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Clinical Outcome of Abdominoplasty Techniques for Abdominal Wall Deformities: Comparative Study

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Abstract

Background and aim: Abdominoplasty is the most commonly performed procedure out of all plastic surgery. In this study, our primary endpoint was to compare different abdominoplasty techniques in patients with various degrees of abdominal wall deformity and redundancy regarding post operative morbidity and satisfaction. Secondary endpoint was to evaluate the outcome of adding concomitant ventral hernia repair.

Methods: This prospective study was conducted on 30 patients presented with abdominal wall deformities or redundancies. Three techniques were applied independently. Repair of co-existing hernias, complication rates, precautions taken to minimize in both pre and post-operative periods and satisfaction levels reached by the patients with their surgery were addressed.

Results: Mini-Abdominoplasty had shown the least complications with no statistical significance among other procedures (p=0.691). Concurrent hernia mesh repair was done in 10 patients (33%), only 2 patients (6%) have complications. However, there was also no significant difference in wound complications between the group that underwent abdominoplasty only and those to whom abdominoplasty plus hernia repair was performed (p= 0.251). Eighteen patient (60%) were very satisfied about the procedure and the results.

Conclusion: abdominoplasty is beneficial for candidate patients with abdominal wall deformities or redundancies. Repair of hernia by the means of prosthetic mesh also didn't add any statistically significant increase in the risk of complications. The patients' satisfaction after abdominoplasty techniques was negatively influenced by complication occurrence.

Keywords: Abdominal wall hernia; Abdominal wall redundancy; Liposuction

Introduction

Obesity is associated with several health problems in addition to psychological and sexual troubles [1]. Dramatic weight loss after bariatric surgery leads to decreased bulk of subcutaneous fatty tissues in these patients, a new problem came to existence in the form of skin laxity and redundancy in many regions of the body including arms, thighs, breast ptosis and above all the abdominal region which is the greatest complaint in many patients [2]. Abdominal wall hernia is also common among patients presenting for abdominoplasty procedures, especially para-umbilical hernias. Such hernia can be easily corrected through the abdominoplasty approach [3]. Abdominoplasty is performed for patients who did not use to be morbidly obese nor post bariatric-with simple over weight, early classes of obesity or even normal weight with abdominal wall redundancies requiring surgery [4,5]. Several types of abdominoplasty have been described according to extension of skin laxity, amount and distribution of adiposity, anterior abdominal wall muscular status and body weight; of importance Mini abdominoplasty, full abdominoplasty, extended abdominoplasty and others [6].

Aim of the Study

The primary endpoint of the study was to compare different abdominoplasty techniques in patients with various degrees of abdominal wall deformity and redundancy regarding post operative morbidity and satisfaction. Secondary endpoint was to evaluate the outcome of adding concomitant ventral hernia repair.

Patients and Methods

This prospective non randomized comparative study was conducted on 30 patients presented to general surgery department at Mansoura University Hospital, Mansoura, Egypt between August 2015 and June 2016, with abdominal wall deformities after written informed consent. The research was approved by ethical committee.

Inclusion Criteria

Patients between 18 and 60 years old, with different abdominal wall deformities including post bariatric patients at least 12 months after the bariatric procedure who's body mass index (BMI) ≤ 40 kg/m^2 and reached stable body weight, patients who agreed the procedure and understands its risks, mentally and psychologically sound patient, cooperative and motivated patient who were willing to commit to post-operative follow up were included in the study.

Exclusion Criteria

Patients aged > 60 or < 18-year-old, post bariatric patients < 12 months after bariatric surgery, still in rapid weight loss period, or with BMI > 40 kg/m^2, mentally and psychologically unstable patients, and patients who were not willing to commit to post-operative follow up were excluded from the study.

Specific Considerations In Preoperative Evaluation

Calculation of BMI, abdominal wall deformity site and extension ; skin laxity, excess adiposity and muscle status were done. Presence of hernia such as para-umbilical, epigastric and incisional hernia to plan for repair during the procedure was assessed. Special consideration was taken towards skin quality, extent and location of striae and location of previous scars if present to be included in the resection. Prophylactic pharmacological and mechanical measures against venous thromboembolism were mandatory for all patients. Pre-operative photographs were taken for all patients in anterior and lateral views (Figure 1).

