Innervation of the nipple-areolar complex after reduction mammoplasty: a histological study

Inervação do complexo areolopapilar após mamoplastia redutora: estudo histológico

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ABSTRACT

Introduction: The periareolar dermal release maneuver in mammoplasty promotes better mobility of the nipple-areola complex. However, there are doubts on possible nerve damages in this kind of topography. This quantitative analysis compared the nerve branches density from the medial, lateral and caudal side-flow of the nipple-areola complex (NAC). Methods: This was a prospective study. The study included 26 women who have undergone a mammoplasty reduction using the Pitanguy’s classic technique. The dermis fragments collected from the medial, lateral and caudal sides were properly prepared and subjected to a histological study in order to determine the nerve branches density in each studied sides. Results: Of 26 studied patients, 42.3% had a higher nerve branches density in the lateral side; 38.5%, on the medial side and 19.2% on the caudal side. The statistical analysis used to evaluate whether there was a predominance of one side where the dermis has been sectioned showed that the proportion comparison test was not significant (p = 0.304). Conclusion: The comparative analysis has shown that there is no preponderance of nerve density in any periareolar dermis side.

Keywords: Mammoplasty; Histology; Anatomy.

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INTRODUCTION

Surgical procedures in the thorax are subject to important skin nerves damage in the breast area, areola and nipple\(^1\). The nipple is a sensitive unit with an erectile function and it is important part of the woman intimacy with significant impact in their psychological and sexual health\(^2\).

A number of studies have been proposed to identify the safe zone for breast resection and maximal preservation of breast innervation\(^1\)-\(^5\).

However, existing studies are controversial on distribution and pathway that these nerves take up to the nipple-papillary complex (NAC)\(^2\).

In the plastic surgery department of the Federal University of Pernambuco a project is under analysis in order to evaluate dermal release maneuver in patients undergoing breast reduction. The main advantage observed is: greater mobility of the NAC. However, there are doubts about possible nerve damage in this topography\(^4\)-\(^10\).

OBJECTIVE

This study proposes a quantitative and comparative histological analysis about the nerve density in the medial, lateral and caudal side of the periareolar dermis.

METHODS

The survey was conducted in the Hospital das Clínicas of the Federal University of Pernambuco (HC-UFPE) in Recife, PE, Brazil. The study was previous approved by Ethical and Research Committee, number ACEE: 05351312.3.0000.5208. This is a prospective study conducted from 2013-2015 in which 26 women were selected, patients aged ranged from 21 to 50 years who were admitted to the plastic surgery clinic with complaints of ptosis or breast hypertrophy. We excluded those with comorbidities, body mass index (BMI) above 30, menopausal or psychiatric disorders (assessed with the mini-mental state examination).

All patients underwent Pitanguy breast reduction\(^11\)-\(^12\) under general anesthesia, and they were operated on by the same surgeon.

The finished periareolar decortication, in which area was previously marked according to each case, initiated the release of periareolar dermis. The procedure was performed with a scalpel blade 15, approximately 0.5 cm of normal skin around the decorticated area, most of the dermis was kept in contact with NAC. After the dermal release, dermal fragments were harvested with approximately 5 cm in length, from the medial, lateral and caudal periareolar dermal area and forwarded to histological analysis (Figure 1).
Samples forwarded to histopathological analysis were technical processed with histological sections of 5 μms and stained with hematoxylin and eosin. Samples were analyzed by two pathologists at different times. The nerve fillets amount was obtained by counting by optic microscopy at 100 times magnification. The macroscopic measurement of the specimen and histological processing (microscopic measurement) were considered.

Based on data obtained, we calculated nerve density was calculated by dividing the average number of threads found by the two pathologists on the micro sample measurement (after histological processing) and thus found the number of nerve fillets per square centimeters (cm²). A comparison of the nerve thickness was done among medial, lateral and caudal side.

