



# Breast Augmentation in Transwomen: Can We have a Formula?

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## Abstract

**Background** Breast augmentation in transwomen is a surgical challenge as there is no available guideline for preoperative assessment of breast implant size, which caters to them specifically. The aim of our study is to derive a formula for preoperative breast implant size estimation, which would remove the personal bias, help in one-to-one discussion, and better understanding, reducing operative time, cost, and revision surgery rate.

**Methods** This is a retrospective study conducted from October 2018 to December 2020. We maintained a routine protocol for measurements in our patients, which has been previously published. Linear multivariate regression equation was applied to derive a formula using minimum of parameters, namely, CC (chest circumference at the inframammary fold [IMF]), POMP (circumference at the point of maximum projection of breast mound), and LOWERDIFF (lower value of difference in each breast between the stretched nipple [IMF] and the nonstretched nipple [IMF distance]).

**Results** A total of 51 transwomen underwent surgery in this period. The mean volume of implant used was 354.51 mL. Complications consisted of pain and discomfort in six patients, delayed healing in two patients, and wound dehiscence in one. A formula for preoperative calculation of breast implant was obtained with these data. A mathematical correlation was found between complications encountered and the percentage by which the inserted implants exceeded the calculated size.

**Conclusion** We could estimate the breast implant size preoperatively through a simple formula that require only four anthropometric measurements. This equation is a significant advantage for the surgeon and a useful tool for patient education. Its usefulness will be established if applied in prospective studies. From our study, it appears 9% above the calculated size is better avoided.

## Keywords

- ▶ breast augmentation
- ▶ implant size estimation
- ▶ silicone implant
- ▶ transwomen

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## Introduction

Breasts are a symbol of femininity and therefore breast augmentation is among the most commonly performed surgeries among transwomen.<sup>1,2</sup> This surgery not only brings an immediate and drastic change in their appearance but also provides a sense of sexual and psychosocial well-being.<sup>3</sup> There are several guidelines in choosing the size of breast implants in normal female patients.<sup>4–7</sup> But we found no such guidelines for transwomen in spite of a thorough literature search. The guidelines for females are not applicable in transwomen for several reasons, such as difference in the shape of the thorax, tightness of skin, and lack of sufficient subcutaneous tissue in many. Moreover, transwomen usually desire very large implants, which can hardly be accommodated in their breast pocket. Preoperative implant size estimation streamlines the implant selection, which reduces the number of implants ordered and does not require multiple sizes. To this end, we were in search of a formula for preoperative assessment of the size of breast implants that can be applied to transwomen based on their body configuration. This is a pilot study, based on records of previously operated patients, and its usefulness can be established by applying the formula prospectively. Such an approach would help in preoperative patient counseling and create a realistic expectation from the patient. In summary, in this article we intend to provide a guideline for preoperative assessment of implant size for breast augmentation in transwomen. The aim of this study was to provide a guideline for preoperative estimation of the required breast implant sizes in transwomen.

## Materials and Methods

Fifty-one patients presenting in our clinic between October 29, 2018 and December 31, 2020, were chosen for this study. It was a retrospective study with analysis of data obtained from our routine measurements.<sup>8</sup> Measurements were taken in the standing position with the help of a measuring tape. In all patients, high-profile microtextured round silicone gel implants (Motiva) were used. Implants were inserted in the subfascial pocket either via the inframammary or periareolar route depending on the size of the areola ( $\geq 4.5$  cm hemircumference). The following four measurements were found useful to obtain the three criteria necessary for arriving at a formula for calculating the size of breast implants:

- Chest circumference (at the inframammary fold [IMF]) or CC.
- Chest circumference at the point of maximum projection of breast mound (POMP)
- Nipple to IMF distance (NIMF; right and left).
- Nipple to IMF distance at maximum stretch (S-NIMF; right and left).

The values of the differences between S-NIMF and NIMF are Calculated for both breasts and the lower of the two values are taken into consideration for calculation.

Thus, the calculated implant size (CALIS) was dependent on CC, POMP, and LOWER DIFF.

## Results

All the data with the calculated and actual implant sizes (ACTIS) and the value of their differences are given in **Table 1**.

A linear multivariate regression equation had been applied to determine the mathematical relation between the variables and to predict the dependent variable on the basis of the given values of the independent variable.

$$\text{CALIS} = -2.5593 \times \text{CC} + 5.7766 \times \text{POMP} + 12.2487 \times \text{LOWERDIFF.}$$

The adjusted  $R^2$  comes to 97.24% and the robustness of the formed equation is confirmed by a statistically significant  $F$  statistics as shown by the analysis of variance (ANOVA).

