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# Single-stage Layered versus Nonlayered Mastopexy with Augmentation in Muscle Splitting Biplane: A Comparative Analysis

Umar D. Khan, MBBS, FRCS

**Background:** Single-stage layered mastopexy with augmentation is a modification of muscle-splitting pocket that reduces risk of complications and revision rate.
**Methods:** A retrospective chart review of all the consecutive cases, performed by a single surgeon, from March 2007 to August 2019, was conducted. All patients had surgery with superomedial pedicle in an approved facility. The patients were divided into group A whose implants were placed through the mastopexy incision, and group B whose implants were placed first and access closed prior to mastopexy.
**Results:** Nonlayered group A included 116 patients and layered group B included 102 patients. Groups A and B had a mean age of 32.3+9.70 and 34.8+10.39 years (range, 20–66), respectively (*P* value 0.070). In groups A and B, 95 (81.9%) and 74 (72.5%) patients underwent primary and 21 (18.1%) and 28 (27.5%) patients underwent secondary procedures, respectively (*P* value 0.099). There were no hematomas in group A and two patients had hematoma in group B (*P* value 0.218). In group A, one patient experienced periprosthetic infection with none in group B (*P* value 0.41). Wound breakdown was observed in ten (8.6%) patients in group A and four (3.9%) patients in group B (*P* value 0.128). In group A, there was a partial or complete nipple loss in two (1.7%) and none in group B (*P* value 0.412). In group A, 15 (12.9%) underwent revision surgery and six (6.5%) in group B (*P* value 0.127).
**Conclusion:** Layered mastopexy with augmentation provides improved safety, fewer complications and revisions with adequate results. *(Plast Reconstr Surg Glob Open 2022;10:e4514; doi: 10.1097/GOX.0000000000004514; Published online 23 September 2022.)*

## INTRODUCTION

Mastopexy and augmentation are among the most common aesthetic procedures performed today.[1] With the use of preformed implants in augmentation mammoplasty and mastopexy with augmentation in the subglandular (SG) pocket, the search for an ideal pocket for implant placement and design for mastopexy to achieve ideal results is far from over.[2–6] Anatomically, the breast lies in front of the muscle with a unique appearance that changes from angle to angle and position to position; therefore, the SG pocket is the ideal pocket for implant placement and for three-dimensional outcomes. However, an unacceptably high capsular contracture rate observed in the SG pocket made the total submuscular position an alternative and practical implant pocket. Soon it was realized that a total submuscular position under the muscles may not give an ideal breast shape, and hence, subsequent changes in the extent of muscle cover for the implant were introduced.[7,8] With the uncertainty of SG pocket reliability in the long term,[9] the dual plane (DP) pocket, an extension of the partial submuscular (PSM) pocket, provided the capacity to manage the excess skin in the lower pole.[5] However, the modification came at the cost of noticeable animation deformity and breast distortion in patients.[10–16] This animation or dynamic deformity is iatrogenic and is due to pectoralis muscle detachment from its fixed sternocostal margin medially and from the breast envelope anteriorly.[11,13,17] The muscle-splitting biplane pocket (MSBP) is the same concept that optimizes results without muscle release. Instead, the muscle is left attached, and an SG pocket is created in front of the muscle in the lower and lateral quadrants of the breast. The muscle is split from the junction of the middle and lower third of the sternum up and laterally to the anterior

*From the Reshape House, West Malling, Kent, UK.*

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axillary fold. (**See figure, Supplemental Digital Content 1**, which displays the muscle split pocket. Bottom red incision shows the pocket access. Initial subglandular pocket is dissected extending between the junction of lower and middle third of sternum, up and laterally to the anterior axillary fold. Pectoralis muscle split starts at the level of middle and lower third of sternum and goes up and laterally, along the direction of the muscle fibers up to the level of anterior axillary folds, **http://links.lww.com/PRSGO/C150**.) This allows the implant to simultaneously sit in front of and behind the pectoralis muscle and allows the breast implant to fill the lower pole directly in the lower and outer SG pocket, while the upper pectoralis muscle covers the upper and medial quadrants.[17] The pocket has shown no animation distortion or deformity and has been used to treat animation deformity by the conversion of PSM and DP pockets to MSBP.[11,12,17] MSBP safety and its relative advantages has allowed its use in mastopexy with augmentation and it is widely used through inframammary, areolar, and axillary incisions with no added risk of revision or bottoming down.[18–26] Layered mastopexy with augmentation is a modification of MSBP.[26,27] The current article describes the development and progression of single-stage mastopexy with augmentation using MSBP, and the complications and revision rates between layered mastopexy and augmentation were compared with those of the nonlayered approach.

