

# ORIGINAL ARTICLE

# Anatomical Bases for Aesthetic Costal Surgery: Assessing the Thoracoabdominal Limits

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**Background:** Knowing the anatomy of the ribs is crucial for understanding various rib procedures. The present study is aimed at describing radiological measurements and ratios of 83 Latin American patients undergoing thoracoabdominal computed tomography (CT).

**Methods:** A total of 83 thoracoabdominal computed tomography scans of women aged 18–35 conducted at a medical center in Lima, Peru, were reviewed from January 2022 to January 2023. The resulting measurements and ratios were used to calculate frequency distributions. All data were stored in a Microsoft Excel database and analyzed using statistical analysis software SPSS version 28.

**Results:** Ratios and measures of the tenth, eleventh, and twelfth ribs are shown in the different tables, and costal characteristics with an adequate statistical significance are defined.

**Conclusions:** Using radiological measurements and rib ratios, we were able to find key anatomical relationships with an adequate level of significance, which could help establish objective results in rib procedures. (*Plast Reconstr Surg Glob Open 2023; 11:e5376; doi: 10.1097/GOX.000000000005376; Published online 15 November 2023.*)

# **INTRODUCTION**

The search for beauty standards through body contouring surgery is one of the most frequently addressed topics in cosmetic surgery consultations, particularly regarding the abdomen and the delimitation of its regions (lower thorax) and hips.<sup>1,2</sup>

In some cases, the anatomy of the patient limits the results, especially when targeting the lateral area of the abdomen (the oblique and serratus muscles), which starts with the lower thoracic region and ends in the hips, which include the pelvic bones.<sup>3</sup> The lower region of the thorax, including the lowermost ribs, is the transition zone between the thorax and the abdomen and is often a key area when performing procedures for highlighting the hip.<sup>4</sup>

From the \*Private Practice, Lima, Peru; †Private Practice Culiacan, Sinaloa, México; ‡Private practice Merida Yucatán, México; §Buenos Aires, Argentina; ¶Private Practice, Santa Maria RS, Brasil; ||Private Practice, Londrina, Paraná, Brasil; \*\*Cayetano Heredia University, Lima, Peru; ††Private Practice, Lima, Peru; ‡‡Brazilian Society of Plastic Surgery, São Paulo, Brasil; §§Emirates Plastic Surgery Society, Dubai, United Arab Emirates; and ¶¶Cocoona Clinics, Dubai, United Arab Emirates.

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Copyright © 2023 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal. DOI: 10.1097/GOX.00000000005376 Many procedures used for such purposes involve rib modification and primarily target floating ribs using techniques such as rib removal, described by Dr. Juan Pedro Verdugo, in addition to rib remodeling techniques described by Kudzaev et al.<sup>5,6</sup>

Although these surgical procedures remain controversial and generate skepticism, they are becoming increasingly popular and are being requested more frequently. Therefore, plastic surgeons must acquire anatomical and functional knowledge when receiving training to perform these procedures.<sup>7</sup> Thus, combining this knowledge with anatomical measurements and ratios for assessing ranges of normality and their respective anatomical characteristics is crucial for proposing an adequate surgical approach and strategy.

The present study aimed to describe the anatomical characteristics observed in Latin American patients with radiological measurements related to ratios that enable us to show frequencies of these areas, thereby expanding the knowledge of this region (Fig. 1).

# **MATERIALS AND METHODS**

In total, 83 thoracoabdominal computed tomography (CT) scans of Latin American women aged 18–35 were examined; all patients had BMIs lower than 30 kg per m<sup>2</sup>.

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

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Fig. 1. Three-dimensional reconstruction of a lung CT scan.

The measurements and ratios were reviewed using OsiriX MD (Pixmeo SARL, Bernex, Switzerland) software. A private health center in Lima, Peru, provided the radiological studies and authorized the use of their CT scans for the purposes of this study with the approval of the institutional research ethics committee and in accordance with the ethical principles of the Declaration of Helsinki.

The thoracoabdominal CT examinations revised in this study included scans without relevant pathological findings, bone and cartilage diseases, or diseases that can deform the thoracoabdominal structure. These CT scans were reviewed from January 2022 to January 2023.

