

THE USE OF PROGRESSIVE TENSION SUTURES IN ABDOMINOPLASTY FOR FEWER COMPLICATIONS AND A SPEEDY RECOVERY

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ABSTRACT

Abdominoplasty is one of the commonest plastic surgery procedures done worldwide, however, it is plagued by a number of local complications including; hematoma and seroma formation, flap necrosis and hypertrophic scars. To avoid these complications, suction drainage and limitation of postoperative ambulation are widely used by most surgeons. The use of progressive tension sutures (PTS) has been introduced in plastic surgery in various operations to ease the advancement of various skin flaps. The basic concept of their use in abdominoplasty is to control redraping of the abdominal flap eliminating dead space and nullifying the need for drains. It also avoids tension on the terminal suture lines by dividing flap tension over many successive points thus minimizing the possibility of flap edge necrosis and allowing early postoperative ambulation. Progressive tension sutures were used in 15 cases. No drains were used and early ambulation was allowed in all cases. The incidence of complications was very low (0.13%), minimal seroma was encountered in one case (6.65%) and was managed conservatively and superficial flap necrosis in another case (6.65%) which was managed by repeated dressings. The average duration of operation was 2.4 hours and the average postoperative hospital stay was 2.6 days. These results suggest that the use of progressive tension sutures in abdominoplasty reduces the risk of local complications, ease the early postoperative period without adding significant operative time or hospital stay.

Key words: Abdominoplasty, progressive tension sutures, PTS, anchor sutures

INTRODUCTION

Abdominoplasty has evolved as a very effective and satisfactory procedure for body contouring especially when combined with liposuction and the repair of diastasis recti^(1,2). Its application has expanded with the growing popularity of gastrointestinal operations for weight reduction⁽³⁻⁶⁾. However, local complications, including hematoma, seroma formation⁽⁷⁾, flap necrosis⁽⁸⁾ and hypertrophic scars continue to plague this procedure⁽⁹⁻¹¹⁾.

Although these complications are manageable, they are distressing to the patient and tend to increase the postoperative period significantly. They also increase the possibility of infection and contour irregularities that may be permanent^(1,12,13).

Surgeons have responded to the high incidence of local complications by using prolonged suction drainage and various compression devices, limiting postoperative ambulation and restricting the resumption of an upright posture⁽¹⁴⁾. Despite the fact that the

advent of abdominal liposuction has allowed more aesthetic sculpting of the entire trunk when combined with abdominoplasty⁽¹³⁾, the combination of significant truncal liposuction and abdominoplasty has been discouraged by many authors due to the increased risk of complications^(1,14-16).

The use of progressive tension sutures (PTS) or "anchor sutures"⁽¹⁷⁾ has been introduced in plastic surgery in various operations to ease the advancement of various skin flaps eliminating dead space and nullifying the need for drains. It also avoids tension on the terminal suture lines by dividing flap tension over many successive points thus minimizing the possibility of flap edge necrosis^(18,19).

The basic concept of progressive tension sutures in abdominoplasty is to control redraping and advancement of the abdominal flap by placing multiple sutures as the abdominal flap is advanced⁽²⁾. Sutures are placed between the deep layer of superficial abdominal fascia (Scarpa's fascia) and the fascia covering abdominal wall muscles and the linea alba⁽¹⁷⁾ which is termed by

some authors as the deep fascia^(2,14,16). PTS can be actually secured between superficial and "deep" fascia as the fat deep to Scarpa's fascia is suctioned at the start of the procedure^(2,16). Otherwise, sharp abdominal flap defatting deep to Scarpa's fascia can achieve the same effect⁽¹⁷⁾. Each incremental advancement is maintained by suture placement, hence the name progressive tension sutures^(16,20).

The tension is distributed over a broad area of the flap, additionally, tension is transferred to the strong superficial fascial system⁽²⁾, and no tension is placed on the distal skin flap as opposed to the conventional procedure where all the tension is centered over the incision line⁽¹⁴⁾.

