Aesth Plast Surg (2022) 46:2124–2130
https://doi.org/10.1007/s00266-022-02903-w

ORIGINAL ARTICLE BREAST SURGERY

Antibiotic Prophylaxis in Reduction Mammaplasty: A National Survey

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Received: 28 December 2021 / Accepted: 3 April 2022 / Published online: 10 May 2022

Abstract

Background Although there is limited evidence for regulating the use of prophylactic antibiotics in reduction mammaplasty, many plastic surgeons prescribe them, even in the postoperative period. This study aimed to conduct a national survey to investigate the antibiotic prophylaxis protocols followed by Brazilian plastic surgeons in reduction mammaplasty.

Methods An anonymous survey comprising 19 questions was sent to all 4864 active members of the Brazilian Society of Plastic Surgery (SBCP). The surgeons electronically received the invitation to participate in the survey and the link to fill out the electronic form.

Results In total, 859 surgeons (17.7%) responded. Most respondents (77.8%) were men and aged 35–55 years (61.5%); 58.6% of them had 10–29 years of specialty training. Only a minor proportion of the respondents (0.5%) reported not prescribing antibiotics at any time (95% confidence interval [CI]: 0.0–0.9), 9.9% (95% CI: 7.9–11.9) prescribed them only preoperatively, and 14.6% (95% CI: 12.2–16.9) prescribed continued antibiotic use for 24 h. The majority of the respondents (75.1%; 95% CI: 72.1–77.9) prescribed antibiotics for additional days after discharge. There were significant associations between antibiotic prescription and the surgeons' age group ($p = 0.015$), time since graduation ($p < 0.001$), experience in the specialty practice ($p = 0.003$), SBCP membership ($p < 0.001$), and surgical site infection rates ($p = 0.011$).

Conclusion Most responding plastic surgeons affirmed that they prescribed prophylactic antibiotics for more than 24 h in reduction mammaplasty cases.

Level of Evidence V This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Mammaplasty · Antibiotic prophylaxis · Surveys and questionnaires · Plastic surgery

Introduction

Breast reduction surgery is one of the most commonly performed plastic surgeries in Brazil and worldwide. According to the statistics from the International Society of Aesthetic Plastic Surgery (ISAPS), breast reduction surgery ranked seventh among the most performed surgeries in 2019 globally. In Brazil alone, approximately 87,640 reduction mammaplasties were performed in 2019 [1].

Although classified as clean surgeries, the surgical site infection (SSI) rates of non-reconstructive breast surgeries vary from 4 to 18%, which is higher than what is expected for this category (<3.4%) [2–4]. A hypothesis for these rates above the expected for clean surgeries would be the performance of large incisions and skin manipulation, since the skin microbiota can be a cause of infection [2]. Another point is that breast tissue also harbors endogenous bactéria,

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being considered, by some authors, as a clean-contaminated surgical site [5].

The prescription of prophylactic antibiotics in reduction mammaplasty remains controversial. Previous studies have demonstrated a significant difference in the SSI rates between the use and non-use of antibiotic prophylaxis in reduction mammaplasty [3, 6, 7]. A meta-analysis revealed a 75% decrease in the incidence of SSI with antibiotic prophylaxis when compared with that with placebo or no antibiotics; implementation of antibiotic prophylaxis effectively prevents infections in the reduction mammaplasty [8].

In an updated guideline for the prevention of SSI, the North American Centers for Disease Control and Prevention (CDC) points out that there is a strong evidence supporting the use of antibiotics before surgical incision and the postoperative use of antibiotics is not required during clean surgeries [9]. Moreover, there is no evidence of any benefit from using more than one dose of antibiotics [9, 10].

The CDC SSI prevention guidelines are not specific [9]; there is no evidence that supports these guidelines in reduction mammaplasty and many plastic surgeons prefer to use antibiotics for a prolonged time [5, 6, 11, 12]. But, a recent study has demonstrated that the use of antibiotics, continued for more than 24 h, was not successful in decreasing the SSI incidence in reduction mammaplasty [13]. Furthermore, some authors do not recommend the use of antibiotics in this surgery, Boccara et al. [14] demonstrating the lack of standardization in clinical practice.

The American Society of Plastic Surgeons (ASPS) guidelines for clinical practice in reduction mammaplasty suggest that the antibiotic prophylaxis decreases the SSI rates after reduction mammaplasty; however, due to the paucity of evidence does not provide any recommendations regarding the optimal timing or duration of antibiotic use [10]. An update of these guidelines is under development since 2019, but the updated guidelines are not published yet.

