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Original Article

MAMAS (mastopexy–augmentation made applicable and safer): A standardized template of pre-operative marking and step-by-step surgical procedure ☆

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ABSTRACT

Simultaneous breast augmentation with mastopexy is growing in popularity. It is a complex procedure that can lead to post-operative complications, patient dissatisfaction, and increased risk of litigation. The aim of this study is to describe an approach for the inverted-T augmentation-mastopexy technique, which limits intraoperative modifications, minimizes errors, and decreases post-operative complications and patient dissatisfaction.

The study included 107 patients with Regnault's grade I and II ptosis and severe pseudoptosis. All patients were marked according to our novel technique, Mastopexy Augmentation Made Applicable and Safer (MAMAS), and operated by a single surgeon. All patients underwent simultaneous breast augmentation with Siltex Mentor Round Silicone Gel breast implants and mastopexy. Pre-

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operatively and post-operatively, patients filled the BREAST-Q. The mean follow-up was 24 months.

Hundred and seven women received treatment in this study. Sixteen presented with post-operative complications, eleven in the early stage of recovery, and five in the late stage. There were eight cases of minor wound healing complications, all treated conservatively. Two cases of infection were noted, both were treated with oral antibiotics. One patient experienced post-operative bleeding after 13 days, which required surgical revision. In the late stage of recovery, five cases of implant displacement occurred and required revision surgery. No cases of capsular contracture and seromas were reported. According to Breast-Q, all patients were satisfied.

MAMAS surgical technique, focusing on precise pre-operative marking for augmentation-mastopexy, is simple and easily reproducible. The procedure has a low complication rate and high patient satisfaction. It provides predictable and stable results over time.

Introduction

The individual procedures of mastopexy and augmentation have been standard aesthetic operations, with innovations and improvements in the subsequent decades that have improved surgical outcomes and minimized post-operative complications.[1,2] However, the combination of the two in a single procedure has been quite controversial, due to increased post-surgical complications, unsatisfactory results, inconsistent published and anecdotal data and considering the opposing forces of volume augmentation and skin envelope reduction.[3,4]

The goal of the concurrent incorporation of these procedures is to effectively augment the size of the breasts with implant insertion, while simultaneously repositioning the nipple-areola complex (NAC) in regard to the newly added volume.[5] Eventually, this combination will eliminate the need of a two-stage operation, which will therefore reduce the post-operative recovery and improve patient satisfaction.[6]

Unfortunately, due to the opposition of implant-based volume expansion juxtaposed to pedicled NAC lift and breast reduction, mastopexy–augmentation is without a doubt a high-risk procedure with increased risk of litigation and patient dissatisfaction,[3,5,7,8] that can lead to post-operative complications, such as poor scarring, compromised wound healing, areola asymmetry, encapsulation, implant infection, partial necrosis and recurrent unilateral or bilateral ptosis.[4,9,10]

Despite those concerns, this combined procedure is getting increasingly popular, with more data available for utilization, but with significant variability and differences between the techniques used.[11] There are various publications documenting these techniques with the intention not only of a satisfactory aesthetic result but also to reduce post-operative complications, therefore eliminating the need of corrective surgery.[12–14]

Depending on the grade of ptosis, the standard single mastopexy techniques are applied on mastopexy–augmentation. In grade I ptosis, circumareolar mastopexy can show improved results with minimal scarring,[15] while for ptosis of all grades, vertical mastopexy is generally preferred.[14] Furthermore, for patients with grade II and III ptosis with atrophy and skin excess, inverted-T mastopexy is recommended.[12,16] This approach has been shown to be the most preferred and is considered ideal due to its flexible application to more or less any size of breast. This technique involves initially a de-epithelialization starting superiorly of the nipple-areola complex and around it and continues by

an incision medially and laterally to the borders of the lower pole of the breast forming two opposing pedicles along the inframammary crease. Then, in this incised area, the implant is placed into the submuscular space, underneath the pectoral muscle, which is then concluded and closed accordingly.[11]