## MATERIAL AND METHODS

Since the mastopexy with augmentation in MSBP technique was first used in March 2007, a retrospective chart review of all the single-stage mastopexies with augmentation in MSBP was conducted. A total of 218 procedures were performed between March 2007 and August 2019. All patients were consulted, underwent surgery, and were followed up by the same surgeon. All patients had round cohesive gel silicone implants. Size, shape, and profile of the implant are determined using a combination of the footprint of the breast and available breast skin envelope. Patients were marked preoperatively in the standing position before surgery. All patients were American Society of Anesthesiologists class I or II, and smokers were asked to stop smoking 2 weeks before and after surgery. Patients with tuberous deformity were included in the series. All patients were administered general anesthesia with full muscle relaxation in an approved hospital facility. All primary surgeries were performed in MSBP, where the implant lies in front of and behind the pectoralis simultaneously.[16]

Data were divided into two groups: group A, patients who underwent mastopexy with augmentation in which implants were placed through the mastopexy incision, and group B, patients who underwent layered mastopexy with augmentation. In group B, the pocket was approached through the inframammary incision in the periareolar and Wise pattern mastopexies or through the lower part of the vertical scar markings. (**See figure, Supplemental Digital Content 1,** http://links.lww.com/PRSGO/C150.) The access was closed following implant placement and before the commencement of the layered mastopexy. This allowed nipple shields to cover the nipple-areolar complex to reduce potential contamination of the operative field during dissection of the pocket and handling of the prosthesis. Initial SG dissection was performed that extends from the inframammary crease up to the junction of the middle and lower third of the sternum medially and up and laterally to the anterior axillary fold. Submuscular access is achieved by splitting the pectoralis at the junction of the middle and lower one-third of the sternum, up and laterally to the anterior axillary fold and in the direction of the muscle fibers. SG, PSM, and DP were converted into MSBP for secondary surgeries. Pockets were washed out and irrigated with normal saline and a mixture of normal saline with povidone iodine before introducing the implants. In group B, a layer of tissue was left to cover the implant when mastopexy was performed, and the pedicle was not completely isolated and remained attached circumferentially to the breast parenchyma for better blood supply, venous return lymphatic drainage, sensory input, and lactation potential. All patients had a perioperative intravenous single dose of antibiotics followed by an oral course for 5 days. Surgery was performed primarily as a day case, and drains were selectively used in patients who had revisionary surgery requiring capsulectomy or patients who had added procedures and required venous thromboembolism prophylaxis.

### Takeaways

**Question**: To compare efficacy of layered mastopexy and compare benefits of the technique with that of nonlayered mastopexy.

**Findings**: Layered mastopexy is a safe technique that reduces complication and revision rates and can be done as a day case without drains in the majority of patients.

**Meaning**: Layered mastopexy is a suitable option for patient's improved safety and outcome of results.

## STATISTICAL ANALYSIS

The data were analyzed using the Statistical Package for the Social Sciences, version 19.0. The results are presented in the text as the frequency and percentage for qualitative/categorical variables (differences in implant size) and the mean + SD for quantitative/continuous variables (age and implant size). The $\chi 2$ test was used to compare the categorical variables, and the *t* test was used for quantitative/continuous variables. For all statistical analyses, only *P* values less than 0.05 were considered significant.

## RESULTS

Nonlayered group A of patients had their surgery during the early part of the series than layered group B. Nonlayered group A included 116 patients with a mean age of 32.3 + 9.70 years (range, 18–67) (Table 1). Of these, smoking status was recorded in 115, and 24 (20.9%) were smokers. Implant sizes were identified in 114 patients, of