Data were typed into a Microsoft Excel spreadsheet exported to SPSS software, version 18, for analysis. In the evaluation of prevalence of side with highest density we calculated the percentage frequency, and constructed the frequency distribution. The comparison of prevalence was performed using the chi-squared test to compare proportions, and to calculate the confidence interval to prevalence found. The conclusion of the analysis considered a significance level of 5%.

**RESULTS**

Results of histological analysis of 26 breast are shown in table 1.

Figure 2 shows quantity of patients related with density of nervous fillets found in each analyzed side.

Statistical data analysis used the Chi-squared test with confidence intervals to analyze each side, which is observed in table 2. We used a significance level of 5% (p < 0.05).

Even when higher prevalence in lateral side was seen, confidence intervals from three evaluated parts submitted to present intersections indicating similarity among prevalence of women with higher density on the medial, lateral and caudal side. Still, we observed that proportion comparison test was not significant (p = 0.304).

No cases of partial or total areola necrosis were seen among studied patients.

**DISCUSSION**

Maintaining the nerve fibers integrity that gives sensitivity to the NAC that is a reason for plastic surgeon who are active work in this area.

Since 1840, with Cooper, apud Munhoz, several authors have tried to describe what kind of nerves were these and what its pathway until it reaches the nipple-papillary complex. However, the various studies written so far present some controversies, particularly concerning to the path that these nerves travel to reach the NAC.

Main anatomical studies seem to agree that innervation of the NAC comes from 3rd, 4th and 5th intercostal nerves, in which the 4th, is the most important of them. This nerve is divided into two major branches, the anterior cutaneous branch, which emerges from the upper-side region of the sternum and follows a shallow downward pathway toward super and medial edge of the areola; and the lateral cutaneous branch.

This latter emits a surface segment, making a subcutaneous path toward lower medial edge of the NAC, and a deep branch, which emerges in the mid-axillary line height and passes adjacent to the fascia of the pectoralis major muscle to the midclavicular line, in which makes an angle of almost 90 degrees, ascending through the breast tissue and ending at the back of the NAC.

Schlenz et al. after anatomical dissection of 28 female cadavers and found a frequency of the lateral cutaneous branch in 93% of breasts, as well as a large-caliber nerves. Therefore, they considered it the most important nerve to the sensitivity of the nipple-papillary complex.
### Table 1: Macro and microscopic analysis of fragment size, number and mean of nerve fibers found by each pathologist, and the density observed in each of the 26 examined breasts.

<table>
<thead>
<tr>
<th>Pathologist</th>
<th>Macro Measure Log 1</th>
<th>Macro Measure Log 2</th>
<th>Macro Density</th>
<th>Micro Measure Log 1</th>
<th>Micro Measure Log 2</th>
<th>Micro Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathologist 1</td>
<td>2.5</td>
<td>3.5</td>
<td>2.0</td>
<td>3.3</td>
<td>2.8</td>
<td>2.5</td>
</tr>
<tr>
<td>Pathologist 2</td>
<td>4.0</td>
<td>4.0</td>
<td>2.5</td>
<td>3.5</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Note:** The table includes data on fragment size, number, and mean of nerve fibers found by each pathologist, along with the density observed in each of the 26 examined breasts.
The originality of the research, on the other hand, it makes difficult the literature comparison.

Since it was described in 1930, the Schartzman maneuver 14 that demands decortication with preservation of periareolar dermis that has been considered as fundamental to vascularization of NAC in the different choices of techniques used for breast reduction.

In Brazil, breast reduction technique developed by Arie and modified by Pitanguy 11,12 is probably the most widely used and taught to plastic surgery residents.

In cases where there is a need for extensive mobilization of NAC, or when the breast presents a firm parenchyma, with little slippage of the overlying and adjacent skin, periareolar dermis imposes limitations on mobilization of the NAC during breast reduction surgery, the technique described above. Another difficulty observed in patients with these characteristics is to maintain the circular shape of the NAC, aesthetically influencing the result. The dermal release maneuver was designed as an alternative to overcome such difficulties. However, when the maneuver is performed to periareolar dermal release, a fear exists on compromising vascularization and, therefore, innervation of NAC.

