A Comparative Study Between the Use of Prolene Mesh and Conventional Muscle Plication for Correction of Musculoaponeurotic Laxity in Abdominoplasty

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ABSTRACT

Abdominoplasty is in increasing demand with the postpartum, post-bariatric, and aging abdomens seeking aesthetic contouring. The traditional technique with midline rectus plication has long been in use and has proven both effective and durable. Mesh usage has been proposed to have an additional supportive effect in cases with severe musculoaponeurotic laxity, but the associated risks make the unconditional use unwarranted. In this work, we compare traditional midline plication to additional mesh insertion. Both groups had satisfactory aesthetic results, with the mesh group having higher complication rates, longer operative time and hospital stay, and a higher cost. Mesh usage should be reserved for cases with concurrent large umbilical or paraumbilical hernias.
Keywords: *Abdominoplasty; Prolene; Polypropylene; Mesh; Muscle Plication; Rectus Diastasis*

Running Title: Prolene Mesh Versus Muscle Plication
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INTRODUCTION

Abdominoplasty has long been in use for the aesthetic restoration of the abdominal contour, with weight loss, aging, and previous pregnancy being the major three indications for seeking the surgery [(1)]. The goal is to achieve maximum aesthetic capacity of all abdominal layers (including skin, muscle, and fat) with the least visible scar and minimal postoperative complications[(2)]. Much advancement has been made since the introduction of the procedure in the nineteen sixties, with the great strides made in incision design, muscle treatment, the advent and advancement in liposuction technology, and better anatomical and physiological understandings [(3)]. In a recent large quantitative analysis of patient satisfaction with abdominoplasty [(4)], the overall satisfaction with the procedure was high, with aesthetic outcome being the dominating factor in the reviews.

Some authors have promoted the adoption of an individualistic approach for each patient seeking abdomen-contouring surgery[(5)]. For example, in those with severe musculoaponeurotic laxity (such as the multiparous abdomen), it has been proposed that the use of a polypropylene mesh would provide stable reinforcement to the midaponeourotic plication, and would thus decrease the risk of recurrence [(6)]. However, the selection of patients in which the use of mesh would provide more benefit remains a controversial topic [(7)].

Nahas [(8)] has been distinctive in aesthetically classifying the abdomen based on the musculoaponeurotic layer. In his classification, four types of laxity are identified with their proposed management options, and patients with severe rectus diastasis required additional maneuvers as midline plication alone was claimed to be insufficient. This diastasis is the main suspect in postoperative prominent abdominal bulge, which is a major source of dissatisfaction for patients undergoing the procedure[(9)]. Furthermore, the use of mesh concurrent with abdominoplasty has been proposed to enhance weight loss and prevent further weight gain by increasing passive and active wall tension and respiratory energy consumption [(10)].

On the other side of the argument, the use of mesh in all cases of abdominoplasty remains unjustified. First, the use of conventional plication alone has been documented to have excellent results [(8)]. Secondly, mesh usage comes with its

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well-established risks including infection, seroma formation, pain, mesh extrusion, delayed healing, increased procedure time and cost, and a longer hospital stay [(11)]. Finally, there is no method to definitively assess musculoaponeurotic laxity except intraoperatively [(7)]. This has led many surgeons to reserve mesh usage for cases needing additional hernia repair, or those with poor waist enhancement after midline plication [(7,12)].

In this work, we have attempted to examine abdominoplasty with and without mesh insertion for patients with severe musculoaponeurotic laxity. Our primary outcome was aesthetic results, while secondary outcomes included complication rates, operative time, hospital stay duration, and cost.

METHODS

This prospective comparative non-blinded interventional study was conducted in two private plastic and reconstructive surgery centers in Egypt and Kuwait in the period between January of 2015 and December of 2017. Patients seeking abdominal contouring surgery were considered candidates for the study and were offered to be part of it. Written informed consents were obtained from all subjects and we adhered to the tenants of the Declaration of Helsinki throughout all our work.

Patients with abdominal musculoaponeurotic deformity were classified according to the classification of Nahas [(8)], and those with a type D deformity (severe rectus diastasis and poor waistline definition) were included in the study. Patients with umbilical or paraumbilical hernias were equally distributed into both arms of the study. We excluded patients with previous abdominal contouring surgery, immunocompromised patients, and those with any contraindication to mesh insertion.

