

Abdominoplasty With Progressive Tension Sutures Versus Conventional Abdominoplasty: A Comparative Study at a Third-level Institution

Víctor C. Ledezma Rodríguez,
MD, PhD*

Sandra A. López, MD*

Alejandro González Ojeda, MD,
PhD†

María F. Pérez Gómez, MD†

Samantha E. González Muñoz,
MD†

Sergio J. Vázquez Sánchez, MD†

Gonzalo Delgado Hernández,
MD†

Gabino Cervantes Guevara, MD,
PhD‡

Enrique Cervantes Pérez, MD,
PhD§¶

Clotilde Fuentes Orozco, MD,
PhD†

Background: Abdominoplasty is a cosmetic surgery that improves the appearance of the abdominal contour. Among the techniques used to reduce complications are progressive tension sutures (PTSs), which involve the use of sutures that fix a flap at several points to the underlying tissue.

Methods: A nonrandomized clinical trial was performed from April 1 to November 30, 2023. Patients older than 18 years who underwent abdominoplasty were included. The variables studied were age, body mass index, comorbidities, surgical time, and postoperative complications.

Results: Twenty-eight patients were included, 14 with conventional closure and 14 with PTSs closure, with a mean age of 37.6 (SD 9.1) years and 39.9 (SD 6.8) years, respectively. In the conventional closure group, 3 (21.3%) patients presented complications, 2 (14.3 %) presented seromas, and 1 (7.1%) presented wound dehiscence, whereas the PTS group did not present any complications ($P = 0.067$). A mean operative time of 137.8 (SD 16.6) minutes was found for conventional closure and 167 (SD 12.0) minutes for PTS closure ($P \leq 0.001$).

Conclusions: Our study showed that the technique with PTS did not present complications compared with the conventional closure. Our results are comparable with the literature. (*Plast Reconstr Surg Glob Open* 2025;13:e6646; doi: 10.1097/GOX.0000000000006646; Published online 25 March 2025.)

INTRODUCTION

Abdominoplasty is a cosmetic surgery that improves the appearance of the abdomen by removing excess skin and fat and strengthening weakened abdominal muscles.¹ It is currently 1 of the 5 most performed procedures in the field of aesthetic plastic surgery in the United States.²

From the *Department of Plastic and Reconstructive Surgery, Centro Médico Nacional de Occidente, Instituto Mexicano del Seguro Social, Department Surgical Clinics, Universidad de Guadalajara, Guadalajara, Jalisco, Mexico; †Hospital de Especialidades, Centro Médico Nacional de Occidente, Instituto Mexicano del Seguro Social, Guadalajara Jalisco México; ‡Department of Welfare and Sustainable Development, Centro Universitario del Norte, Universidad de Guadalajara, Colotlan, Jalisco, Mexico; §Department of Internal Medicine, Hospital Civil de Guadalajara "Fray Antonio Alcalde," Guadalajara, Jalisco, Mexico; and ¶Health Sciences University Center, Universidad de Guadalajara, Guadalajara, Jalisco, Mexico.

Received for publication April 22, 2024; accepted January 29, 2025.

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DOI: 10.1097/GOX.0000000000006646

It is often requested for several factors related to abdominal contour, such as sagging skin, stretch marks, weakened abdominal muscles, deformities around the umbilicus, and unattractive scars.^{3,4} A history of pregnancy, inadequate distribution of body fat, and excessive weight loss with or without bariatric surgery are the factors that have been described for pathological changes in body contour.⁵

Conventional abdominoplasty is indicated for patients with significant musculofascial and skin laxity,⁶ where the excess skin is excised transversely, giving rise to a single horizontal closure scar. However, postoperative complications can harm the expected outcome, one of the main causes being the high tension generated by the horizontal closure after conventional abdominoplasty.⁷ According to studies, the complication rates of cosmetic abdominoplasty range from 32% to 37%.⁸ Seroma is the most frequent complication after abdominoplasty surgery, followed by hematoma, surgical site infection, wound dehiscence, and necrosis.⁹