In order to avoid complications, several considerations have to be taken for a successful result. These include surgical history and diabetes but also type of implant, implant surface, and location.[17] Importance should be given to the type of implant (saline vs. silicone), not only due to aesthetic reasons but also to avoid post-op drawbacks such as capsular contraction, infection, and, in rare cases, lymphoma (BIA-ALCL).[16,18] On top of that, the location of the implant must be considered thoroughly as well, as the suprapectoral (subglandular) location has shown to be generally preferred over the subpectoral location because of its natural-looking outcome.[11] However, in mastopexy–augmentation, the subpectoral placement of the implant is preferred, due to lower risk of capsular contracture and revisional surgery.[16]

Undoubtedly, despite contradicting evidence, there has been considerable improvement in the outcomes of simultaneous mastopexy with breast augmentation. While the circumareolar and crescent mastopexy augmentations for minimal ptosis have the least scarring,[12,19] vertical and inverted-T techniques are the most preferred techniques, because they allow the removal of larger amounts of skin and help achieve better shaping and tightening of the breasts.[16] The only drawback is that the inverted-T technique has more scarring, thus resulting in dissatisfaction by some patients.[13]

The article explores the idea of a structured universal plan that could sufficiently minimize excessive and time-consuming pre-operative markings, intraoperative changes, and ensuing post-operative complications. Several algorithms have been used in the past in order to achieve the desired outcomes of this procedure. These algorithms assimilate the use of the following basic anatomical lines; the midclavicular plane, sternal notch, sternal line, the two NACs, and inframammary fold (IMF) and their distances between each other. In addition, the standard pre-operative markings of the breast meridian line, the vertical limbs with their medial and lateral extensions, the distance between the two NACs, and the future location of the nipple are approximated for the intended incisions. Also, other factors that are taken into consideration are age, overall size and weight of the breasts, size of NAC, size of ptosis, quality of the skin and overall health of the breast.[20–22]

Ultimately, the aim of this study is to create a manual specifically for the inverted-T augmentation–mastopexy technique that will utilize the above mentioned parameters and provide surgeons with a potential useful tool that could shorten the operative time of the procedure, give them a more structured and reassured way to operate, limit intraoperative modifications, minimize errors, decrease post-operative complications and increase overall patient satisfaction.

Patients and methods

Ideal patients for our surgical technique included patients with Regnault's grade I and II ptosis, as well as severe pseudoptosis. Patients with breast hypertrophy and BMI higher than 30 kg/m^2 were excluded (Table 1). Our criteria are matched by women with pre-op cup size A to D.

A total of 107 women underwent bilateral simultaneous breast augmentation with mastopexy from February 2018 to February 2021. Their mean age was 37 (range, 25–61) with a mean BMI of 22 kg/m^2 (range, 18–28). The mean follow-up was 24 months (range, 13–34). The type of implant that was selected for our patients was Siltex Mentor Round Silicone Gel (Table 2), with a mean volume of

Table 1
Patient inclusion criteria.

Characteristics	Number of patients (N = 107)
Inclusion criteria	
Patients with Grade I ptosis	43
Patients with Grade II ptosis	26
Severe pseudoptosis	16
Glandular ptosis	22

Table 2
Distribution of profiles of implants to patients.

Implant profile	Number of patients ($N = 107$)
Implants – mentor round	
Moderate	4
Moderate plus	20
High	5
Xtra moderate plus	67
Xtra high	11

325cc (range, 200–450cc). Other types of breast implants were ruled out in order to reduce the bias. From all the implants that were used, 67 were placed submuscularly using the dual-plane technique, while 40 were placed subfascially.

The overall result was measured by utilizing the following 3 factors: the number of complications (healing, infection, bleeding, seroma, and capsular contracture), the BREAST-Q-Score filled by the patients before and 12 months after the surgery during their check-up, and the assessment of the result by the surgeon (implant position).

Breast-Q

The Breast-Q is an internationally standardized tool, used for the evaluation of the overall quality of life of patients after surgery.[23] An approved Czech version was used, validated in accordance with the MAPI Trust,[24] approved by Dr. Pusic. The BREAST-Q scales were: satisfaction with breasts, satisfaction with the overall outcome, psychosocial well-being, sexual well-being, physical well-being of the chest, and satisfaction with care.

After using the patients' answers before and after the operation for each scale's characteristics, they were converted using the Q-Score software based on RUMM 2030 Plus,[25] which converts data from 1 to 5 to continuous scores ranging from 0 to 100. A higher score indicates increased satisfaction and quality of life.