For the sake of simplicity, the equation is set as the following:

$$\text{CALIS} = -2.56 \times \text{CC} + 5.78 \times \text{POMP} + 12.25 \times \text{LOWERDIFF.}$$

**Table 2** shows the details of patients' actual and CALIS, their differences, and percentages by which the inserted implants exceeded the calculated size. Those who had complications have also been highlighted.

From the chart, it is evident that in 26 patients the ACTIS exceeded the calculated size. Of these, eight patients (Sl. nos. 6, 11, 14, 15, 16, 28, 39, and 43) exceeded the next available bigger size. One was lost to follow-up (Sl. no. 15). We checked the records to note that six of these patients (Sl. nos. 11, 14, 16, 28, 39, and 43—highlighted in *bold* in **Table 2**) did have postoperative discomfort, pain, delayed healing (in two), and wound dehiscence (in one necessitating secondary suturing). In the long term, stretching of skin, prominence of veins, and capsular contractures occurred, but none required operative intervention. A mathematical relation was found between the incidence of complications and the percentage by which the ACTIS exceeded the CALIS. This figure was around or equal to 9% ( $>8.76\%$  to be specific) or above.

In 25 patients, implants of lesser size were inserted. None of them had any postoperative morbidity. Of these, in five patients, implants lesser than the next immediate lower size was inserted. On analysis, we found that availability of appropriate size of implants was the problem in four, but in one we could not find any explanation as to why the CALIS could not be inserted. Size differences of available Motiva high-profile round implants vary between 20 and 40 mL. We have used implant sizes ranging from 280 to 440 mL in which the differences in size varied from 20 to 30 mL.

**Figs. 1–3** are examples of different variations in calculated and actual sizes of implants inserted. A slight difference in values were noted when differences between S-NIMF and NIMF of both breasts were considered as shown in the “situation 2” columns in **Table 1**, while in “situation 1,” only the lower of the two differences (LOWER DIFF) were

**Table 1** Patient's physical measurement, calculated and actual implant size and value of their differences

Patient no.	Chest circumference (CC)	Point of maximum projection (POMP)	Right breast N-IMF	Right breast S-NIMF	Difference between right N-IMF and S-NIMF (DIFFRB)	Left breast N-IMF	Left breast S-NIMF	Difference between left N-IMF and S-NIMF (DIFFLB)	Actual implant size (ACTIS)	Calculated implant size (CALIS), situation (1)	Difference between ACTIS and CALIS (1)	Calculated implant size (CALIS), situation (2)	Difference between ACTIS and CALIS (2)
1	88	93	5.5	8	2.5	5	8	3	325	342	16.955 (-)	331.6	6.56(-)
2	67	72	4	8	4	4	8	4	280	292.2	12.2 (-)	281.5	1.54(-)
3	80	88	5	7	2	5	7	2	350	327.1	22.86 (+)	318.9	31.1(+)
4	73	82	5	9	4	5	9	4	300	335.3	35.26 (-)	325	24.96(-)
5	89	96	6.6	9	2.4	7	9	2.5	380	355.5	24.52 (+)	353.2	26.83(+)
6	85	92	5	8	3	5	8	3	380	350	30.01 (+)	338.4	41.6(+)
7	90	93	5	7.5	2.5	5	7.5	2.5	350	336.8	13.165 (+)	327.3	22.8(+)
8	93	101	6	8	2	5	7.5	2.5	300	369.2	69.19 (-)	348.4	48.36(-)
9	76	82	5	7	2	5	7	2	300	303.1	3.08 (-)	297.6	2.38(+)
10	91	102	8	13	4.5	9	12	3	410	392.3	17.67 (+)	410.1	0.12(-)
11	86	91.5	5	8	3	5	8	3	380	344.5	35.455 (+)	333.7	46.28(+)
12	98	108	9	11	2	8	11	3	350	396.8	46.78 (-)	399	48.96(-)
13	85	92	6	10	4	7	10	3.5	380	356.1	23.885 (+)	358.7	21.35(+)
14	82	92	6	9	3	6	9	3	410	357.7	52.33 (+)	351.4	58.67(+)
15	80	87	5	8	3	5	8	3	380	333.9	46.06 (+)	324.3	55.7(+)
16	97	105	5.5	9	3.5	6	9	3.5	440	400.4	39.595 (+)	385.7	54.31(+)
17	77	84	4.2	6.5	2.3	5	6.5	1.5	300	305.9	5.935 (-)	308.7	8.72(-)
18	76	94	6	10	4	6	9.5	3.5	380	390.7	10.695 (-)	378.6	1.38(-)
19	101	104	5	8	3	5	8	3	325	378.3	53.27 (-)	363.5	38.52(-)
20	94	102	5.5	9	3.5	6	8.5	3	380	384.7	4.65 (-)	370.2	9.77(+)
21	91	102	6.5	9.5	3	7	10	3	410	392.3	17.67 (+)	395.4	14.58(+)
22	93	106	7	12	5	11	7	4	410	422.5	12.54 (-)	410.8	0.76(-)
23	88	93	6	9	3	7	9.5	2.5	300	342	41.955 (-)	357.1	57.06(-)
24	78	83	7	10.5	3.5	7	10	3	325	316	9.02 (+)	319.9	5.14(+)
25	94	100	6	8	2	6	8	2	350	360.9	10.86 (-)	354.9	4.88(-)
26	77	85	7	9.5	2.5	7	9.5	2.5	325	324	1.045 (+)	328.6	3.64(-)
27	82	86	4.5	6	1.5	5	6	1.5	280	304.7	24.675 (-)	296.1	16.09(-)
28	102	109	7	10	3	7	10	3	440	404.6	35.44 (+)	399.3	40.66(+)
29	81	91	5	10	5	5	9.5	4.5	325	372.8	47.835 (-)	355.9	30.92(-)