In recent years, the use of progressive tension sutures (PTSs) has gained popularity primarily due to its ability to eliminate dead space and tension force between the fascia and the skin flap.⁶ This technique involves the use of sutures that firmly attach a flap at various points to the underlying tissue, extending from the superficial fascia of the flap to the muscle fascia.¹⁰ Previous research has

Disclosure statements are at the end of this article, following the correspondence information.

supported the efficacy of using PTS to minimize the risk of seroma and avoid drain placement.¹¹

This study aimed to evaluate the results in abdominoplasty with PTS closure versus conventional closure; under the hypothesis that “patients undergoing abdominoplasty with progressive tension stitch closure will have a lower frequency of postoperative complications than patients with conventional closure.”

METHODS

Type of Study

A nonrandomized clinical trial of patients undergoing abdominoplasty in the plastic surgery service of the Centro Médico Nacional de Occidente was performed between April 1, 2023, and November 30, 2023.

Inclusion and Exclusion Criteria

All patients older than 18 years of age who were entitled patients of the Centro Médico Nacional de Occidente, who underwent abdominoplasty, and who signed their informed consent were included. Patients with positive smoking, who were pregnant, who had a history of keloid and hypertrophic scars, and who had undergone a previous abdominoplasty were excluded.

Variables

The study variables were age, body mass index (BMI), comorbidities (overweight, obesity, and hypothyroidism), surgical time, and postoperative complications.

Procedure

Once the patients entered the study, they were assigned to 1 of 2 groups, the assignment was made by a systematic method of 1 in 1, in which the even numbers were included in the group where the PTS closure technique was used and the odd numbers in the group where conventional closure was used.

During the procedure, surgical time and complications were recorded. After surgery, the presence and type of immediate (first 24h after surgery) and 30-day postoperative complications were noted as follows: presence or absence. Postsurgical complications include wound infection, wound dehiscence, eventration, skin necrosis, seroma, hematoma, deep venous thrombosis, and pulmonary thromboembolism.

Data Analysis

Data were analyzed with SPSS (IBM), v24. Descriptive statistics were used, qualitative variables were described in frequencies and percentages, and quantitative variables were reported as mean and SD (\pm).

The Shapiro–Wilk test was used to determine the distribution. The comparison of quantitative variables between groups was performed using the Student *t* test; for qualitative variables, the chi-square test and/or Fisher exact test were used. Values of *P* less than 0.05 were considered statistically significant.

For the group of patients who underwent abdominoplasty with conventional closure, the proportion of

Takeaways

Question: Does the use of the progressive tension sutures help to reduce postsurgical complications versus conventional closure?

Findings: Our study showed that the technique with progressive tension sutures did not present complications compared with the conventional closure. Our results are comparable with the literature.

Meaning: It is imperative that plastic surgeons possess knowledge of effective preventive procedures to lower the incidence of postoperative complications following abdominoplasties.

complications is 30.0% (expected frequency = 0.30), with a maximum error of 5% and a 95% confidence interval (CI). For the group of patients undergoing abdominoplasty with PTS closure, the proportion of complications is 2.0% (expected frequency = 0.02), with a maximum error of 5% and a 95% CI. The following equation was used:

$$n = (2pq) (Jt^2) / \Delta^2$$

Where

- $p = (p_a + p_b) / 2 = 0.16$;
- $q = 1 - P = 0.84$;
- $Jt^2 = 3.86$ (constant);
- $\Delta = (p_a - p_b)^2 = 0.0784$;
- p_a = usual incidence = 0.3;
- p_b = hypothetical incidence = 0.02.

$$n = 2 (0.16) (0.84) (3.86) = 1.037568 / \Delta^2 = 13.23.$$

A sample size of 14 patients per group was calculated, with a total of 28 patients required.

