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## ORIGINAL STUDY

# Clinical Outcome and Patient Satisfaction with Medial Versus Posteromedial Brachioplasty Scar a Comparative Study

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### Abstract

**Objectives:** To compare between medial and posteromedial scar brachioplasty and to highlight the impact of Brachioplasty scar placement on clinical outcome and patient satisfaction.

**Background:** The recent increase in demand for brachioplasty surgery has urged researchers to find the most suitable scar placement to enhance clinical outcomes and patient satisfaction.

**Methods:** This study was applied to two equal groups of patients, each group consisted of 17 patients. The study compared the rate of early and late complications and the quality of the scar for each group, in addition to this, the study tested patients' satisfaction through a custom-made questionnaire.

**Results:** The clinical outcome and the scar quality were better in the posteromedial group but it wasn't statistically significant, but the patient's satisfaction was in favor of the posteromedial group and the difference was statistically significant ( $p = 0.010$ ).

**Conclusion:** Our data suggests that in brachioplasty using the posteromedial scar placement approach would be the optimal choice for the patients in terms of patient satisfaction.

**Keywords:** Aesthetic surgery, Arm lift, Brachioplasty, Plastic surgery, Scar placement

## 1. Introduction

I ncreasing awareness of the risks of obesity and the escalating attention to body shape has raised the number of bariatric operations over the past 2 decades. Consequently, the number of patients with serious deformities has increased [1]. According to available data, the yearly number of brachioplasties performed in the US increased from 338 to 14,505 over the course of eight years, a 4191% increase. This is in contrast to the 36% increase in breast augmentation surgeries performed during the same period, demonstrating the procedure's high popularity and general public acceptance [2]. After massive weight loss, patients are usually presented with variable amounts of excess skin with decreased elastic properties, residual lipodystrophy, and ptosis

of different anatomic regions, namely in the breasts, arms, thighs, buttocks, and trunk [3].

Over the years, the procedure has undergone numerous improvements and enhancements, however, most of the expert surgeons believe that postoperative scarring remains the main worry for patients [4]. The complication rate in most of the studies ranged from 36% to 53% with a range of revision between 4% and 22.9% [5,6]. The most frequent complications are pathologic scarring, seroma, dehiscence, infection, and hematoma [7].

Three main locations are frequently selected for Brachioplasty incisions: the posteromedial incision, the bicipital incision (also known as the medial incision), and the posterior incision (also known as the posterior straight incision or brachial sulcus incision) [2]. Most of the studies had concluded the

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superiority of the posteromedial approach over the others in terms of patient satisfaction [2,8].

The aim of this work was to compare medial and posteromedial scar brachioplasty and to highlight the impact of Brachioplasty scar placement on clinical outcomes and patient satisfaction.

## 2. Methods

This is a prospective comparative study conducted at the Department of Plastic Surgery; Menoufia University Hospital and the Private sector in Kuwait on 34 patients divided into two equal groups between January 2020 to February 2023. Each group consisted of 17 patients. All the patients were suffering from different degrees of arm skin excess and laxity with or without excess fat due to weight loss after bariatric surgery. The first group of patients had their brachioplasty surgery done using the medial scar technique while the second group had their brachioplasty surgery done using the posteromedial technique. As per the study protocol, the inclusion criteria were patients aged between 18 and 60, Body Mass Index BMI less than 35, and the loss of weight was because of bariatric surgery and the weight of the patients was steady for at least 6 months. The patients with uncontrolled hypertension and diabetes mellitus were excluded from the study.

The sample size was calculated using Power Analysis and Sample Size Software (PASS 2020) (NCSS, LLC. Kaysville, Utah, USA). The minimal total hypothesized sample size of 30 eligible patients (15 Per Group) is needed to compare the posteromedial scar technique and the Medial scar technique in post-bariatric Brachioplasty in terms of clinical outcome and patient satisfaction.; assuming an effect size of 25%, a significance level of 5%, and a power of 80% using the Chi-square test [2,9].