Figure 1: Pre-operative photographic documentation.

The choice of the type of operation was based on extension of skin laxity, amount and distribution of adiposity, anterior abdominal wall muscular status and body weight. Mini abdominoplasty was chosen in nonobese patients with excess skin laxity limited to the lower abdomen (below the umbilicus), with mild excess adipose tissue and muscle weakness. Full Abdominoplasty was considered in patients with marked skin laxity, excess adiposity and sever muscle weakness in addition to striae resulting from multiple pregnancies and weight loss. However Extended Abdominoplasty was suitable for patients with more soft tissue laxity especially in the flanks area that extends beyond the incision of a full abdominoplasty. Whenever it was needed to remove excess fat from targeted areas , reducing the bulges and improving the contour liposuction was added to the procedure.

Surgical Techniques

Pre-operative markings were made for a standard liposuction procedure when it was planned, involving whole regions to be liposuctioned including: flanks, upper and lower abdomen, Mons pubis and lateral breast. Surgical incisions were marked. The lower incision is marked first with its central portion at or slightly above the level of symphysis pubis, then it is continued in a lateral direction to the level of anterior superior iliac spine guided by the skin fold in full abdominoplasty, it was extended to the middle axillary line in extended abdominoplasty (Figure 2). Special care was taken regarding the symmetry of the incision. Then the upper incision was marked, usually at the level of the umbilicus. Finally the periumbilical incision was marked. In patient who were planned to undergo limited abdominoplasty, marking of the incision did not go beyond the level of the anterior superior iliac spine and no periumbilical markings were done. The midline, costal margins and the lateral borders of rectus abdominis muscle (linea semilunaris) are marked as they will be the limit for internal extent of undermining. All marking were done while the patients were standing.

Figure 2: Extended abdominoplasty: **A:** Incision and flap creation; **B:** Excision of excess skin; **C:** After wound closure (note that the scar extends lateral to mid-axillary line).

The patients were placed in the supine position, general anesthesia was administered with endotracheal intubation and prophylactic dosage of antibiotic were given with induction of anesthesia. Liposuction was started (in patients who were planned to undergo liposuction) by infiltration of tumescent fluid according to super-wet technique, the tumescent fluid that was used is a mixture of Ringer's lactate solution, epinephrine by a dosage of 1 ml per one liter Ringer's lactate and lidocaine 2% solution by a dosage of 40 ml lidocaine per one liter of Ringer's lactate, then liposuction was performed. Guided by the pre-operative marks, the lower transverse incision was made first by scalpel, and then deepened down to reach the external oblique aponeurosis and rectus sheath using electrocautery, flap was dissected and elevated in an upward direction until the level of the umbilicus. When the level of the umbilicus was reach a vertical ellipse shaped periumbilical incision was made to separate the umbilicus from the surrounding skin, then the whole umbilical stalk was separated using scissors down the level of the rectus sheath leaving a sufficient amount of fat surrounding the umbilical stalk to ensure its viability. At this point the lower flap was split longitudinally to facilitate the subsequent flap elevation above the level of the umbilicus. Elevation of the flap was continued till reaching the xiphoid process superiorly and costal margins laterally. A further inferior flap elevation was made till the level of symphysis pubis inferiorly. Hemostasis was done either by ligation or electrocoagulation of perforators. After complete flaps elevation, plication of linea alba was done starting from the xiphoid process in a downward direction reaching the umbilicus, then the suture was passed through the lateral edge of the umbilical stalk in order not to affect its vascularity, then it was continued downwards in the midline to the level of the symphysis pubis. In patients with severe muscle weakness, a two layers plication was done to ensure maximum benefit. In patients who were planned for mini-abdominoplasty, no peri-umbilical incision was done, and the umbilicus was either not separated or separated at its base from the underlying sheath flap (Figure 3). The upper flap was pulled downward and medially and the excess skin was marked for subsequent resection with both sides symmetrical. The location of the new umbilicus was marked and a vertical ellipse incision is made similar to the incised umbilicus, the skin is excised with the underlying subcutaneous tissue in a cone shaped manner. Before closure, hemostasis was inspected to avoid post-operative bleeding. And two suction drains are brought out at the lateral edges of the wound.