To quantitatively assess baseline aesthetic impression of patients preoperatively, we employed the recently-introduced Body-QoL® Questionnaire[(13)] (available at: http://www.bodyqol.org/). The latest version of the instrument is concerned with four domains: satisfaction with body, sex life, self-esteem and social performance, and physical symptoms. For each of the five statements in each domain, subjects are asked to pick a number from 1 to 5 in a Likert-scale agreement manner, summing up to a final score out of 100.

Patients then underwent traditional abdominoplasty surgery with or without mesh insertion. After routine preoperative laboratory results were obtained, and clearance by an anesthesiologist, abdominal body marking was carried out in the operating theatre. The procedure was carried out under complete general anesthesia and antibiotic prophylaxis. Liposuction was utilized when indicated. A hidden concave lower incision to the level of the rectus fascia was made extending between both ileac regions and parallel to the lower abdominal fold. Vertical midline plication from the xiphoid to the pubis was then carried out using non-absorbable interrupted 0-nylon sutures. In the mesh group, a well-spread prolene mesh with an average size of 20x30 cm was fixed using a interrupted suturing or a fascial stapler to the external oblique fascia after proper dissection (Figure 1), with the umbilical stalk exteriorized through a hole in the center of the mesh (Figures 2 and 3). Extra skin was excised, and subcutaneous drains were left in place before skin closure. Operative time was calculated for each surgery.

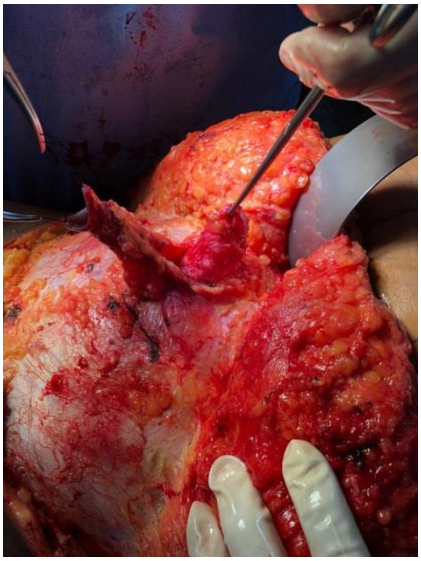

Fig. 1. Dissection to reach external oblique fascia to place the mesh.

Fig. 2. Inlay prolene mesh in place with umbilical stump exteriorized through hole in mesh.

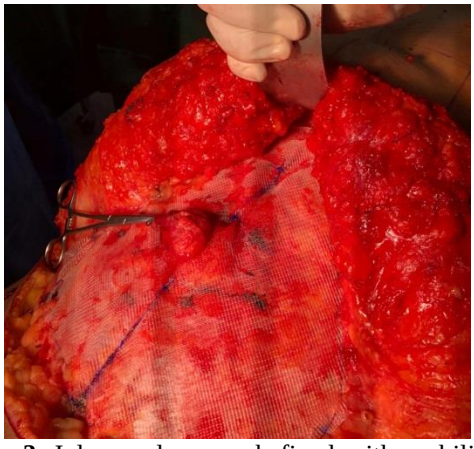

Fig. 3. Inlay prolene mesh fixed with umbilical stump exteriorization

Patients were encouraged to do ambulatory leg exercises on the first day postoperative, and received postoperative pain medication (indomethacin 500 mg, 3 times daily) and antibiotics (co-amoxiclav 1g, twice daily). The drains were removed when free and the patients were discharged one day after the drains were removed and the wounds were deemed primarily healed. Hospital stay duration was calculated for each patient. Patients were followed up for an average of 8 months. The primary outcome was aesthetic improvement using the Body-QoL® Questionnaire. Secondary outcomes included the occurrence of complications, recurrence, and the need for revision.

All results were tabulated and analyzed using SPSS v23 (IBM, United States). Descriptive statistics were carried out with the calculation of mean and standard deviation (SD). Comparative analytical statistics were performed between preoperative and postoperative aesthetic impression in both groups using the student t-test. A probability value (p-value) less than or equal 0.05 was considered statistically significant.

RESULTS

Our study included fourteen female patients seeking abdominal contouring surgery. Seven patients were treated with a traditional abdominoplasty surgery with midline rectus plication, while the other seven had an additional prolene mesh application. Four patients had a paraumbilical hernia and were distributed evenly between both groups (2 patients in each group).

The mean age of the whole patient sample was 37.5 years (range: 32 – 49 years). The difference in age between both groups was not statistically significant ($p = 0.456$). Eleven of the fourteen patients (78.6%) were seeking abdominal contouring for a multiparous abdomen, while three were for post-bariatric surgery reasons.