Preoperative Marking

Surgical marking is performed with the patient in the supine position on the operating table (Fig. 1). First, the costal margin is marked, tracing a curved line from the xiphoid process to the midaxillary line on the right and left. The patient is then asked to elevate the pubis by a bimanual maneuver, showing the desired level after surgery. The location of the incision is established, 6cm above the vulvar fork, and a curvilinear line is drawn laterally up to 1 cm below the left and right iliac crest. From this line, an ellipse is delimited taking the umbilicus as the superior point, thus marking the tissue to be removed.

A median line is drawn caudally from the xiphoid process to 6cm above the vulvar fork. Then, 2 curvilinear lines are demarcated, one at 3cm on the left side and the other at 3cm on the right side, starting from the same limit points of the median line. Within both lines, cross marks are drawn to align the wound edges after excision. Starting from the costal margin, 2 paramedian lines are drawn, one to the left and one to the right, until reaching the lower line of the ellipse previously delineated. A vertex is marked 2 cm from the outer side, starting from the middle of each paramedian line, and a triangle is drawn on each side, also marking cross lines within both triangles.



Fig. 1. A photograph of the preoperative marking with the patient in supine position.

Surgical Technique

To start, the abdominal flap is elevated above the muscular fascia and dissection is performed up to the costal margin (Fig. 2A). Once the dissection is complete, the

diastasis of the rectus abdominis and external obliques is marked for plication (Fig. 2B). Then, 2-0 Vicryl sutures are placed to align the repair of the rectus abdominis and external obliques and relieve the tension of the primary closure (Fig. 2C).

For this study, the PTS technique of Pollock is used.^{10,12} The needle is first placed in the Scarpa fascia without crossing the dermis. A 2-0 Vicryl suture is used for a continuous PTS in the midline along the linea alba from the xiphoid process to the point immediately superior to the umbilicus. Interrupted sutures are placed along the semilunar lines bilaterally and in the lateral and medial spaces adjacent to the semilunar lines. The surgeon's first assistant advances the flap forward as each PTS is placed, ensuring adequate flap advancement and avoiding an anchoring effect with anterior PTS placement. This eliminates dead space and reduces skin tension at the incision site. Approximately 18 PTSs are used for adequate space closure (Fig. 3). No surgical drains are used (Fig. 4).

For the group of patients who underwent abdominoplasty with conventional closure, deep sutures were placed in both the fascial and subcutaneous layers to provide structural support and minimize tension at the incision site. Surgical drains were inserted adjacent to the primary surgical wound, ensuring continuous drainage of serous fluid during the postoperative period. Fluid output was closely monitored, with drains typically being removed once the volume decreased to a minimal level of less than 30–50 mL for 24 hours. Drain removal generally occurred between 5 and 10 days postoperatively, depending on the patient's healing trajectory.

RESULTS

A total of 28 patients were included, 14 in the conventional closure group and 14 in the PTS closure group. The mean age for the conventional closure group was