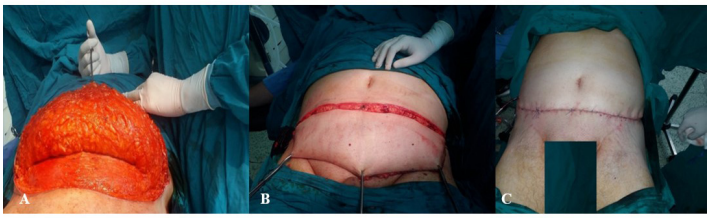

Figure 3: Mini-abdominoplasty. **A:** Incision and flap elevation; **B:** Excision of excess skin (note that the umbilicus has not been translocated); **C:** After wound closure.

One temporary midline suture was placed to approximate the margins of the wound, the upper margins were strongly advanced bilaterally towards the midline and secured by placement of temporary sutures. Closure is done in two layers; Scarpa's fascia and deep dermis as a layer applying most of the tension on Scarpa's fascia and deep dermis and subcuticular sutures advancing from lateral to medial with multiple simple sutures on wide spaces to secure the resulting long subcuticular sutures. Removal of any dog ears if present. The umbilicus is also closed in two layers, deep inverted sutures and simple sutures. Finally; the vascularity of the flap was assessed by capillary refill time above the upper margin of the wound. In mini-abdominoplasty the separated umbilicus was fixed to the underlying sheath on a level of 2-3 cm lower to its original site (umbilical float technique. It is important to say that in patients who had concomitant hernia at time of presentation we performed mesh repair.

Post-Operative Care

Patients were encouraged for immediate ambulation. Prophylactic antibiotics, post-operative analgesics were administered. Prophylactic anti-coagulation was continued till discharge. Post-operative photographs were taken. Patients were usually discharged on the 2nd or 3rd day post-operative, viability of the flaps and umbilicus was checked before discharge. They were discharged on prophylactic antibiotics, analgesics with advice to minimize their physical effort and daily dressing for the wounds. Abdominal binder or compression garments were used for 1 month.

Follow Up

Follow up was done in the outpatient clinic. Drains were usually removed within a period of one week or when it drains less

than 30 mL per day and there is no evidence of collection except in cases who had mesh repair for an existing hernia, suction drains were left for a period of at least 3 weeks. Sutures were usually removed after 2 or 3 weeks according to condition of the wound. Further photographs were taken. Follow up was done at 3rd and 6th month post-operative involving evaluation of:

- Complete resolution of post-operative wound complications if present.
- Scar as regard: appearance, symmetry, complications as hypertrophic scar or keloid.
- Level of satisfaction according to Likert scale 1 (Table 1). This scale was applied by an independent observer (resident physician of the Surgery Department) in a personal interview with the patients [7].

Satisfaction level	Value
Very satisfied	1
Satisfied	2
Dissatisfied	3
Very dissatisfied	4

Table 1: Likert-style Satisfaction Survey after Abdominoplasty [7].

Statistical Analysis

The statistical analysis was done using the statistical package of services solutions (SPSS; SPSS Inc., Chicago, IL, USA) software, version 21.0. Exploratory analysis and testing of continuous data for normality of distribution is done using Kolmogorov–Smirnov statistic and Shapiro–Wilk statistic. Continuous data with normal distribution are expressed in terms of (mean ± standard deviation) while non-parametric data are expressed as median and range, categorical data presented in the form of proportion and number. Plots and figures were designed using Microsoft Office Excel 2013.P value considered to be important < 0.05.

Results

Demographic and general data are shown in Table 2.

Operative Data are explained in Table 3

Significant complication that measured were: seroma, hematoma, infection, tissue ischemia and gangrene, wound dehiscence, umbilical gangrene, need for blood transfusion, venous thromboembolism and need for hospital re-admission. No mortality or major complications were encountered. Complications are shown in Figure 4.

Patients parameters	Value
Age	40.66 ± 9.04
Gender:	
Male	5 (16.7%)
Female	25 (83.3%)
BMI	33.47 ± 2.67
Bariatric procedure:	5 (16.7%)
Scars of previous operations:	24 (80%)
BMI: Body Mass Index	

Table 2: Demographic & general data.

