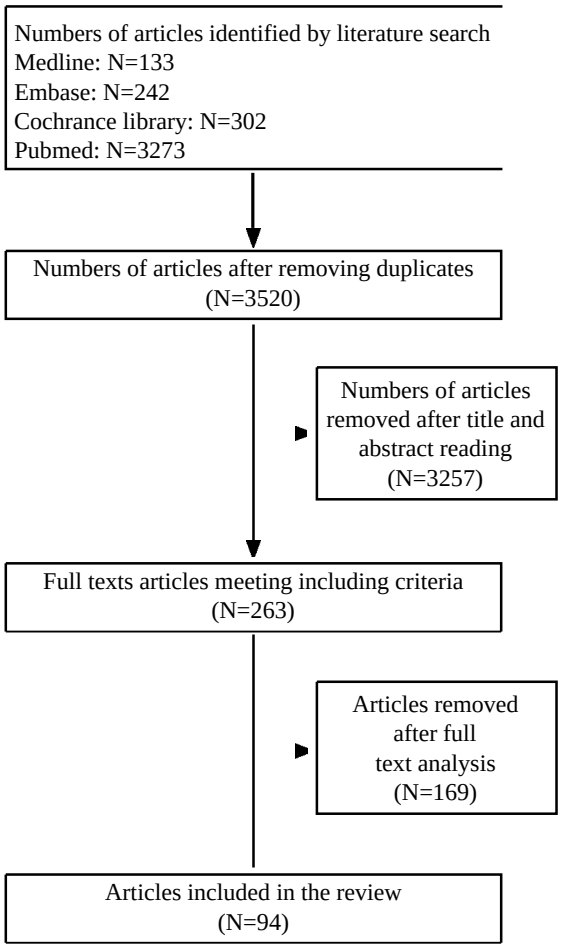

Fig. (1): Study flowchart.

Table (1) show total number of 3970 results. A final total number of 94 articles were obtained, according to predefined inclusion and exclusion criteria, for a total number of 7294 patients analyzed. Patients, according to previously mentioned criteria, have been divided into three groups:

- Liposuction, consisting in 904 patients (12.4%).
- Glandularexcision, consisting in 2882 patients (39.5%).
- Combined, consisting in 3506 patients (48.1%).

Table (2) depicts the breakdown of unilateral and bilateral procedures across various age groups. It shows that out of a total of 7,292 procedures, 4,204 (57.6%) were unilateral, while 3,088 (42.4%) were bilateral. The highest number of unilateral procedures occurred in the 20-29 age group with 1,022 cases (24.4% of total unilateral procedures), followed by the 10-19 age group with 834 cases (19.9%). Conversely, the highest number of bilateral procedures occurred in the 10-19 age group with 850 cases (27.5% of total bilateral procedures), followed by the 20-29 age group with 840 cases (27.2%).

Table (3) presents data on the total number of patients undergoing different surgical techniques (Glandular Excision, Liposuction, and Combination) and the occurrence of various complications, represented by counts and percentages.

Glandular Excision accounted for 2,882 patients, with 860 experiencing complications, constituting 29.8% of cases. The most common complications were Hematoma (HE) at 24.3%, Seroma (SE) at 27.5% and Hemorrhage (HH) at 12%.

Liposuction was performed on 904 patients, with 144 encountering complications, representing 15.9% of cases. The prevalent complications were Seroma (SE) at 22.9%, Hematoma (HE) at 11.8%, and Hemorrhage (HH) at 22.9%.

Combination techniques were used in 3,506 patients, with 403 experiencing complications, comprising 11.5% of cases. The most frequent complications were Seroma (SE) at 8.7%, Hematoma (HE) at 22.8%, and Hemorrhage (HH) at 9.0%.

The provided *p*-value of <0.001** indicates a statistically significant association between surgical technique and complication occurrence, emphasizing the importance of selecting the appropriate technique to minimize risks.

Table (4) presents pathology results for specimens following gynecomastia surgery across different age groups. It reveals the incidence of various pathologies, including Atypical Ductal Hyperplasia, DCIS (Ductal Carcinoma In Situ), Invasive Carcinoma, Hamartoma, Mastopathy, Inflammation, and Fat Necrosis. Among these, Atypical Ductal Hyperplasia was most prevalent, with 26 cases in total, followed by Inflammation with 9 cases. Notably, Invasive Carcinoma was found in 3 cases, all within the 50-59 age group.