As opposed to "quilting sutures"⁽²¹⁾, progressive tension sutures are not only intended to prevent fluid accumulation by eliminating dead space, but also to secure flap advancement and fixation protecting it from the disrupting shear forces produced by patient's movements thus allowing early ambulation which is restricted with the conventional method⁽²⁾.

A frequent concern regarding the use of progressive tension sutures is the time it adds to the procedure. Certainly no special skills are required to perform this simple technique. The primary challenge is the coordination between the surgeon and the assistant in suture placement. Once this coordination is achieved, placement of the sutures takes about 20 to 30 minutes depending on the extent of undermining. When compared with the time, expense, patient anxiety, and inconvenience of managing a complication, the time added is insignificant^(14,16).

PATIENTS & METHODS

15 patients were operated upon in the period from September 2004 to April 2005. Abdominoplasty with or without liposuction was done in all cases. 5 cases (33%) had ventral abdominal wall hernia and 8 cases (53%) had divarication of recti. Cases with ventral abdominal wall hernias necessitating mesh use were excluded.

Technique

The Whole area of liposuction and dissection was infiltrated with tumescent solution (13 ml 2% xylocaine, and 1 ml of 1:1000 epinephrine

added to each liter used of Ringers lactate solution). First, Liposuction above the umbilicus was carried out and was limited to the fat deep to Scarpa's fascia. Care was taken to avoid oversuction in the upper abdomen, as this area usually thins when the flap is advanced.

Elevation of abdominal flap was started using mostly sharp undermining which was wider in the inferior abdomen and narrows above the umbilicus, similar to what Matarasso⁽²²⁾ has termed an "inverted V" dissection. Diathermy was used for coagulating perforating vessels and only minimally for dissection as diathermy dissection has been implicated as a factor in seroma formation.

When liposuction was not done prior to undermining, sharp defatting of the elevated abdominal flap deep to Scarpa's fascia was done to secure tension suture placement between superficial and deep fascia⁽¹⁷⁾.

After flap undermining was complete, repair of divarication of recti or ventral hernias was done using Prolene 1/0 sutures.

The patient was then placed in a moderately flexed position, and the flap advancement was begun from the highest level of dissection. The flap was advanced with the surgeon's nondominant hand while 2-0 Vicryl sutures were placed from the superficial to the deep fascia.

The assistant then stabilized the flap in place while the surgeon tied the suture. The process of advancement and suture placement was repeated. The sutures were initially placed in the midline about 1 cm to 2 cm apart.

Lateral sutures were placed with wider spacing, approximately 3 cm to 4 cm apart or as needed to minimize the dead space and control the position of the flap. An important advantage of this technique is that it enables the surgeon to determine the magnitude and direction of the flap advancement with confidence that it will remain in that position until healing⁽²⁾.

After placement of each suture, the flap was evaluated for significant dimpling. Minor dimpling will go away within a few weeks. If the dimpling remained deep as the flap was placed under tension after a further tension suture was tied, the stitch was replaced, as this means either that the stitch was placed too superficially, or that the advancement was too aggressive or in an inappropriate direction⁽¹⁶⁾.

When the umbilicus was reached, a circular

excision of Scarpa's fascia was made and the area was defatted. A marking suture was placed from the umbilicus through the skin in the midline and tagged for later localization of the umbilical stalk.

This suture should be placed 1 cm to 2 cm superiorly to compensate for the continued inferior flap advancement.

The midline advancement was continued until it met the inferior wound edge. If indicated, the mons pubis can be defatted sharply or by liposuction and advanced superiorly.

Elevation of the mons was done conservatively and in a controlled fashion.

Next, the flaps were marked and excess skin was excised. The superior edge of the superficial fascia was then approximated with the inferior edge.

The wound was closed in layers with 3-0 Vicryl in the deep dermis and 4-0 Prolene running subcuticular suture in the skin.

An umbilicoplasty was done at the appropriate level in most cases, and the marking stitch was used to help locate the umbilical stalk.

No drains were used but the patients were instructed to wear a compressive garment of at least 2 weeks postoperatively and its use may be continued beyond this point for support and patient comfort, however it is not relied upon for dead space elimination.