Parameters	Value
Type of operation:	
Mini-Abdominoplasty	5 (16.7%)
Full Abdominoplasty	21 (70%)
Extended Abdominoplasty	4 (13.3%)
Liposuction:	4 (13.3%)
Neo-Umbilicus:	4 (13.3%)
Concurrent Hernia Repair:	10 (33.3%)

Table 3: Operative data.

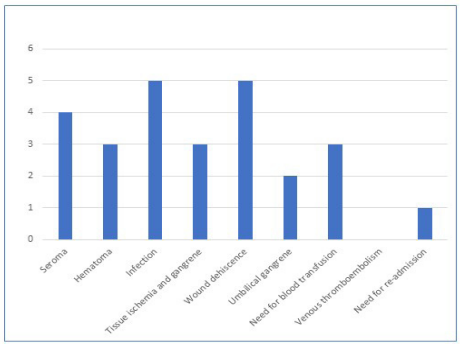

Figure 4: Post-operative complications.

Complications related to the type of procedure are shown in Table 4. Mini-Abdominoplasty had shown the least complications percentage in comparison to full and extended abdominoplasty. However, there was no statistically significant difference between

them (p=0.691). For the 10 patients who underwent concurrent hernia mesh repair with the abdominoplasty procedure; 2 (20%) of them suffered from at least one of the complications, while 8 (80%) of them didn't suffer from any complications. For the 20 patients who didn't have hernia mesh repair with the abdominoplasty procedure; 8 (40%) of them suffered from at least one of the complications, while 12 (60%) of them didn't suffer from any complications without statistically significant difference between them (p = 0.251) (Figure 5).

Type of operation	Complications		
	No	Yes	Total
Mini-Abdominoplasty:			
• Count (by case)	4	1	5
• % within type of operation	80%	20%	100%
Full Abdominoplasty:			
• Count (by case)	13	8	21
• % within type of operation	61.90%	38.10%	100%
Extended Abdominoplasty:			
• Count (by case)	3	1	4
• % within Type of operation	75%	25%	100%
Total			
▪ Count (by case)	20	10	30
▪ % within all patients	66.70%	33.30%	100%

Table 4: Type of operation and percentage of complications within each type.

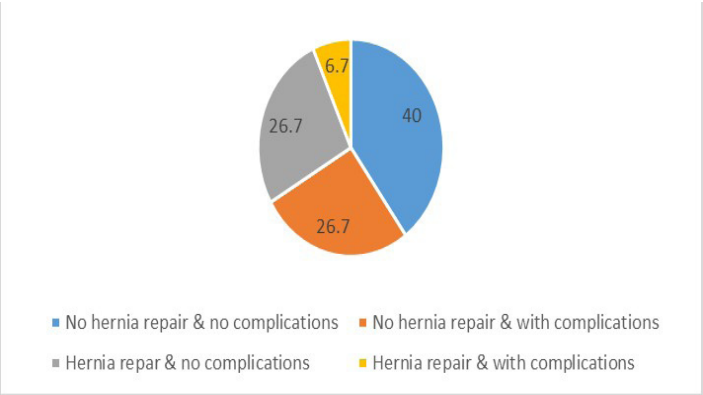

Figure 5: Percentage of complications within total patients in relation to concurrent hernia repair.

Satisfaction level of the patients was measured on a 4-degree scale (likert scale) and expressed in Figure 6. Table 5 shows level of satisfaction after procedure in relation to type of operation. There was also no statistically significant difference between them (p=0.56). For the 10 patients who suffered from complications; 4 (40%) of them were very dissatisfied, 2 (20%) of them were dissatisfied, one (10%) of them was satisfied and 3 (30%) of them were very satisfied. For the 20 patients who didn't suffer from any complications; none of them was very dissatisfied, one (5%) of them was dissatisfied, 4 (20%) of them were satisfied and 15 (75%) of them were very satisfied. There was statistically significant difference between them (p = 0.007).