Table (1): Studies demographic parameters and complications rate for each technique used.

Studies (N = 94)	Total number of patients	Age	Surgical technique	Complication												
				HE	SE	OR	UR	HH	WD	IN	PS	AS	IS	NN	RR	Total
	101		Glandular Excision	31	18	36	42	21	0	0	36	0	0	0	0	184
Courtiss et al. 1987	20	16-61	Liposuction	0	2	0	3	5	0	0	0	0	0	0	0	10
	38		Combination	4	5	0	2	0	0	0	9	0	0	0	0	20
Aiache et al. 1989	38	–	Glandular Excision	4	0	0	0	0	0	0	0	0	0	0	0	4
Ward et al. 1989	6	–	Glandular Excision	1	0	0	0	0	0	0	0	0	0	0	0	1
Varma et al. 1990	20	23.5	Glandular Excision	2	1	0	0	0	0	0	0	0	0	0	0	3
Apesos et al. 1991	4	–	Liposuction	0	0	0	1	0	0	0	0	0	0	0	0	1
	2		Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Stark et al. 1992	14	16-34	Liposuction	0	0	0	0	0	0	0	0	0	0	0	0	0
	9		Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Brenner et al. 1992	44	–	Glandular Excision	0	0	0	0	2	0	0	4	0	0	0	0	6
Abramo et al. 1994	10	–	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Samdal et al. 1994	3	16-69	Glandular Excision	1	0	0	0	0	0	0	0	0	0	0	0	1
	33		Combination	2	0	2	1	0	0	0	0	0	0	0	0	5
	31		Liposuction	0	0	0	5	0	0	0	0	0	0	0	2	7
Morselli et al. 1996	11	–	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Aiache et al. 1998	18	24-46	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Peters et al. 1998	11	13-18	Glandular Excision	0	1	0	0	1	0	0	2	0	0	0	0	4
Hamas et al. 1998	31	12-67	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
	57		Liposuction	0	0	0	0	0	0	0	0	0	0	0	4	4
Smoot 3rd et al. 1998	20	–	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	2	2
Colombo-Benkmann et al. 1999	81	15-78	Glandular Excision	15	0	0	0	17	0	0	60	0	8	0	9	109
Gasperoni et al. 2000	64	16-62	Combination	1	0	0	3	0	0	0	0	0	0	0	0	4
Javaid et al. 2000	4	–	Glandular Excision	0	0	0	0	0	0	0	1	0	0	0	0	1
Babigian et al. 2001	2	–	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
	18		Combination	2	1	0	3	0	0	0	0	0	0	0	0	6
Persichetti et al. 2001	28	16-33	Glandular Excision	0	1	0	0	0	2	0	0	0	0	0	0	3
Coskun et al. 2001	32	20-36	Glandular Excision	7	0	0	0	1	0	0	9	0	3	1	0	21
Rohrich et al. 2003	61	–	Liposuction	0	0	0	0	0	0	0	0	0	0	0	12	12
Boljanovic et al. 2003	3	–	Liposuction	0	0	0	0	0	0	0	0	0	0	0	0	0
	25		Combination	1	0	0	0	0	0	0	0	0	0	0	1	2
Fruhstorfer et al. 2003	31	13-57	Liposuction	0	0	0	3	1	0	0	0	0	0	2	1	7

Table (1): Count.