RESULTS

- 15 cases were operated upon, 13 cases were females (80%) and 2 cases were males (20%).
- Age ranged from 29-44 years with a mean age of 34.73 years (SD 9.38).
- 9 cases had a ventral abdominal hernia and/or divarication of recti (60%), of which 1 case (0.6%) had a ventral hernia alone, 4 cases (26.6%) had divarication of recti, and 4 cases (26.6%) had both.
- The operative time ranged from (2-3.5 hours) with an average of 2.4 hours (SD: 0.47).
- No drains were inserted.
- No cases of hematoma collection were encountered (0%).
- Mild seroma was collected in one case (6.7%) which were treated conservatively by aspiration and pressure garment and resolved completely.
- Superficial central skin necrosis at suture line occurred in one case (6.7%), which was treated conservatively with repeated dressings until complete healing was achieved.
- Early ambulation was possible in all cases (100%).
- Hospital stay ranged from (2-5 days) with an average of 2.6 days (SD: 0.91).

No	Sex	Age	Divarication of recti	Ventral Hernia	Duration of operation	Local Complications			Hospital Stay
						Hematoma	Seroma	Flap Necrosis	
1	F	33			3 hours	-	-	-	3 days
2	F	40			2.5 hours	-	-	-	2 days
3	F	29	YES		2 hours	-	-	-	3 days
4	F	28	YES	YES	2.5 hours	-	-	-	2 days
5	F	31	YES		2 hours	-	Minimal	-	4 days
6	F	34			3.5 hours	-	-	-	2 days
7	F	30	YES	YES	2 hours	-	-	Superficial	5 days
8	F	37			2.5 hours	-	-	-	3 days
9	F	32	YES	YES	2 hours	-	-	-	2 days
10	M	4			3 hours	-	-	-	2 days
11	F	44	YES	YES	2.5 hours	-	-	-	2 days
12	F	39		YES	2 hours	-	-	-	2 days
13	M	43	YES		2 hours	-	-	-	2 days
14	F	31	YES		2.5 hours	-	-	-	3 days
15	F	29			2 hours	-	-	-	2 days

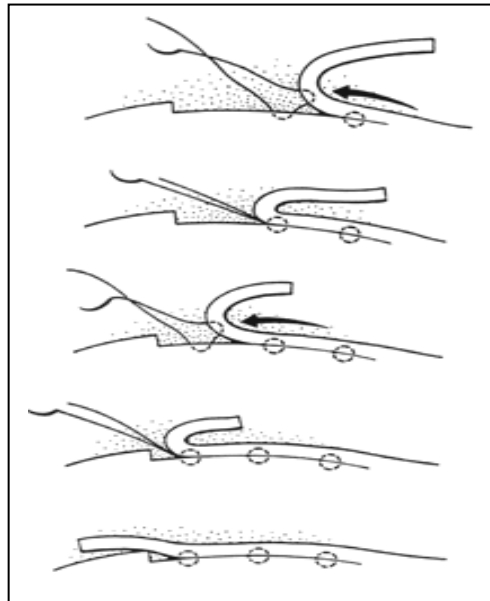


Fig. (1): Placement of progressive tension sutures (Pollock & Pollock 2004¹⁶)

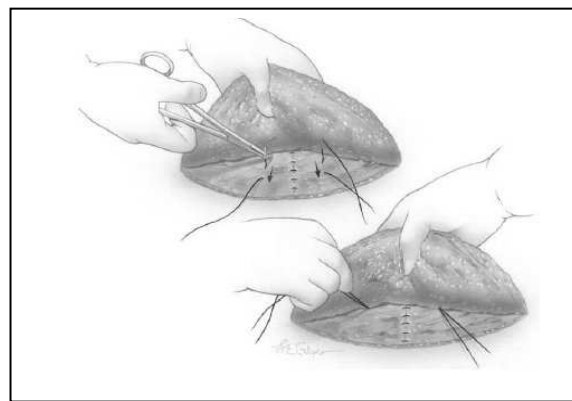


Fig.(2): Flap advanced and sutured (Pollock & Pollock, 2004¹⁶)