Table one demonstrates a summary of the Body-QoL® Questionnaire scores for both groups preoperatively and at 6 months postoperatively. The mean Body-QoL® Questionnaire score preoperatively for the traditional plication group was 36.4 (SD: 12.1), while that for the mesh group was 38.2 (SD: 14.8). The difference was not statistically significant ($p = 0.8075$). The mean postoperative Body-QoL® Questionnaire score for the traditional plication group was 62 (SD: 13.3), while that for the mesh group was 69.7 (SD: 16.6). The difference was not statistically significant ($p = 0.3571$).

Figures 4 demonstrates the front view of a 38-year-old multiparous female preoperatively and at 6 months postoperatively with plication alone. Note the bikini line scar and the achievement of adequate contouring. Figures 5 and demonstrate front and side view of a 41-year-old multiparous female with lower paraumbilical hernia preoperatively and at 6 months postoperatively with mesh insertion. Note the achievement of

adequate flank contour and the disappearance of the hernia.

Regarding our secondary outcomes, the complications were recorded for each patient. One of the two patients that had preoperative paraumbilical hernia in the plication group had recurrence of the hernia with localized abdominal bulge and needed revision of the surgery with mesh insertion. One patient (14.3%) in the mesh group had seroma from the mesh while another patient (14.3%) had mesh-related infection and consequent mesh extrusion and wound gaping. Both patients required surgical mesh removal. Two patients in the mesh group (28.6%) had chronic pain that was adequately managed with non-steroidal anti-inflammatory agents.

The average duration of the procedure in the midline plication group was 193.5 minutes (SD: 38.2 minutes), while the average duration in the mesh group was 294 minutes (SD: 54.7 minutes). The difference was statistically significant (p = 0.0018).

The average total drain volume was 234.5 mL (SD: 42.6 mL) in the plication group and 387 mL (SD: 61.2 mL) in the mesh group (p = 0.0001). The average hospital stay in the midline plication group was 3.5 days (SD: 1.1 days), while the average hospital stay in the mesh group was 5.5 days (SD: 2). The difference was statistically significant (p = 0.0389).

Table 1. Body-QoL® Questionnaire results for both study groups (score 1-100) preoperatively and postoperatively with the calculated student t-test

Variable	Plication without Mesh	Plication with Mesh	P value
Preoperative (Mean ± SD)	36.4 ± 12.1	38.2 ± 14.8	0.8075
Postoperative (Mean ± SD)	62 ± 13.3	69.7 ± 16.6	0.3571

Fig. 4. Front view of a 38-year-old multiparous female preoperatively (left) and at 6 months postoperatively (right) with plication alone

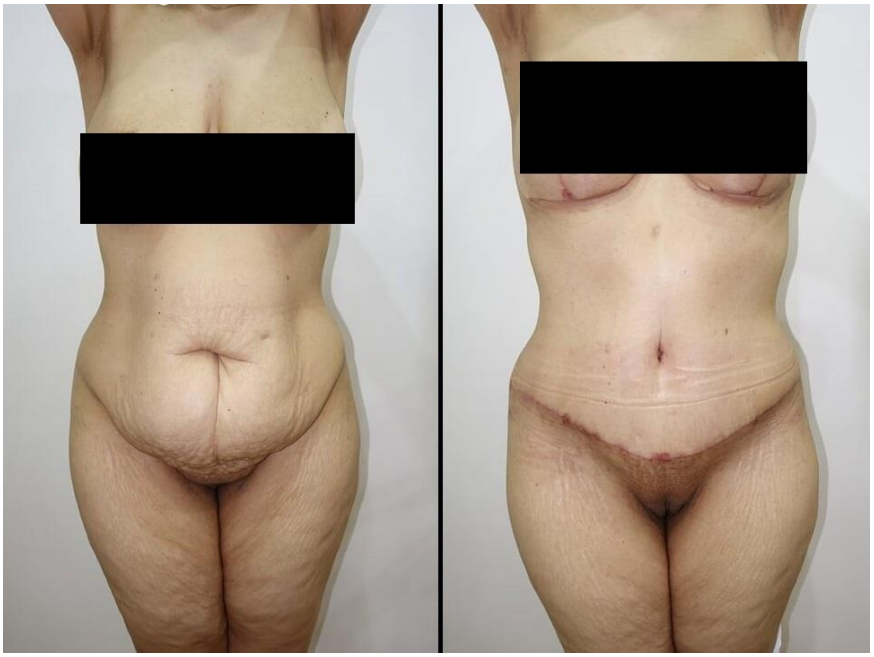

Fig. 5. Front view of a 41-year-old multiparous female with lower paraumbilical hernia preoperatively (left) and at 6 months postoperatively (right) with mesh insertion