Studies (N = 94)	Total number of patients	Age	Surgical technique	Complication												
				HE	SE	OR	UR	HH	WD	IN	PS	AS	IS	NN	RR	Total
	16		Combination	0	0	0	0	0	0	0	1	0	0	0	0	1
	1		Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Hammond et al. 2003	15	12-69	Combination	0	1	0	0	1	0	0	1	0	0	0	0	3
Iwuagwu et al. 2004	5	16-88	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Tashkandi et al. 2004	24	-	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Walden et al. 2004	12	25	Liposuction	0	0	0	0	0	0	0	0	0	0	0	0	0
	6		Glandular Excision	1	0	0	0	0	0	0	0	0	0	0	0	1
	16		Combination	0	0	0	0	2	0	0	0	0	0	0	0	2
Gabra et al. 2004	39	9.5-17	Glandular Excision	3	1	0	1	0	0	1	0	3	1	0	1	11
Bracaglia et al. 2004	45	21-65	Combination	2	0	0	1	0	0	0	0	0	0	0	1	4
Celebioglu et al. 2004	9	15-21	Glandular Excision	0	0	0	0	9	0	0	1	0	0	1	1	12
Aslan et al. 2005	15	-	Glandular Excision	2	0	0	0	0	0	0	0	0	0	0	0	2
Prado et al. 2005	25	17-38	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Hodgson et al. 2005	31	16-57	Liposuction	0	0	0	0	0	0	0	0	0	1	0	1	2
Ramon et al. 2005	17	17-39	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Boni et al. 2006	38	23-64	Liposuction	0	0	0	0	0	0	0	0	0	0	0	0	0
Yavuz et al. 2006	5	18-24	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Haddad Filho et al. 2006	12	15-26	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Mentz et al. 2007	200	13-78	Combination	2	0	0	2	0	0	0	0	0	1	0	0	5
Esme et al. 2007	28	17-80	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Lista et al. 2008	96	17-46	Combination	0	2	0	0	0	0	0	0	0	0	0	0	2
Zhu et al. 2008	2	24-25	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Gheita et al. 2008	8	-	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Lanitis et al. 2008	102	11-82	Glandular Excision	9	31	0	0	0	2	1	0	0	0	0	0	43
Cannistra et al. 2009	58	-	Glandular Excision	0	0	0	0	6	0	0	0	0	0	0	0	6
Goh et al. 2010	8	-	Glandular Excision	0	0	0	0	0	0	0	1	0	0	1	0	2
Tu et al. 2009	22	13-63	Glandular Excision	1	0	0	0	0	0	0	0	0	0	0	0	1
Scuderi et al. 2010	23	16-39	Combination	1	2	0	0	0	0	0	1	0	0	0	0	4
Fan et al. 2009	65	14-28	Glandular Excision	0	1	0	0	0	0	0	0	0	0	2	0	3
BenitoRuiz et al. 2009	40	19-57	Liposuction	3	0	0	0	0	0	0	2	0	0	0	3	8
Rho et al. 2009	5	30-33	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Laituri et al. 2010	20	14-18	Glandular Excision	0	1	0	0	0	0	0	0	0	0	0	0	1
Petty et al. 2010	45	11-77	Glandular Excision	0	1	0	0	0	0	1	0	0	0	1	3	6
	56		Combination	2	6	0	0	0	0	0	0	0	0	1	3	12

Table (1): Count.