The degree of skin and fat excess was assessed as well as the degree of skin elasticity, the two scar placement options were discussed with the patients, and the choice of desired location site was done by the patients themselves. The potential complications associated with the surgery were discussed with the patients including obvious scarring, residual or recurrent skin laxity, hematoma, seroma, wound dehiscence, and asymmetry, in addition to the potential risks of general anesthesia. The informed consent was signed by the patients including the procedure type, the possible common and serious complications, and the alternative solutions. Standardized brachioplasty photographs were taken preoperatively and at each follow-up visit.

The preoperative markings for the medial scar technique were done with the patient standing,

arms abducted 90°, and forearms supinated (to find and expose the medial intermuscular groove optimally). The initial mark, which indicates where the future scar will be, is a straight horizontal line that is located beneath the medial intermuscular groove (red line).

After drawing the upper line, downward traction is used to bring the upper skin to the first line. To determine the lower line and assess redundant skin, a pinch test is performed. The incision pattern is elliptical, with the distal limit occurring immediately after the distal end of the extra skin tissue (often near the medial epicondyle) and the proximal limit close to the axillary dome. Excess fat in the other areas of the arm that will need liposuction is assessed and marked with a different color (Fig. 1). For the posteromedial scar technique, the marking starts with a manual inspection, and an estimate of the overall resection extent is the first step in the marking process. The apex of the axillary fossa and the medial epicondyle serve as the first two points of reference. Markers are drawn in these two locations. A red line represents the anticipated scar location, which is in the posterior-medial position. After that, the committed upper incision is positioned 1 cm above the anticipated incision line. This marking generally follows the scar line's path. Additionally, the roughly anticipated lower incision line is set, with a big possibility that any “tailor-tacking” during the operation could alter its extent. Pinching the skin to approximate the amount of the excision is a common method used to identify this line. The patients are then asked to raise their arms high. This makes it possible to judge the upper and lower scar's geometric and linear proportions. At this point, the distal portion of the scar is adjusted to prevent dog ears and uneven scar approximation (Fig. 2).

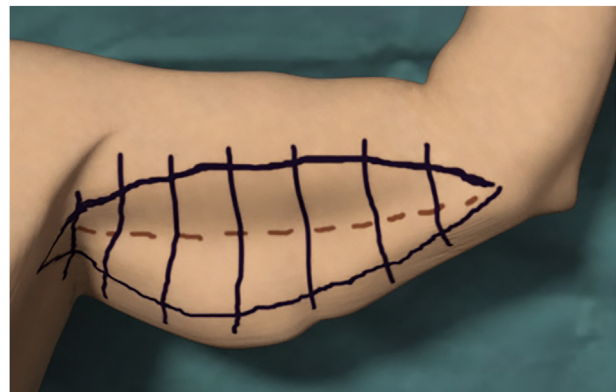


Fig. 1. Marking of the medial scar brachioplasty.

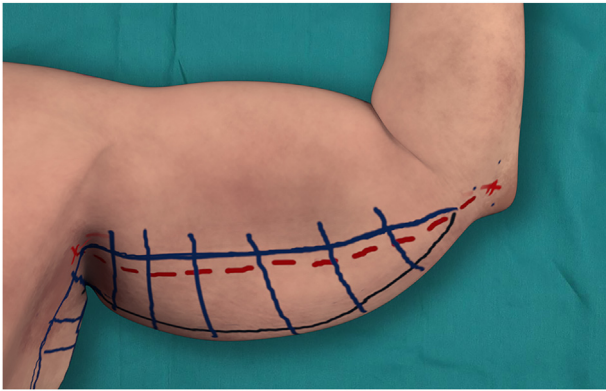


Fig. 2. Marking of the posteromedial scar brachioplasty.

General anesthesia was used in all patients with the patients lying supine and the arm abducted to approximately 90° with the forearm flexed at 90°. Pre-operative (intravenous 1.2 gm of Amoxicillin/clavulanate and 1 gm of intravenous Tranexamic acid) was administered at the time of anesthesia induction. Liposuction is typically required in most patients, and a standard saline solution is infiltrated into the liposuction sites, the liposuction openings are designed in the excision site to prevent additional scarring. A 4-mm cannula is used for liposuction in designated arm locations. The Intra-operative Staple Approximation Technique (tailor-tacking) is used to simulate the ultimate scar and ensure tension-free closure and symmetry. Skin excision is carried out only in the subcutaneous plane to prevent bleeding and maintain the integrity of subcutaneous arteries and lymphatics. Hemostasis is done with electrocautery and the skin is closed in three layers.