(Continued)

Table 1 (Continued)

Patient no.	Chest circumference (CC)	Point of maximum projection (POMP)	Right breast N-IMF	Right breast S-NIMF	Difference between right N-IMF and S-NIMF (DIFFRB)	Left breast N-IMF	Left breast S-NIMF	Difference between left N-IMF and S-NIMF (DIFFLB)	Actual implant size (ACTIS)	Calculated implant size (CALIS), situation (1)	Difference between ACTIS and CALIS (1)	Calculated implant size (CALIS), situation (2)	Difference between ACTIS and CALIS (2)
30	91	97	7	10	3	6	10	4	380	370	10.0275 (+)	356.9	23.08(+)
31	76	84.5	5	8	3	5	8.5	3.5	300	329.8	29.755 (-)	327.5	27.52(-)
32	92	99	6.5	10	3.5	6	10	4	380	378.6	1.415 (+)	369.7	10.26(+)
33	81	86	5	9	4	6	9	3	325	325.6	0.61 (-)	334.2	9.71(-)
34	78	84	5.5	8	2.5	6	8.5	3	325	315.6	9.375 (+)	318.7	6.29(+)
35	90	100	6.5	10	3.5	6	10	4	350	389.5	39.475 (-)	379.1	29.1(-)
36	76	81	5	8	3	5	8	3	300	309.6	9.56 (-)	303	3.02(-)
37	77	86	4	7	3	4	7	3	325	335.9	10.85 (-)	319.3	5.66(+)
38	80	86	5	8.5	3.5	5	8.5	3.5	325	334.3	9.295 (-)	324.5	0.5(+)
39	89	95	6	9	3	6	9	3.5	410	357.1	52.94 (+)	354.8	55.17(+)
40	82	88	4	6.5	2.5	4	6.5	2.5	350	328.5	21.535 (+)	313.2	36.76(+)
41	85	91	5	9	4	5	9	4	350	356.5	6.47 (-)	343.8	6.2(+)
42	85	91	6.5	10	3.5	7	9.5	3	350	344.2	5.78 (+)	341.4	8.65(+)
43	90	99	8	11	3	8	11	3	440	377.6	62.42 (+)	382	58(+)
44	84	90	4.5	7.5	3	4	8	4	350	341	8.99 (+)	331	19.02(+)
45	91	101	6	10	4	6	10	4	410	400.9	9.1 (+)	388.3	21.69(+)
46	80	89	6	9	3	6	9	3	350	345.5	4.52 (+)	340.8	9.2(+)
47	77	86	5.5	8	2.5	5	8	3	325	329.7	4.725 (-)	320.5	4.46(+)
48	108	120	7	10	3	8	10	2.5	460	446.5	13.455 (+)	444.6	15.39(+)
49	83	88.5	4	6	2	4	6.5	2.5	280	322.7	42.665 (-)	315.4	35.36(-)
50	92	100	7	9	2	7	9	2	380	366	14.02 (+)	356.7	23.26(+)
51	85	92.5	5	9	4	5	9	4	350	365.1	15.125 (-)	351.3	1.3(-)