Studies (N = 94)	Total number of patients	Age	Surgical technique	Complication												
				HE	SE	OR	UR	HH	WD	IN	PS	AS	IS	NN	RR	Total
	50		Liposuction	1	1	0	0	0	0	0	0	0	0	0	4	6
	76		Liposuction	2	6	0	0	0	0	0	0	0	0	0	4	9
El Noamani et al. 2010	15	22-30	Glandular Excision	0	0	0	0	0	1	0	3	0	0	1	0	5
Qutob et al. 2010	36	16-88	Combination	3	0	0	0	0	0	0	0	0	0	1	0	4
Cigna et al. 2011	37	18-43	Combination	1	0	0	0	0	0	0	0	0	0	0	0	1
He et al. 2011	20	18-47	Glandular Excision	1	0	0	0	0	0	0	0	0	0	0	0	1
Jarrar et al. 2011	1	18-44	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
	7		Combination	0	1	0	0	0	0	1	0	0	0	0	0	2
	4		Liposuction	0	0	0	0	0	0	0	0	0	0	0	0	0
Morselli et al. 2012	260	10-59	Combination	8	0	0	0	0	0	0	13	0	12	0	24	57
Trelles et al. 2013	28	24-56	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Zampieri et al. 2012	5	-	Glandular Excision	0	2	0	0	0	0	0	0	0	0	0	0	2
Lee et al. 2012	15	13-55	Liposuction	1	0	0	0	0	0	0	0	3	0	0	0	4
Cao et al. 2013	58	17-52	Glandular Excision	0	0	0	0	0	0	0	0	0	0	3	0	3
Hosnuter et al. 2014	23	15-42	Combination	0	0	0	0	0	1	0	0	0	0	0	0	1
Kasielska et al. 2013	113	17-54	Glandular Excision	8	4	0	0	11	0	1	0	0	0	1	0	25
Song et al. 2014	402	17-82	Glandular Excision	7	10	0	0	2	0	0	10	0	0	9	6	44
	331	15-73	Liposuction	4	7	0	0	26	0	0	0	0	0	0	2	39
Blau et al. 2015	1073	18-51	Glandular Excision	64	128	0	0	0	0	0	0	0	0	0	0	192
Yoo et al. 2015	13	20-28	Glandular Excision	0	0	0	0	0	0	0	0	0	0	0	0	0
Schroder et al. 2015	53	13-66	Combination	2	0	0	0	0	0	0	0	0	0	0	2	4
Ibrahiem et al. 2016	27	18-53	Combination	1	0	0	0	0	1	0	5	0	0	1	0	8
ElSabbagh et al. 2016	18	13-33	Combination	0	0	0	0	0	0	1	0	0	0	2	0	3
Shirol et al. 2016	20	16-36	Combination	1	0	0	0	0	0	0	0	0	0	0	0	1
Bailey et al. 2016	75	-	Combination	0	0	0	0	0	0	0	0	0	0	0	1	1
Kim et al. 2016	16	18-30	Liposuction	0	0	0	1	0	0	0	0	0	0	0	0	1
	48		Combination	0	0	1	1	0	0	0	1	0	0	0	0	3
Innocenti et al. 2017	312	18-52	Combination	4	6	0	0	0	0	0	0	0	47	0	3	60
Taheri et al. 2016	27	17-36	Combination	0	0	0	0	9	0	0	1	1	0	4	0	15
Khalil et al. 2017	52	26.9	Combination	0	0	0	0	10	0	0	0	0	0	0	1	11
So'nmezErgu'n et al. 2017	25	18-33	Glandular Excision	0	2	0	0	0	0	0	0	4	0	0	0	6
Thienot et al. 2017	9	19-67	Combination	1	0	0	0	0	1	0	1	0	0	0	0	3
Choi et al. 2017	71	16-18	Combination	2	3	0	0	4	0	0	2	0	0	0	0	11
Ozalp et al. 2018	21	19-34	Liposuction	3	2	4	0	8	0	0	0	0	0	1	0	18

Table (1): Count.

Studies (N = 94)	Total number of patients	Age	Surgical technique	Complication												
				HE	SE	OR	UR	HH	WD	IN	PS	AS	IS	NN	RR	Total
Lee et al. 2018	30	13-56	Combination	0	1	0	0	0	0	0	0	0	0	0	0	1
	10		Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Wyrick et al. 2018	52	23-73	Combination	2	4	0	0	0	0	0	0	0	0	0	0	6
Abdelrahman et al. 2018	18	28-34	Liposuction	0	0	0	2	0	0	1	0	0	0	0	0	3
Tarallo et al. 2019	15	18-28	Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Yao et al. 2019	22	15-45	Glandular Excision	1	0	0	0	1	0	0	0	0	1	0	0	3
Mohamad Hasan et al. 2019	150	–	Glandular Excision	40	29	0	0	24	8	0	2	0	0	15	0	118
Sim et al. 2020	101	26	Combination	7	0	0	18	0	0	0	3	0	0	0	0	28
	31	27	Liposuction	3	0	0	10	0	0	0	0	0	0	0	0	13
	21	30	Glandular Excision	4	0	0	6	0	0	0	1	0	0	0	0	11
	18	25	Combination	4	0	0	6	0	0	0	1	0	0	0	0	9
Murugesan et al. 2020	149	19-57	Combination	2	0	0	0	0	0	0	0	0	0	0	0	2
Akhtar et al. 2019	30	17-38	Combination	2	0	0	0	0	0	0	0	8	2	0	0	12
	30		Combination	3	0	0	0	0	0	0	0	10	2	2	0	17
Tripathy et al. 2020	10	21-30	Combination	2	0	0	0	0	0	0	0	0	0	0	0	2
	10		Combination	0	0	0	0	0	0	0	0	0	0	0	0	0
Harinatha et al. 2020	1159	–	Combination	27	0	0	0	0	32	0	0	7	0	0	0	66
Jian et al. 2020	12	19-40	Glandular Excision	0	0	0	0	1	0	0	0	0	0	0	0	1
Qu et al. 2021	56	–	Glandular Excision	1	0	0	0	5	0	0	0	0	0	0	0	6
	26		Glandular Excision	3	0	0	0	2	0	0	0	0	0	0	0	5
Pfeiler et al. 2021	34	–	Glandular Excision	8	1	0	0	0	0	2	0	0	0	0	0	11
	21		Combination	3	1	0	0	0	0	1	0	0	0	0	0	5