Results of this study showed that there is no side with a preponderance of nerve branches ($p = 0.304$), thus, the dermal release does not compromise the section of a side which is predominant in relation to the density of nerve endings to NAC.

Another fact to consider is that the section is limited to the dermis. There is no way to ensure that the sectioned nerve branches at this level are sensory or motor. The studies found describe the main nerves responsible for the sensitivity of NAC in the subcutaneous level and not in the dermis where the maneuver releasing is done.

Table 2. The density distribution of nerve fillets on the medial, lateral and caudal sides.

<table>
<thead>
<tr>
<th>Higher density side</th>
<th>n</th>
<th>%</th>
<th>IC (95%)</th>
<th>p-value $^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial</td>
<td>10</td>
<td>38.5</td>
<td>0.02-0.57</td>
<td>0.304</td>
</tr>
<tr>
<td>Lateral</td>
<td>11</td>
<td>42.3</td>
<td>0.26-0.61</td>
<td>0.034</td>
</tr>
<tr>
<td>Caudal</td>
<td>5</td>
<td>19.2</td>
<td>0.09-0.38</td>
<td>0.304</td>
</tr>
</tbody>
</table>

$^1$p-value and chi-squared test for proportions comparison ($p$-value $<0.05$ the proportions differed significantly).

Riccio et al.2 recommended a careful resection of the lower side quadrant of the breast, considered as an unsafety area, because this region would own the most reliable innervation of the breast, through the lateral cutaneous branch.

Based on these studies, which is assigned to the lateral cutaneous branch of greater relevance, explain the fact that our study found a higher density of nerve branches in the dermis side periareolar. This finding, however, is not accompanied by a statistically significant difference ($p = 0.304$).

Sarhadi et al.4 held tangential and transverse histological sections on the areola and they observed that even deep lateral cutaneous branch fibers ascending through the breast perpendicularly on the breast tissue does not culminate immediately on the posterior face of the areola, but in its adjacent dermis, contributing to the formation of subdermal plexus and thus for the random distribution of the input fibers to the NAC pathway.

This study great part of the dermis surrounding the areola was preserved, since the incisions were performed to release dermal already closed to the skin surrounding the decorticated area. According to Sarhadi et al.4, therefore, the area that received innervation from this important nerve branch was preserved.

Our results lead to consider innervation of periareolar dermis, unlike studies reported in the literature that describe the pathway of nerves in subcutaneous plane. This fact, if on one hand it reveals the originality of the research, on the other hand it makes difficult the literature comparison.

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Counting of nerve fillets was performed by two pathologists, and ultimate result was the average of these values. Such care is justified to reduce the possibility of the same nervous fillets have been considered more than once.

Although not objective of this study, it is important to report that no case observed the appearance of areola necrosis, whether partial or total, among 26 patients who underwent surgery. The analysis of this result, as well as the objective measurement of sensitivity done with Semmes-Weinstein monofilaments, which are part of the study under final phas, and conducted by the same group of researchers.

**CONCLUSION**

The comparative analysis has shown that there is no preponderance density of nerve fillets in any side of periareolar dermis.
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COLLABORATIONS

JZS  Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of surgeries and/or experiments; writing the manuscript or critical review of its contents.

OMLP  Completion of surgeries and/or experiments.

FAMBA  Completion of surgeries and/or experiments.

DMT  Completion of surgeries and/or experiments.

JMP  Completion of surgeries and/or experiments.

ATC  Writing the manuscript or critical review of its contents.

RA  Completion of surgeries and/or experiments.

JLAA  Analysis and/or interpretation of data.

AEOR  Final approval of the manuscript; conception and design of the study.

REFERENCES


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