which 98 had implants of the same size with a mean size of 302 + 76.6 $cm^3$ (range, 170–559) and 16 patients had implants of different sizes with a mean size on the right 303 + 80.4 $cm^3$ (range, 200–495) and 322 + 112.4 (range, 200–615) on the left side. In this group, 63 (54.3%) had high profile, 24 (20.7%) had moderate profile, and 29 (25.0%) had low-profile implants. Of these, 64 (55.7%) had textured implants (pore size, 200–300 $mm^2$). Forty-eight (41.7%) had microtextured implants (pore size 100–200 $mm^2$) and 3 (2.6%) had smooth implants (Table 2). Ninety-five (81.9%) patients underwent primary procedures (Fig. 1) and 21 (18.1%) underwent secondary procedures. Forty-eight (41.4%) patients had vertical scar incisions with superomedial pedicle, 46 (39.7%) had periareolar scar incisions with superomedial pedicle, 10 (8.6%) had Wise pattern scar with superomedial pedicle, and 12 (10.3%) patients had unilateral incisions or combinations of mastopexy incisions. In this group, 27 (23.3%) patients had drains, and 63 (54.%) patients underwent surgery performed as a day case. There was no hematoma, and five (4.3%) patients had infection in this group. Wound breakdown was observed in 10 (8.6%) patients. Nipple sensation, using digital tactile touch, was recorded in 88 patients and was present in 77 (98.7%), and there was partial or complete nipple loss in two (1.7%) patients. In this group, nine (7.8%) had grade III/IV capsular contracture, and 15 (12.9%) underwent revision surgery (Table 3).

Layered group B included 102 patients with a mean age of 34.8 + 10.39 years (range, 20–66) (Table 1). Of these, smoking status was recorded in 99 patients, and 13 (13.1%) were smokers. Implant sizes were identified in 102 patients: of these, 89 had implants of the same size with a mean size of 298 + 80.1 $cm^3$ (range, 220–800), and 13 patients had implants of different sizes with a mean size on the right 362 + 79.1 $cm^3$ (range, 240–560) and 395 + 83.9 $cm^3$ (range, 265–615) on the left side. Seventy-two (70.6%) had high profile, 30 (29.4%) had moderate profile, and no patients had low profile implants. Of these, 53 (52.0%) had textured implants (pore size 200–300 $mm^2$), 12 (11.8%) had microtextured implants (pore size 100–200 $mm^2$), and 37 (36.3%) had smooth implants (Table 2). Fifty-one (50.0%) patients had vertical scar incisions (Fig. 2), 11 (10.8%) had periareolar scar incisions, 27 (26.5%) had Wise pattern scar incisions, and 13 (12.8%) patients had unilateral incisions or a combination mastopexy incision. All three incisions and their combination included superomedial pedicles. In this group, 14 (13.7%) patients had drains, and 92 (90.2%) patients underwent surgery performed as a day case. Two patients had hematoma, and no patients had periprosthetic or wound infection in this group. Wound breakdown was observed in four (3.9%) patients and was not significant (0.128) (Table 3). Nipple sensation, using digital tactile touch, was present in 94 (97.9%) patients, and there was no partial or complete nipple loss. In this group, five (4.9%) patients had grade III/IV capsular contracture and six (6.5%) underwent revision surgery (Table 3).

**Table 1. Relative Distribution of Mean Age and Range Distribution Between the Two Groups**

| Age in Years | Group A. Nonlayered Mastopexy with Augmentation (n = 116) | Group B. Layered Mastopexy with Augmentation (n = 102) | *P* |
|---|---|---|---|
| Range | 18–67 | 20–66 | 0.070 |
| Mean + SD | 32.3 + 9.70 | 34.8 + 10.39 | |

## DISCUSSION

The MSBP used for implant placement is a unique submuscular pocket in which the implant lies in an SG pocket in front of the lower pectoralis muscle and in the submuscular pocket behind the upper pectoralis muscle.[16] The lower SG pocket allows the implant to fill the pocket without the need for the muscle to be released from its insertion, and hence, allows the absence of breast animation deformity.[11,16] The MSBP was subsequently used for the treatment and correction of breast animation deformity in cases where initial surgery was performed in DP (Fig. 3).[11,12] MSBP is also used for revisionary surgeries following PSM or SG pockets.[28,29]

The pocket was also used for internal and external mastopexies.[21,30–33] Later, modifications of the pocket design were reported by other authors for its use in internal mastopexy and to minimize lateral displacement in some cases.[23,31] MSBP also allows transaxillary approach, which has been used for primary and revision surgeries.[22,24]

The complication and revision rates in mastopexy with augmentation in MSBP in its first article were reported at 13.5% and 4.5%, respectively, with a 3-year follow-up. Subsequently, a 9- and 13-year follow-up