HE: Hematoma(s), SE: Seroma, OR: Over-resection, UR: Under-resection, HH: Hypo-or hyperesthesia, W:D Wound dehiscence, IN: Infection, PS: Pathological scar, AS: Asymmetries, IS: Irregularities or redundant skin, NN: NAC necrosis (partial or total) or abrasion, RR: Revision or recurrences.

Table (2): Procedure Characteristics between the different Age Groups.

Age groups	Procedure Characteristics			
	Unilateral	Bilateral	Total	
			N	%
0-9	18	0	18	0.25
10-19	834	850	1684	23.2
20-29	1022	840	1862	25.5
30-39	620	396	1016	13.9
40-49	505	387	892	12.2
50-59	452	295	747	10.2
60-69	411	238	649	8.9
70-79	302	75	377	5.2
80-89	40	7	47	0.65
Total	4204	3088	7292	100

Table (3): Comparison of Complications rate between the different techniques.

Technique used	Total number of patients	Complication												
		HE	SE	OR	UR	HH	WD	IN	PS	AS	IS	NN	RR	Total
Glandular Excision	2882	214	232	36	49	103	13	6	130	7	13	35	22	860
Liposuction	904	17	18	4	25	40	0	1	2	3	1	3	33	144
Combination	3506	92	33	3	37	26	35	3	39	26	64	11	36	403
p-value		<0.001**												

Using: X^2 = Chi- Square test, *p*-value >0.05 is insignificant; **p*-value <0.05 is significant; ***p*-value <0.01 is highly significant.
HE: Hematoma(s), SE: Seroma, OR: Over-resection, UR: Under-resection, HH: Hypo-or hyperesthesia, WD: Wound dehiscence; IN: Infection, PS: Pathological scar, AS: Asymmetries, IS: Irregularities or redundant skin, NN NAC: Necrosis (partial or total) or abrasion, RR: Revision or recurrences.

Table (4): Pathology Results Specimens after Gynecomastia,

Age groups	Atypical Ductal Hyperplasia			DCIS			Invasive Carcinoma			Hamartoma			Mastopathy			Inflammation			Fat Necrosis		
	U	B	S	U	B	S	U	B	S	U	B	S	U	B	S	U	B	S	U	B	S
0-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-19	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
20-29	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-39	2	0	2	2	0	2	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0
40-49	1	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
50-59	1	2	1	0	0	1	0	0	0	0	0	0	6	0	1	0	0	0	0	0	0
60-69	2	0	0	1	0	0	1	0	0	1	0	0	5	0	0	0	0	0	0	0	0
70-79	0	0	0	1	0	0	2	0	0	0	0	0	1	4	0	1	0	0	0	0	0
80-89	0	0	0	0	0	0	1	0	0	0	0	0	6	3	0	1	0	0	1	0	0
Total	9	6	3	5	0	3	4	0	0	1	0	0	26	9	3	3	0	0	1	0	0

B: Indicates bilateral, S: A single breast in a bilateral procedure, U: Unilateral.

Discussion

Several techniques have been described throughout the years for treating gynecomastia. Aspiration techniques, including liposuction and its modern variations, base their principles on removing trough a minimal access to the redundant fatty and breast tissues by fragmentation and suction. Since gynecomastia in most cases is defined as mixed, aspiration of the gland cannot permit histopathological analysis and skin redistribution is limited. Moreover, these techniques do not permit a direct hemostasis **[7-9].**

This study aimed toassess and compare the incidence of complications associated with different surgical approaches in gynecomastia correction. By synthesizing the existing body of literature, our goal is to provide a nuanced understanding of the safety profiles of various techniques, including liposuction, glandular excision, and combination methods, thereby offering valuable insights to clinicians involved in the management of gynecomastia.