A radiologist performed the measurements, and a person encrypted and stored all the data in a database in Microsoft Excel, version 16.43 (Microsoft, Redmond, Wash.). The data were analyzed using statistical analysis software SPSS version 28 by analysis of variance (ANOVA) with a Bonferroni mean adjustment, to morphology (chi square test) in addition to performing a paired sample t test, among other statistical tests. *P* less than 0.05 was considered statistically significant.

The following parameters were measured in this study:

# 1. Length of the tenth, eleventh, and twelfth ribs:

In the axial plane, in 2D view, the lengths of the tenth, eleventh, and twelfth ribs were measured using the measure curvature function. All data were expressed in centimeters (Fig. 2)

# 2. Maximum distance between the tenth, eleventh, and twelfth ribs:

In the coronal plane, in 2D view, the distances between the tenth, eleventh, and twelfth ribs were measured. All data were expressed in centimeters. [See Video 1 (online), which shows the maximum distance between the tenth, eleventh, and twelfth ribs, distance from the tenth, eleventh, and twelfth ribs to the iliac crest, angles between the tenth, eleventh, and twelfth ribs, and the spine and chest wall length.]

# **Takeaways**

**Question:** How are the costal radiological measurements and their associated ratios presented in axial computed tomography?

**Findings:** The findings of 83 thoracoabdominal computed tomographies were evaluated, measuring the lengths and distances, rib angles, and the distance from the skin to the rib structure, which decreased by 30% on subtracting the rib measurements. Similarly, ratios of rib distance were associated with increased thoracic width and the distance from the iliac crests.

**Meaning:** The radiological measurements and ratios significantly differed (P < 0.001); therefore, they could be used to plan the approach to rib surgery to get optimal outcomes.







**Fig. 2.** Display of the length of the tenth, eleventh, and twelfth ribs. A, Length of the tenth rib. B, Length of the eleventh rib. C, Length of the twelfth rib.



**Fig. 3.** Displays of angulations where curvatures of the tenth, eleventh, and twelfth ribs are observed.

# 3. Distance from the tenth, eleventh, and twelfth ribs to the iliac crest:

In the coronal plane, in 2D view, the distances from the tenth, eleventh, and twelfth ribs to the upper edge of the ischium were measured using the measure function. All data were expressed in centimeters [See Video 1 (online)].

# 4. Angle between the tenth, eleventh, and twelfth ribs and the spine:

In the coronal plane, in 2D view, the angles between the tenth, eleventh, and twelfth ribs and the spine were measured using the angle function. All data were expressed in degrees [See Video 1 (online)].

## 5. Angulations where the curvatures of the tenth, eleventh, and twelfth ribs are observed

In a 3D reconstruction, angular measurements at the sites where the ribs show their respective curvatures were performed (Fig. 3).

6. Chest wall length:

In the coronal plane in 2D, the chest wall length was measured as the distance from the skin to the tenth, eleventh, and twelfth ribs using the measure function; additional measurements were taken regardless of the rib length for comparisons between both the measurements [See Video 1 (online)].

# 7. Distance Between the tenth, eleventh, and twelfth ribs:

In the coronal plane in 2D, the distances between the tenth and eleventh and eleventh and twelfth ribs were measured using the measure function in centimeters (Fig. 4).

8. Comparison of muscle insertion width in tenth, eleventh, and twelfth ribs:

In the coronal plane in 3D reconstruction, the insertion width of tenth, eleventh, and twelfth ribs was



**Fig. 4.** Displays of distance between the tenth and eleventh and eleventh and twelfth ribs.

measured using the measure function in millimeters (Figure 5, which displays muscle insertion width in ribs).

# 9. Asymmetry of the tenth, eleventh, and twelfth ribs:

A 3D reconstruction of thoracic CT was performed to highlight asymmetries in each pair of the tenth, eleventh, and twelfth ribs. [See Video 2 (online), which shows the asymmetry of rib 12, which is shorter on the left (red) than on the right side (green), as well as the oblique trajectory of ribs 9, 10, 11, and 12 (blue)].

#### 10. Trajectory of the tenth, eleventh, and twelfth ribs:

Thoracic CT scans were subjected to 3D reconstruction to determine the oblique and linear trajectories of the tenth, eleventh, and twelfth ribs [See Video 2 (online)].

