

Determinations of a Safe Musculofascial Plication in Abdominoplasty

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SUMMARY

This study was conducted to determine a safe vertical musculo-fascial plication distance in abdominoplasty operation in order to avoid the risk of developing respiratory distress during the post operative period. Abdominoplasty is a surgical procedure that removes excess abdominal skin and fat (panniculectomy), and tightens lax anterior abdominal wall muscle; in which musculo-fascial plication is a major component of abdominoplasty in patient with significant divaricating of the recti muscles. Respiratory decompensation may occur as a result of undue plication which reduces the intra abdominal volume with diaphragmatic excursion leading to abdominal compartmental syndrome. Fifty six patients for abdominoplasty were selected prospectively, during the period from June 1998 to February 2004, male to female ratio 1:13, mean age 39.5, mean weight 95.2 kilogram. To determine a safe plication distance (PD). The difference between two pre-operative measurements of the abdominal circumference was measured, before (BB) and after (AB) application of abdominal binder. The safe plication distance (PD) in centimeters= (BB) - (AB). The mean plication distance is 13.5cm. The changes in the pulmonary functions test before and after surgery were clinically insignificant. Pre-operative determination of safe plication distance is simple and convenient method which reduces the risk of developing respiratory distress in patients undergoing abdominoplasty in the post-operative period.

KEY WORDS:

Complication of abdominoplasty, Respiratory problem in abdominoplasty, Abdominal compartmental syndrome

INTRODUCTION

The operation to excise the abdominal panniculus (panniculectomy) was performed at the end of the 9th century. However, modern abdomino-plasty including umbilical transposition and musculo-aponeurotic plication, was not practiced by most surgeons until 1957 when Verona reported; the upward umbilical transposition, and Pitanjuys published a series of 300 consecutive abdominal lipectomies^{1,2}. Musculofascial plication is a major component of abdomino-plasty in patient with significant divaricating of the recti muscles^{3,4,5}.

During abdominoplasty procedures and after reflecting the abdominal flaps, the surgeons used to ask themselves, to what extent, they should plicate the anterior muscular wall; the answer was a matter of judgment. Well experienced surgeon

might guess how much plication is required, but usually it is less than the required correction to deal with abdominal protrusion.

Respiratory decompensation may occur as a result of undue over plication of musculo-fascial procedures that reduce respiratory reserve by decreasing intra-abdominal volume and diaphragmatic excursion thus raising intra-abdominal pressure to a critical level, leading to abdominal compartmental syndrome^{6,7,8}. Direct and indirect measurement of the intra-abdominal pressure was evaluated by several investigators in order to predict the development of respiratory derangement and eliminate the risk of post-operative respiratory failure following abdominoplasty with plication^{6,7,9}.

Other pulmonary problems that may be encountered in patients undergoing abdominoplasty are atelectasis, pulmonary thrombosis, pulmonary embolism and fat embolism syndrome^{8,10,11}. In this article, we describe a simple and convenient method for pre-operative determination of a safe plication distance in patients undergoing full abdominoplasty (panniculectomy with wide plication of significant diastases of the rectus abdominus muscle) in order to avoid respiratory problem related to increased intra-abdominal pressure.

MATERIALS AND METHODS

Between June 1998 and February 2004, 56 patients, (4 male and 52 female), male to female ratio of 1:13, were selected prospectively for a combination of abdominoplasty, umbilical upward transposition or neo-umbilicoplasty along with vertical plication of musculo-fascial complex. Their age ranged between 26-52 year, with a mean age of 39.5, their weights ranged between 80-132 kilograms, with a mean weight of 95.2, their height ranged between 150cm to 172cm, with a mean of 156cm, the abdominal circumference ranged between 92cm to 134cm, and the body mass index was between 31.6 to 38.6 kilograms per square meter.

All were characteristically overweight for their age and height having "barrel shaped" trunk contour. The females included in the study were mostly multiparous and of short stature. The anterior abdominal wall was very lax, and including the whole composite of tissue with an abdominal apron which was pendulous to varying extent, may overlap the symphysis pubis and genitalia partially or totally, in the standing position. Twenty-eight patients had skin problems in either

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Table I: The pre-operative estimated distance of plication

Number of Patients	Preoperative estimated placation distance
5	5 - 9cms
17	10-14cms
34	15-19cms
Total 56	The mean 13.5cms

TableII: Respiratory function pattern following abdominoplasty operation

Post-operative day	Mild restrictive curve	Moderate restrictive curve	Normal respiratory curve	Total No. patients
Day 2	39	1	16	56
Day 7	7	0	49	56
Day 14	1	0	55	56



Fig. 1: Per-operative marking (Tummy tuck operation with plication of the musculo-aponeurotic layer)



Fig. 2: Per-operative plication

the abdominal or breast folds; these cutaneous problems where in the form of, dermatitis and dark pigmentation.

The patients were mostly abdominal breathers, with limited thoracic movement during respiration. Their pulmonary function tests were normal, which was performed pre operatively. All patients were physically fit as evaluated by the physician.

Clinically the extent of abdominal protrusion, the amount of pendulosity, the presence of previous abdominal scars and degrees of ventral hernia, when present, were pre operatively assessed. The feasibility of excising the whole infra umbilical skin and fat was evaluated at this stage. The placement of surgical incision scar, the amount of resected tissues and the expected result of this recon-touring procedure was discussed in detail with each patient.