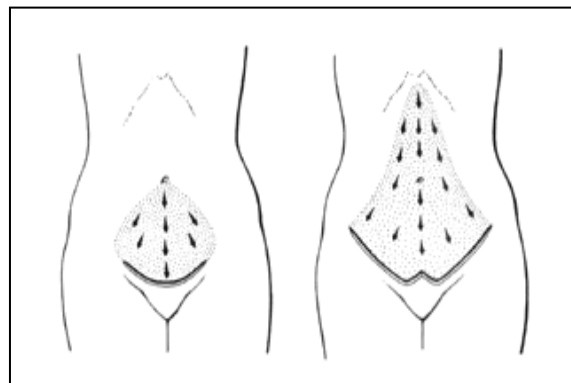


Fig.(3): Patterns of progressive tension suture placement (Pollock & Pollock, 2004¹⁶)

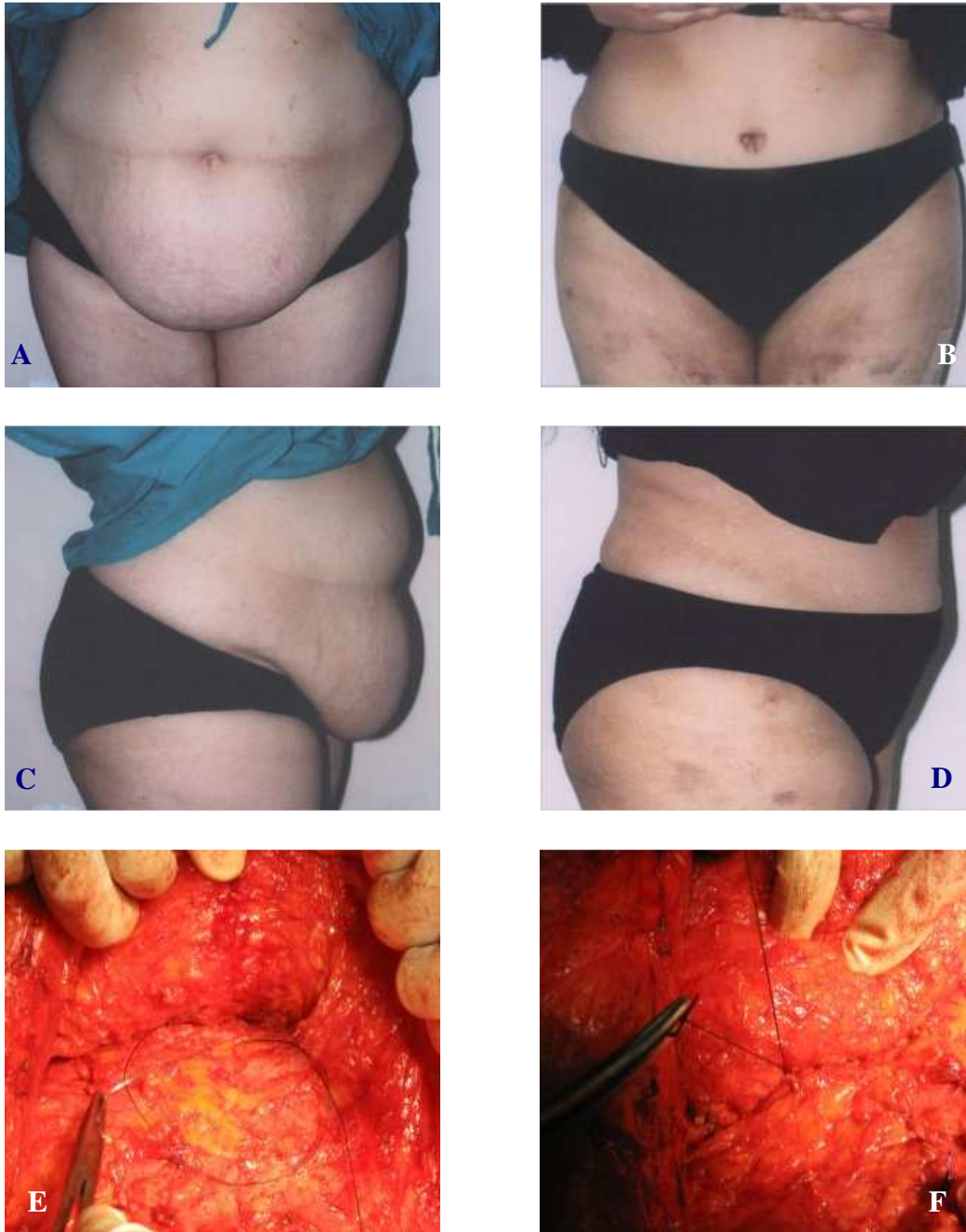


Fig. (4): Case 1

*A, C: Preoperative Anterior & Lateral Views
E, F: Progressive Tension Sutures Placed & Tied*