**Table 2. Distribution of Sizes, Texturing, and Profiles of the Implants Used in the Series**

| | Group A. Nonlayered Mastopexy with Augmentation | Group B. Layered Mastoepxy with Augmentation | *P* |
|---|---|---|---|
| Texture of the implants (%) | | | |
| Microtextured | 48 (41.7) | 12 (11.8) | 0.001 |
| Textured | 64 (55.7) | 53 (52.0) | |
| Smooth | 3 (2.6) | 37 (36.3) | |
| Profile of the implants (%) | | | |
| Low profile | 29 (25.0) | 0 (0) | 0.001 |
| Moderate profile | 24 (20.7) | 30 (29.4) | |
| High profile | 63 (54.3) | 72 (70.6) | |
| Size of the implants | n (Range), Mean ± SD | | |
| Same size implants ($cm^3$) | 98 (170–559), 302 ± 76.6 | 89 (220–800), 298 ± 80.1 | 0.741 |
| Different size implants ($cm^3$) | n (Range), Mean ± SD | | |
| Right | 16 (200–495), 303 ± 80.4 | 13 (240–560), 362 ± 79.1 | 0.060 |
| Left | 16 (200–615), 322 ± 112.4 | 13 (265–615), 395 ± 83.9 | 0.109 |

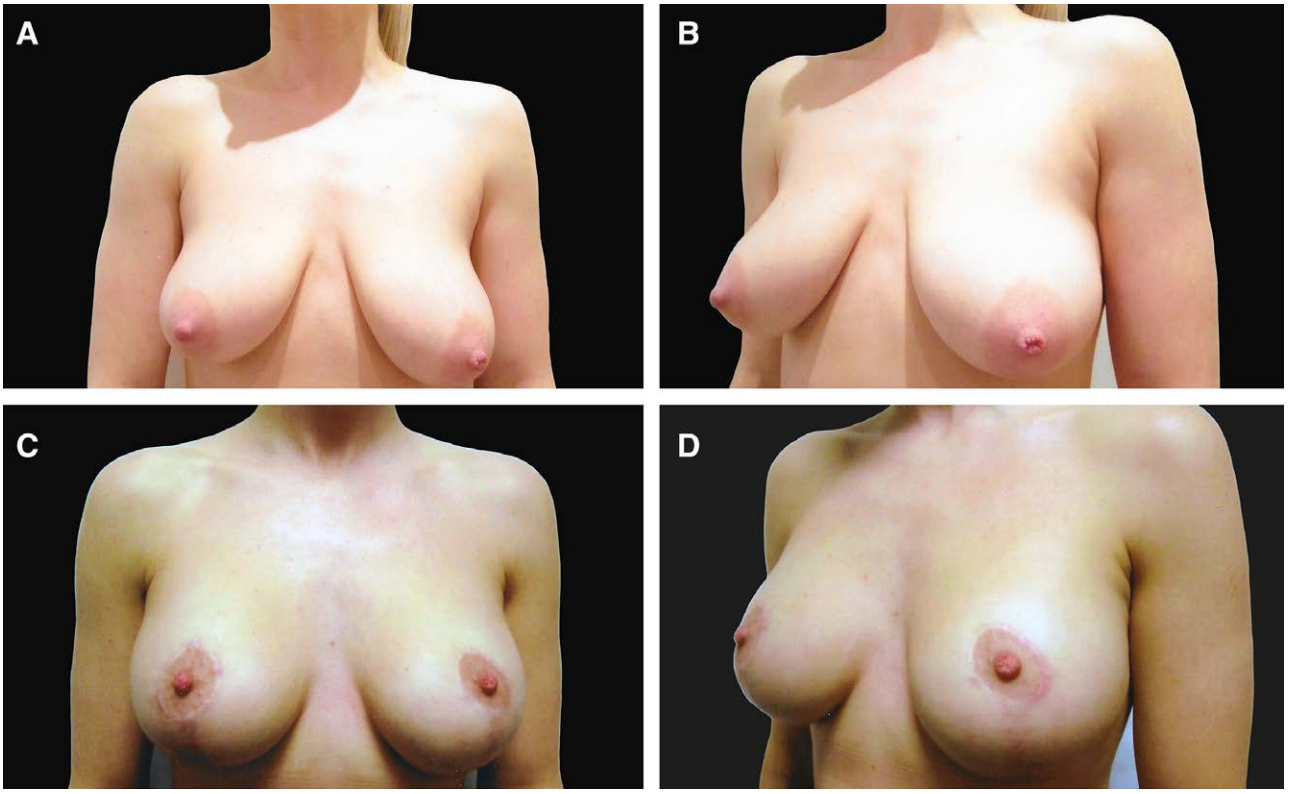


**Fig. 1.** Before and after results. A and B, A 29-year-old patient who presented with bilateral grade III ptosis following two childbirths. C and D, Postoperative views taken 1 year and a month following vertical scar nonlayered mastopexy using 260 $cm^3$ round cohesive gel silicone implants.

