

## Brachioptosis: New Grading and Algorithm of the Management

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### ABSTRACT

Since the introduction of liposuction and the marked progress in the surgical treatment of obesity, there have been an increased number of candidates for upper arm rejuvenation. Brachioptosis can be the result of excess fat and/or skin or both. The amount of fat relative to the amount of excess skin as well as the quality of the skin verifies the degree of brachioptosis and the method of treatment. This study included 92 patients ((184 arms, 78 females and 12 males) who have had brachioptosis and underwent surgical management from May 2008 to July 2012 with an average follow-up period of 2 years. The age of patients ranged from 19 to 54 years with a mean age of 34 years. Review the patients' data including clinical examination and surgical management could establish a new grading of brachioptosis and an algorithm for its management. The authors classified brachioptosis into three main grades depending on the obesity of the arms. These grades include (1) Non-obese arms (NOA) (2) Simple obese arms (SOA), and (3) Morbid obese arms (MOA). Each grade includes subtypes depending on the skin excess and skin elasticity. This grading is a useful guide for implementing the proper diagnosis and treatment of brachioptosis.

### INTRODUCTION

Brachioptosis is a term that describes the disproportion and distortion of the arms due to excess skin, excess fat or both. The term "brachioplasty" describes the procedure of rejuvenating the arm while addressing all the pathology of brachioptosis. Illouz and DeVillers [1] discuss the anatomy and morphology of the arm. The upper arm contains a deep and superficial fat layer. The deep fat layer is thin and found in the posterior and deltoid region of the arm. The superficial fat layer is circumferential and tends to hypertrophy, particularly in the posterior one third of the arm. A greater amount of fat is therefore found in the more proximal area of the arm. Chamosa [2] found that the anterior surface and distal third of the arm tend to have less thick adipose tissue. Occasionally, a specific lipodystrophic zone can be found on the posterior-external area of the arm, located between the proximal and medial thirds. The skin of the medial aspect of the arm is thin, devoid of hair follicles, and prone to sag.

The aesthetic arm is considered to be lean, with an anterior convexity of the deltoid merging with the convexity of the biceps. The posterior surface should be slightly convex from the axilla to the elbow. Glanz and Gonzalez-Ulloa [3] have demonstrated that with age, the inferior posterior curve of the upper arm progresses, with loss of superior structures leading to ptosis or the bat-wing appearance. According to Lockwood [4], factors predisposing to soft tissue laxity of the arms include aging, heavy arm fat deposits, weight fluctuation, sun damage, and previous liposuction.

Different methods of arm rejuvenation were described [5-10]. The evolution in brachioplasty aims to contour the arm while minimizing resulted scar. With increasing in the percentage of individuals having massive loss of weight, especially after the wide practice of bariatric surgery, rejuvenation of the arm has become related to rejuvenation of the lateral chest wall [11].

Brachioptosis was a subject to many classifications depending on the amount of fat and excess skin redundancy. Illouz and DeVillers [1] classified patients into groups of favorable, poor, or borderline candidates. Favorable candidates are patients who are young with good skin tone and moderate fat hypertrophy. Poor candidates are those who are older with sagging and excess fat hypertrophy, often caused by weight loss in addition to aging. Borderline candidates are patients with equivocal examination results. They can be treated with liposuction, but they must be warned that they may need additional surgical intervention. This classification is based on the quality of the skin at different age group and the excess fat. Recently, with the increasing number of patients having massive weight loss either with or without bariatric surgery, a group of young patients may have excess skin with poor skin tone and little fat [12,13].

In 1998, Teimourian and Malekzadeh [14] introduced another classification system that classified the patients into four groups based on the excess fat and the skin laxity. Teimourian classified skin laxity from minimal to moderate; and it lacks grouping of patients with severe skin laxity. In 2007, El Khatib [15] introduced an excellent dynamic staging for brachioptosis which inter-correlated the grading of skin ptosis with the degree of excess fat and thereafter, he put the strategy of treatment of each stage. However, he staged the patients with minimal fat deposit and no skin ptosis as stage 1. In fact, these types of arms are not considered to be brachioptosis. Furthermore, other forms of brachioptosis are not described in the staging.

This study presents the retrospective review of multicenter experience in different forms of brachioptosis and their management. The authors could establish a new grading of brachioptosis and guidelines for the management of different types.