The Brazilian Society of Plastic Surgery (SBCP) is the second-largest worldwide in terms of the number of surgeons (closely behind the ASPS). Since there is no study describing the antibiotic prophylaxis practices of Brazilian plastic surgeons in reduction mammaplasty, the current study aimed to investigate the antibiotic prophylaxis protocols followed by the plastic surgeons in reduction mammaplasty in Brazil.

Methods

Inclusion and Exclusion Criteria and Survey

Formal authorization was initially obtained from the SBCP to survey its members. The eligibility criterion for this study was current membership of the SBCP, either titular or associate membership. There were no restrictions with respect to gender, age, time of acquiring degree, or region of the country. We did not include members in training (residents) or aspiring members of the SBCP or plastic surgeons whose e-mail addresses were outdated.

An electronic form (Microsoft Forms Office 365) was sent, by the SBCP, to its 4864 members who met the eligibility criteria of the study to collect demographic data (gender, age range, time since graduation, experience in the specialty practice, etc.) and responses to questions regarding clinical practice in reduction mammaplasty, mainly related to antibiotic prophylaxis. The link was sent via e-mail together with an explanation of the study's objectives and a consent form. In order to increase adherence to the study, a reminder was sent electronically to all non-respondents 30 days after the first e-mail, followed by another one after 30 days and a last one 30 days after the second reminder. One month after the third reminder (i.e., 4 months after the first reminder), non-respondents were considered as losses.

Statistical Methods

Data were represented as absolute and relative frequencies, and the existence of associations between two categorical variables was verified using Fisher's exact test. To evaluate the effects of demographic, training, professional, and surgical characteristics on the antibiotic prescription, multinomial regression models of univariate and multivariate models were used. In the latter, variables that were not significant at 5% were excluded. For all statistical tests, the significance level was set at 5%. The analyses were performed using Statistical Product and Service Solutions, version 20.0 (IBM Corp. Released 2011; IBM SPSS Statistic for Windows, version 20.0; Amonk, NY, USA: IBM Corp.) and STATA 12 (StataCorp 2011; Stata Statistical Software: Released 12. College Station, TX, USA: StataCorp LP).

Results

Data were collected between December 2019 and April 2020. At the end of 2019, the SBCP had 5568 titular or associate members, and 4864 (1663 titular and 3201 associate members) were considered active members, i.e., compliance with the SBCP membership requirements.

The responses obtained until April 2020 were computed that corresponded to 859 respondents (response rate: 17.7%). The majority (77.8%) of the respondents were male, 61.5% were aged between 35 and 55 years, 60.6% had experience in the specialty practice of 10–19 years, and

63.4% performed an average of 16 or more reduction mammaplasties per year (Table 1).

Most of the surgeons (83.2%) reported that their surgical time for performing reduction mammaplasty was 2–4 h, and 72.2% discharged their patients from the hospital the day after the procedure (Table 1).

Only 0.5% of the surgeons did not prescribe prophylactic antibiotics at any time, whereas majority of the respondents (75.1%) prescribed antibiotics after hospital discharge (Table 2). The most prescribed antibiotics during hospitalization and after discharge were intravenous cefazolin and oral cefadroxil, respectively (Table 3).

Significant positive associations were observed between antibiotic prescription and age group ($p = 0.015$), experience in the specialty practice ($p = 0.003$), SBCP membership ($p < 0.001$), SSI rate after reduction mammaplasty ($p = 0.011$), and the use of drains in reduction mammaplasty ($p < 0.001$) (Table 1).

Discussion

Mammaplasty is among the most frequently performed plastic surgery procedures in Brazil and worldwide [1]. Scarring problems are frequent with this procedure, ranging from small areas of epitheliosis to major complications requiring surgical reintervention [15]. Although there is a lack of scientific evidence supporting the use of antibiotics in breast reduction surgery, many surgeons prefer to administer antibiotics often beyond the preoperative dose recommended by the CDC for clean surgeries [6, 9]. Although it is generally classified as a clean surgery, the SSI rates of reduction mammaplasty are higher than those of other procedures in this category [3, 8, 14].