**Table 3. Relative Distribution of General Characteristics and Complications**

| Variables | Group A. Nonlayered Mastopexy with Augmentation (n = 116) (%) | Group B. Layered Mastopexy with Augmentation (n = 102) (%) | *P* |
|---|---|---|---|
| Smokers | 24 (20.9) | 13 (13.1) | 0.136 |
| Infection | 5 (4.3) | 0 (0) | 0.041 |
| Haematoma | 0 (0) | 2 (2.0) | 0.218 |
| Wound breakdown | 10 (8.6) | 4 (3.9) | 0.128 |
| Nipple loss (partial or complete) | 2 (1.7) | 0 (0) | 0.412 |
| Use of drains | 27 (23.3) | 14 (13.7) | 0.072 |
| Revisions | 15 (12.9) | 6 (6.5) | 0.127 |
| Day cases | 63 (54.3) | 92 (90.2) | 0.001 |
| Added procedure | 9 (7.8) | 12 (11.) | 0.319 |

showed complication rates of 11.1% and 13.1%, respectively, where revision surgeries were performed in 10.1% of primary procedures.[32,33] Since the introduction of mastopexy with augmentation in MSBP, small modifications have been continuously introduced and incorporated to reduce complications and revision rates in mastopexy with augmentation in MSBP. Introduction of cat's tail modification to vertical scars, selection of incision based on preoperative nipple-areolar complex to inframammary crease measurements, limited use of periareolar markings for mastopexy, and finally, the use of layered mastopexy with augmentation have all contributed to reduced complication and revision rates and to achieve full potential of mastopexy with augmentation in MSBP.[27,28,34,35] The development of layered mastopexy with augmentation is a journey that started with the use of the MSBP, and further improvement is expected to continue in the future to reduce complication and revision rates.[16,27] Layered mastopexy with augmentation showed that the procedure was performed as a day case in 90.2% of patients who underwent layered mastopexy with augmentation compared with 54.3% of patients who underwent nonlayered mastopexy with augmentation. It is partly due to change in practice as patients can save their overnight cost of the surgery. Also, having the augmentation and mastopexy components performed separately in the same setting and procedure allows better control to each component. The nipple-areolar complex vascular supply and drainage is better secured, as the pedicle is not entirely dependent on length-to-breadth ratio. Layered mastopexy modification also allowed