# 11. Tenth, eleventh, and twelfth rib agenesis or lumbar ribs (thirteenth ribs):

Thoracic CT scans were subjected to 3D reconstruction to highlight tenth, eleventh, and twelfth rib agenesis or to identify thirteenth ribs.



Fig. 5. Displays of muscle insertion width in ribs.

#### 12. Morphology of tenth, eleventh, and twelfth ribs:

Thoracic CT scans were subjected to 3D reconstruction to highlight tenth, eleventh, and twelfth rib morphology. [See Video 3 (online), which shows the rib morphology. Concave surface (red); convex surface (yellow)].

#### **Description of the Ratios**

#### 1. Ratios between the distance between the tenth, eleventh, and twelfth ribs and the thoracic width:

In the axial plane, in 2D view, the distances between each pair of the tenth, eleventh, and twelfth ribs and the thoracic width were measured to calculate the ratio between these two parameters

2. Ratios between the distance between the tenth, eleventh, and twelfth ribs and the distance between the two iliac crests:

In the axial plane, in 2D view, the distance between each pair of the tenth, eleventh, and twelfth ribs and the distance between iliac crests were measured to calculate the respective ratios

#### **Table 1. Descriptive Data**

N = 83	Minimum	Maximum	Mean	SD
Age	25	35	29.45	3.194
Height (cm)	160	179	169.01	6.298
Weight (kg)	60	78	68.98	5.616
BMI	19.04	29.34	24.22	2.443

#### Table 2. Rib Length Comparison

# RESULTS

In total, we reviewed 83 thoracoabdominal CT scans of Latin women, whose demographic characteristics are outlined in Table 1. After measuring rib distances and lengths (Table 2), including the chest wall (Table 3) angles with spine and curvatures (Tables 4–6), we calculated rib ratios associated with thoracic distances and iliac crests (Tables 7 and 8), in addition to assessing asymmetries, deformities, and rib trajectories. Only one patient showed asymmetry (1.20%), all patients had oblique ribs (100%), and rib agenesis (0%) had no evidence.

The results about costal spaces are shown in Table 9, measurements of fibromuscular insertion widths were recorded in Table 10, and morphology of the anterior face is shown in Table 11.

#### DISCUSSION

Designing and defining the body shape through body contouring surgery is becoming increasingly popular, especially for female beauty standards that associate attractiveness with the athletic physique and body volumization.<sup>8,9</sup> Body contouring procedures and their respective variants improve the shape, style, and symmetry of the body, considering the personal goals of each patient. Fat grafting in different body parts, such as the subcutaneous and intramuscular spaces, improves the projection as well as the results of liposuction, providing harmony to the transitions of different parts of the body.<sup>10</sup> There are osteomioarticular differences typical of each ethnic group. Herein, we focus

Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Rib length	10 <sup>th</sup> R rib (cm)*	18.024	20.971	19.533	0.902		
_	11th R rib (cm)+	15.008	17.979	16.554	0.854		
	12th R rib (cm)	8.029	11.922	9.910	1.086	2220.1	0.0001
	10th L rib (cm)*	18.001	20.964	19.459	0.880		
	11th L rib (cm)†	15.030	17.971	16.472	0.912		
	12 <sup>th</sup> L rib (cm)‡	8.003	11.924	9.867	1.228	1927.100	0.0001

\*†‡Applying analysis of variance/Bonferroni mean differences. R, right; L, left; F, test variation.

# **Table 3. Chest Wall Comparison**

Variable	Measurement	Minimum	Maximum	Mean	SD	t	Р
Chest wall measurement	Skin-rib 10 (mm)	25.123	39.915	32.779	4.362		
	Skin-muscle 10 (mm)	17.586	27.940	22.945	3.053	68.468	0.0001
	Skin-rib 11 (mm)	25.153	34.817	30.023	2.839		
	Skin-muscle 11 (mm)	17.607	24.372	21.016	1.987	96.351	0.0001
	Skin-rib 12 (mm)	25.001	29.960	27.429	1.493		
	Skin -muscle 12 (mm)	17.500	20.972	19.200	1.045	167.355	0.0001

Applying paired sample t test.