All the patients followed up in the clinic post-operatively twice a week in the first 3 weeks then in the 2nd, 3rd, and 6th month post-operative. Dressing is done in the outpatient clinic twice a week for 2–3 weeks depending upon healing. Pressure garment is used in the first 2–3 weeks only. The patients were assessed for early complications like hematoma, seroma, wound dehiscence, wound infection, loss, or alteration of sensation in the arm, motor nerve malfunction of the forearm and hand, and for late complications like ugly scarring, contour irregularities, and recurrent or persistent skin laxity. In our study, the quality of the scar is assessed at the end of the 6th post-operative month by the Stony-brook-scar-evaluation scale [10], the scale scores from 0 to 5, with 0 being the worst scar and 5 being the best scar.

Assessment of the patient's satisfaction was done by a pre-designed patient satisfaction questionnaire

that was filled by the patients at the end of the 6th postoperative month. The questionnaire is composed of 10 questions with 3 answers for each question, the choices score 0, 1 and 2. Upon the completion of the questionnaire, the score is recorded by adding the score of each question. The questionnaire was offered in Arabic and English languages. According to the preferred language of the patients. After collecting the overall score for each patient, we categorized the total score into 4 grades. From 0 to 5 unsatisfied patients, from 6 to 10 barely satisfied patients, from 11 to 16 moderately satisfied patients, and from 16 to 20 satisfied patients.

**Ethical considerations:** This study was authorised by the Menoufia University Academic and Ethical Committee under approval ID (191219SURG4). Each patient had to complete a written informed consent form to participate in the experiment. This study was guided by the World Medical Association's Helsinki Declaration, an ethical guideline for human research.

### 2.1. Statistical analysis

Data collected throughout history, basic clinical examination, laboratory investigations, and outcome measures were coded, entered, and analyzed using Microsoft Excel software. The Data was then fed to the computer and analyzed using SPSS software package version 20.0. (IBM Corp. Armonk, NY, USA). Qualitative data were described using numbers and percentages. The Shapiro–Wilk test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The significance of the obtained results was judged at the 5% level. The used tests were the *Chi-square test*: For categorical variables, to compare between different groups, Fisher's Exact or Monte Carlo correction: Correction for chi-square when more than 20% of the cells have expected count less than 5, and *Student t-test*: For normally distributed quantitative variables, to compare between two studied groups.

## 3. Results

The study was conducted on 34 patients divided into two equal groups. Each group consisted of 17 patients. All the patients were suffering from different degrees of arm skin excess and laxity with or without excess fat due to weight loss after bariatric surgery. Each group consisted of 17.6% males (n = 3) and 84.4% females (n = 14), the range of age

in the first group was 23–58 with a mean age of 37.24 (SD 11.49). In contrast, the age range in the second group was 23–54 with a mean age of 36.47 (SD 9.06). The degree of weight loss between the bariatric surgery and the time of Brachioplasty was recorded, in the Medial group ranged from 25 to 45 Kg with a mean value of 33.18 (SD 5.81) while in the Posteromedial group ranged from 24 to 48 Kg with a mean value of 36.41 (SD 6.55) (Table 1).

The BMI of the patients at the time of surgery in the Medial group ranged from 26 to 31 with a mean value of 29.06 (SD 1.75) while in the posteromedial group was ranged from 26 to 32 with a mean value of 28.82 (SD 1.78). In the Medial group patients, 76.5% (N = 13) had no relevant medical nor surgical history, and 23.5% had a positive history in the form of Hidradenitis 11.2% (n = 2), Hyperthyroidism 5.9% (n = 1) and uncontrolled hypertension 5.9% (n = 1). On the other side the Posteromedial group patients 82.4% (N = 14) had no relevant medical nor surgical history and, 17.6% had a positive history in the form of Hidradenitis 5.9% (n = 1), Hyperthyroidism 5.9% (n = 1) and uncontrolled hypertension 5.9% (n = 1). In both groups, 23.5% (n = 4) were smokers while 76.5% (n = 13) were nonsmokers by the patients' given history (Table 1).