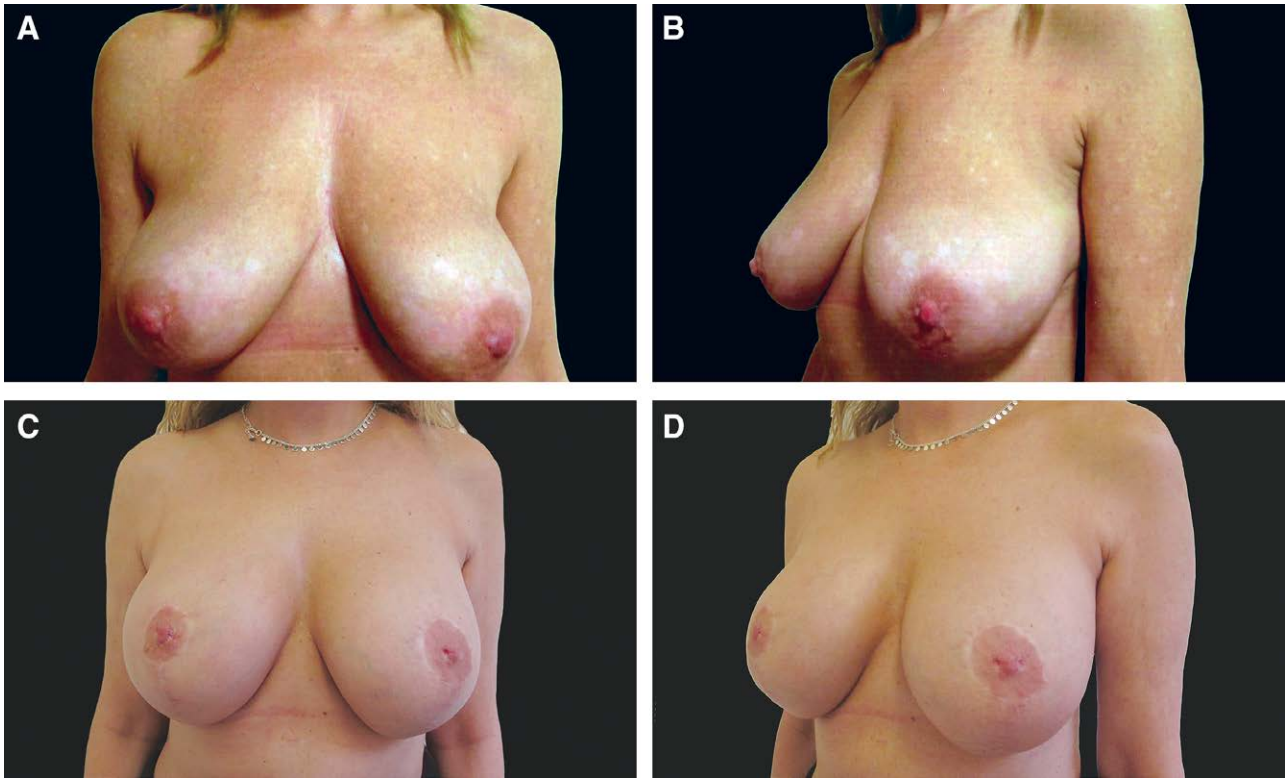


**Fig. 2.** Before and after results. A and B, A 32-year-old patient who presented with large grade III ptotic breasts. C and D, Postoperative photographs taken 4.5 years after surgery showing results following vertical scar layered mastopexy with augmentation using 300 $cm^3$ round high profile cohesive gel silicone implants.