B, D: Postoperative Anterior & Lateral View

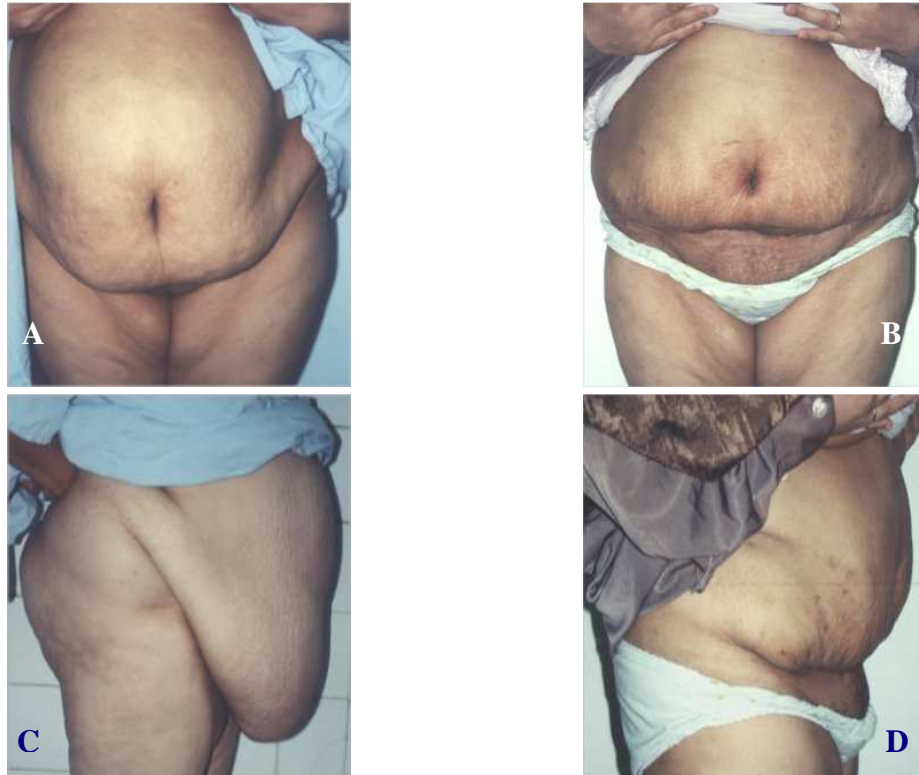


Fig. (5): Case 2

A, C: Preoperative Anterior & Lateral Views

B, D: Postoperative Anterior & Lateral Views

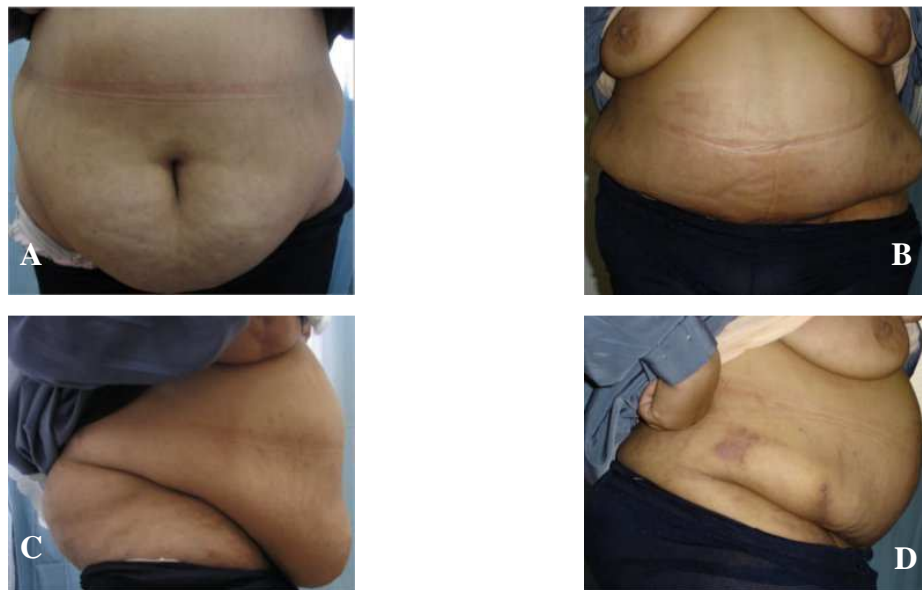


Fig. (6): Case 3

A, C: Preoperative Anterior & Lateral Views

B, D: Postoperative Anterior & Lateral Views

DISCUSSION

Several factors are proposed to contribute to the high incidence of local complications in abdominoplasty ranging from concurrent use of liposuction to alterations in blood supply, presence of dead space, and patient movement. All of these may play some part.

The high incidence of local complications may be prevented by using prolonged suction drainage and various compression devices, limiting postoperative ambulation and restricting the resumption of an upright posture, however the use of such measures do not eliminate the risk of such complications⁽²⁾.

The use of progressive tension sutures in abdominoplasty is claimed by many authors to greatly reduce the rate and severity of early local complications, namely; hematoma and seroma formation and flap necrosis and to allow for early postoperative ambulation avoiding complications of prolonged recumbancy and achieving a faster return to work^(2,18-20). Progressive tension sutures effectively eliminate dead space and prevent fluid collection both acutely and chronically.

Shear forces that disrupt wound healing may also be a major contributor to seroma formation.

The abdominoplasty wound is particularly susceptible to shear, as the abdomen moves with each respiration and body movement. Suture fixation of the superficial fascia to the deep is strong, dependable, and long lasting.