The overall complications in the medial group were 29.5% (n = 5) while the overall complications of the Posteromedial group were 17.7% (n = 3). In the medial group the early post-operative complication was 29.5% (n = 5) in the form of Hematoma 5.9% (n = 1), Seroma 11.8% (n = 2), Wound

infection 5.9 (n = 1), wound dehiscence 5.9 (n = 1) and delayed healing 11.8% (n = 2) while, In the posteromedial group the early post-operative complication was 17.7% (n = 3) in the form of Seroma 5.9% (n = 1), wound dehiscence 5.9 (n = 1) and delayed healing 5.9% (n = 1). In the medial group the late post-operative complication was 17.7% (n = 3) in the form of Asymmetry 5.9% (n = 1), recurrent or residual laxity 11.8% (n = 2), contour deformity 5.9 (n = 1), sensory nerve affection 5.9 (n = 1) while, In the posteromedial group the early post-operative complication was 5.9% (n = 1) in the form of recurrent or residual laxity 5.9% (n = 1) (Table 2).

Stony-brook scar scale was used in this study for scar assessment at the end of the 6th postoperative month. The mean score for the Medial group is 3.71 (SD 0.92) while the mean score of the posteromedial group is 3.88 (SD 0.93). Although the posteromedial group had a slightly higher mean value in overall satisfaction, this difference was statistically insignificant (p = 0.581) (Table 2).

After the interpretation of the answers in the 10 questions patients' satisfaction questionnaire we found out that In the Medial group, the range of the scores of the questionnaire was 7–20 with a mean value of 15.53 (SD 3.14) while in the Posteromedial group, the range was 14–20 with a mean value of 17.47 (SD 2.10), The difference between both groups was in favor of the posteromedial group and was statistically significant (p = 0.042) (Table 3) (Fig. 3).

Table 1. Demographic data, medical history, and anthropometric measurements of the patients.

Type of data	Medial (n = 17)		Posteromedial (n = 17)		Test of Sig.	p
	No.	%	No.	%		
<b>Gender</b>						
Male	3	17.6	3	17.6	$\chi^2 = 0.000$	1.000
Female	14	82.4	14	82.4		
<b>Age (years)</b>						
Min. – Max.	23.0–58.0		23.0–54.0		t = 0.215	0.831
Mean ± SD.	37.24 ± 11.49		36.47 ± 9.06			
Median (IQR)	35.0 (27.0–41.0)		36.0 (28.0–43.0)			
<b>Weight lost (kg)</b>						
Min. – Max.	25.0–45.0		24.0–48.0		t = 1.524	0.137
Mean ± SD.	33.18 ± 5.81		36.41 ± 6.55			
<b>BMI (kg/m<sup>2</sup>)</b>						
Min. – Max.	26.0–31.0		26.0–32.0		t = 0.389	0.700
Mean ± SD.	29.06 ± 1.75		28.82 ± 1.78			
<b>Comorbidities</b>						
Null	13	76.5	14	82.4	$\chi^2 = 0.934$	1.000
Hidradenitis	2	11.8	1	5.9		
Hyperthyroidism	1	5.9	1	5.9		
Controlled HTN	1	5.9	1	5.9		
<b>Smoking</b>						
Nonsmoker	13	76.5	13	76.5	$\chi^2 = 0.000$	1.000
Smoker	4	23.5	4	23.5		

Table 2. The rate of early and late complications and scar quality score.