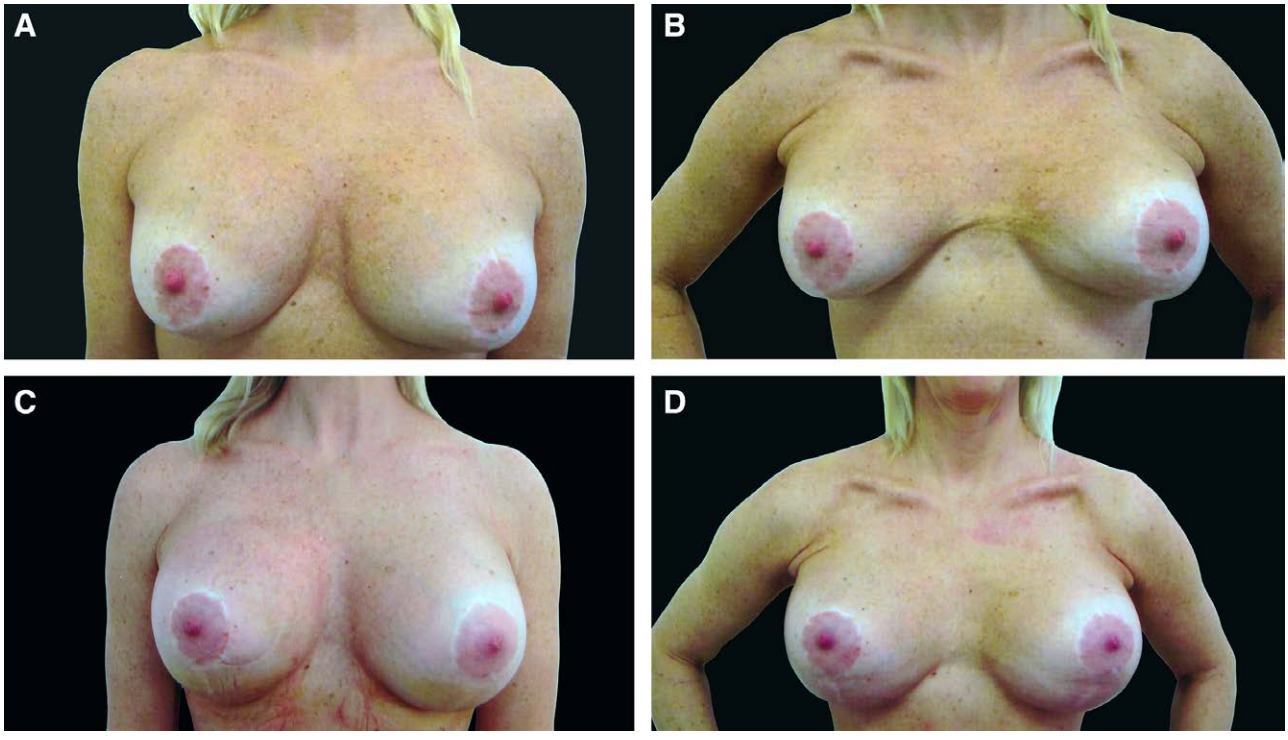


**Fig. 3.** Preoperative photographs of a 39-year-old patient before her pectoralis contraction test. She presented with a history of mastopexy with breast augmentation in dual plane using 300 $cm^3$ cohesive gel round silicone implants (A). B, Noticeable animation deformity was noted following pectoralis contraction. C, Postoperative photograph taken 7 weeks following 475 $cm^3$ cohesive gel round silicone implants and conversion of DP to MSBP. D, Pectoralis contraction test showing significant reduction of animation deformity following pocket conversion.

nipple shields to cover the nipple-areolar complex during pocket dissection and implant handling. This may have reduced the superficial wound infection rate from 4.3% in the nonlayered group to 0% in the layered group, as observed in a previous retrospective study.[36] Similarly, the incidence of wound breakdown was 3.9% in the layered group and was considerably less than 8.6% in the nonlayered group; however, the difference was not significant (*P* value 0.128). The revision rate was 12.9% of patients in the nonlayered group and 6.5% in the layered mastopexy with augmentation group. There was 0% nipple-areolar complex loss or compromise in the layered group when compared with 1.7% in the nonlayered group. Even though there was no statistical significance in nipple loss between the two groups (*P* value 0.412), nipple circulation compromise was higher in the nonlayered group. The factors contributing to this serious complication in the series are difficult to ascertain. Total nipple loss was seen in the patient who presented with large, ptotic, and asymmetrical breasts, and a combination of reduction, symmetrization, and longer length pedicle might have resulted in complete loss of the nipple. Partial necrosis was seen in the patient with revision mastopexy with implant exchange who presented with type IV capsular contracture. In MSBP, the pectoralis muscle adequately covers the implant in the medial and upper quadrants of the breast. When SG pocket conversion to MSBP is performed in revision mastopexy with augmentation or revision augmentation mammoplasty, implant rippling in this part of the breast is completely rectified.[28,30]

In both the layered and nonlayered mastopexy groups, patients are followed up for up to 2 years, as long-term complications related to implants are similar in the augmentation mammoplasty and augmentation mastopexy groups.[19,20,33] The most common reason for revisions in nonlayered group A was waterfall deformity following periareolar mastopexy with augmentation. Even with the use of a higher number of smooth implants since 2017, the capsular contracture rate in the layered (6.5%) group was lower than that in the nonlayered group (7.8%). This lower rate of capsular contracture may be due to the shorter follow-up period in the layered mastopexy group and may change with a longer follow-up. The author was using textured implants before the link between breast implant-associated anaplastic large cell lymphoma and textured implants.[37] Since 2018, the author is exclusively using smooth implants.

### Strength/Weaknesses to the Study

The strength of the study is that the same implant pocket was used in both groups using round cohesive gel silicone implants by the same surgeon. Although layered mastopexy with augmentation is designed to have better arterial input, sensation, and lactation potential associated with venous and lymphatic drainage, no objective study was performed to confirm these claims. Long-term implant-related complications are difficult to evaluate and can potentially change the revision rate. Patient outcome analysis of the results was not performed using standardized questionnaires such as the BREAST-Q, SF-36, or PROMIS score.

## CONCLUSIONS

Layered mastopexy with augmentation is a modification of mastopexy with augmentation in the MSBP. This retrospective study showed a significant decrease in wound complication and revision rates due to not only the impact of the pocket but also changes made in the markings and tissue arrangement in the envelope. This may explain the decrease in complications and revision rate along with the improved safety of the procedure. The process of ongoing audit will continue in future work and experience shared with peers.

***Umar D. Khan, MBBS, FRCS***
Reshape House
2-4 High Street, West Malling
ME19 6QR Kent,
UK
E-mail: mrumarkhan@aol.com

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## ETHICAL APPROVAL STATEMENT

*All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.*

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