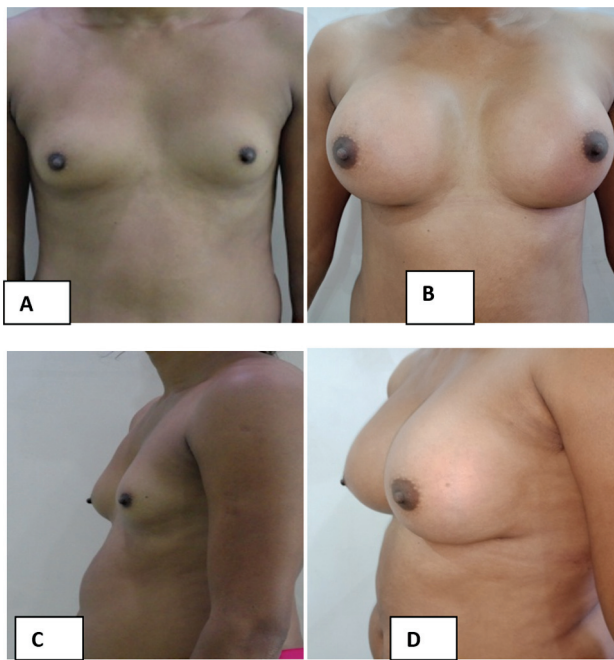
**Table 2** Details of patient's actual and calculated implant sizes, their differences and percentages by which inserted implants exceeded the calculated size

Patient no.	Chest circumference (CC)	Point of maximum projection (POMP)	Right breast N-IMF	Right breast S-NIMF	Difference between right N-IMF and S-NIMF (DIFFRB)	Left breast N-IMF	Left breast S-NIMF	Difference between left N-IMF and S-NIMF (DIFFLB)	Actual implant size (ACTIS)	Calculated implant size (CALIS), situation (1)	Difference between ACTIS and CALIS (1)	Difference as % of CALIS
1	88	93	5.5	8	2.5	5	8	3	325	341.955	16.955 (-)	4.96
2	67	72	4	8	4	4	8	4	280	292.2	12.2 (-)	4.18
3	80	88	5	7	2	5	7	2	350	327.14	22.86 (+)	6.99
4	73	82	5	9	4	5	9	4	300	335.26	35.26 (-)	10.52
5	89	96	6.6	9	2.4	6.5	9	2.5	380	355.48	24.52 (+)	6.9
6	85	92	5	8	3	5	8	3	380	349.99	30.01 (+)	8.57
7	90	93	5	7.5	2.5	5	7.5	2.5	350	336.835	13.165 (+)	3.91
8	93	101	6	8	2	5	7.5	2.5	300	369.19	69.19 (-)	18.74
9	76	82	5	7	2	5	7	2	300	303.08	3.08 (-)	1.02
10	91	102	8	12.5	4.5	9	12	3	410	392.33	17.67 (+)	4.5
11	86	91.5	5	8	3	5	8	3	380	344.545	35.455 (+)	10.29
12	98	108	9	11	2	8	11	3	350	396.78	46.78 (-)	11.79
13	85	92	6	10	4	6.5	10	3.5	380	356.115	23.885 (+)	6.71
14	82	92	6	9	3	6	9	3	410	357.67	52.33 (+)	14.63
15	80	87	5	8	3	5	8	3	380	333.94	46.06 (+)	13.79
16	97	105	5.5	9	3.5	5.5	9	3.5	440	400.405	39.595 (+)	9.89
17	77	84	4.2	6.5	2.3	5	6.5	1.5	300	305.935	5.935 (-)	1.94
18	76	94	6	10	4	6	9.5	3.5	380	390.695	10.695 (-)	2.74
19	101	104	5	8	3	5	8	3	325	378.27	53.27 (-)	14.08
20	94	102	5.5	9	3.5	5.5	8.5	3	380	384.65	4.65 (-)	1.21
21	91	102	6.5	9.5	3	7	10	3	410	392.33	17.67 (+)	4.5
22	93	106	7	12	7	11	7	4	410	422.54	12.54 (-)	2.97
23	88	93	6	9	3	7	9.5	2.5	300	341.955	41.955 (-)	12.27
24	78	83	7	10.5	3.5	7	10	3	325	315.98	9.02 (+)	2.85
25	94	100	6	8	2	6	8	2	350	360.86	10.86 (-)	3.01
26	77	85	7	9.5	2.5	7	9.5	2.5	325	323.955	1.045 (+)	0.32
27	82	86	4.5	6	1.5	4.5	6	1.5	280	304.675	24.675 (-)	8.1
28	102	109	7	10	3	7	10	3	440	404.56	35.44 (+)	8.76
29	81	91	5	10	5	5	9.5	4.5	325	372.835	47.835 (-)	12.83

