

Comparative Analysis of Saline and Silicone Gel Implants in Subpectoral Breast Augmentation: A Prospective Study**Soni Suman¹, Shahnawaz Anees², Sushant Kumar Sharma³, Bhartendu Kumar⁴, V.P. Choudhary⁵**¹M.B.B.S., M.Ch. Plastic Surgery, Senior Resident, Department of General Surgery, S.K.M.C.H., Muzaffarpur, Bihar, India²M.B.B.S., M.Ch. Plastic Surgery, Senior Resident, Department of Plastic Surgery, Sri Krishna Medical College, Muzaffarpur, Bihar, India³M.B.B.S., M.S. General Surgery, Associate Professor, Department of General Surgery, S.K.M.C.H., Muzaffarpur, Bihar, India⁴M.B.B.S., M.S. General Surgery, Professor & H.O.D., Department of General Surgery, S.K.M.C.H., Muzaffarpur, Bihar, India⁵M.B.B.S., M.S. General Surgery, M.Ch. Plastic Surgery, Professor, Department of Plastic Surgery, P.M.C.H., Patna, Bihar, India

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Abstract:**Background:** Breast augmentation is a popular cosmetic procedure with a critical choice between saline and silicone gel implants, each offering distinct advantages and disadvantages. This study aimed to provide objective data comparing these two implant types, shedding light on their complications, patient satisfaction, and aesthetic outcomes.**Methods:** Over a 1-year period, 120 women underwent primary cosmetic breast augmentation, with data collected through clinical evaluations, surveys, and ultrasound scans. Complication rates, implant characteristics, patient satisfaction, and factors influencing rippling and folds were assessed.**Results:** The study found no significant differences in complication rates between saline and silicone gel implants. Patient satisfaction remained high regardless of implant type. Rippling and folds were associated with lower body mass index and smaller implant volumes, with no significant variation between implant types.**Conclusion:** Saline and silicone gel implants are both viable options for breast augmentation, offering comparable complication rates and patient satisfaction. Individualized decision-making, considering factors like cost and rupture detection, is essential. Implant type did not significantly affect patient satisfaction, and rippling and folds are influenced by other factors.**Recommendations:** Patients should consult board-certified plastic surgeons to make informed decisions based on their body type, aesthetic goals, and personal preferences. Surgeons should consider factors beyond implant type when discussing potential complications and satisfaction with patients.**Keywords:** Breast augmentation, saline implants, silicone gel implants, complication rates, patient satisfaction.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Breast augmentation is a highly popular cosmetic surgery procedure that aims to enhance the size and shape of a woman's breasts. Its popularity can be attributed to significant advancements in surgical techniques and breast implant technology, which have broadened the range of options available to women [1].

This procedure is sought for various reasons, including improving body symmetry, restoring breast volume lost due to weight reduction or pregnancy, and for reconstructive purposes following a mastectomy. The core of breast augmentation lies in the

choice between two main types of breast implants: saline and silicone gel implants. Each type has distinct features and implications, making the decision a critical one for both patients and surgeons. This choice is influenced by factors such as the desired aesthetic outcome, the feel of the implants, and potential risks associated with each type [2].

Saline implants consist of a silicone shell filled with sterile salt water (saline). They are typically inserted empty and then filled to the desired volume, allowing for a smaller incision. One of the advantages of saline implants is the ease of detect-

ing ruptures; if a saline implant ruptures, the saline is absorbed and expelled naturally by the body, and the breast visibly deflates [3]. However, saline implants are generally firmer and may not feel as natural as silicone implants. They also have a higher chance of visible rippling.

On the other hand, silicone gel implants are filled with a silicone gel that closely mimics the feel of natural breast tissue. The gel inside these implants is thicker, which may provide a more natural feel. However, detecting ruptures in silicone implants can be challenging, as the gel may remain within the implant shell or escape into the breast implant pocket without visible changes. Regular monitoring with MRI or ultrasound is recommended for these implants. Silicone implants are less likely to wrinkle or ripple and are often preferred for their natural feel [4].

Both saline and silicone gel implants can be placed under the pectoral muscle (subpectoral placement), which offers several advantages. This placement can provide a more natural contour and appearance, reduce the risk of complications like capsular contracture, and is less likely to interfere with mammographic breast cancer screening [5]. Ultimately, the choice between saline and silicone gel implants is highly individualized. It depends on the patient's body type, desired outcome, and personal preferences, as well as the surgeon's recommendations based on their professional experience. It's crucial for patients to have a thorough consultation with a board-certified plastic surgeon to discuss all options, risks, and benefits to make an informed decision. The purpose of this study was to collect objective data comparing silicone gel and saline implants. Patients and doctors can utilize this information to choose an implant.

Methodology

Study Design: This research was a prospective study.