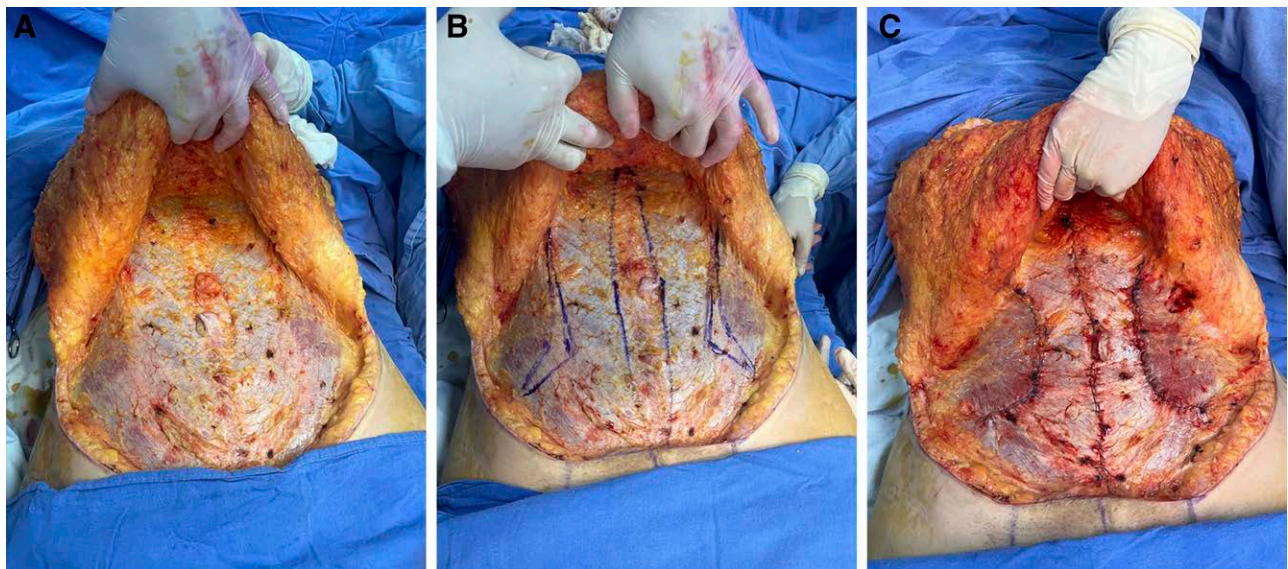


Fig. 2. Abdominal dissection and abdominal muscle plication. A, Elevation of the abdominal flap. B, Marking of diastasis of the rectus abdominis and external obliques. C, Plication of rectus abdominis and external obliques.

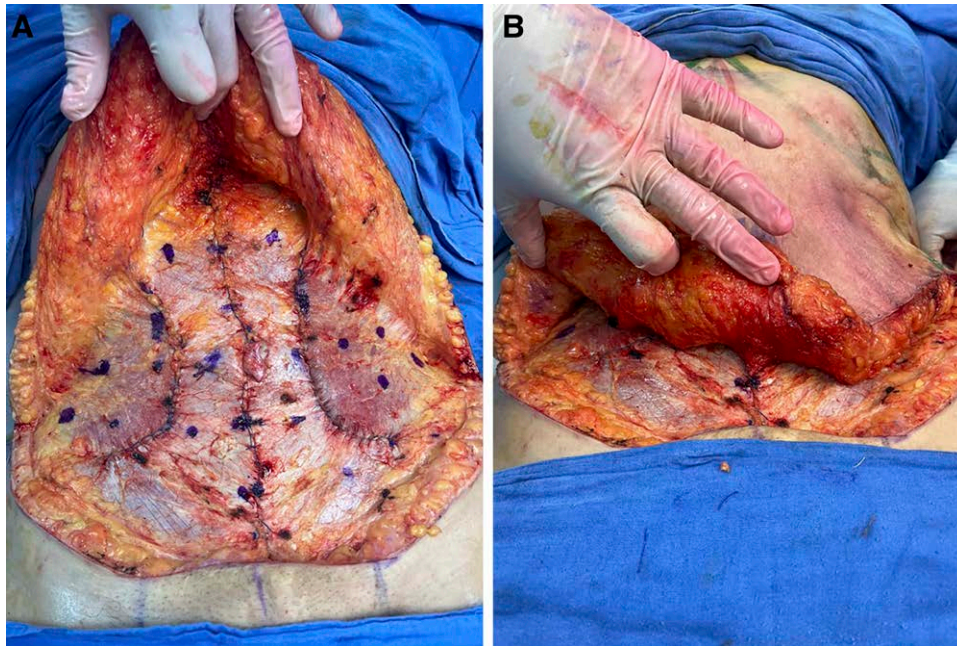


Fig. 3. Placement of PTSs. A, Approximately 18 points are marked on the Scarpa fascia as a reference for progressive tension sutures. B, Result of PTS placement.



