Comparison of the Inflammatory Response to Trauma in the Inverted T Technique and Axillary Access Technique for Breast Reduction Surgery

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ABSTRACT

Eighteen patients with hypertrophy and bilateral breast ptosis were operated on for breast reduction: ten were submitted to axillary access mammaplasty and eight to the inverted T technique. Sixteen patients, eight of which submitted to axillary access breast reduction and eight submitted to the inverted T technique, received interleucin-1β and TNF-α pro-inflammatory cytokines.

The mean length of surgery was 36 minutes, less for the axillary technique. The mean cost for the operating room was twice as much for the inverted T technique. The recovery period for patients to return to all activities was approximately 80 days for the inverted T technique, and forty days less for the axillary technique.

The dosage of pro-inflammatory cytokines showed a significant difference ($p<0.05$) in levels of IL-1β of patients submitted to the axillary surgical route compared to those of patients submitted to the inverted T technique, in which the former had higher levels of IL-1β than the latter. Regarding the dosage of TNF-α, a certain upward trend was observed, although without statistical significance, in patients submitted to the inverted T technique, for most of the periods studied (preoperative, 24, 48 and 72 hours postoperative). Although a significant decrease in the levels of IL-1β in patients submitted to the inverted T technique was observed in comparison to the axillary route, one cannot conclude that there was actually less trauma associated to the former technique, considering that the levels of TNF-α, on the other hand, tended towards the opposite direction. Nonetheless, it can be said that the serum level of pro-inflammatory cytokines does not seem to be an ideal method for identifying a greater or lesser degree of trauma to breast tissue, and it would be necessary to measure other pro-inflammatory mediators or even increase the study sample.

INTRODUCTION

The first description of reduction mammaplasty in the literature was in the VII century A.D. Durstan[1], in 1669, also described breast reduction surgery. Beisenberg[2] treated gynecomastia, but it was only in the beginning of the past century that the major contributions related to the issue began to be cited in the literature, as, for example, studies by Arié[3], Mouly and Dufourmentel[4], Strombeck[5], Pitanguy[6], Andrews[7] and Peixoto[8], among others. These authors brought new contributions to the development of breast reduction techniques. According to many authors, the surgical technique for treating breast hypertrophy and ptosis should be the one the surgeon is best at. The negative aspects pointed out for classical reduction mammaplasty are the size of scars, a fact with which most patients agree.

The results of an interactive survey on mastoplasty carried out at the XXI São Paulo Plastic Surgery Day in Campos do Jordão – São Paulo, in June 2001, showed that patients' major complaint referred to inappropriate scars (59.4%), 5.1% did not choose any one of the given alternatives, 7.6% had breast asymmetry, 11.4% inadequate shape, and 16.5% late postoperative ptosis.

We considered the comments above as a starting point to begin to perform, as of January 1984, a new, less aggressive reduction mammaplasty with an areolar access technique, that preserves a larger number of central mammary lobules and presents a sole areolar scar. The experience with the technique has been described both in Brazilian[9, 10] and international[11, 12, 13, 14, 15, 16] literature.

Over a period of nine years, the technique was performed on five-hundred patients that is a thousand breasts. After this period, the conclusion was that breasts could be submitted to a mammaplasty utilizing the axillary route without any scar at the end. The experience with the technique was initially described in 1993[17] in La Revue de Chirurgie Esthétique de Langue Française.

The new technique has the following advantages:

1. It is less aggressive when compared to classical techniques, because any breast quadrant may be approached by the axillary route. Moreover, resection is mainly approached by lateral quadrants, as they are responsible for the inelegant aspect of most patients in the late postoperative period.
2. It can be performed either under local or epidural anesthesia.
3. It is more economical, since it only requires four sutures for both armpits.
4. Its major advantage is it avoids any scar in the breast, because the axillary scar is hidden by natural folds.
5. Less trauma is believed to occur in the axillary route technique if compared to the inverted T technique, mainly due to immediate patient recovery (forty days less, minimum) and due to the absence of breast scars, yielding a single axillary scar of approximately a third of the size of inverted T surgery scars.

Axillary access breast reduction surgery was described in the literature as early as 1924, by D'Artigues[18]. Many publications have described it, although the technique has not become popular to date.