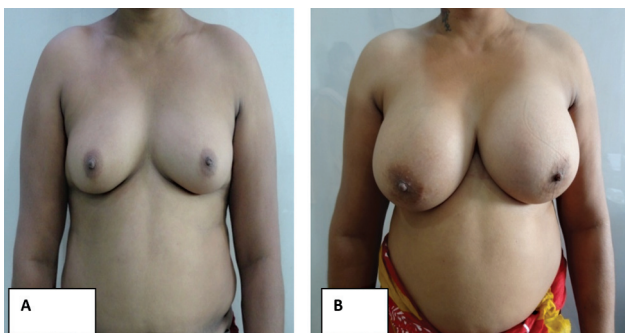
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Table 2 (Continued)

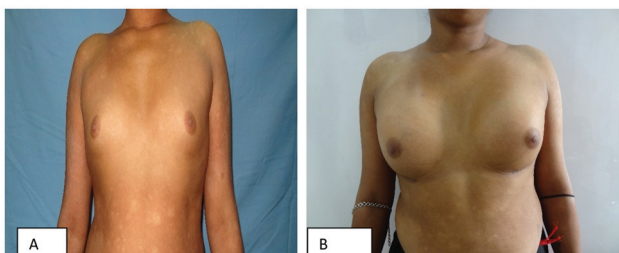
Patient no.	Chest circumference (CC)	Point of maximum projection (POMP)	Right breast N-IMF	Right breast S-NIMF	Difference between right N-IMF and S-NIMF (DIFFRB)	Left breast N-IMF	Left breast S-NIMF	Difference between left N-IMF and S-NIMF (DIFFLB)	Actual implant size (ACTIS)	Calculated implant size (CALIS), situation (1)	Difference between ACTIS and CALIS (1)	Difference as % of CALIS
30	91	97	7	10	3	6	10	4	380	369.9725	10.0275 (+)	2.71
31	76	84.5	5	8	3	5	8.5	3.5	300	329.755	29.755 (-)	9.02
32	92	99	6.5	10	3.5	6	10	4	380	378.585	1.415 (+)	0.37
33	81	86	5	9	4	6	9	3	325	325.61	0.61 (-)	0.19
34	78	84	5.5	8	2.5	5.5	8.5	3	325	315.625	9.375 (+)	2.97
35	90	100	6.5	10	3.5	6	10	4	350	389.475	39.475 (-)	10.14
36	76	81	5	8	3	5	8	3	300	309.56	9.56 (-)	3.09
37	77	86	4	7	3	4	7	3	325	335.85	10.85 (-)	3.23
38	80	86	5	8.5	3.5	5	8.5	3.5	325	334.295	9.295 (-)	2.78
39	89	95	6	9	3	5.5	9	3.5	410	357.06	52.94 (+)	14.83
40	82	88	4	6.5	2.5	4	6.5	2.5	350	328.465	21.535 (+)	6.56
41	85	91	5	9	4	5	9	4	350	356.47	6.47 (-)	1.82
42	85	91	6.5	10	3.5	6.5	9.5	3	350	344.22	5.78 (+)	1.68
43	90	99	8	11	3	8	11	3	440	377.58	62.42 (+)	16.53
44	84	90	4.5	7.5	3	4	8	4	350	341.01	8.99 (+)	2.64
45	90.5	101	6	10	4	6	10	4	410	400.9	9.1 (+)	2.27
46	80	89	6	9	3	6	9	3	350	345.48	4.52 (+)	1.31
47	77	86	5.5	8	2.5	5	8	3	325	329.725	4.725 (-)	1.43
48	108	120	7	10	3	7.5	10	2.5	460	446.545	13.455 (+)	3.01
49	83	88.5	4	6	2	4	6.5	2.5	280	322.665	42.665 (-)	13.22
50	92	100	7	9	2	7	9	2	380	365.98	14.02 (+)	3.83
51	85	92.5	5	9	4	5	9	4	350	365.125	15.125 (-)	4.14



**Fig. 1** (A) Preoperative Antero posterior view of patient no. 41. (B) 18 months after implantation with motiva high profile 350cc implants Antero posterior view of the same patient. (C) Preoperative Lateral view of patient no. 41. (D) 18 months after implantation with motiva high profile 350cc implants lateral view of same patient.