## PATIENTS AND METHODS

This study included anthropometric examination, grading and surgical management of brachioptosis in 92 patients (184 arms). The age of the patients ranged from 19 to 54 year-old with a mean of 34 years (78 females and 12 males). The study was conducted in Alsalm International Hospital (Kuwait), Ain Shams University Hospitals, and Cairo University Hospital from May 2008, and July 2012 with an average follow-up period of 2 years.

### *Anthropometric study of arms (92 patients, 184 arms):*

Every patient was subjected to physical examination of the arm which included the status of musculoskeletal system, the fat component, the skin excess and skin tone.

- *Muscle examination:* The muscles of the arms were examined for either bulkiness or atrophy. Some patients had strong and bulky muscles associated with brachioptosis while other patients showed a degree of muscle atrophy especially among patients who have had massive weight loss.
- *Fat examination:* The normal fat thickness at the arm is about 1.5cm [3,4]. Excess fat was examined by the pinch test while the arm was abducted and the elbow was flexed. In normal non-obese arms, pinch test was equal or less than 1.5cm and the underlying muscles could be easily felt. In obese arms, the pinch test encountered a fat thickness more than 1.5cm, the obesity was uni-

form from the axilla to the elbow joint and the underlying muscles were difficult to be felt. The anticipated fat excess ranged from 200 to 500mL. In the morbid obese arms, there was a circumferential fat excess extending from the axilla to the elbow joint and the anticipated fat excess was more than 500mL (Fig. 2).

- *Skin examination:* Skin was examined for both laxity and tone (Fig. 1). Skin sagging  $\geq 2$ cm and  $\leq 5$ cm and usually limited from the axilla to the mid-arm was considered as mild skin laxity. Skin laxity  $\geq 5$ cm and  $< 10$ cm was considered as moderate skin ptosis. Skin laxity more than 10cm, which usually extending from the axilla to the elbow joint was considered as severe skin laxity (Fig. 2).

Standard photographs in the front and back views were taken for both arms while the arms were abducted. After extensive study and review of 92 patients (184 arms), the authors could suggest a new grading for brachioptosis and an algorithm of the management as follow:

### *1- Non-obese arms (NOA):*

These arms have normal or sometimes less than normal thickness of fat. According to the degree of skin laxity, this type is divided into 3 subtypes:

- *Non-obese arms with mild ptosis (NOA-I):*

These arms have normal thickness of fat with mild skin laxity ( $\geq 2$ cm and  $< 5$ cm) measured from the inferior edge of the muscle. Ptosis is usually existed at the upper arm with minimal or no ptosis at the elbow (Fig. 2). This group included 12 patients (24 arms) and underwent axillary brachioplasty (Fig. 3).

- *Non-obese arms with moderate ptosis (NOA-II):*

These arms have normal thickness of fat with skin laxity ( $\geq 5$ cm and  $< 10$ cm). With pinch test, the index and thumb fingers of the surgeon could be approximated. These arms were usually seen in patients after weight loss. This group included 8 patients and underwent major Brachioplasty (Fig. 4).

- *Non-obese arms with severe ptosis (NOA-III):*

These arms have normal or even the arms are depleted of fat with severe skin ptosis which always exceeds 10cm from the inferior border of the muscle of the arm. Maximum skin laxity is a maximum at the axilla and extending to the elbow joint. In severe cases, the underlying muscles have a degree of atrophy. These arms are almost seen in patients who have had massive weight loss following successful bariatric surgery. This group included 22

patients who underwent major Brachioplasty or extended Brachioplasty.

2- *Simple obese arms (SOA):*

These arms have excess fat at the anterior, medial and posterior aspects; however, in the severest form, skin cannot be approximated at the inferior border of the arm with pinch test. The anticipated excess fat ranged from 200mL and 500mL According to the degree of skin laxity, this type is subdivided into 3 subtypes:

• *Simple obese arms mild skin ptosis (SOA-I):*

These arms are characterized by the deposition of fat with skin laxity >2cm and <5cm. These arms are frequently seen among young females with good skin tone. The excess fat and skin laxity were mostly existed at the upper posteromedial aspect of arm. This group included 14 patients who underwent laser lipolysis, liposuction, and laser skin tightening. Laser lipolysis is performed by long pulsed Nd-YAG 1064 nm (Smart-lipo®), DEKA, Italy.