A higher satisfaction rate was obtained with two hundred breasts operated on by the axillary route reduction technique and followed for five years, when compared to the rates obtained when the inverted T technique or periareolar technique were used. We obtained 160 of 240 blood samples of patients submitted to breast reduction. Eight patients were submitted to the inverted T technique and eight patients to the axillary route technique. An assay for detecting serum pro-inflammatory cytokines- Tumor Necrosis Factor (TNF-α) and Interleucine-1β (IL-1β) - was performed on eighty 5 ml blood samples from each group of patients. The literature has widely described cytokines, mainly IL-1β and TNF-α that are a link between cell injury, recognition of non-self and the development of local and systemic signs, in addition to signs of inflammation, such as cell migration, edema, fever and hyperalgesia (Dinarello 1986[19], Hopkins 1990[20] and Dinarello 1996[21]). To that purpose, the present study assessed serum levels of TNF-α and IL-1β as possible markers of the level of tissue damage, in two kinds of breast reduction surgical techniques: axillary route and breast route (inverted T technique).

OBJECTIVES

The objective of the present project was to widen the knowledge on the new reduction mammaplasty technique by the axillary route, by comparing the inflammatory response to trauma that follows breast reduction surgery. In order to reach the objective, two techniques were compared from a quantitative and qualitative standpoint: classical inverted T and axillary route.

The scientific proof of less trauma or similarities may contribute to the knowledge and promotion of the technique in the medical milieu, in addition to financial and psychological advantages to women who need this kind of intervention.

EXPERIMENTAL PROTOCOL

Eighteen female patients, ranging from 18 to 52 years of age, with breast hypertrophy, discomfort due to breast weight benefited from reduction. Random criteria were used to select the patients. All patients were assessed by an anesthetist in the preoperative period and the following lab tests,

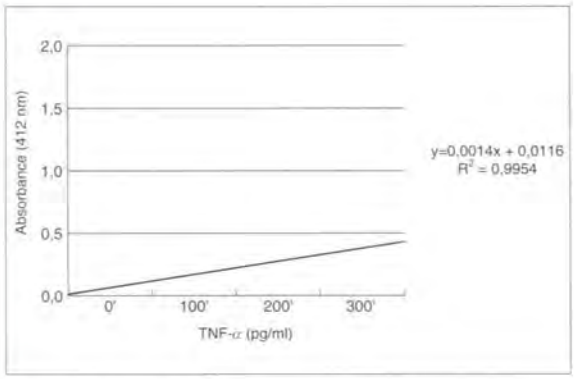

Fig. 1 - Standard TNF-α curve (30 min).

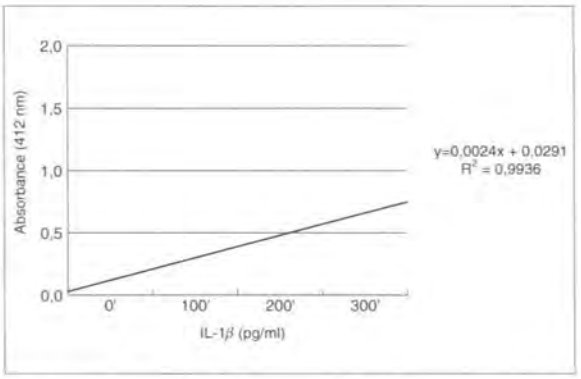

Fig. 2 - Standard IL-1β curve (30 min).

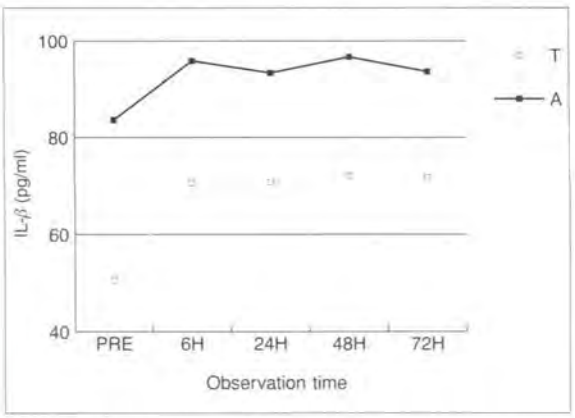

Fig. 3 - Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery, using the results of the standard-curve IL-1β in two independent samples.