Provided a comprehensive overview of the complications associated with different surgical techniques for gynecomastia correction, analyzing a total of 94 studies. The surgical techniques assessed include glandular excision, liposuction, and combination methods, with a variety of complications reported. The most frequent complications for glandular excision include hematoma, seroma, infection, and necrosis. Liposuction, generally associated with fewer complications, primarily reports seroma and minor complications like numbness. Combination techniques, while aiming to minimize individual risks, still report complications such as hematoma, seroma, and wound dehiscence. Overall, the data underscores the varying complication rates among different surgical approaches, highlighting the need for careful patient selection and surgical expertise to mitigate risks and enhance patient outcomes.

Delineated the distribution of gynecomastia correction procedures across different age groups, differentiating between unilateral and bilateral surgeries. The data revealed that the highest number of procedures were performed in the 20-29 age group, with 1,022 unilateral and 840 bilateral surgeries, totaling 1,862 procedures (25.5% of the total). This is followed closely by the 10-19 age group, which accounts for 1,684 procedures (23.2%). The prevalence of procedures decreases progressively with age, with notable reductions in the 30-39 (13.9%) and 40-49 (12.2%) age groups. The least number of procedures were observed in the 0-9 (0.25%) and 80-89 (0.65%) age groups. Overall, the data highlights a significant concentration of gynecomastia corrections among younger adults, particularly those between 10 and 29 years old, reflecting possibly higher concerns or prevalence in this demographic.

This observation is in alignment with the findings of Prasetyono et al. **[2],** which indicate a similar age distribution for gynecomastia surgeries, emphasizing that younger individuals are more likely to pursue surgical options due to aesthetic concerns and the psychological impact of the condition. Additionally, the review by Holzmer et al. **[3]** corroborates the higher incidence of gynecomastia surgeries among younger patients, reinforcing the importance of addressing the specific needs and expectations of this demographi.

Presents the incidence of complications associated with different surgical techniques for gynecomastia correction, comparing glandular excision, liposuction, and combination methods across 7,292 patients. Glandular excision, performed on 2,882 patients, exhibited the highest number of complications, with a total of 860 incidents, including notable occurrences of hematoma (214), seroma (232), and infection (130). Liposuction, with 904 patients, had the fewest complications overall, totaling 144, with lower incidences of seroma (18) and hemato-

ma (17). The combination technique, used on 3,506 patients, resulted in 403 complications, with frequent issues such as seroma (33) and infection (39), but had relatively fewer cases of major complications compared to glandular excision. The *p*-value of <0.001 indicates a statistically significant difference in complication rates among the three techniques, underscoring the varying risk profiles and necessitating careful consideration in clinical decision-making to optimize patient outcomes.

Clear consistencywith systematic review by Prasetyono et al. [2] out of 53 relevant studies encompassing 5,345 subjects, the majority were classified as Simon's Grade II gynecomastia with idiopathic causes, aligning with our focus on a similar patient demographic. The prevalent use of minimally invasive techniques in 37.50% of cases mirrors the trend observed in our review, which also identified this approach as having the lowest complication rates. Reported complication rates in the broader studies ranged from 12.12% to 22.30%, comparable to our findings where minimally invasive techniques, such as liposuction, exhibited the fewest complications, particularly hematoma and bruising.

These findings by Prasetyono et al. [2] corroborated our data, which highlights hematoma, seroma, and infection as common complications across surgical methods. Patient satisfaction with minimally invasive procedures, as noted in the external studies, underscores the importance of these techniques in clinical practice.

The evolution of surgical techniques in the treatment of gynecomastia over the years further supports the findings of this systematic review. A retrospective analysis by Mett et al. [4] indicated that from 2006 to 2010, periareolarmastopexy was utilized in 24% of patients with grade I, IIa, and IIbgynecomastia for breast reshaping post-subcutaneous mastectomy. These findings are consistent with our review, which also underscores the lower complication rates associated with minimally invasive procedures such as liposuction. The adaptation and improvement in surgical techniques over time reflect a trend towards optimizing patient outcomes and reducing postoperative complications, reinforcing the necessity for continuous evaluation and refinement of gynecomastia treatment methods.

