medical sciences forum

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Proceeding Paper

Management of Antibiotic Prophylaxis in Mastectomy and Mamoplasty Procedures †

Yahanna da Costa Anacleto Estrela [1], Igor de Sousa Oliveira [1] and Sávio Benvindo Ferreira [2,*]

[1] Medical Student at the Life Sciences Unit, Teacher Training Center (TTC) Campus of the Federal University of Campina Grande, Cajazeiras, Paraíba, Brazil; yahannaestrela@gmail.com (Y.d.C.A.E.); igordesousao1@gmail.com (I.d.S.O.)

[2] PhD in Pharmacology, Professor of Microbiology, Academic Unit of Life Sciences (UACV), Teacher Training Center (CFP), Federal University of Campina Grande (UFCG), Cajazeiras 58900-000, Paraíba, Brazil

* Correspondence: savio.benvindo@professor.ufcg.edu.br

† Presented at the 3rd International Electronic Conference on Antibiotics (ECA 2023), 1–15 December 2023, Available online: https://eca2023.sciforum.net/.

Abstract: Antibiotic prophylaxis is used to prevent infections related to surgery from the administration of antimicrobials before, during and after the procedure. Its practice is mainly recommended in surgeries classified as contaminated or potentially contaminated. Its use should also be considered in clean surgeries in which the occurrence of infections brings serious consequences, such as mastectomy and mammoplasty. Thus, the present study aims to discuss the use of antibiotic prophylaxis in mammoplasty and mastectomy surgeries. This is a narrative literature review, in which the Health Sciences Descriptors (DeCS) "mammoplasty", "mastectomy" and "antibiotic prophylaxis" were used to search the MedLine and LILACS databases, included in the Virtual Library in Health (BVS). It was observed that the occurrence of infections after mammoplasties or mastectomies can cause damage, such as delay in recovery, in adjuvant therapy, loss of the reconstructed breast or impaired cosmesis, when applicable, which corroborates the use of antibiotic prophylaxis in these procedures. Patients are screened for methicillin-resistant (MRSA) and methicillin-sensitive Staphylococcus aureus (MSSA). The main antibiotics used in prophylaxis were cephalosporins (cefazolin, cefadroxil and cefuroxime), isoxazolylpenicillins (flucloxacillin), aminoglycosides (gentamicin) and glycopeptides (vancomycin) in associations. In the studies found, antimicrobial prophylaxis proved to be promising, therefore, the research ratified the importance of using antibiotic prophylaxis in mammoplasty and mastectomy surgeries to prevent infections, also associated with adequate skin preparation practices, with 2% chlorhexidine and 70% isopropyl alcohol.

Keywords: antibiotic prophylaxis; mastectomy; mammoplasty; surgery

Citation: da Costa Anacleto Estrela, Y.; de Sousa Oliveira, I.; Ferreira, S.B. Management of Antibiotic Prophylaxis in Mastectomy and Mamoplasty Procedures. *Med. Sci. Forum* **2023**, *24*, x. https://doi.org/10.3390/xxxxx

Academic Editor(s): Name

Published: 1 December 2023

1. Introduction

Antibiotic prophylaxis is an essential and well-defined strategy for preventing infectious complications related to surgery, promoting a significant improvement in postoperative progress. This strategy consists of administering antimicrobial agent criteria before, during, and after the surgical procedure, aiming to eradicate potential pathogens and reduce the incidence of infections [1,2].

The need and type of antibiotic prophylaxis to be administered are guided by the surgery contamination classification. To this end, criteria are used that address factors such as the area of the body where the surgery will be performed, use of aseptic techniques, existence of violation of the gastrointestinal tract, and whether or not there is extravasation of contents. It is important to note that the criteria may vary slightly according to each hospital service [3,4].

Its administration is particularly recommended in surgeries classified as contaminated or potentially contaminated, in which the presence of microorganisms at the surgical site increases the risk of infection. Furthermore, even in surgeries considered clean, antibiotic prophylaxis should be considered when the possibility of infection leads to serious consequences for the patient, such as mastectomy and mammoplasty [1,5].