Fig. 4. A photograph of the postoperative results with the patient in supine position.

37.6 ± 9.1 years, whereas for the PTS closure group, it was 39.9 ± 6.8 ($P = 0.595$).

BMI was calculated to determine the patients' comorbidities according to their obesity classification. In the conventional closure group, 4 (28.6%) patients had normal BMI, 7 (50%) were overweight (BMI > 25 kg/m²), and 3 (21.4%) had grade I obesity (BMI > 30 kg/m²). In the PTS closure group, 4 patients (28.6%) had normal BMI, 9 (64.3%) were overweight, and 1 (7.1%) had grade I obesity. Another comorbidity found in the patients was hypothyroidism, with 1 (7.1%) case in the conventional closure group and 2 (14.3%) in the PTS closure group ($P = 0.703$). Finally, of the total number of patients in the study, 8 did not present any comorbidity, of which 4 (28.6%) belonged to the conventional closure group and 4 (28.6%) to the PTS closure group ($P = 0.703$).

Regarding the procedure, the surgical time in the conventional closure group was 137.8 ± 16.6 minutes, whereas in the PTS closure group, it was 167.1 ± 12.0 minutes ($P \leq 0.001$).

Among the postoperative wound complications, none of the patients in the PTS closure group presented complications. On the other hand, in the conventional closure group, 3 patients presented complications; 2 (14.3%) of them presented seroma, treated through aspiration, and 1 (7.1%) had wound dehiscence ($P = 0.067$; odds ratio, 0.440; 95% CI, 0.283–0.685). Reoperations were not required (Fig. 5).

DISCUSSION

Our study compared 2 groups using different closure techniques to evaluate the postoperative results of

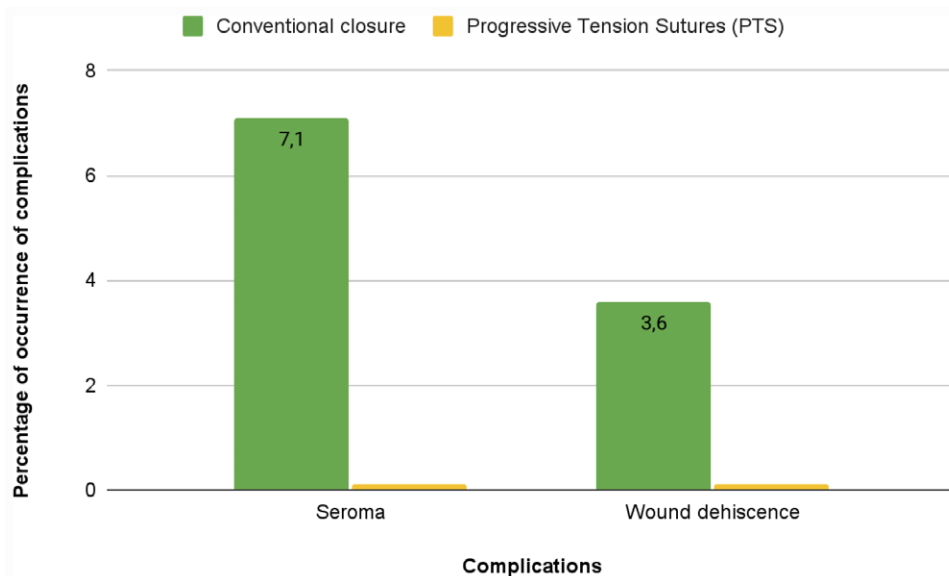


Fig. 5. A graph that shows the comparison of the presence or absence of surgical wound complications by study group.

abdominoplasty. The group using PTS reported no complications, whereas the group with conventional closure experienced local complications in 3 patients, supporting the effectiveness of this technique according to previous studies by Rosen et al¹³ and Wang et al,¹⁴ which suggest that preventive techniques, such as PTS, are effective and significantly reduce the risk of complications.