Statistical analysis

Statistical analysis was conducted using Statistical Package for Social Sciences version 23.0 (SPSS Inc., Chicago, IL, USA). Paired *t*-test with a two-sided α of 5% was used in this study. Continuous variables were expressed using means $\pm$ standard deviations (SD).

Markings

We start by marking the midline, breast meridians (distances from jugular notch to mid-clavicle varying from 7 cm to 8.5 cm), and breast footprints. These footprints were then adjusted according to the implant width, IMFs (in their complete extent), and medial borders of the pocket preparation are marked for symmetry. With this approach, the lowering of the IMF is only done unilaterally when needed to compensate for asymmetry. If the pocket is planned for submuscular implant placement, then the medial borders of muscle release are marked; usually at 4 o'clock and 8 o'clock respectively.

Next, the IMF level was transferred to the midline and half of the implant width was added superiorly to mark the point of maximal projection of the implant. This point was then transferred horizontally back to the breast meridians with the patient standing or sitting upright, while lifting the arms with hands joined behind the head. This maneuver predicted the position of the nipple after simple breast augmentation with implants.[26] Crossing of the horizontal line marking half of the implant width with the breast meridian line in a patient with lifted arms was marked as the future nipple position. Then, 2 cm was added superiorly for marking the upper border of the future areola for submuscular placement and 1 cm for subfascial placement. Using a Wise-pattern wire marker,

Table 3
Implant volume to vertical limb length marking ratio chart.

Implant volume (cc)	Vertical limb length marking (cm)
<300	7
300–350	7.5
351–400	8
401–450	8.5
451–500	9

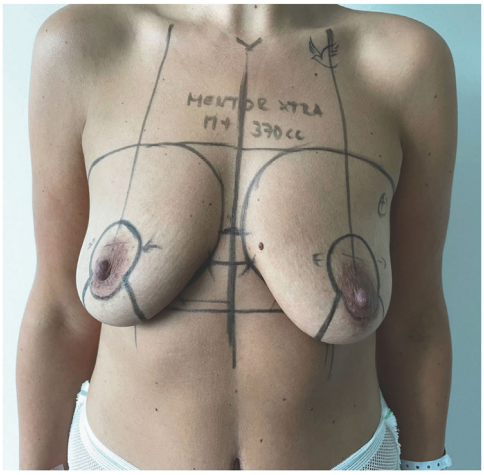

Figure 1. Pre-operative markings on a patient.

we drew an incomplete circle to mark the future areolar opening, presuming the width matches the areola cut with a 42 mm areola marker.

Vertical lines were marked using the Bisenberger maneuver for both medial and lateral limb. The length is limited according to the size of the implant ranging from 7 cm to 9 cm. Since, the implant volume used for this primary procedure rarely exceeds 400 cc (Table 3), vertical limbs longer than 8 cm are only used for secondary mastopexy augmentations.

At this point, we push onto the breast horizontally in a lateral direction and mark a horizontal line from the lower border of the medial limb marking (according to the chart) and draw the line until it crosses the IMF line. This maneuver is subsequently repeated for marking the connection from the lateral limb to the lateral IMF by pushing the breast in a horizontal medial direction.

Lastly, we mark the superior pedicle de-epithelialization zone starting from the keyhole zone and continuing to the NAC, including a small cuff of tissue caudally from the NAC (Schwartzman's maneuver) (Figure 1).

Surgical technique

After prepping and draping, we start by infiltrating the breast with 50cc of saline with adrenaline (200cc of saline containing 1cc of adrenaline) per side. We then cut the skin along the marked line in the IMF and then switch to cautery to perform the subcutaneous dissection in cranial direction. Depending on the upper pole breast tissue pinch test, we prepare either a subfascial (upper pole pinch test > 5 cm) or a submuscular dual-plane I type (pinch test < 5 cm). The pinch test 5 cm was set to make absolutely sure that the edge of the implant would not be visible. When performing a submuscular breast augmentation, 10 cc of Marcaine per side was injected to the pectoral muscle both to the pedicle and to the parasternal medial insertions. The pocket was meticulously checked for

hemostasis and therefore usage of drains is avoided. Afterwards, it was irrigated with Adams triple ATB solution and Betadine. Eventually, prepping with Betadine was repeated and surgical gloves were changed before implant insertion.