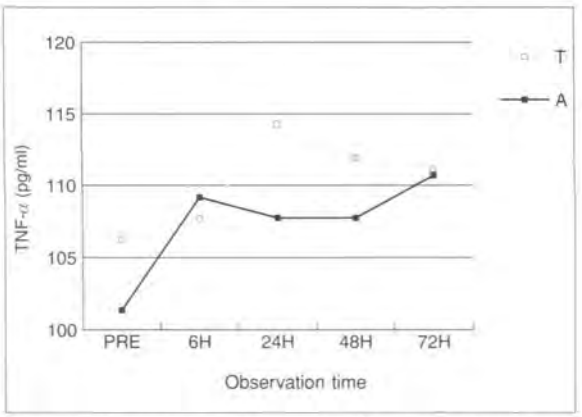

Fig. 4 - Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery, using the results of the standard-curve TNF-α in two independent samples.

		IL-1β				
Patient	**Technique**	**Pre**	**6 h**	**24 h**	**48 h**	**72 h**
1	A	84.5417	108.1429	104.2143	109.2143	80.2857
2	A	-	107.4286	103.8571	97.7857	-
3	A	-	99.2143	93.8571	101.0000	103.5000
4	A	-	59.3333	51.4167	49.1250	50.7917
5	A	-	104.2143	107.6071	105.6786	101.7143
6	A	111.0000	-	106.7143	112.4286	116.7143
7	A	55.3750	97.0714	82.0714	94.9286	100.2857
8	A	-	-	97.4286	103.5000	102.4286
Average		83.6389	95.9008	93.3958	96.7076	93.6743
SD		27.8235	18.4467	18.9465	20.0608	21.7200
9	T	-	95.6429	100.2857	83.8571	99.2143
10	T	54.1250	51.0000	53.5000	62.4583	48.9167
11	T	46.4167	49.9583	48.0833	45.7917	46.0000
12	T	-	103.5000	101.3571	107.7857	98.8571
13	T	53.2917	49.7500	46.4167	47.0417	53.5000
14	T	-	108.5000	101.7143	100.2857	101.7143
15	T	48.5000	51.6250	58.7053	71.4167	62.6667
16	T	-	54.7500	56.2083	58.2917	62.6667
Average		50.5833	70.5908	70.7842	72.1161	71.6920
SD		3.7229	26.7320	25.4330	23.3308	24.1111
T test (p)		0.0871	0.0291	0.0325	0.0203	0.0430

Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery, using the results of the standard-curve IL-1β in two independent samples.

		TNF-α				
Patient	**Technique**	**Pre**	**6 h**	**24 h**	**48 h**	**72 h**
1	A	98.1429	109.9286	107.4286	108.5000	112.0714
2	A	-	109.2143	116.3571	109.2143	-
3	A	-	101.7143	103.8571	109.2143	108.1429
4	A	-	115.2857	101.3571	106.3571	113.8571
5	A	-	114.5714	108.1429	111.0000	106.3571
6	A	106.3571	-	102.7857	103.5000	115.6429
7	A	99.5714	103.5000	103.1429	108.1429	107.0714
8	A	-	109.9286	118.8571	106.0000	111.7143
Average		101.3571	109.1633	107.7411	107.7411	110.6939
SD		4.3886	5.0903	6.5422	2.3492	3.5561
9	T	-	102.0714	111.0000	106.7143	107.0714
10	T	102.0714	97.4286	99.9286	94.9286	105.2857
11	T	100.6429	111.0000	113.1429	95.6429	94.5714
12	T	-	110.6429	109.2143	107.7857	108.1429
13	T	115.2857	110.2857	106.0000	108.8571	117.4286
14	T	-	109.2143	132.7857	107.4286	-
15	T	107.0714	103.5000	120.2857	148.1429	101.7143
16	T	-	117.4286	122.0714	125.6429	143.8571
Average		106.2679	107.6964	114.3036	111.8929	111.1531
SD		6.6136	6.3019	10.3611	17.4348	15.9850
T test (p)		0.1459	0.3133	0.0781	0.2626	0.4715

Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery, using the results of the standard-curve TNF-α in two independent samples.

in addition to the conventional ones, were performed: dosage of inflammatory agents, cytokines, interleucine-1β and TNF-α in all patients operated on, in addition to epidural anesthesia. Patients accepted by the protocol remained in the hospital for 72 hours and had blood drawn five times (15 ml each time, separated in 3 samples kept in 5ml tubes, at the following moments: preoperative, 6, 24, 48 and 72 hours after surgery, approximately, in order to measure cytokines, interleucin-1β and TNF-α.