Wound tension is another major contributor to local complications. Tension compromises the circulation of the distal flap, which can lead to necrosis. Progressive tension sutures prevent these problems by transferring the tension to the superficial fascial system across the entire flap.

Patient activity is another factor contributing to abdominoplasty complications.

Many surgeons resort to prolonged immobilization which carries a long list of complications and does not effectively reduce these shearing forces which can be simply caused by the mere respiratory movements of the abdomen. With the use of progressive tension sutures, it is the sutures that limit shearing not immobilization, allowing for early mobilization.

In this study 15 cases of abdominoplasty were done using progressive tension sutures. 9 cases had either a ventral hernia or divarication of recti or both. Only two cases (13.33%) had a

mild local complication in the form of mild seroma formation (one case, 6.7%) and minimal superficial skin necrosis (one case, 6.7%).

They were all treated conservatively till full recovery. This low rate of local complications conforms with that of other studies^(2,14,16). The use of progressive tension sutures did not cause a significant increase in the operative time (average: 2.4 hours). The average hospital stay was short (2.6 days) and early ambulation was possible in all cases.

CONCLUSION

The use of progressive tension sutures in abdominoplasty effectively reduces the risk of local complications, eases the early postoperative period allowing early mobilization without adding significant operative time or hospital stay. It can be applied in cases with ventral hernias or divarication of recti.