Study Setting: The study was carried out at 'S.K.M.C.H.' and was conducted over a 1-year period, from '2022 to 2023'. It focused on evaluating the outcomes of primary cosmetic breast augmentation procedures. All surgical procedures were performed by a single surgeon, ensuring consistency in surgical techniques and postoperative care.

Participants: The participants were 120 women undergoing primary cosmetic breast augmentation during the study period.

Inclusion and Exclusion Criteria: Inclusion criteria were limited to women undertaking primary cosmetic breast augmentation. The study excluded patients undertaking mastopexies, unilateral procedures, breast reconstruction, and transgender patients to maintain a homogeneous study group and to focus on the specific outcomes of primary cosmetic breast augmentation.

Bias: To minimize selection bias, all eligible patients during the study period were invited to participate. However, as a single-surgeon, single-center study, there may be inherent biases related to surgical technique and patient selection.

Variables: Key variables studied included the type of breast implant used, surgical techniques, postoperative complications, aesthetic outcomes, and patient satisfaction. Variables such as implant size, patient age, and preoperative breast size were also considered.

Data Collection: Data were collected through clinical evaluations, photographic assessments, and ultrasound scans. Surveys were administered to patients at least three months post-surgery to gather information on patient satisfaction and subjective outcomes.

Statistical Analysis: The data were analyzed using SPSS, version 26.0. An independent t-test was employed for comparing means. A P value of less than 0.05 was considered statistically significant.

Ethical Considerations: The ethics committee approved the study, guaranteeing that it followed the rules of ethics for using human participants in research. All participants gave their informed consent, and patient data privacy and confidentiality were scrupulously upheld throughout the investigation.

Result

During the 1-year research period, a total of 120 women underwent primary cosmetic breast augmentation as part of the study. These participants had an average age of 31 years, ranging from 18 to 62 years.

The mean duration of follow-up for these patients was approximately 4.6 months, with variations ranging from as short as 1 day to as long as 3 years.

Table 1: Demographics and Clinical Characteristics of the study

Characteristic	Value/Percentage
Total Patients	120
Average Age	31 years
Age Range	18 to 62 years
Mean Follow-Up Duration	4.6 months

Average Implant Volume	426ml
Implant Type	
• Saline	65%
• Silicongel	35%
Visible Rippling (Survey)	18%
Palpable Rippling (Survey)	32%
Satisfaction with Breast Firmness (Survey)	87%
Postoperative Breast Size Satisfaction (Survey)	73%
Desired Different Breast Size (Survey)	
• Larger	25%
• Smaller	2%
Ultrasound Scans Performed	80 (66.4%)
Ripples in Ultrasound	37 (46.3%)
Saline Implants with Ripples (Ultrasound)	23%
Silicone Gel Implants with Ripples (Ultrasound)	28%
Folds in Ultrasound	10%
Saline Implants with Folds (Ultrasound)	10%
Silicone Gel Implants with Folds (Ultrasound)	7%

In terms of implant characteristics, the average volume of implants utilized in the procedures was 426ml, with volumes ranging from 250ml to 800ml. Of the patients, 65% received saline implants, while the remaining 35% were fitted with silicone gel implants. Importantly, there were no significant demographic differences observed between the two groups that received saline and silicone gel implants.

Throughout the study, there were no reports of systemic complications or deep venous thromboses among the participants. However, five patients did exhibit visible rippling in their breast photographs. Additionally, four patients displayed animation deformities, as assessed by their respective surgeons. It is worth noting that none of these four patients expressed concerns or sought surgical correction for these deformities. Furthermore, 3 patients developed capsular contractures and subsequently underwent open capsulotomies, with one of them opting for larger implants during the procedure. Importantly, no reoperations were performed specifically for size changes, and there were no significant differences in complication and reoperation rates between the two groups receiving different types of implants.

In approximately half of the cases, pectoralis flexion resulted in nipple displacement of less than 1cm, with no notable distinction between the two implant types. In cases where nipple displacement exceeded 1cm, the distribution was fairly balanced between upward and downward directions. On average, the nipple displacement was found to be negligible. Out of the study's participants, a substantial portion, comprising 76.7% (92 women), completed the provided surveys. Interestingly, the distribution of saline (65%) and silicone gel (35%) implants among the survey respondents closely mirrored that of the overall patient population.

Among the survey participants, approximately 18% reported visible rippling, while 32% experienced palpable rippling. Those who reported rippling tended to have lower body mass indices and smaller implant volumes. It is noteworthy that a significant majority (87%) of the respondents expressed satisfaction with the firmness of their augmented breasts, with 73% indicating that they were content with their postoperative breast size. A minority of respondents expressed a desire for different sizes, with 25% preferring larger breasts and 2% desiring smaller ones. Importantly, there were no significant differences in these preferences based on the type of implants used in the procedures.