METHOD

ASSAY FOR DETECTING SERUM PRO-INFLAMMATORY CYTOKINES

Blood samples obtained from patients in the preoperative period, 6 hours, 24, 48 and 72 hours after surgery, were centrifuged (2,400 rpm for 10 minutes), freezing cell-free supernadant at -70° C, to later dose cytokines, according to Thonson, 1996[22]. Specific kits were used for dosing cytokines. In this fashion, concentrations of interleucin-1β (IL-1β) and Tumor Necrosis Factor (TNF-α), were determined by ELISA assays, specific to each cytokine (human interleukin-1β – Enzyme Immunoassay Kit and TNF-α Human Enzyme Immunoassay Kit, both from CAYMAN Chemical Company, Ann Arbor, MI 48108 USA).

The kits for IL-1β and TNF-α were used according to manufacturer's instructions, and each sample was assayed three times. In this fashion, plates were initially washed with a standardized buffer solution which was removed before beginning the assay. Then 100 microlitres of the samples to be tested were added in each well. In some wells, standard TNF-α (or IL-1β standard) was added to obtain a standard-curve (Graphs I and II). Then 100 microliters of anti-TNF-α antibody conjugate (or anti-IL-1β conjugate) was added to each well, except for Blank wells (controls). Plates were incubated for a whole night in a refrigerator at 4°C. On the following day, wells were emptied and washed 5 to 6 times with a standard buffer solution. Two-hundred microliters of Ellman's reagent with chromogen were added to each well and the plate was covered with plastic wrap and left in the dark for thirty minutes. Afterwards, plates were read on an ELISA reader using a 420 nm filter. These assays detect a minimum limit of 1.5pg/ml of TNF-α and IL-1β. The standard-curves determined in these experimental protocols were the following: $y = 0.0014x+0.0116$; $R2 = 0.9954$ and $y = 0.0024x+0.0291$; $R2 = 0.9936$ for TNF-α and IL-1β, respectively.

Two statistical assessment techniques were performed.

A non-parametric test (Mann-Whitney Test) (Graphs III and IV) is recommended for statistical analysis, instead of *Student's* T test due to the requirements of the latter; that is to say, a normal distribution of the variable (TNF-α or IL 1-β), although *Student's* T test was performed as exploratory, as was analysis of variance (longitudinal for times), the results of which should be interpreted with caution. Therefore, conclusions actually derived from the Mann-Whitney test. An alpha significance level of 5% was considered; hypothesis test established alpha = 5%, or equal to: 0.05.

RESULTS

All surgeries were performed at the same hospital, by the same team and with the same epidural anesthesia.

Patient's age varied between 18 and 52 years, and the average age of patients that chose the axillary technique was 30 years. For those who preferred the conventional technique the average age was 34 years; thus, a four year difference (Table I). According to Table II, the amount of resected breast tissue varied between 200 and 1,500 g.

Histological findings were: adipose hypertrophy, cyst, fibroadenocystic mastopathy, chronic lymphadenitis and bilateral ductal ectasia (Table III). The average surgical time for the axillary route procedure was three hours and nine minutes, and three hours and forty-five minutes for the inverted T technique. The average time for the axillary technique was 36 minutes less.

The mean expense with operating room material was R$ 209.60 for the axillary technique and R$ 418.57 for the inverted T technique. So, the axillary technique represented a fifty percent cost reduction in relation to the conventional technique.

Table IV, shows that the anesthetic material used was practically the same for both techniques.

A total of four sutures were used for both breasts in the two-hundred breasts operated on using the axillary route, although in the present study, in which 18 patients were operated on in a public hospital, the average number of sutures used for the technique totaled nine for both breasts, and totaled twice as many, 18, for both breasts in the inverted T technique.

Despite the current concept that little skin is removed in the axillary route, by comparing the average amount of resected skin in both techniques, the study proves that practically the same amount is removed. Axillary technique, right breast: 9 x 5.8 x 4 and left breast: 8.5 x 5.9 x 3.9. Inverted T technique, right breast: 7.6 x 5.8 x 4.9 and left breast: 7.6 x 5.8 x 4.8. In order to perform a qualitative study to assess both techniques, a questionnaire was answered by patients, (responses were given four months and one year after surgery), with the following questions: assess the result as satisfactory, unsatisfactory or if more was expected, rating the procedure from zero to ten. Results: none considered the result unsatisfactory; two in each technique expected more; axillary technique satisfactory: 8 patients and inverted T: 6 patients. The average mark for the

axillary technique was 9.5, and 7.0 for the inverted T.