In the revised guidelines for the prevention of SSI, the CDC recommends using a preoperative dose of prophylactic antibiotics before the surgical incision for surgeries classified as clean [9]. Specific studies and reviews in reduction mammaplasty have also demonstrated the benefits of administering prophylactic antibiotics [3, 6, 7, 10, 16–19]. However, the ideal duration of antibiotic use still needs to be clarified with randomized clinical trials [8, 10, 20]. A recent study showed that there is no difference in the SSI rates with (beyond 24 h) or without antibiotics postoperatively [21]. Moreover, there is an ongoing clinical trial comparing the effect of administration of a single preoperative dose and maintaining antibiotics for 24 h on the SSI rates after reduction mammaplasty [13].

Surveys of North American plastic surgeons published at different times demonstrated that the trends of prescribing prophylactic antibiotics in reduction mammaplasty have changed, but the majority of surgeons continue to prescribe antibiotics postoperatively. A survey of 5112 ASPS member plastic surgeons published in 2008 showed that 93% of the respondents prescribed antibiotics preoperatively and 74% prescribed their continued use postoperatively. Among the latter, 95% prescribed them for 7 days, whereas 5% prescribed them for longer periods [22].

A survey published in 2013 reported that of 606 plastic surgeons certified by the American Board of Plastic Surgery, 71% prescribed antibiotics only intraoperatively and 56% prescribed antibiotics for more than 24 h [17]. Another survey of 1343 American plastic surgeons published in 2017 showed that 98% of them prescribed antibiotics in the preoperative and intraoperative periods and 58.2% maintained their use in the postoperative period of reduction mammaplasty [18].

A survey of all plastic surgeons certified by the Israeli Association for Plastic Surgery published in 2000 found that 71% of them prescribed prophylactic antibiotics in breast reduction surgery [23]. In contrast, another survey of 230 plastic surgeons in the UK and Ireland published in 2006 found that 46% of the respondents prescribed at least one dose of antibiotics, while 47% did not use any antibiotic prophylaxis in reduction mammaplasty [24].

Although the SBCP is the second-largest plastic surgery society globally in terms of the number of surgeon members and the Brazilian plastic surgery is internationally recognized, we found no data in the literature on the conduct of plastic surgeons in Brazil regarding prophylactic antibiotics in breast reduction surgery. Majority (95%) of the respondents in this survey reported using at least one dose of prophylactic antibiotics, and 75.4% reported maintaining antibiotics in the postoperative period of reduction mammaplasty, despite the absence of evidence regarding the benefit of this practice [13].

The general principles of antimicrobial prophylaxis include four main aspects: The antimicrobial must be safe; an antibiotic with a narrow spectrum of coverage should be selected for the anticipated pathogens (in clean surgeries, coverage should include the most predominant pathogen, i.e., *Staphylococcus* spp.); the antibiotic should be administered preoperatively so that the serum and tissue concentrations are at adequate levels at the time of incision; and the antibiotic should be administered for the shortest period of effect with timely discontinuation [6, 25, 26]. Hence, first-generation and second-generation cephalosporins are the recommended prophylactic antibiotics [25, 26]. Indeed, similar to what was observed in other studies, cephalosporins were the most prescribed antibiotics by the surgeons in this survey.

The experience of the surgeon was represented by the period of certification in the specialty and titular SBCP membership. In this survey, the greater the experience of the surgeon, the lower the use of prophylactic antibiotics in breast reduction surgery. Most surgeons (80.6%) reported

Table 1 Characteristics of the responding surgeons and associations between these characteristics and the antibiotic prophylaxis regimen prescribed in reduction mammoplasty