Clinical outcome		Medial (n = 17)		Posteromedial (n = 17)		Test of Sig. $\chi^2$	p
		No.	%	No.	%		
Early complications	Hematoma	1	5.9	0	0.0	1.030	1.000
	Seroma	2	11.8	1	5.9	0.366	1.000
	Wound infection	1	5.9	0	0.0	1.030	1.000
	Wound dehiscence	2	11.8	1	5.9	0.366	1.000
	Delayed healing	2	11.8	1	5.9	0.366	1.000
Late complications	Asymmetry	1	5.9	0	0.0	1.030	1.000
	Recurrent or persistent skin laxity	2	23.5	1	11.8	0.810	0.656
	Contour deformity	1	11.8	0	0.0	2.125	0.485
	Sensory nerve	1	5.9	0	0.0	1.030	1.000
	Motor nerve	0	0.0	0	0.0	—	—
Stony-brook scar scale	Patients with a score of 1	0	0	0	0	$\chi^2 = 1.363$	0.793
	Patients with a score of 2	2	11.8	1	5.9		
	Patients with a score of 3	4	23.5	5	29.4		
	Patients with a score of 4	8	47.1	6	35.3		
	Patients with a score of 5	3	17.6	5	29.4		
	Min. – Max.	2.0–5.0		2.0–5.0		t = 0.557	0.581
	Mean $\pm$ SD.	3.71 $\pm$ 0.92		3.88 $\pm$ 0.93			
Median (IQR)	4.0 (3.0–4.0)		4.0 (3.0–5.0)				

Table 3. Interpretation of the patient's satisfaction questionnaire.

Patients Satisfaction questionnaire	Medial (n = 17)		Posteromedial (n = 17)		Test of Sig.	p
	No.	%	No.	%		
Unsatisfied (0–5)	0	0.0	0	0.0	$\chi^2 = 3.524$	0.139
Barely satisfied (6–10)	1	5.9	0	0.0		
Moderately satisfied (11–15)	7	41.2	3	17.6		
Satisfied (16–20)	9	52.9	14	82.4		
Total Score						
Min. – Max.	7.0–20.0		14.0–20.0		t = 2.118 <sup>a</sup>	0.042 <sup>a</sup>
Mean $\pm$ SD.	15.53 $\pm$ 3.14		17.47 $\pm$ 2.10			

<sup>a</sup> Significant.

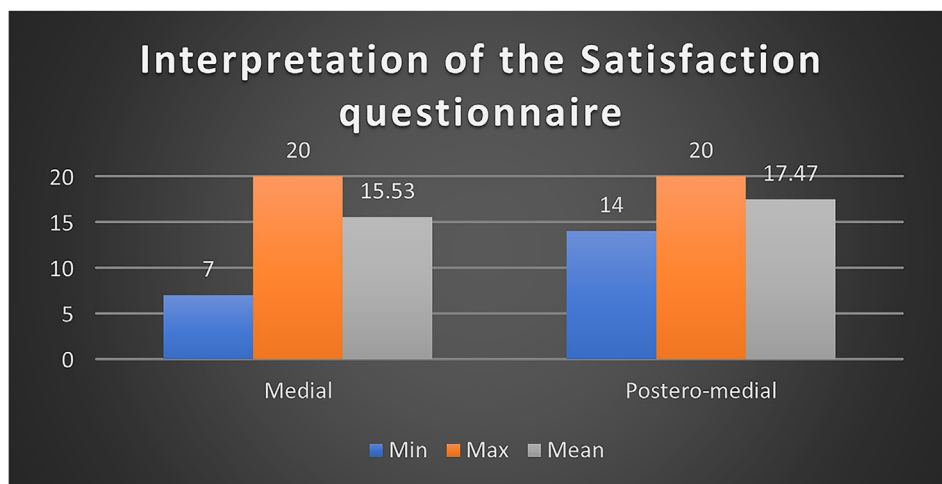


Fig. 3. Interpretation of the satisfaction questionnaire.

#### 4. Discussion

The rise in awareness of obesity problems and the increasing obsession with the self-body image due to the widespread use of self-photography and

social media in addition to, the great advances of surgical and non-surgical weight loss techniques, all lead to a progressive increase in the numbers of massive weight loss patients that in parallel

increases the number of post-bariatric surgeries every year. Statistics collected by the American Society of Plastic Surgeons demonstrate a significant rise in the number of brachioplasty procedures performed between 2000 and 2012, with an increase of 4392 percent in 2012 relative to 2000 [11].