#### **Table 4. Comparison of Right Spine Angles**

Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Spine angles (degrees)	10 <sup>th</sup> rib (R)*	75.14	79.91	77.45	1.36		
	11 <sup>th</sup> rib (R)†	72.00	73.95	72.95	0.62		
	12 <sup>th</sup> rib (R)‡	70.02	71.94	70.99	0.62	1040.51	0.0001

\*†‡Applying analysis of variance/Bonferroni mean differences. F, test variation.

Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Spine angles (degrees)	10 <sup>th</sup> rib (L)*	75.01	79.96	77.40	1.42		
	11 <sup>th</sup> rib (L)†	72.00	73.99	73.03	0.54		
	12 <sup>th</sup> rib (L)‡	70.05	72.00	71.08	0.61	972.0	0.0001

#### **Table 5. Comparison of Left Spine Angles**

\*†‡Applying analysis of variance/Bonferroni mean differences. F, test variation.

Ta	ble	e 6.	Compari	son of	Costal	Curvature	Angles
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Variable	Measurement	Mean	SD	F	Р
Right spine	COST 10*	147.54	10.01		
	COST 11†	149.18	9.99		
	COST 12	146.41	9.66	1.65	0.19
Left spine	COST 10*	147.50	10.91		
	COST 11	149.40	9.80		
	COST 12	147.52	10.29	0.92	0.40

\*†‡Applying analysis of variance/Bonferroni mean differences.

F, test variation.

on Latin American patients in Peru. However, when performing imaging studies associated with ratios, we intend to standardize concepts that allow for establishing surgical plans aimed at providing better results. Therefore, we must understand that there are differences in each patient and ethnic group. Thus, the development of ratios and concepts is intended to establish standards based on statistics and frequencies. Herein, we describe the results of our investigation in a Latin American population.

Physical beauty in each region depends mainly on constructs, culture, and factors such as mainstream media and trends. This allows each professional to adjust these factors according to their experience. This work seeks to demonstrate the effectiveness of tools for enhancing the experience of every surgeon.

The waist is one of the areas often targeted for body contouring as the transition between the thorax and the hips. In our experience, the symmetrical reduction of the waist helps enhance the volume of the hips and buttocks, in addition to stylizing the work done in the abdominal region, such as the rectus abdominis, oblique, and serratus muscles.<sup>11</sup>

Considering all the above, body contouring surgery combined with body volumizing is the future of plastic surgery. However, these procedures face some limitations in the waist region. In some cases, patients may have little fat on the waist, or its curvature may be unexpected despite having removed a good proportion of fat from this area. Therefore, other options, such as rib surgery, may help achieve an optimal outcome.<sup>11</sup>

The thoracoabdominal CT measurements performed and described in this study, aimed at surgical planning, could help us to better direct the surgery and provide a correct understanding of the technique. Thus, in this study, we sought to describe these characteristics for better understanding when deciding on the approach to rib structure.

The lengths of the tenth, eleventh, and twelfth ribs indicate the amount of bone structure included in each rib. This allows us to estimate the dissection length in cases of bone detachment or assess whether a bone structure can be removed in a rib resection. The results table shows the average length of each rib in our measurements. Because the tenth ribs have the highest amount of bone, they should be removed judiciously (Fig. 2).

The maximum distance between the tenth, eleventh, and twelfth ribs is relevant because they are the immovable pillars of the waist. When defining the waistline, this parameter can direct us towards a resection or a remodeling (fracture). Targeting this distance improves waist reduction. When the waist cannot be found or modified due to a fracture, the muscular structures can be combined with waist reduction. The tenth rib showed the longest distance; therefore, modifying this rib may contribute the most to waist reduction. Nevertheless, the eleventh and twelfth ribs do not have negligible distances; thus, an adequate approach will complement waist reduction [**See Video 1 (online**]].

The distance from the tenth, eleventh, and twelfth ribs to the iliac crests enables us to assess the length of the waist in relation to the area that can be modified—the ribs. Thus, when altering this measurement with respect

#### Table 7. Comparison of Rib Distance-to-Thoracic Width Ratios

Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Rib distance-to-thoracic width ratio	Distance-R10*	0.72	0.97	0.83	0.06		
	Distance-R11†	0.69	0.87	0.79	0.05		
	Distance-R12	0.64	0.77	0.70	0.03	177.24	0.0001

\*†‡Applying analysis of variance/Bonferroni mean differences. F. test variation.