Surgeons' characteristics	Total *N* (%)	Prescription patterns of antibiotic prophylaxis *N* (%)				
		None	Preoperative only	For 24 h	For additional days after discharge	P^a
Sex	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.284
Female	191 (22.2)	1(25.0)	13 (15.3)	25 (20.0)	152 (23.6)	
Male	668 (77.8)	3(75.0)	72 (84.7)	100 (80.0)	668 (77.8)	
Age group (years)	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.015
< 35	76 (8.8)	0 (0.0)	6 (7.1)	4 (3.2)	66 (10.2)	
35–45	326 (38.0)	2 (50)	26 (30.6)	40 (32.0)	258 (40.0)	
46–55	202 (23.5)	1 (25.0)	20 (23.5)	34 (27.2)	147 (22.8)	
56–65	166 (19.3)	0 (0.0)	17 (20.0)	32 (25.6)	117 (18.1)	
> 65	89 (10.4)	1 (25.0)	16 (18.8)	15 (12)	57 (8.8)	
Certification time in Plastic Surgery (years)	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.003
≤ 10	260 (30.3)	1 (25.0)	14 (16.5)	25 (20.0)	220 (34.1)	
10–19	260 (30.3)	1(25.0)	30 (35.3)	37 (29.6)	192 (29.8)	
20–29	183 (21.3)	1 (25.0)	18 (21.2)	37 (29.6)	127 (19.7)	
30–40	131(15.3)	1 (25.0)	18 (21.2)	21 (16.8)	91 (14.1)	
> 40	25 (2.9)	0 (0.0)	5 (5.9)	5 (4.0)	15 (2.3)	
SBCP category	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	< 0.001
Associate member	460 (53.6)	2 (50.0)	41 (48.2)	46 (36.8)	371 (57.5)	
Titular member	399 (46.4)	2 (50.0)	44 (51.8)	79 (63.2)	274 (42.5)	
Clinical practice	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.266
Private clinic only	318 (37.0)	3 (75.0)	27 (31.8)	46 (36.8)	242 (37.5)	
Private clinic and general hospital	329 (38.3)	0 (0.0)	38 (44.7)	44 (35.2)	247 (38.3)	
Private clinic and university hospital	142 (16.5)	0 (0.0)	12 (14.1)	21 (16.8)	109 (16.9)	
General hospital only	40 (4.7)	0 (0.0)	6 (7.1)	7 (5.6)	27 (4.2)	
General hospital and university hospital	16 (1.9)	0 (0.0)	1 (1.2)	5 (4.0)	10 (1.6)	
University hospital only	14 (1.6)	1 (25)	1 (1.2)	2 (1.6)	10 (1.6)	
Mammaplasties per year	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.315
≤ 5	51 (5.9)	0 (0.0)	1 (1.2)	8 (6.4)	42 (6.5)	
6−15	264 (30.7)	1 (25.0)	29 (34.1)	32 (25.6)	202 (31.3)	
16−30	278 (32.4)	1 (25.0)	25 (29.4)	50 (40.0)	202 (31.3)	
> 30	266 (31.0)	2 (50.0)	30 (35.3)	35 (28.0)	199 (30.9)	
Average duration of mammaplasty (h)	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.178
≤ 2	79 (9.2)	2 (50.0)	8 (9.4)	10 (8.0)	59 (9.1)	
2–3	355 (41.3)	1 (25.0)	42 (49.4)	57 (45.6)	255 (39.5)	
3–4	360 (41.9)	1 (25.0)	30 (35.3)	45 (36.0)	284 (44.0)	
> 4	65 (7.6)	0 (0.0)	5 (5.9)	13 (10.4)	47 (7.3)	
Use of drains	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	< 0.001
No	562 (65.4)	2 (50.0)	70 (82.4)	101 (80.8)	389 (60.3)	
Yes	297 (34.6)	2 (50.0)	15 (17.6)	24 (19.2)	256 (39.7)	
Time of hospital discharge	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.530
On the same day	231 (26.9)	1 (25.0)	29 (34.1)	32 (25.6)	169 (26.2)	
Next day (up to 24 h)	620 (72.2)	3 (75.0)	55 (64.7)	93 (74.4)	469 (72.7)	
> 24 h after surgery	8 (0.9)	0 (0.0)	1 (1.2)	0 (0.0)	7 (1.1)	
SSI rate	859 (100.0)	4 (100.0)	85 (100.0)	125 (100.0)	645 (100.0)	0.011
≤ 1%	692 (80.6)	2 (50.0)	62 (72.9)	94 (75.2)	534 (82.8)	

continued

Surgeons' characteristics	Total *N* (%)	Prescription patterns of antibiotic prophylaxis *N* (%)				
		None	Preoperative only	For 24 h	For additional days after discharge	*P*[a]
1–5%	152 (17.7)	1 (25.0)	22 (25.9)	29 (23.2)	100 (15.5)	
5–10%	12 (1.4)	1 (25.0)	0 (0.0)	2 (1.6)	9 (1.4)	
10–15%	3 (0.3)	0 (0.0)	1 (1.2)	0 (0.0)	2 (0.3)	