After the implant insertion, the position was checked and the IMF Scarpa's fascia was reconstructed. We use a running Vicryl 0 suture, grabbing the superior and caudal border of the fascia together with a bite of the underlying perichondrium each turn. From this moment on, the implant was kept intact and in situ, preferably without any further exposure.

The following step was to incise the skin along all the marked lines leading to the planned inverted-T scar, cut the NAC with a 38- or 42-mm marker, and de-epithelialize the superior pedicle. Then, the fishtail-shaped wedge of lower pole tissues was always resected perpendicularly until Scarpa's fascia was reached. It's important to mention that in asymmetrical breasts, more volume was removed from the bigger breast as same sized implants are used preferably for both breasts.

Afterward, the medial, lateral pillars and superior pedicle were mobilized by undermining approximately 3 cm in every direction. This step facilitates wrapping the implant with pillars from both sides.

Final closure included two Vicryl 2–0 interrupted sutures for dermal fixation of the pillar skin edges to the midline, 3 to 4 Vicryl 2–0 interrupted sutures were then used to connect the medial and lateral breast tissue pillars. Similarly, a few further Vicryl 2–0 interrupted sutures fixated the breast tissue of the pillars to the subcutaneous tissue of the IMF to close any dead-space.

Dermis was sutured with Monocryl 3–0 interrupted sutures in the vertical and IMF, while Monocryl 4–0 was preferred for the NAC. The same materials were used for running subcuticular closure. Finally, the wounds were sealed with Steri-Strips, and breasts were covered with gauze dressing and bandage.

Post-operative care

First, dressing change took place on the 1st post-op day and bandage was changed for compression bra. I.V. antibiotics were switched to oral ATB (Cefadroxil) for 5 more days. The patients were advised not to shower in the first 5 days after surgery; while Steri-Strips should not be removed for 2–3 weeks until the first check-up. Recovery period also included wearing compression bra for 6 consecutive weeks after surgery. Breast fixation belt can be administered for 2–3 weeks in patients with submuscular implants placement.

Results

A total of 107 patients received treatment between February 2018 and February 2021. Figures 2 and 3 illustrate a typical result of our technique. Sixteen patients presented with post-operative complications; 11 were in the early stage of recovery and 5 in the late stage.

More specifically, in the early stage of recovery, 8 cases of minor wound healing complications were reported, and all were treated conservatively by local wound care. There was no need for an extensive treatment like a surgical revision or a hyperbaric chamber. Additionally, 2 cases of infection were noted, 3 and 5 weeks post-operatively, and both were treated with oral antibiotics, local wound revision, and office-based secondary closure under local anesthesia. Lastly, only one patient experienced post-operative bleeding 13 days after the operation took place and it was the only occasion where interventional surgical revision was performed under general anesthesia.

Moreover, regarding the late stage of recovery, five cases of implant lateral and caudal malposition and asymmetry occurred and all required revisional surgery to correct them. Interestingly, no patient suffered with capsular contracture throughout the whole process of post-operative healing. It is worth mentioning that no cases of seroma were reported, in either early or late stage of post-operative recovery (Table 4).

In closing, satisfaction was measured using the Breast-Q questionnaire (Tables 5 and 6). All patients completed the questionnaire before and after the surgery and the final results were calculated in conjunction with the above complications and the surgeons' assessment. The mean score for outcome satisfaction was 85.4 (SD = 11.7) and for satisfaction with breasts after the surgery was 87.7 (SD