Table 8. Comparison of Rib Distance-to-Iliac Crest Lengt	th Ratios
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Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Rib distance-to-iliac crest ratio	Distance-R10*	0.86	1.16	1.01	0.08		
	Distance-R11+	0.82	1.09	0.95	0.06		
	Distance-R12	0.76	0.94	0.84	0.05	136.34	0.0001
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\*†‡Applying analysis of variance/Bonferroni mean differences.

F, test variation.

#### Table 9. Comparison of Rib Spacing

Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Rib spacing	10-11	4.10	6.96	5.53	0.81		
	11-12	4.03	5.96	4.97	0.58	26.45	0.000

\*†‡Applying analysis of variance.

F, test variation.

#### Table 10. Comparison of Rib Insertion Width

Variable	Measurement	Minimum	Maximum	Mean	SD	F	Р
Rib spacing	N10*	7.06	9.98	8.57	0.85		
	N11†	9.07	12.95	10.99	1.13		
	N12‡	4.05	5.98	4.96	0.55	997.38	0.0001
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\*†‡Applying analysis of variance/Bonferroni mean differences.

F, test variation.

#### Table 11. Rib Morphology

		Right Spine				Left spine			
Morphology	N10	N11	N12	Total	Morphology	N10	N11	N12	Total
Concave	31 (35.27%)	33 (37.5%)	24 (27.27%)	88	CONCAVO	31 (34.44%)	35 (38.89%)	24 (26.67%)	90
Convex	28 (35.44%)	31 (38.24%)	20 (25.32%)	79	CONVEXO	28 (35.44%)	31 (39.24%)	20 (25.32%)	79
FLAT	24 (29.27%)	19 (23.17%)	39 (47.56%)	82	PLANO	24 (30%)	17 (21.25%)	39 (48.75%)	80
Total	83	83	83	249	Total	83	83	83	249

Applying chi-square, P < 0.05.

to the hip, we can consider how the transition from the thorax to the waist may be modified. The tenth rib will obviously always have the longest distance, but knowing the means helps us determine the distance while planning the transition strategy [See Video 1 (online)].

We show that the spacing between the tenth and eleventh ribs is greater than that corresponding to the eleventh and twelfth when measuring distances between ribs; this shows us indirectly that greater tension between the fibromuscular structures may be achieved, and greater difficulty when dissecting this area is noted (Fig. 4).

Correspondingly, measurements of the widths where the muscle fibers are inserted in the ribs were performed, revealing that the eleventh rib shows the greatest average (10.99 mm), which informs us that more structure has to be dissected, and greater tension forces have to be released in it. This may compromise undermining and predispose the rib to a greater risk of complications. Thus, the work on this rib should involve more effort and attention when performing surgery (Fig. 5).

Regarding morphology, concavity was predominant in the tenth and eleventh ribs, whereas convexity is predominant in the eleventh. The flat form is more frequent in the twelfth; this allows us to understand the level of difficulty when performing deperiostization and undermining as the convex shape provides greater difficulty for the forceps to enter and separate the periosteum, with a subsequent risk of pleural injury. The concave form is the second most difficult form, whereas the flat form is the least difficult to manipulate and dissect [**See Video 2 (online)**].

The angles between the tenth, eleventh, and twelfth ribs and the spine, that is, the angles between these ribs and the central axis of the spine, indirectly help us figure out the direction of the rib. More specifically, the more acute the angle of the rib, the more oblique the direction of downward rib will be. Conversely, the closer this angle is to 90 degrees, the straighter the direction of the rib will be. Therefore, the surgical approach will depend on this angle. In our study group, the angles of the tenth ribs tended to be straighter than those of the twelfth ribs, which tended to be the most acute. Accordingly, the tenth ribs are the straightest, whereas the twelfth ribs are the most oblique and directed downward [**See Video 1 (online**)]. In this manner, the trajectory could be predicted; likewise, this could indirectly indicate the possibility of overriding between these ribs.