SBCP Brazilian Society of Plastic Surgery, *SSI* Surgical Site Infection

[a]*p*-descriptive level of Fisher's exact test

Table 2 Prescription patterns of antibiotic prophylaxis in reduction mammaplasty

	CI 95%	*N* (%)
Prescription of prophylactic antibiotics		859 (100.0)
None	0.5 (0.0–0.9)	4 (0.46)
Preoperative only (on anesthesia induction)	9.9 (7.9–11.9)	85 (9.89)
For 24 h (or during the hospital stay)	14.6 (12.2–16.9)	125 (14.55)
For additional 1–4 days after discharge	14.6 (12.2–16.9)	125 (14.55)
For additional 6–7 days after discharge	50.1 (46.7–53.4)	430 (50.05)
For more than 7 days after discharge	10.5 (8.4–12.5)	90 (10.48)

CI confidence interval

an estimated SSI rate of less than 1%. However, there was a statistically significant difference among the surgeons prescribing antibiotic prophylaxis only during anesthesia induction and those prescribing antibiotics during hospital stay and after discharge. The former group mainly comprised surgeons over 65 years of age (18.8%), with over 40 years passed since graduation (18.8%). They reported an SSI rate between 5 and 10% (25.9% respondents), which was comparatively higher than that of the other groups.

On the other hand, the surgeons who prescribed antibiotics both during the hospital stay and after discharge mainly comprised surgeons aged up to 45 years (50.2%), with up to 19 years passed since graduation (45.0%), less than 10 years of experience in this specialty practice

Table 3 Types of antibiotics prescribed in reduction mammaplasty

	CI 95%	*N* (%)
Type of antibiotics administered intravenously during hospital stay (including the preoperative period)		859 (100.0)
Cefazolin	95.0 (93.5 a 96.5)	816 (95.0)
Ciprofloxacin	1.2 (0.4–1.9)	10 (1.2)
Ceftriaxone	0.6 (01–1.1)	5 (0.6)
Cefuroxime	0.2 (0.0–0.6)	2 (0.2)
Others	1.4 (0.6–2.2)	12 (1.4)
None	1.6 (0.8–2.5)	14 (1.6)
Type of antibiotics administered after discharge		859 (100.0)
Cefadroxil	42.3 (38.9–45.6)	363 (42.3)
Cephalexin	25.1 (22.2–28.1)	216 (25.1)
Ciprofloxacin	3.6 (2.4–4.9)	31 (3.6)
Amoxicillin	1.3 (0.5–2.0)	11 (1.3)
Azithromycin	1.0 (0.4–1.7)	9 (1.0)
Cefuroxime	1.0 (0.4–1.7)	9 (1.0)
Others	2.4 (1.4–3.5)	21 (2.4)
None	23.2 (20.3–26.0)	199 (23.2)

CI confidence interval

(34.1%), and with associate SBCP membership (57.5%). Furthermore, majority of them reported SSI rates up to 1% (82.8% respondents), which was comparatively lower than that of the other groups.

This study has some limitations. One of the major limitations is concerning the response rate, which was relatively low (17.7%), even though the invitation e-mails for the study were sent by SBCP itself. Additionally, three reminders at intervals of 30 days had been sent. Another bias that should be considered with this study is the reliability of the data collected in this type of research, as pointed out by DeBono, who investigated the use of prophylactic antibiotics by plastic surgeons in the UK [27]. An example of bias that can occur in this type of study is that the surgeons' conduct may vary according to the place of work: surgeons who work both in General Hospitals or University Hospitals, which tend to have strict protocols on the use of antibiotics, and in private clinics, may vary their approach depending on the setting in which they work. However, to the best of our knowledge, this is the first survey regarding the antibiotic prophylaxis followed by the Brazilian plastic surgeons in breast reduction surgery. Further research is needed to establish guidelines on this topic, but these results may stimulate discussion and the development of consensus in the Brazilian plastic surgery field and community.

Conclusion

Most responding Brazilian plastic surgeons affirmed that they prescribe prophylactic antibiotics for more than 24 h in reduction mammaplasty.

Acknowledgements The authors are grateful to the Brazilian Society of Plastic Surgery (SBCP) for its logistical support in carrying out this survey.

Declarations

Conflict of interest The authors declare that they have no conflict of interest. They also state that there is no commercial interest in the subject of this study and that the study had no financial or material support.

Ethical Standards The guidelines of the Declaration of Helsinki were followed. The Institutional Research Ethics Committee approved the study project (CAAE #17507019700005505), and all the participants provided their informed consent via electronic consent forms.

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