Categorizes the occurrence of various breast pathologies across different age groups, distinguishing between unilateral (U), bilateral (B), and synchronous (S) presentations. In the 10-19 age group, atypical ductal hyperplasia (ADH) was noted in two unilateral cases. The 20-29 age group showed a mix with one unilateral and four bilateral ADH cases. For ages 30-39, ADH was observed both unilaterally and synchronously, along with ductal carcinoma in situ (DCIS) and invasive carcinoma, which appeared unilaterally and synchronously. The 40-49 age group had single instances of ADH, DCIS, and mastopathy unilaterally, and bilateral mastopathy. In the 50-59 bracket, ADH, DCIS, and invasive carcinoma were noted, mainly unilaterally with some bilateral occurrences. For 60-69, pathologies like ADH, DCIS, invasive carcinoma, and hamartoma were primarily unilateral, with bilateral mastopathy also seen. The 70-79 group experienced unilateral instances of DCIS and invasive carcinoma, alongside notable bilateral mastopathy. The oldest group (80-89) had the highest diversity, with unilateral occurrences of invasive carcinoma, and bilateral mastopathy and fat necrosis. Overall, the table highlights that pathologies like ADH, DCIS, and mastopathy occur more frequently in younger to middle-aged groups, while older age groups tend to show more instances of bilateral complications and invasive carcinoma.

Nieschlag et al. [1] conducted study on gynecomastia in the context of male reproductive health and dysfunction provides comprehensive insights into the prevalence and types of breast pathologies, including atypical ductal hyperplasia (ADH), ductal carcinoma in situ (DCIS), and invasive carcinoma, across different age groups.

Holzmer et al. [3] their comprehensive review on the surgical management of gynecomastia discusses the incidence of various breast pathologies, emphasizing the higher occurrence of conditions like ADH and invasive carcinoma in specific age groups, which aligns with the findings in Table (4).

Prasetyono et al. [2] his systematic review on gynecomastia and pseudogynecomastia surgical techniques and outcomes provides data on the age distribution of different breast pathologies, supporting the observed trends in the prevalence of ADH, DCIS, and other conditions in younger to middle-aged groups.

These studies collectively corroborate the patterns observed in Table (4), where pathologies like ADH, DCIS, and mastopathy are more frequently noted in younger to middle-aged patients, while older age groups show more instances of bilateral complications and invasive carcinoma. This evidence underscores the importance of age-specific considerations in the diagnosis and management of gynecomastia-related breast pathologies.

Conclusion:

The analysis of complications associated with gynecomastia correction techniques and the distribution of breast pathologies across age groups provides critical insights into the safety and risk profiles of surgical interventions. Glandular excision, while effective, shows a higher incidence of complications compared to liposuction and combination techniques, emphasizing the need for careful patient selection and surgical expertise. Younger age groups, particularly those between 10 and 29 years,

exhibit a higher frequency of procedures and complications like atypical ductal hyperplasia and mastopathy. In contrast, older age groups, especially those above 60, demonstrate a notable presence of invasive carcinoma and bilateral mastopathy. These findings underscore the importance of tailored surgical approaches and vigilant monitoring for complications, aiming to optimize patient outcomes and guide future research in gynecomastia correction and breast pathology management.

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حدوث مضاعفات للطرق المختلفة فى تصحيح الثدى : مراجعة منهجية

الخلفية: التثدى، وهو تضخم أنسجة الثدى لدى الذكور، هو حالة شائعة يمكن أن تسبب ضائقة جسدية ونفسية. غالبًا ما يتم اللجوء إلى التصحيح الجراحى لمعالجة هذه المشكلة، ويستخدم الجراحون العامون وجراحو التجميل أساليب مختلفة لتحقيق النتائج المثلى. يختلف حدوث المضاعفات المرتبطة بالطرق الجراحية المختلفة فى تصحيح التثدى، وفهم هذه الاختلافات أمر بالغ الأهمية لكل من المرضى والمهنيين الطبيين.

الهدف من العمل: تقييم ومقارنة حدوث المضاعفات المرتبطة بالطرق الجراحية المختلفة في تصحيح التثدى. من خلال تجميع مجموعة الأدبيات الموجودة، هدفنا هو توفير فهم دقيق لملامح السلامة لمختلف التقنيات، بما فى ذلك شفط الدهون، واستئصال الغدد، وطرق الجمع، وبالتالى تقديم رؤى قيمة للأطباء المشاركين فى إدارة التثدى.