Because incision shape and placement are some of the most critical elements of surgical planning, as they play an ultimate role in determining scar concealment and wound tension [4]; the trials of modifying the incision shape, chasing the optimal placement of the incision, and comparing between the different site is continuous by the authors. As patient satisfaction is the main goal of all cosmetic surgery; the authors had developed plenty of surveys and questionnaires to evaluate the satisfaction of the patient after any development or modification of cosmetic surgical technique to guide themselves and other surgeons in the hard process of proper technique selection.

One of these trials was done by Samra et al. when they attempted to simulate the position of the brachioplasty scar in the medial (bicipital groove) and posterior (brachial sulcus) by using a marker pen to draw the site of the scar in a normal arm, the participants of this survey were public (lay people), patients and plastic surgeons. The interpretation of the outcome of this study revealed that it is more acceptable to have a medial straight Brachioplasty scar than a posterior straight scar. A posterior scar is preferred over a medial scar if the scar shape is sinusoidal [11].

One of the drawbacks of this study is that a big portion of the participants were lay people who may not have experienced any long scars before, and their perception of the scar is not well established.

In our study, we modified that concept in our questionnaire at the end of the 6<sup>th</sup> postoperative month. In question number 8, we marked the site of the medial scar in the posteromedial group and vice versa and we asked the patient if they felt that the drawn site of the scar was better, the same, or worse than their scar, their answers had given a score of (0, 1, 2) respectively. The mean score for the medial group was 1.05 (SD 0.74) while the mean score for the posteromedial group was 1.76 (SD 0.43), this difference between both groups in favor of the posteromedial group was statistically significant.

Another trial of emphasizing the scar placement impact was done by Simone et al. when they developed an analytical model using a device to analyze the difference in the skin response to tension in the medial and posteromedial skin, their physical model concluded that pathologic scarring

is less likely in the posteromedial location because of the lower intrinsic skin tension on the posteromedial aspect of the arm compared to of the medial location, the author in this study assessed the quality of the posteromedial scar by Patient and Observer using Vancouver Scar Scale as well as an assessment questionnaire [8].

In our opinion one of the drawbacks of this study is that; in the clinical outcome assessment and questionnaire, they didn't include another group operated with medial scar, so the assessment of the scar quality and patient satisfaction is absolute, and lack of comparison group which make it not accurate.

In our study, we divided the patients into two groups, one with a medial scar and the other with a posteromedial scar to be able to make a comparison. We used the Stony-Brook scar scale to measure the quality of the scar. Unlike what Simone et al. concluded and although the posteromedial group had a slightly higher mean value in overall satisfaction, in our study; this difference was not statistically significant.

Furthermore, we developed a custom-made 10-question survey to measure and compare patients' satisfaction at the end of the 6<sup>th</sup> postoperative month. The results of this survey ensure the superiority of the posteromedial scar Brachioplasty over the medial scar brachioplasty in terms of patient perception of the final scar and overall satisfaction. These high patients' satisfaction after Brachioplasty with posteromedial scar is compatible with the findings of Simons et al.

Elnaggaey and Aziz published a study comparing the posteromedial and posterior placement of the scar. Although, the comparison group is not the same as our study; they concluded the superiority of posteromedial scar in terms of patients' satisfaction and this agrees with our results [2].

In a large review of Brachioplasty complications done by Sisti et al., an overall complication rate of 28.9% was observed. In our study the overall complications in the medial group were 29.5% and for the posteromedial group 17.7% which proves the superiority of posteromedial in terms of possible complications.

A limitation to our study is a relatively small sample of patients, selection bias as this study was done partially in the private sector and the choice of scar placement was completely for the patient. Another limitation of the questionnaire was the confounding nature of the patients' style of clothing. As this study was done in the Middle East, a big percentage of the patients are covering their arms in public which renders the answer to some questions inaccurate.

## 5. Conclusion

In conclusion, the placement of the scar has no significant impact on the clinical outcome of the surgery in terms of complications and quality of the scar, but it has a significant impact on patients' satisfaction which was in favor of posteromedial scar placement.

## Ethics information

No conflict of interest.

## Funding

There were no funders for this study. The study was done in the Department of plastic surgery, faculty of medicine, Menofyia University.

## Conflict of interest

No conflict of interest.

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