Ultrasound scans were conducted on a substantial portion of the study participants, specifically 66.4% (80 women). In these scans, ripples, which are defined as wrinkles on the anterior surface of the implants, were observed in 37 women. Among these, 23% had saline implants, and 28% had silicone gel implants.

Additionally, 10% of participants with saline implants and 7% of participants with silicone gel implants had folds, which are deeper creases where the implant shell meets itself. Notably, no instances of implant leaks or ruptures were found, nor were there any appreciable variations in the frequency of ripples or folds between the two types of implants. Women who exhibited rippling and folds had a significantly lower average body mass index (21.3 kg/m²) compared to those without such issues (22.8 kg/m²). Moreover, there was a strong correlation found between rippling and folds and lower mean implant volumes; individuals with these problems had an average implant volume of 397 ml, whereas those without them had an average volume of 435 ml.

Discussion

The study findings from the 1-year research period revealed that 120 women underwent primary cosmetic breast augmentation, with an average age of 31 years. The majority received saline implants (65%), and no significant demographic differences were observed between the saline and silicone gel implant groups. There were no reports of systemic complications or deep venous thromboses during the study, but visible rippling was observed in five patients, and four displayed animation deformities, none of whom sought correction. Three patients experienced capsular contractures and underwent open capsulotomies, with one opting for larger implants. No reoperations for size changes were performed, and complication rates did not significantly differ between implant types.

Pectoralis flexion resulted in minimal nipple displacement, with no significant difference between implant types. Survey responses from 76.7% of participants showed that implant type did not significantly affect satisfaction with firmness or post-operative size. Ultrasound scans on 66.4% of participants found no significant differences in the incidence of ripples or folds between implant types, and no implant leaks or ruptures were detected. Rippling and folds were associated with lower body mass index and smaller implant volumes.

The study indicates that both saline and silicone gel implants are viable options for primary cosmetic breast augmentation, with no significant differences in complication rates or patient satisfaction based on implant type. Rippling and folds, while observed in some cases, were not significantly impacted by the choice of implant, suggesting that factors such as body mass index and implant volume may play a more substantial role in their occurrence. Overall, the findings provide valuable insights for both patients and practitioners considering breast augmentation procedures.

The majority of respondents to a poll done by the American Society of Plastic Surgeons indicated that silicone gel implants were their implant of choice. Perceived advantages over saline implants, such as the possibility of a more natural consistency and less rippling, were the basis for this preference [6, 7]. Patients have long been advised about the aesthetic benefits of silicone gel implants, which include a decreased likelihood of needing a second surgery for rupture since the implants do not deflate, unlike saline implants, which absorb all of the leakage. It's crucial to balance these benefits, though, with the increased expense and difficulty of identifying silicone gel implant ruptures without the use of imaging investigations.

have been observed for both saline and silicone gel implants [16]. In general, the implants resemble the patients. It is important to note, though, that sili-

The benefits of textured gel implants over textured saline implants were demonstrated by Handel et al.'s study [8], which looked into the matter. The palpability of the breast implant shell may be impacted by the textured saline implant's texture, which is prone to rippling [9]. The possibility of tissue adherence to the implant increasing the likelihood of ripples but because texturing has been linked to breast implant-associated anaplastic large-cell lymphoma (BIA-ALCL), the disparity between smooth gel and smooth saline implants is becoming more significant [10].

Even though it is seen as a problem, ripples are a typical deformation that occurs when a breast implant is positioned in different orientations. One popular technique to increase soft tissue coverage is to insert implants subpectorally [11]. Most cosmetic surgeons fill saline implants to the prescribed maximum capacity since under-filling increases the chance of rippling. Implants with more cohesiveness (more silicone cross-linking) are thought to result in less rippling, although they can also become more rigid. Remarkably, rippling and folds can still be seen in even the most cohesive "form stable" implant designs [11, 12].

A rippling rate of 7.1% was reported in large retrospective research by Codner et al. [13], and no discernible difference in rippling rates was found between silicone gel and saline implants. Nonetheless, a link between rippling and saline implants was found among underweight patients with subglandular implants. As in this study, larger body mass indices were associated with a lower likelihood of rippling. In the study by Codner et al. [13], 2.7% of patients had saline implant deflation.

Plastic surgeons handling both types during consultations are aware that many women indicate a preference for silicone gel implants. But in vivo, this difference might be harder to see, especially in a subpectoral pocket and in women with moderate breast capacity. Saline implants have various advantages, including quicker incisions, immediate rupture diagnosis, and a lesser danger associated with leaking saline [14]. Conversely, the identification of a ruptured silicone gel implant frequently requires costly imaging methods that aren't always reliable. Regardless of silicone bleed's potential connection to systemic illnesses, the lack of silicone gel reduces worries regarding silicone bleed [15]. Despite the paucity of information about capsular contracture rates, some writers propose a benefit for saline implants. Furthermore, saline implants are less expensive than silicone gel implants.