Angulations where curvatures of the tenth, eleventh, and twelfth ribs are observed. These angulations allow for predicting the degree of difficulty with respect to the previous projection of the rib, as well as the degree of curvature observed, which will be shown at the time of its approach. In this manner, the ribs with greater angles have a greater curvature, and this could produce overriding between ribs, making their dissection more difficult. In the information collected, no statistically significant data regarding angular similarity were found; however, the possibility of the previously described overriding becomes relevant (Fig. 3).

Chest wall length was defined as the distance from the thoracic skin to the rib, which contains structures such as fat and muscle. Thus, shortening the tenth, eleventh, and twelfth ribs reduces this measure by approximately 30%, suggesting that this reduction could be extrapolated to rib resection surgery [See Video 1 (online)].

When performing the 3D reconstruction of the CT scans, we found a single case of asymmetry in the twelfth rib (1.2%). In addition, 100% of the ribs had an oblique trajectory. No rib agenesis (0%) was found in this study [See Video 2 (online)].

The ratios of the rib lengths to thoracic width and the distance between the iliac crests provide details on the relationship of the waist with the thorax and the hip. Because the structure of the hips is fixed, these ratios may be reduced by remodeling (fracture) the rib structures, thus enhancing the transition to the waist and embellishing the hips.

# **FINAL NOTES**

- 1. The tenth rib is the one with largest bone portion; thus, it is the one that possibly requires the greatest undermining and the greatest risk of complications. We must not forget that the next largest is rib 11; so it requires the same precaution at the time of undermining.
- 2. Rib 10 is the one that provides the widest waist; its resection or modification is possibly the most relevant in waist reduction. In that order, the first rib also provides an important width; so its approach complements adequately the work done on the tenth.
- 3. The angulation of the rib allows us to predict the trajectory of the rib: that is, the more acute angle, the greater the oblique trajectory. Likewise, angulations that are formed in the curvatures in relation to its trajectory allow us to predict overriding, which causes a great difficulty when performing rib surgery. These data are important at the time of dissection.
- 4. About the thoracoabdominal wall, if we remove the measurements of the ribs, the measurement of the wall is reduced by approximately 30% immediately, an important fact when considering a rib resection.
- 5. Although it is true that the ribs provide anchorage for thoracoabdominal structures, their modification allows for improving the transition from the thorax to the hips; through the loss of the structural rigidity, these contribute to the waist.
- 6. Despite the fact that in our study, we found only one case of asymmetry in the twelfth rib, it is important that the tomographic approach before surgery includes a 3D reconstruction to evaluate this possibility. In our opinion, the twelfth rib is one of those with the greatest possibility of presenting this anomaly. This is because these ribs do not have articulation (they are "floating") and above all, because they are smaller and could become agenetic.
- 7. The costal ratios allow for knowing trends, which, in presurgical planning, help us to prepare and propose clear follow-up objectives in the postsurgical period.
- 8. The difficulty in dissection and deperiostization of the ribs is associated with tension between their muscle insertions, the distance between them, and their morphology. Therefore, we find that the tenth and eleventh ribs are the most difficult for such procedures, and the twelfth is the least difficult. These takeaways are important for surgical planning.
- 9. Our objective, when brainstorming these concepts, was to provide the plastic surgeon with important topics that must be considered to ensure successful surgery, because the development of these concepts is based on anatomical descriptions that, statistically, provide a certain degree of certainty. It is important to

understand that knowing these concepts is related to understanding anatomy, and based on this, key considerations should be made when planning a surgery. This study is not intended to, nor is it designed to, suggest surgical techniques or reconsider currently known procedures.

10. Our principal limitation is that this is a descriptive study; for this reason, studies with other designs should be done for specific conclusions in rib techniques.

# **CONCLUSIONS**

The measurements taken in 83 thoracoabdominal CT scans of female Latin American patients provided crucial data for assessing anatomical relationships based on the ratios and lengths of the tenth, eleventh, and twelfth ribs. Combined with adequate surgical planning, these measurements may enable plastic surgeons to achieve target outcomes using specific costal surgical techniques by evaluating the effectiveness of these procedures.

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#### DISCLOSURE

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

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