• *Simple obese arms with moderate ptosis (SOA-II):*

These arms are characterized by simple obesity of the arms with skin laxity ≥5 and <10cm. In this type, the laxity of the skin is a maximum at the axilla and usually ends before the elbow joint. This group included 12 patients who underwent major Brachioplasty.

• *Simple obese arms with severe Ptosis (SOA-III):*

These arms are characterized by simple obesity and severe skin laxity >10cm. Skin ptosis was

profound at the axilla and involves the entire arm ending at the elbow joint (Figs. 8,9). This group included 16 patients who underwent a staged liposuction followed 3 months later by major Brachioplasty.

3- *Morbid obese arms (MOA):*

These arms are characterized by marked obesity which usually involves the entire arm. By pinch test, the index and thumb finger can not be approximated. The excess fat is usually a maximum at the upper arm and continues to involve the lower arm and elbow joint. The skin is usually stretched over the accumulated underlying fat (Fig. 10). This group included 8 patients who underwent a staged bariatric surgery or liposuction, then major or extended Brachioplasty.

**RESULTS**

Review of clinical data of 92 patients (184 arms) and their surgical management could establish a new grading of Brachioplasty and algorithm for the management types (Fig. 11).

Good aesthetic results were reported in 78 patients (84.8%). However, the reported complications were wound dehiscence at the axilla in 4 patients (6 arms) underwent major Brachioplasty. All wounds healed by conservative treatment in the form of regular dressing. Keloid and hypertrophic scar was reported in 3 patients (6 arms), asymmetry in 3 patients, and unsatisfactory aesthetic results due inadequate skin excision in 4 patients. Secondary revisions were performed to 5 patients (9 arms).



Fig. (1A): Examination of fat excess at mid arm.



Fig. (1B): Examination of the brachioptosis and degree of skin laxity.

Fig. (2): Grading of brachioptosis depending on degree of laxity and fat excess.

<b>Grading of Brachioptosis</b>		
<ul style="list-style-type: none"> <li>• <b>Skin laxity</b> <ul style="list-style-type: none"> <li>◦ Mild skin ptosis: &gt;2cm and &lt;5cm</li> <li>◦ Moderate skin ptosis: &gt;5cm and &lt;10cm</li> <li>◦ Severe skin ptosis: &gt;10cm</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Adiposity</b> <ul style="list-style-type: none"> <li>◦ Non obese arm</li> <li>◦ Simple obese arm "200-500mL"</li> <li>◦ Morbid obese arm "&gt;500mL"</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Skin tone</b> <ul style="list-style-type: none"> <li>◦ Good</li> <li>◦ Faire</li> <li>◦ Bade</li> </ul> </li> </ul>



Fig. (3A): Non-obese arm with mild skin laxity  $\leq 5$ cm.



Fig. (3B): 2-years after axillary brachioplasty.



Fig. (4A): Non-obese arm with skin laxity  $> 5$ cm and  $< 10$ cm from the inferior border of biceps.



Fig. (4B): 6 months after major Brachioplasty.



Fig. (5A): Non-obese arm with severe skin laxity after massive weight loss.



Fig. (5B): 6 months after extended Brachioplasty.



Fig. (6A): Simple obese arm with mild skin laxity.



Fig. (6B): 6 months after laser lipolysis and skin tightening.



Fig. (7A): Simple obese arm with moderate skin laxity ">5cm and <10cm".



Fig. (7B): One month after major Brachioplasty.



Fig. (8A): Simple obese arm with severe skin laxity ">10cm".



Fig. (8B): Staged liposuction then major Brachioplasty.

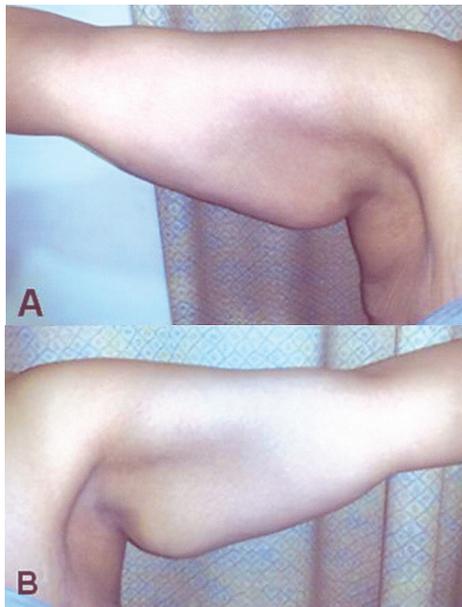


Fig. (9A,B): Simple obese arm with severe skin laxity ">10cm" 6 months after liposuction.