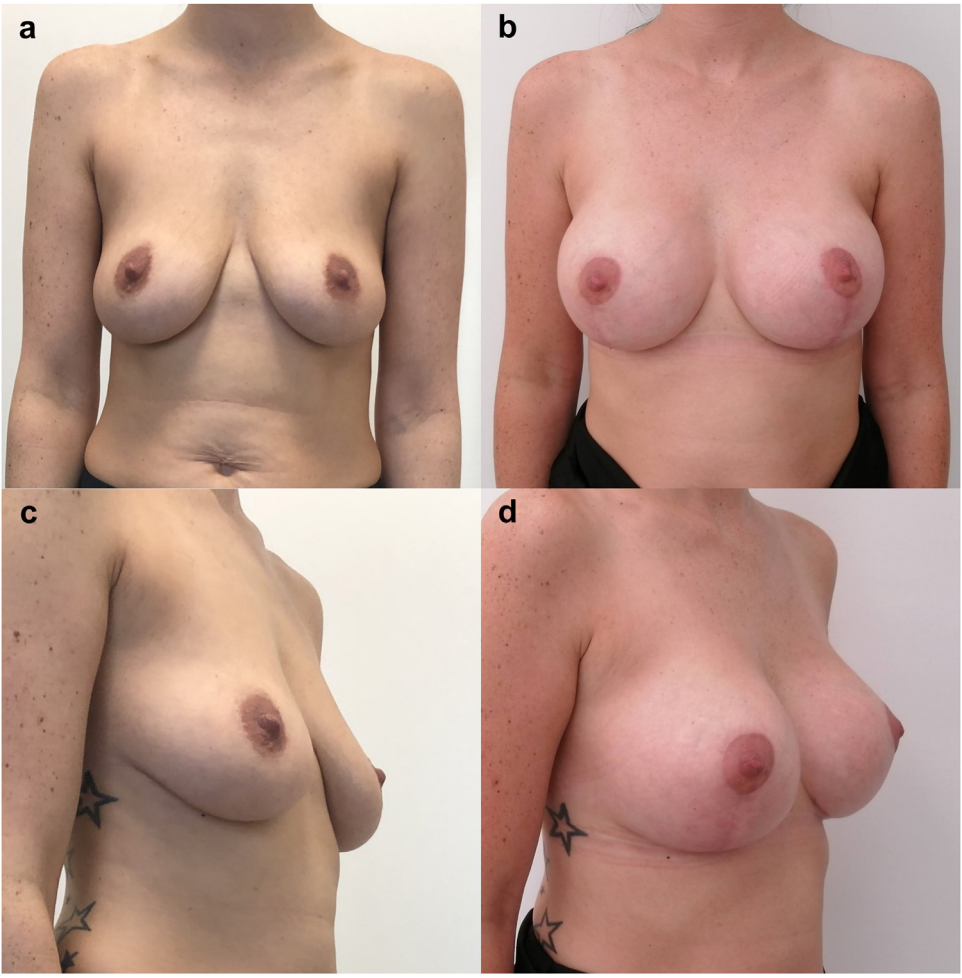

Figure 2. A and B. This 34-year-old female with Grade II ptosis and right breast asymmetry requested breast augmentation, after years of dissatisfaction with her appearance. After consultation, the patient was considered a satisfactory candidate for simultaneous augmentation–mastopexy. Mentor round moderate plus 300 cc implants were used bilaterally. C,D. Pictures were taken 8 weeks after operation. The patient's breasts appear to look full, in good shape and symmetrical.

Table 4
Complications.

Complications	Number of patients	%
Tissue-related complications	10	9.4
Wound healing	8	7.5
Infection	2	1.9
Post-operative bleeding	1	0.9
Implant displacement	5	4.7
Seroma	0	0
Capsular contracture	0	0
Overall complications	**16**	**15**