**Fig. 2** (A) Preoperative views. (B) Eleven months after implantation with high-profile 410-mL implants showing ptosis. The estimated implant size was 357.67 mL (case 14). Female breast pattern can be noted.



**Fig. 3** (A) Preoperative views of a case with tight skin envelope. (B) Eight months after implantation with 325-mL implants. While our calculation in this case estimated an implant size of 378.27 mL (case 19), 380 mL would have been ideal.

considered. But for the sake of parsimony and easy applicability, situation 1 was considered in the final calculation of the implant size.

## Discussion

Literature is sparse with regard to breast augmentation in transwomen and little or no data are available on the calculation of the implant size. The High Five decision support process, as advocated by Tebbetts and Adams,<sup>6</sup> is not applicable in transwomen. The procedure differs from that of females in several ways.<sup>9,10</sup> Balakrishnan et al<sup>11</sup> noted that there is no quick formula for estimation of implant size in transgender patients. Most patients we operate on are castrated males and therefore the classic assessments for female breast augmentation is not applicable in transwomen despite some of them having a breast mound (►Fig. 3). According to the World Professional Association for Transgender Health (WPATH), exogenous hormones should be taken for 1 to 2 years to maximize growth of native breast tissue to facilitate surgical augmentation, but it is not a prerequisite for breast augmentation.<sup>12</sup> In our experience, very few of the patients actually conform to a regular hormone treatment plan and were found noncompliant when asked to undertake hormone therapy for 1 to 2 years prior to operation.

Weigert et al<sup>3</sup> noted a high satisfaction rate in their patients with an average implant size of 327 mL. Our value is slightly larger, that is, 354.51 mL using high-profile Motiva implants. Selection of implant size is based on the balance between assessment of the surgeon and expectations of patients. In transwomen, the demand for large breasts with an aesthetic cleavage is universal irrespective of their morphological characteristics. Some patients are also guided by members of their peer group. These create a challenge of fulfilling unrealistic expectations. A formula to guide their expectation and preoperative estimation by the surgeon is long overdue. Ideally the implant size inserted should be the nearest size available to the calculated one. Our experience indicated the existence of a mathematical correlation between different anthropometric measurements and implant sizes. The inserted implant size could exceed the calculated value if it was kept below 9%, corresponding roughly with the next available high-profile Motiva implants in the range we used.

The importance of the stretchability of skin over the breast mound should be taken into consideration in transwomen. Some of these patients had striae over the skin of the chest and they were self-medicating with steroid-containing creams. These cause thinning of skin, making it more difficult for the overlying skin to accommodate the stretch. In such patients, we would opt for a lower-volume implant than the calculated figure.

Overall, Motiva implants in sizes from 240 to 550 mL have a difference of 20 to 40 mL between the smaller and the next bigger size. In our series, the implant sizes varied from 280 to 440 mL. In this range, the differences between the smaller and the next bigger size varied from 20 to 30 mL. On the

calculation of the bra and cup sizes, the literature stresses the importance of the difference in circumference at the point of maximum projection of the breasts or chest and the underbust.<sup>13,14</sup> We took both into consideration in addition to the differences in patients of asymmetric breast mounds to arrive at a formula. We went back to check the records.

The reasons for discrepancy were the following:

- Availability of the particular size.
- Succumbing to the desire of the patient, which is not ideal.
- Human error in measurements.

Limitation of this study is the small sample size. A multicentric study is desirable to find the usefulness of this pilot study.

## Conclusion

It is always difficult to find a formula when there are many variables, and the human body is not a rigid structure to be amenable to the exact measurements. Yet, in our clinical practice, we found that a simple, easy-to-apply mathematical formula can be arrived at for preoperative estimation of the breast implant size. Hence, it is invaluable as a guide to surgeons for better planning. By this formula, we hope to provide an objectively well-assessed choice of implant volume, so that a well-informed or educated patient with reasonable expectations gets an optimum and satisfactory outcome from a breast augmentation surgery.

**Conflict of Interest**  
None declared.

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