Fig. (9C,D): Major Brachioplasty.



Fig. (10A): Anterior.



Fig. (10B): Posterior views of Morbidly obese arms.

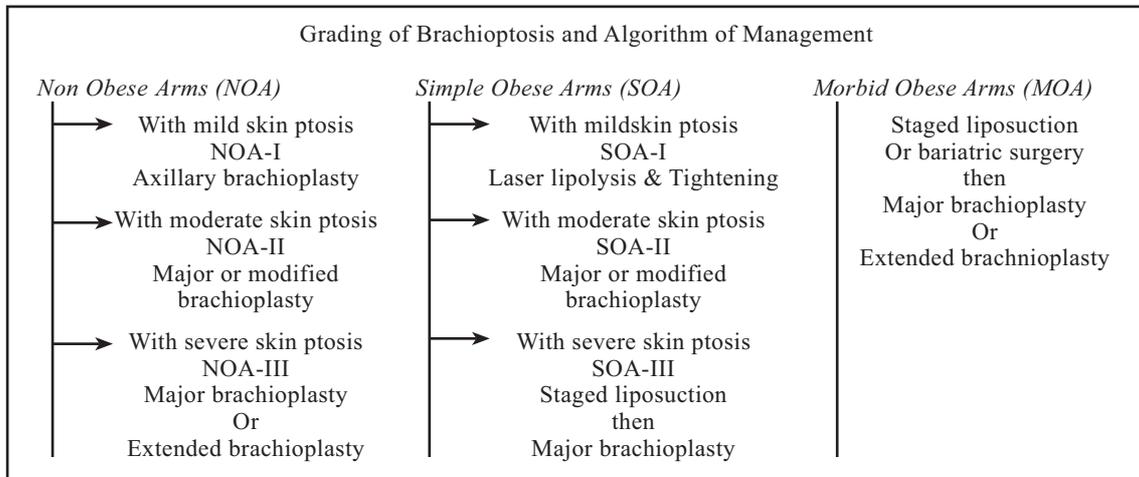


Fig. (11): Grading of Brachioptosis and an algorithm of the management.

## DISCUSSION

Brachioplasty was first introduced in 1954 by Correa-Iturraspe and Fernandez [16]. Since then, the procedure has undergone a series of modifications to improve the appearance of the scar and the resulting contour of the arm. Teimourian and Malekzadeh [14] described four categories of upper arm problems and offered guidelines to provide simple procedures. However, this classification described the degree of skin laxity from minimal to moderate and lacks grouping of patients with severe skin laxity especially seen after massive weight loss.

Elkhatib [15] proposed a classification of the contour deformity of the arm based on the amount of lipodystrophy and degree of ptosis. However, he considered that patients with mild lipodystrophy usually have no ptosis; meanwhile classified them as stage I Brachioptosis. In our grading, brachial ptosis is considered when skin ptosis exceeds 2 cm distance from the brachial sulcus whatever the degree of fat deposition. Furthermore, our grading described certain types of Brachioptosis which are not presented in other classification as non-obese arms with mild or moderate skin ptosis.

The problems of the different techniques reported in the literature continue to include hypertrophic and keloid scars, visible scars, postoperative residual contour deformities, residual skin ptosis, and patient dissatisfaction with the length and location of the scar [17]. The concept in treating lipodystrophy and ptosis changed from arm reduction to arm rejuvenation aiming at restoration of arm contour with good located minimal scar [18]. Moreover, the advances in bariatric surgery have led to a population with massive weight loss that require

upper and lower body contouring. In those patients, Brachioptosis is inevitably combined with laxity of the skin at the later chest wall. Therefore, extended brachioplasty was introduced to rejuvenate both areas [12,13,19].

We proposed a new grading based on the obesity of the arm and subtypes based on the degree of skin laxity. The advantages of this grading over the previous described classifications are: A) It classified Brachioptosis into 3 main groups according to the amount of fat accumulation. The surgeon must give attention to deflate the arm before performing skin resection. Some arms with mild skin ptosis may improve by the sole therapy of laser lipolysis and skin tightening while in other arms with marked obesity, liposuction prior to brachioplasty help at minimizing the length of the scar. B) It classified the main types into subtypes depending on the degree of skin ptosis which enables the surgeon a guideline to select the proper technique.

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