Regarding pro-inflammatory cytokine dosages, a significant difference ($p<0.05$) was observed between the levels of IL-1 β of patients submitted to axillary route surgery and those submitted to the inverted T technique, pointing out that the former had higher levels of IL-1β than the latter. On the other hand, no significant differences were observed between the levels of TNF-α in both groups of patients studied, although it is possible to say that there seems to be a certain upward trend for TNF-α levels in patients submitted to the inverted T technique for most of the times studied (pre-surgical, 24, 48 and 72 hours after surgery). The small number of patients in each group (n: 8) certainly may have contributed to not obtaining statistical significance.

Complications: two patients operated on by the axillary technique had a seroma and the same number was registered in the inverted T technique: two. Keloids: one in the axillary technique and four in the inverted T. Herpes: one case, only in the axillary technique. Hypertrophic scar: one in the axillary and two in the inverted T. Dehiscence: two in T and none in the axillary (Table V).

DISCUSSION OF RESULTS

Various routes may be chosen in order to reduce the mammary gland. The present study shows that the inverted T technique does not invalidate the axillary technique or vice-versa. Both techniques can reduce the gland, and only size and site of scars vary. The final result does not depend solely on the technique, but also on the quality of the tissue (glandular, fatty or mixed) of each breast.

CONCLUSION

The comparison of both techniques leads to the conclusion that neither one invalidates the other, although, many advantages could be linked to the axillary technique.

The axillary technique provides faster recovery so patients may return to normal activities approximately 40 days sooner and at a lower cost, a very important factor nowadays. The level of satisfaction was higher for patients submitted to the axillary route technique.

The present study also proves that mammary tissue memory will only change a year after surgical treatment. Breasts operated on by the axillary route, at six months postoperative, presented little scarring retraction and a similar memory to the aspect of the initial breast. Only after a year, complete scarring retraction and a very different aspect from the original breast, approximately 50% smaller than the initial volume, are observed.

Conversely, in the inverted T technique, there is a complete scar retraction at six months postoperative and breast seesawing bascule only occurs a year after surgery. Both are believed to differ as to follow-up because the axillary technique is a closed technique while the inverted T is open.

In relation to cytokine dosages: interleucine-1β and TNF-α, only 16 patients were studied, eight of axillary technique and eight of the inverted T technique, and samples from two patients could not be performed.

Results differed: IL-1β levels presented a significant difference ($p<0.05$) between patients submitted to axillary route surgery and those submitted to the inverted T technique, where the former had higher levels of IL-1β than the latter. There were no significant differences between TNF-α lev-

Table I

	Axillary		Inverted T	
Age	N. of patients	%	N. of patients	%
18-30 years	7	70	4	50
31-52 years	3	30	4	50
Total	10	100	8	100
	Average: 30.5		Average: 34.37	

Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery.

Table II

	Axillary		Inverted T	
Grams*	N. of patients	%	N. of patients	%
200-400	5	50	1	12.5
401-600	5	50	2	25
601-800	0	0	1	12.5
801-1000	0	0	2	25
1001-1500	0	0	2	25
Total	10	100	8	100

Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery.
*Amount of resected tissue in grams.

Table III

	Axillary	Inverted T
Adipose hypertrophy	5	5
Simple cyst	1	2
Fibroadenocistic mastopathy	6	2
Chronic lymphadenitis	1	0
Bilateral ductal ectasia	0	1

Histological study. Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery.

Table IV

	Axillary	Inverted T
Bupivacaine	30	30
Fentanyl	2.6	2.5
Dormonid	15	15
Atropine	1.4	2

Anesthetic vaterial (average in ml). Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery.

Table V

	Axillary		Inverted T	
	N. of patients	%	N. of patients	%
Seroma	2	40	2	20
Keloids	1	20	4	40
Herpes	1	20	0	–
Hypertrophic scar	1	20	2	20
Dehiscence	0	0	2	20
Total	5	100	10	100

Complications. Comparison of trauma inflammatory response to axillary vs. inverted T technique breast reduction surgery.

els for both groups studied, but there was a certain upward trend for TNF-α levels in patients operated on by the inverted T technique, in most of times studied (preoperative, 24, 48 and 72 hours postoperative). It can be said that the serum dosage of IL-1β and TNF-α does not seem to be an ideal method for identifying the level of trauma in healthy mammary tissue, that is to say, without infection or cancer; it may be necessary to dose other pro-inflammatory mediators or, maybe, the small number of patients studied may have contributed to the statistical non-significance.

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