Type of operation	Level of satisfaction				Total
	Very dis-satisfied	Dissatis-fied	Satis-fied	Very satis-fied	
Mini-Abdomino-plasty:					
- Count (by case)	0	1	2	2	5
% within type of operation	0.00%	20%	40%	40%	100%
Full Abdomino-plasty:					
- Count (by case)	3	2	3	13	21
% within type of operation	14.30%	9.50%		61.90%	100%
Extended Abdomino-plasty:					
- Count (by case)	1	0	0	3	4
% within Type of operation	25%	0.00%	0.00%	75%	100%
Total					
- Count (by case)	4	3	5	18	30
% within all patients	13.30%	10%		60%	100%

Table 5: Type of operation and level of satisfaction.

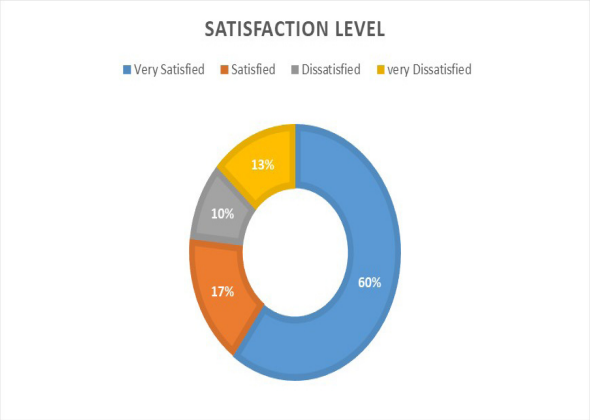

Figure 6: Satisfaction level according to Likert Scale.

Discussion

Abdominoplasty is one of the most frequently performed plastic surgical procedures and it is one of the top five procedures of aesthetic surgery in the USA, for patients - who did not use to be morbidly obese nor post bariatric- with simple over weight, early classes of obesity or even normal weight with abdominal wall redundancies requiring surgery [4,5]. We performed full abdominoplasty on 21 (70%) who were the majority of our patients, mini-abdominoplasty on smaller number 5 (16.7%) in whom the deformity was confined to the lower abdomen and extended abdominoplasty on 4 (13.3%) who had more tissue adiposity and laxity in the flank area than to be corrected by full abdominoplasty. This goes parallel with Hunstad & Repta (2009) as they stated that the majority of abdominal wall deformity patients required full abdominoplasty for correction of this deformity and only small fraction of such patients were suitable for mini-abdominoplasty procedure or need extended abdominoplasty procedure for correction [6]. As the majority of abdominoplasty candidates present with marked skin laxity, excess adiposity and sever muscle weakness in addition to striae resulting from multiple pregnancies and weight loss; full abdominoplasty is the most widely used procedure for correction of abdominal wall deformities [8].

In our study; overall uneventful recovery without any complications happened with 20 (66.6%) patients (80% of mini abdominoplasty cases, 66.7% of extended abdominoplasty cases and 61.9% of full abdominoplasty cases) while overall complications involved 10 (33.3%) patients (20% of mini abdominoplasty cases, 38.1% of full abdominoplasty cases and 33.3% of extended abdominoplasty cases). These complications were distributed as follows: seroma in 4 (13.3%) patients, hematoma in 3 (10%) patients (none of them were clinically significant nor required re-operation). Also, tissue ischemia and gangrene in 3 (10%) patients, and 3 (10%) patients required blood transfusion. Infection and wound dehiscence in 5 (16.7%) patients, umbilical gangrene in 2 (6.7%) patients, and only one (3.3%) patient required hospital re-admission for surgical interference to manage seroma after lipoabdominoplasty in full abdominoplasty technique as it persisted beyond few weeks and failed conservative measures. Diagnostic evaluation was done for the cavity by computed tomography scan, and managed by opening part of the incision, curettage of the exudates and granulation tissue of the cavity, insertion of a drain then closure of the incision and applying pressure dressing. No one was had venous thromboembolism.

Garcia-Garcia, et al. (2014) reported in their study that overall complications were 45.8% which is more than our overall complications [7]. It was distributed as: seroma (23.6%), while we reported (13.3%), hematoma (6.9%), while we reported (10%), but they stated that these cases of hematoma required blood transfusion while our cases were only small hematomas and didn't require any intervention, infection (13.9%) while we faced (16.7%), tissue necrosis (6.9%),while we faced (10%), umbilical gangrene (4.2%) was less than our study (6.7 %), need for hospital readmission in (11.1%) which is significantly more than our study as only one (3.3%) of our patients required so. Bracaglia, et al. (2011) study results showed that 37% of their patients suffered from complications which is more than our complication rate [1]. Fraccalvieri, et al. (2007) had a complication rate of 50.43% in their study which is significantly more than our complication rate and they reported one case with venous thromboembolism [2]. Grieco, et al. (2015) mentioned in their study that seroma was the most frequent complication while in our study we found infection to be the most frequent, they also reported one case of venous thromboembolism while we did not [5].