Patient satisfaction is a major factor of success in cosmetic surgery, and high levels of satisfaction cone gel implants are more profitable for breast implant manufacturers and are widely advertised [6].

Although similar results have been seen with rippling, silicone gel implants might offer less obvious benefits. Patients with prior experience with both types of implants frequently comment on the more natural consistency of silicone gel implants, especially when very cohesive gel or capsular contracture is not present. There may not be any size or shape changes in the event of a leak, which eliminates the need for an unplanned and inconvenient implant replacement. It is important to note that the majority of women who have silicone bleeds to some extent are asymptomatic and unaware of them, and it is still unclear what the clinical relevance of little intracapsular silicone leaks is.

Conclusion

The study provides valuable insights into the choice between saline and silicone gel implants for primary cosmetic breast augmentation. With a focus on objective data and patient outcomes, it is evident that both implant types offer viable options, and the decision should be highly individualized, taking into account factors such as the patient's body type, desired outcomes, and personal preferences, along with the surgeon's recommendations. Importantly, complication rates, patient satisfaction, and the occurrence of rippling and folds do not significantly differ between the two implant types. The advantages and disadvantages of each type must be carefully weighed, considering factors such as cost, rupture detection, and feel. Ultimately, patient satisfaction remains the primary determinant of success in cosmetic surgery, and both saline and silicone gel implants have shown high satisfaction rates. It is essential for patients to have comprehensive consultations with board-certified plastic surgeons to make informed decisions that align with their aesthetic goals and preferences.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendations: Patients should consult board-certified plastic surgeons to make informed decisions based on their body type, aesthetic goals, and personal preferences. Surgeons should consider factors beyond implant type when discussing potential complications and satisfaction with patients.

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References

1. Adams Jr WP, Mallucci P. Breast augmentation. *Plastic and reconstructive surgery*. 2012 Oct 1;130(4):597e-611e.
2. Spear SL, Jespersen MR. Breast implants: saline or silicone? *Aesthetic surgery journal*. 2010 Jul 1;30(4):557-70.
3. Hidalgo DA, Spector JA. Breast augmentation. *Plastic and reconstructive surgery*. 2014 Apr 1;133(4):567e-83e.
4. Schaub TA, Ahmad J, Rohrich RJ. Capsular contracture with breast implants in the cosmetic patient: saline versus silicone—a systematic review of the literature. *Plastic and reconstructive surgery*. 2010 Dec 1;126(6):2140-9.
5. Heidekrueger PI, Sinno S, Hidalgo DA, Colombo M, Broer PN. Current trends in breast augmentation: an international analysis. *Aesthetic Surgery Journal*. 2018 Jan 17;38(2):133-48.
6. Hidalgo DA, Spector JA. Breast augmentation. *PlastReconstr Surg*. 2014; 133:567e–583e.
7. Chang EI, Hammond DC. Clinical results on innovation in breast implant design. *PlastReconstr Surg*. 2018;142(4S The Science of Breast Implants):31S–38S.
8. Handel N, Jensen JA, Black Q, et al. The fate of breast implants: a critical analysis of complications and outcomes. *PlastReconstr Surg*. 1995; 96:1521–1533.
9. Handel N, Cordray T, Gutierrez J, et al. A long-term study of outcomes, complications, and patient satisfaction with breast implants. *PlastReconstr Surg*. 2006; 117:757–767; discussion 768.
10. Brody GS, Deapen D, Taylor CR, et al. Anaplastic large cell lymphoma occurring in women with breast implants: analysis of 173 cases. *PlastReconstr Surg*. 2015; 135:695–705.
11. Nahabedian MY. Round form-stable breast implants: diagnosis and management of complications. *PlastReconstr Surg*. 2019; 144:73S–81S.
12. Mohebbi K, Wixtrom RN. Breast implant engineering and performance. *PlastReconstr Surg*. 2018;142(4S The Science of Breast Implants):6S–11S.
13. Codner MA, Mejia JD, Locke MB, et al. A 15-year experience with primary breast augmentation. *PlastReconstr Surg*. 2011; 127:1300–1310.
14. Swanson E. Breast augmentation. In: *Evidence-based Cosmetic Breast Surgery*. Cham, Switzerland: Springer; 2017:33–74.
15. Rohrich RJ, Reece EM. Breast augmentation today: saline versus silicone—what are the facts? *PlastReconstr Surg*. 2008; 121:669–672.
16. Ching S, Thoma A, McCabe RE, et al. Measuring outcomes in aesthetic surgery: a compre-

hensive review of the literature. *PlastReconstr*

Surg. 2003; 111:469–480; discussion 481.