Fig. 6. Side view of a 41-year-old multiparous female with lower paraumbilical hernia preoperatively (left) and at 6 months postoperatively (right) with mesh insertion

DISCUSSION

In this work, we attempted to compare traditional abdominoplasty with midline plication to that with an additive mesh insertion in patients with severe musculoaponeurotic weakness and rectus diastasis. We found that the aesthetic outcome was not significantly different in one group over the other, but the complication rate, procedure duration, drain volume, hospital stay, and cost were significantly higher in the mesh group. Mesh insertion was only better in preventing concurrent hernia recurrence.

Nahas [8] has classified the abdomen aesthetically into 4 classes (A – D). In his experience, the use of midline plication alone is enough for advanced rectus diastasis. This is in line with our data in the traditional plication group in which we achieved adequate contouring and comparable aesthetical results with no recurrences. However, in work by Nahas, no report on the status of paraumbilical hernias preoperatively and postoperatively was made. Yet, long term follow up of these patients has demonstrated that the effect of plication was longstanding and satisfactory [14].

Nahas and colleagues [15,16] have also investigated the best type of suture for rectus plication and have demonstrated that the use of absorbable suturing (e.g. polydioxanone) could have a comparable effect to the non-absorbable suture (e.g. nylon). In our work, we have preferred the classically described usage of non-absorbable 0-nylon suturing for rectus plication[3]. We also followed the described method by Nahas and colleagues [17] for dealing with the umbilical stump in our plication groups and have achieved satisfactory results.

The use of mesh in abdominoplasty has been long proposed to achieve better aesthetic and durable results in those with severe aponeurotic laxity [7], or for those with concurrent large umbilical or paraumbilical hernias [18]. The rationale driving the introduction of mesh in abdominoplasty surgery is mainly the increase of active and passive abdominal wall tension leading to better flank contouring, and even enhancing weight loss by increasing respiratory muscle exertion [10]. Caldeira et al. [9] have promoted the use of a submuscular alloplastic mesh in patients with severe musculoaponeurotic laxity and have reported excellent aesthetic results after long-term follow up, but described the intervention as an "aggressive plan" that should be reserved for very severe cases, and reported complications such as chronic pain and fistula formation.

Cheesborough and Dumanian [12] have conducted a retrospective analysis of patients with ventral hernia that underwent abdominoplasty either with mesh insertion or with a prosthetic ventral hernia repair, and found the use of mesh to be both safe and reliable for those with musculoaponeurotic laxity and concurrent ventral hernia. This is in line with our findings that showed the superiority of mesh insertion in patients with large ventral hernias.

Abdominoplasty remains one of the riskiest aesthetic procedures with one of the highest morbidity and mortality rates [2], and thus risk evaluation should always be in mind. Mesh infection is a serious complication that has been reported with various rates in the literature[11,19]. In our study, one of the seven patients that had a mesh inserted had a mesh-related infection followed by mesh extrusion and wound gaping at one week postoperatively that required aggressive antibiotic therapy and mesh removal followed by wound closure. Seroma formation has a natural subclinical or clinical course in abdominoplasty[20]. Martino et al. [21] have proposed that the use of quilting sutures lowers the rate of seroma formation. In our experience, we did not use quilting sutures and encountered no cases of clinically significant seromas in traditional midline plication. The mesh group, though, had one case of seroma formation that required mesh removal. Our study is also in line with the literature in that mesh usage increases the costs of surgery and hospital stay [11].

Limitations to our work include a small sample size and the short follow up duration. Larger studies with longer follow up intervals are needed to establish the non-inferiority of traditional midline plication to mesh insertion in patients with severe musculoaponeurotic laxity. Another limitation is that we did not classify the ventral hernias in our small sample of patients that had such hernias (4 patients) to demonstrate whether specific sizable hernias required mesh insertion or not.

In conclusion, our work supports the notion that mesh usage in abdominoplasty surgery is not superior to traditional midline plication alone and may even increase the surgical complication rate. Mesh usage should be reserved for cases with concurrent large umbilical or paraumbilical hernias.

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