We found that seroma was the most prevalent complication in 7.1% of cases, followed by dehiscence, within the conventional closure group. This finding is similar to what was reported in the international literature by Seretis et al.¹⁵ In their meta-analysis, they found that the seroma rate was 7.5% in studies in which some preventive technique had been performed, compared with 19.5% in patients who underwent a conventional technique. Other meta-analyses performed by Brown et al¹⁶ and Ardehali et al¹⁷ also compared techniques and found a lower incidence of seroma when compared with the conventional technique.

Salari et al¹⁸ in their review of 143 studies found that the younger the age of the patients, the fewer cases of seroma ($P \leq 0.05$). In our case, the average age was 37.6 years for the conventional closure group and 39.9 years for the PTS group ($P = 0.595$) without finding a statistical difference in our case.

Van der Sluis et al¹⁹ carried out a systematic review of 7 studies on patients who underwent abdominoplasty, finding that 99% of the patients were women, with an average of 40 years. These data are similar to ours, because the average age coincides, and in our study, 100% were female patients.

Regarding surgical time, a significant statistical difference was obtained because it was demonstrated that additional time was required in the closure with the use of PTS, with a mean duration of 167.1 ± 12.0 minutes, whereas in the conventional closure group, it was 137.8 ± 16.6 minutes ($P \leq 0.001$). This agrees with previous studies by

Patronella²⁰ and Spring,²¹ with the additional time commitment being minimal compared with the benefit of using the technique with PTS. However, in a systematic review by Jabbour et al,²² they found a difference of 23.19 minutes between abdominoplasties with PTSs and drains versus those with drains only, although they did not find a statistical difference ($P = 0.07$).

Apart from a high BMI, no pathological conditions other than hypothyroidism were found in our study; however, no statistically significant relationship was observed between these comorbidities and postoperative complications ($P = 0.703$). These results are like those of the study by Batac et al,²³ in which obese and nonobese patients were studied, observing the possible relationship between obesity and the formation of complications after abdominoplasty; however, no significant difference was found regarding the formation of dehiscence and seromas despite being obese. In another study by Bunting et al,²⁴ there was also no significant association between complications, higher BMI, and the medical comorbidities described.

One of the limitations of the present study was the sample size because most studies similar to this one have larger study groups, which may allow better measurement of the variables studied; moreover, the identified difference in the number of patients across BMI categories between the studied cohorts presents a significant limitation. The follow-up time was another important limitation because it did not allow us to assess long-term complications that could have an important impact on decision-making when choosing a surgical technique. Another limitation that may interfere with the results obtained is the age range, which could be reduced to obtain more homogeneous results. Additionally, and no less important, the human resources used are a limitation, because these procedures were not all performed by the same surgical team, which may alter the results obtained. Thus, we

highly recommend that future studies focus on recruiting larger cohorts. This will significantly enhance the statistical power of the study and allow for more precise measurement of variables, ultimately leading to stronger, more widely applicable findings.

CONCLUSIONS

Our study showed that the conventional closure group presented local complications, such as seromas and wound dehiscence, whereas the PTS group did not report any complications. Although the surgical time was longer in the PTS group, this is not a limitation to perform this procedure in our institution in future cases. Our results are comparable with international literature.

Clotilde Fuentes Orozco, MD, PhD

Unidad de Investigación Biomédica 02
Centro Médico Nacional de Occidente
Instituto Mexicano del Seguro Social
Department Surgical Clinics
Universidad de Guadalajara, Jalisco, México
E-mail: clotilde.fuentes@gmail.com

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

ETHICAL APPROVAL

The protocol was approved by the institutional review board of the Hospital de Especialidades del Centro Médico Nacional de Occidente, under the registration number 2018-1001-164).

DECLARATION OF HELSINKI

The study was performed under the principles of the 1989 Declaration of Helsinki and the Mexican Health Guidelines.

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