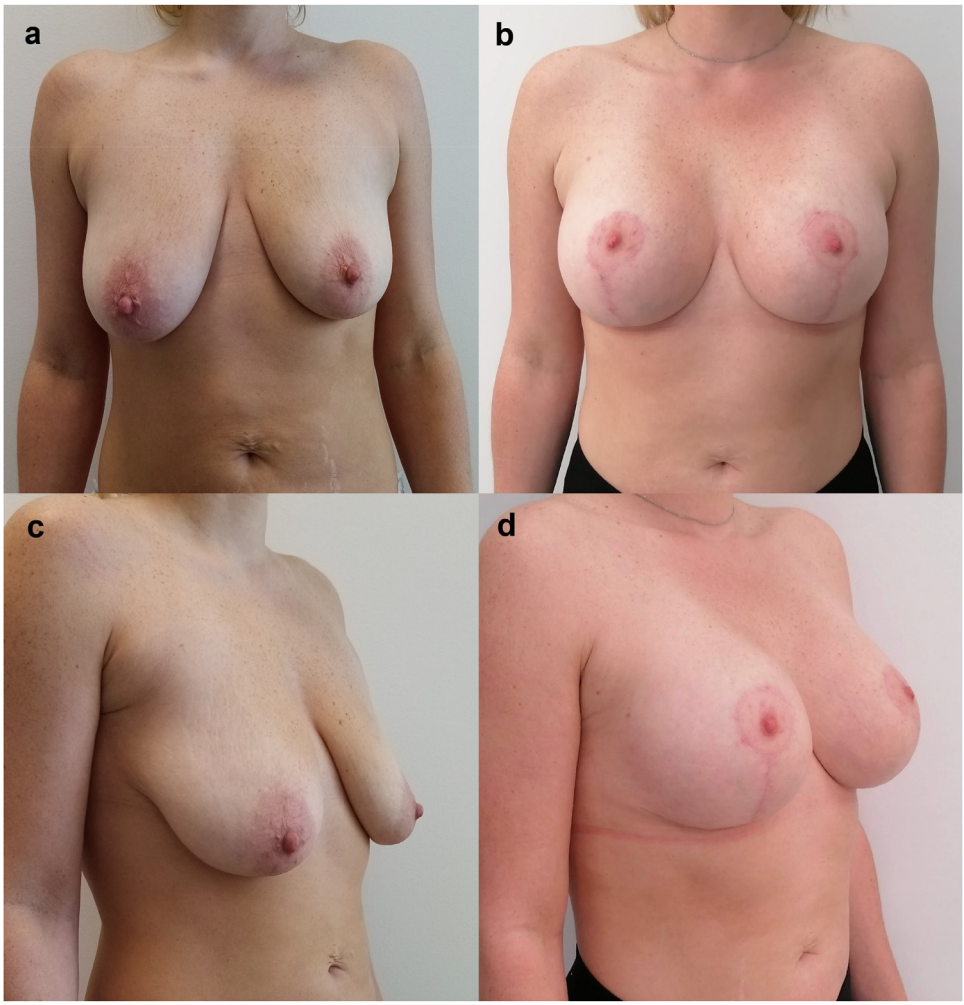

Figure 3. A and B. A 38-year-old patient presenting with Grade I ptosis and left breast asymmetry. The patient requested initially mastopexy, but after consultation, it was decided that simultaneous augmentation–mastopexy was the most fitting in this case. Mentor round moderate 300 cc implants were used bilaterally. C and D. Pictures were taken 6 weeks after operation. The patient's breasts seem natural and symmetrical in shape.

= 11.7), comparing to the satisfaction with breasts before the surgery, which was only 42.28 (SD = 8.1). It was significant improvement ($p < 0.05$). The photos taken before and after the surgery shows improvement of the breast shape, symmetry and position of the NAC (Figures 2 and 3).

Discussion

Augmentation–mastopexy is progressively becoming a standard procedure in plastic surgery. While surgeons have managed individually to reduce the post-operative complications of this operation, there is still a lack of a standardized approach that would universally increase the satisfactory rate among patients and concurrently reduce the amount of complications and revisions. Therefore, after considering the drawbacks encompassing this procedure and after years of related surgical experience,

Table 5
Breast-Q results pre-operatively.

Characteristics	Mean	Standard deviation (SD)
Satisfaction with breasts	42.28	8.12
Psychosocial well-being	59.85	11.98
Physical well-being, chest	51.71	13.14
Sexual well-being	72.37	10.62

Table 6
Breast-Q results post-operatively.

Characteristics	Mean	Standard deviation (SD)
Satisfaction with breasts	87.67	11.66
Satisfaction with outcome	85.36	11.75
Psychosocial well-being	87.27	9.55
Physical well-being, chest	83.62	12.99
Sexual well-being	83.85	11.58
Satisfaction with care	93.18	5.37

Table 7
Revision rates MAMAS vs. other studies.

Study	Revisional rate
MAMAS	4.7
Stevens et al	16.9
Calobrace et al	23.2
Swanson et al	15.5
Messa et al	13.5

we offer this novel approach, that emphasizes on carefully planned pre-operative markings to achieve the best outcome.