In other study performed by Khan (2012) on three groups, one of the groups had abdominoplasty in a technique similar to ours. Seroma rate in this group was 25.5% with is much more than our rate [9]. In our study 5 (16.7% of total number) out of 30 patients underwent mini abdominoplasty technique, only one patient (20%) was complicated by seroma, infection and wound dehiscence, hematoma, and tissue necrosis, the patient didn't require re-operation. Friedman, et al. (2015) in their study implemented mini-abdominoplasty in 63 out of 264 patients (24% of total number) and they didn't report any hematoma, tissue necrosis nor umbilical necrosis but they reported one patient with seroma that required re-operation, but our complicated patient didn't [10]. In our full abdominoplasty patients 8 out of 21 (38.1%) suffered from complications while only 20% of mini-abdominoplasty patients were complicated which is 18.1% lower, Mast (2013) mentioned that mini-abdominoplasty patients have 10% less complication rate than full abdominoplasty procedure [11].

In our study we had 10 patients with existing abdominal wall hernia that required correction along with the abdominal

wall deformity, we found that repair of hernia through the abdominoplasty procedure to be very helpful in exposure of the defect and applying the required repair, which come in agreement with the study conducted by Gardner, et al. (1996) [12]. Garcia-Garcia, et al. (2014) encountered hernia in 6.4% of their patients and they performed concurrent repair with abdominoplasty [7]. Two (20%) of our patients who had developed complications with one patient who had repair of para-umbilical hernia developed necrosis of the umbilicus, while Gardner, et al. (1996) reported 13.33% complication rate in his patients which was less than ours with one case of necrosis of the umbilicus (12). Neinstein, et al. (2015) didn't report any umbilical necrosis [13]. As in our study, Sakr et al. (2019) conducted a study on multiparous women and found that there was no significant difference in wound complications between the group that underwent abdominoplasty only and those to whom abdominoplasty plus hernia repair was performed (p= 0.346) [14].

In our study satisfaction results (measured by Likert scale) were distributed in over all patients as 18 (60%) of the patients very satisfied, 5 (16.7%) satisfied, 3 (10%) dissatisfied and 4 (13.3%) very dissatisfied. There was no significant difference of one technique over other. In relation to complications: the complicated patients, 4 (40%) of them were very dissatisfied, 2 (20%) of them were dissatisfied, one (10%) of them was satisfied and 3 (30%) of them were very satisfied. While the 20 patients who didn't suffer from any complications; none of them was very dissatisfied, one (5%) of them was dissatisfied, 4 (20%) of them were satisfied and 15 (75%) of them were very satisfied. (p = 0.007). Garcia-Garcia, et al. (2014) study showed in their satisfaction survey (measured by Likert scale) that: in complicated patients 36.4% were very satisfied, 33.3% were satisfied, 12.1% were dissatisfied and 18.2% were very dissatisfied, these results were better than ours [7]. While in non-complicated patients 64.1% were very satisfied, 30.8% were satisfied, 5.1% were dissatisfied and 0% were very dissatisfied (p = 0.001). Our results proven to be better.

Our study was limited by small sample size and heterogeneity of the cases. It is also worth to be mentioned that on the short term follow up that extended up to 6 months in most of the patients weight regain was not noted as a complication as our study was not taking the concerns of long term follow up complications.

Conclusion

The patients' satisfaction after abdominoplasty techniques was negatively influenced by complication occurrence. If abdominoplasty techniques are done correctly and chosen wisely according to every patient need and degree of deformity, they will lead to high satisfaction levels, improvement in patient's perception of self-image and dramatic improvement in his/her quality of life. It is of utmost importance to take measures to guard against complications and perform reasonable follow up for their early detection and management as they have a statistically significant negative impact on the satisfaction levels of the patients.

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