The initial measurement of abdominal circumference at the point of maximum protrusion of the abdominal wall was recorded as the reference point, before applying an abdominal binder (BB). To determine a safe plication distance, a pre-operative three to six weeks program of abdominal binder application was started. The binder is tightened by the patient to the extent that it can be tolerated and kept day and night and they were taught inspiratory

exercises. The abdominal binder was increasingly tightened over a period of three-six weeks. Then a new record of the measurement, after the period of binder application (AB) was done, at the same reference point. The difference between the two readings represented the distance of the intended plication.

$$BB - AB = \text{Plication distance (PD)}$$

(Table I), shows the plication distances recorded by binding methods pre-operatively. Special attention was awarded for patients with chronic constipation and chronic cough, which should be managed pre operatively.

During surgery, the intended plication distance were marked on the anterior abdominal wall muscle after dissecting, and reflecting abdominal flaps (Figure 1). The marking should include the whole distance between xiphi-sternum and symphysis pubis, keeping in mind that the widest plication is applied to the site of maximum protrusion. Plications with No. 1 continuous Nylon suture were performed in many rows in order to accomplish total gap closure. Sacrificing previous umbilicus and neo-umblicoplasty were performed for patients in whom short umbilical stumps were encountered, or where an associated big umbilical hernia was present.

Pulmonary function tests were recorded frequently in each patient as well as base line pre-binder and post-binder measurements during the pre-operative period. Then another three records were done post operatively; on the second, seventh and fourteenth days. These three last records were compared with the pre-operative base line records.

RESULT

The range of plication distance is shown in Table I, with a mean 13.5 centimeters. The respiratory functions patterns which were recorded post-operatively are shown in Table II. The values which were mainly affected in 39 patients with mild restrictive curve were decrease in the vital capacity (VC) and forced expiratory volume for first second (FEV₁), while the values affected in one patient with moderate restrictive curve were decreased total lung capacity, (VC), residual volume and reserve volume in addition to (FEV₁). The estimated plication distance was accomplished by 2-5 rows of sutures, Figure II. The number of the patients who required neo-umbilicoplasty was 11; seven patients out of these had concomitant ventral hernias and four patients with short umbilical stumps. The amount of resected skin and fat from the abdominal flaps ranged from 1.5-9.6 kilograms. The hospital stay ranged between 3-7 days, with a mean of four days.

DISCUSSION

The correction of the abdominal wall laxity and protrusion is almost always an integral part of abdominoplasty. The upper abdominal musculo aponeurosis complex is tightened with a running nylon suture from xiphoid to umbilicus, and a second suture is run from umbilicus to symphysis pubis to tighten the lower abdominal segment^{12,13,14}.

In our patients we were faced with two additional problems. Actually with such wide plication distances, we needed several rows of plication (two to five rows). In cases where the umbilical stump was long enough to remain floating at the surface of the plicated muscles, the original umbilicus was better left intact, while if the umbilical stump was too short and could not appear on the top of the plicated muscles, any attempt to bring the umbilicus to the surface would render the pulled umbilical stump ischemic and end with gangrene. Further more in cases of associated umbilical hernias sacrificing the old umbilicus and repairing the abdominal muscular wall by a continuous running suture from xiphisternum to symphysis pubis will ensure better results in the form of hernial defect repair along with neo umbilicoplasty to make this procedure possible (in 11 patients).

The amount of excised skin and fat mass in our series was 1.5-9.6 kilograms compared with the work of Ran Talisman *et al*, 1.15-6.5 kilograms⁷, this can be explained on bases of our group selection. Thirty-nine patients developed mild restrictive pulmonary function values, due to post-operative pain. Pulmonary function tests showed a return of curve to normal in 33 patients on day 7 and in six patient on day 14 (Table II). Clinically these patients were stable and required nothing other than reassurance.

One patient developed moderate respiratory distress in the form of rapid shallow breathing, his pulmonary function tests showed moderate restrictive curve affecting most of the pulmonary function values. This patient needed 3-4 weeks in order to return to normal pulmonary function values and breathing pattern (Table II). Management was successful by, conservative measures in the form of respiratory physiotherapy and breathing exercises, alleviation pain by pain killers and broncho-dilators with supplementary oxygen therapy.

Many investigators evaluate the risk of development of respiratory distress syndrome following full abdominoplasty (panniculectomy and anterior abdominal muscular plication) via intravesical pressure monitoring, and it was used to measure the changes in the intra- abdominal pressure in order to avoid abdominal compartmental syndrome^{7,8,9}. Monitoring intra-gastric pressure can be used to measure the changes in the intra-abdominal pressure and will be more sensitive in reflecting intra-abdominal pressure then intra-vesicle pressure. But still we have to find the tool to do so.

CONCLUSION

Pre operative determination of safe plication distance of the anterior abdominal musculo-fascial wall, during abdominoplasty, is a simple and convenient method which significantly reduces the risk of developing respiratory distress in the early post operative period. Neo umbilicoplasty is a useful adjuvant procedure that you may need, during abdominoplasty with wide plication of abdominal wall.

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