The complications of this procedure are well known and our results were similar while lower in overall complications (15%) when compared with other major publications documenting these disadvantages in a large scale.[9,10,27–29] More specifically, concerning the early stage of recovery, only 9.4% of our patients experienced tissue-related complications (wound healing and infection), showcasing lower rates in comparison to Calobrace et al[9] and Swanson et al,[29] with 13.6% and 32.9%, respectively. This is one of the most common shortcomings of this procedure, which is usually due to the increased skin tension of the T-scar on the lower pole of the breast that compromises the healing.[30] While the issue of this drawback is considerable and needs further investigation to limit its occurrence, it was successfully treated by local wound care without the need of extensive intervention. As part of tissue-related complications, it is important to mention that only 1.9% of our patients experienced post-surgical infections, which is comparable to many other major publications; the infections were similarly treated in a conservative way, without negatively affecting the final result. Furthermore, 0% of the women developed seroma or capsular contracture, a positive and rather common result among similar articles presenting their results.[27] Lastly, a single case of post-operative hematoma arose, a rather low occurrence but expected possibility in surgeries involving any type of breast augmentation[31]; the case required surgical revision under general anesthesia.

Regarding the late stage of recovery, 4.7% in total had to undergo revisional surgery. The patients developed implant displacement and asymmetry, which required surgical revision. Despite this, in our case, the occurrence remained significantly lower than the average, as reported in several literature reviews[9,10,28,29] (Table 7). Arguably, the main reason of this incidence could be due to limited lower breast pole support. Certain surgeons tried to address this issue in the past, incorporating their own edits in practice to increase implant support and stability. Retrospectively, De Vita et al[6] incorporated the use of an inferior dermoglandular flap, which showed promising results in stabilizing the implant and improving tissue healing at the sensitive location of the inverted-T scar. Likewise, Mansur et al[30]

developed an alternative way, by utilizing the fasciae and creating a fascioglandular flap, diverting the tension from the skin, with the intention of limiting post-operational implant location complications. Nevertheless in the latter study, while it is mentioned that there was no recurrence of ptosis, the authors did not include any detailed results or overall satisfaction patient report (Breast-Q or other) and it is a subject of a future summary.

However, it is important to mention that there is limited literature on patient satisfaction using the Breast-Q instrument on simultaneous augmentation–mastopexy. The majority of these studies did not document a thorough patient satisfaction report, which generated a problem when comparing published results. While several studies such as Spear et al,[7] created their own patient questionnaires with the goal of accurately recording their findings, there is definitely a need for a future universal embrace of tools such as Breast-Q in order to avoid inconsistency in regards to augmentation–mastopexy.

Nevertheless, we found one similar study in terms of the number of patients, conducted by Hubbard,[32] where the mean outcome satisfaction was 82.78 and breast satisfaction was 75.94.[33] In our study, outcome satisfaction of our patients was slightly higher (85.36) and satisfaction with breasts was significantly higher (87.67). In 2019, Ono et al[34] presented their Four-Step Augmentation–Mastopexy: Lift and Augmentation at Single Time (LAST). With this technique, they also fist insert the implant, then with a patient in sitting position, they determine vertical and horizontal skin and gland resection manually pinching the skin. After this maneuver, patient is returned back to supine position, the surgeon seals the implant pocket, performs the gland resection and followed by the mastopexy.[34]

The novelty of our technique is in its simplicity and versatile use and after the proper application of pre-operative markings in the operating room, no adjustments are needed. The key for success of our technique is the exact length of vertical limbs according to the breast implant size (Table 3) and glandular resection.

Lastly, there were expected limitations in our study. One was short follow-up, since some pathologies such as capsular contracture or BIA-ALCL do not manifest early, and also during such a short period of time, it is impossible to see the long-term results. Ultimately, with the increasing number of patients, the surgeon's experience is increasing, so we presume improvement in surgeon's patient selection, implant selection, and operating technique over time. It is a single surgeon study, which is both strength and limitation of the study.

Conclusion

Our pre-operative making technique MAMAS for augmentation–mastopexy is simple and easily reproducible. It reduces the complication rate and increases the patients' satisfaction. It provides predictable and stable results over time.

Declaration of competing interest

Juraj Payer is an advisory board member for Mentor
Matej Patzelt has no conflict of interest
Petra Polackova has no conflict of interest
Nikolaos Chalkidis has no conflict of interest

Financial Disclosure Statement

The authors have nothing to disclose

Ethical Statement

The study protocol was designed according to the declaration of Helsinki and approved by the Ethics Committee Third Faculty of Medicine, Charles University. Informed consent was obtained from all enrolled patients.

Consent

The patient consented to the video being published.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jpra.2024.03.007.

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