REFERENCES

1. **Floros C, Davis PK.**: Complications and long-term results following abdominoplasty: a retrospective study. *Br J Plast Surg.* 1991 Apr; 44(3):190-4.
2. **Pollock H, & Pollock T.**: Progressive tension sutures: A technique to reduce complications in abdominoplasty. *Plastic & Reconstructive Surgery,* 2000 Jun; 105(7): 2583-6.
3. **Hurwitz DJ, Rubin JP, Risin M, Sajjadian A, Sereika S.**: Correcting the saddlebag deformity in the massive weight loss patient. *Plast Reconstr Surg.* 2004 Oct;114(5): 1313-25.
4. **Rhomberg M, Pulzl P, Piza-Katzer H.**: Single-stage abdominoplasty and mastopexy after weight loss following gastric banding. *Obes Surg.* 2003 Jun;13(3):418-23.
5. **Soundararajan V, Hart NB, Royston CM.**: Abdominoplasty following vertical banded gastroplasty for morbid obesity. *Br J Plast Surg.* 1995 Sep;48(6):423-7.
6. **Savage RC.**: Abdominoplasty following gastrointestinal bypass surgery. *Plast Reconstr Surg.* 1983 Apr;71(4):500-9.
7. **Van Uchelen JH, Werker PMN, Kon M.**: Complications of abdominoplasty in 86

- patients. *Plast Reconstr Surg* 2001;7: 1869-73.
8. **Dillerud E.:** Abdominoplasty combined with suction lipoplasty: a study of complications, revisions, and risk factors in 487 cases. *Ann Plast Surg.* 1990 Nov;25(5):333-8; discussion 339-43.
 9. **Mayr M, Holm C, Hofter E, Becker A, Pfeiffer U, Muhlbauer W.:** Effects of aesthetic abdominoplasty on abdominal wall perfusion: a quantitative evaluation. *Plast Reconstr Surg.* 2004 Nov;114(6):1586-94.
 10. **Hensel JM, Lehman JA Jr, Tantri MP, Parker MG, Wagner DS, Topham NS.:** An outcomes analysis and satisfaction survey of 199 consecutive abdominoplasties. *Ann Plast Surg.* 2001 Apr;46(4):357-63.
 11. **Chaouat M, Levan P, Lalanne B, Buisson T, Nicolau P, Mimoun M.:** Abdominal dermolipectomies: early postoperative complications and long-term unfavorable results. *Plast Reconstr Surg.* 2000 Dec; 106(7):1614-8; discussion 1619-23.
 12. **Vastine VL, Morgan RF, Williams GS, Gampper TJ, Drake DB, Knox LK, Lin KY.:** Wound complications of abdominoplasty in obese patients. *Ann Plast Surg.* 1999 Jan;42(1):34-9.
 13. **Matarasso A.:** Awareness and avoidance of abdominoplasty Complications. *Aesthetic Surg J*, 1997; 17: 256.
 14. **Pollock H, & Pollock T.:** Reducing abdominoplasty complications *Aesthetic Surg J*, 2002 Sep-Oct;22(5): 475-476.
 15. **Lockwood T.:** Maximizing aesthetics in lateral-tension abdominoplasty and body lifts. *Clinics Plastic Surgery*, 2004 Oct ;31: 523-537.
 16. **Pollock H, & Pollock T.:** Progressive tension sutures in abdominoplasty. *Clinics Plastic Surgery*, 2004 Oct ;31: 583-589.
 17. **Baxter RA. :** Controlled results with abdominoplasty. *Aesthetic Plast Surg.* 2001 Sep-Oct;25(5):357-64.
 18. **Rios JL, Pollock T, Adams WP Jr.:** Progressive tension sutures to prevent seroma formation after latissimus dorsi harvest. *Plastic & Reconstructive Surgery*, 2003 Dec;112(7):1779-83.
 19. **Pollock H, & Pollock T.:** Management of Face Lifts With Progressive Tension Sutures. *Aesthetic Surg J* 2003;23:28-33.
 20. **Mladick RA.:** Progressive tension sutures to reduce complications in abdominoplasty. *Plast Reconstr Surg.* 2001 Feb;107(2):619.
 21. **Baroudi R & Ferriera C.:** Seroma: how to avoid it and how to treat it. *Aesthetic Surg J*, 1998;18:439.
 22. **Matarasso A.:** Discussion on: Abdominal dermolipectomies: early postoperative complications and long term unfavorable results. *Plast Reconstr Surg* 2000; 106:1619.
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