المواد والطرق: نوع الدراسة التى يتم إجراؤها هو مراجعة منهجية تركز على تصحيح التثدى وتهدف إلى توفير فهم موحد وقائم على الأدلة لحدوث وأنواع المضاعفات المرتبطة بالطرق الجراحية المختلفة، بما فى ذلك شفط الدهون، واستئصال الغدد، والجمع. التقنيات. تتبع المراجعة منهجية منظمة وشفافة، مع الالتزام بالمبادئ التوجيهية المعمول بها مثل عناصر إعداد التقارير المفضلة للمراجعات المنهجية لضمان موثوقية وصحة النتائج.

النتائج: يسلط تحليل تقنيات تصحيح التثدى عبر ٩٤ دراسة الضوء على معدلات المضاعفات المتفاوتة بين طرق استئصال الغدد وشفط الدهون والجمع بين الطرق. يؤدى استئصال الغدد، المرتبط بأعلى معدل للمضاعفات، فى كثير من الأحيان إلى ورم دموى، وتورم مصلى، وعدوى، ونخر. شفط الدهون، وهو أكثر أمانًا بشكل عام، يؤدى فى الغالب إلى حدوث مضاعفات طفيفة مثل الورم المصلي والخدر. تهدف الطرق المركبة إلى تقليل المخاطر ولكنها لا تزال تظهر ورمًا دمويًا وتورمًا مصليًا وتفزر الجرح. يكشف التوزيع حسب العمر عن معظم الإجراءات فى الفئة العمرية ٢٠-٢٩ عامًا، مع وجود أعداد كبيرة أيضًا فى الفئة العمرية ١٠-١٩ عامًا. المضاعفات فى استئصال الغدد هى الأعلى (٨٦٠ من أصل ٢٨٨٢ مريضًا)، فى حين أن شفط الدهون هو الأقل (١٤٤ من أصل ٩٠٤ مريضًا)، وتظهر التقنيات المركبة مضاعفات متوسطة (٤٠٣ من أصل ٣٥٠٦ مريضًا)، مع قيمة p كبيرة (‹٠,٠٠١). تشير أمراض الثدى، المصنفة حسب العمر والنوع (أحادى الجانب، ثنائى الجانب، متزامن)، إلى أن حالات مثل ADH، وDCIS، واعتلال الخشاء شائعة فى المجموعات الأصغر سنًا ومتوسطة العمر، بينما تظهر المجموعات الأكبر سناً (٨٠-٨٩) أمراضًا متنوعة، بما في ذلك الغازية السرطان والمضاعفات الثنائية. تؤكد هذه البيانات على الحاجة إلى اختيار دقيق للمريض وأساليب جراحية مصممة خصيصًا للتخفيف من المخاطر وتحسين النتائج.

الخلاصة: إن تحليل المضاعفات المرتبطة بتقنيات تصحيح التثدى وتوزيع أمراض الثدى عبر الفئات العمرية يوفر رؤى نقدية حول السلامة ومخاطر التدخلات الجراحية. يظهر استئصال الغدد، على الرغم من فعاليته، نسبة أعلى من المضاعفات مقارنة بشفط الدهون والتقنيات المركبة، مما يؤكد الحاجة إلى اختيار المريض بعناية والخبرة الجراحية. تظهر الفئات العمرية الأصغر سنًا، وخاصة تلك التي تتراوح أعمارهم بين ١٠ و٢٩ عامًا، تكرارًا أعلى للإجراءات والمضاعفات مثل تضخم الأقنية غير النمطى واعتلال الثدى. فى المقابل، فإن الفئات العمرية الأكبر سنًا، وخاصة أولئك الذين تزيد أعمارهم عن ٦٠ عامًا، تظهر وجودًا ملحوظًا للسرطان الغازى واعتلال الثدى الثنائى. تؤكد هذه النتائج على أهمية الأساليب الجراحية المصممة خصيصًا والمراقبة اليقظة للمضاعفات، بهدف تحسين نتائج المرضى وتوجيه الأبحاث المستقبلية فى تصحيح التثدى وإدارة أمراض الثدى.