From this perspective, mastectomy involves partial or complete removal of the breast, often associated with multiple incisions and potential tissue trauma, which can lead to the introduction of microorganisms into the surgical site. Mammoplasty, in turn, encompasses breast reconstruction or reduction procedures and also presents risks due to tissue manipulation and the creation of spaces conducive to bacterial proliferation [6].

Infectious complications after these surgical procedures cause great harm to the patient. An increase in the patient's hospitalization time and consequent delay in recovery, need for antibiotic therapy, delay in adjuvant oncological therapies, other revision surgeries, impaired cosmesis, unsatisfactory reconstructive result, or loss of the reconstructed breast can be observed, which ratifies the importance of using antibiotic prophylaxis in these procedures [7,8].

Therefore, the need to institute studies on the aforementioned topic is understood. Therefore, the present study aims to discuss the use of antibiotic prophylaxis in mammoplasty and mastectomy surgeries.

2. Materials and Methods

2.1. Characterization of the Research

The present study is qualitative, descriptive, and exploratory. In this sense, the procedure for collecting and analyzing scientific productions chosen was the narrative review, which is a traditional review methodology, which seeks to provide narrative syntheses of studies included by the author according to his perspective, without describing the collection and selection criteria. explicitly [9].

According to the objective of the research, it was guided by the following question: "How is antibiotic prophylaxis performed in mastectomy and mammoplasty procedures and how effective is it?".

2.2. Conducting the Investigation and Selection Criteria

Data collection took place during June 2023 from the MedLine and LILACS databases, accessed through the Virtual Health Library (VHL). To this end, the descriptors used were "mammoplasty", "mastectomy" and "antibiotic prophylaxis", which were associated with the Boolean operators "AND" and "OR".

Furthermore, the criteria for sample selection were publications that explicitly addressed, in their title and summary, the use of antibiotic prophylaxis in mastectomy or mammoplasty surgeries. These publications must meet the inclusion criteria (complete texts, published in English, Spanish, and Portuguese, in the last five years).

The selection of the final study sample occurred based on the individual analysis of each bibliography, correlating the findings to the proposed theme and excluding those that only addressed breast cancer or the use of antibiotic prophylaxis in other plastic surgeries.

2.3. Presentation of Discoveries and Synthesis of Information

After reading the works, the research was developed into a descriptive dissertation, carried out based on the critical analysis of nine articles, with the aim of answering the study's guiding question. We also sought to extract innovative findings for the use of antibiotic prophylaxis in mammoplasty and mastectomy procedures.

The results were compiled by subtopics that lead the discussion of the study, namely: infectious agents in surgical wounds; selection of the prophylactic regimen; and effectiveness of antibiotic prophylaxis.

2.4. Ethical Aspects

There was no need to submit the study to the Research Ethics Committee (CEP), as the research was not carried out on human beings and available public data was used.

3. Results

3.1. Infectious Agents Isolated from Surgical Wounds

Among the studies analyzed, only three mentioned performing cultures on infected wounds. Of these, only the studies by Agarwal et al. and Miller et al. specified the microorganisms found. 22 cultures were performed on surgical infections in the study by Miller et al., separated into groups that received beta-lactams (N = 5) and alternative antibiotics (N = 17). In the group that received beta-lactam, no organism was identified in three cultures (60%), *Pseudomonas aeroguinosa* was identified in 1 culture (20%), and *Klebsiella oxytoca* also in a culture (20%). In patients who received alternative antibiotics, no organisms were identified in 8 cultures (47%), *Pseudomonas aeroguinosa* and methicillin-sensitive *Staphylococcus aureus* were identified in 3 cultures each (17.6%) and, in one culture each (5.8%). %), *Serratia marcescens*, *Proteus mirabilis,* and *Streptococcus agalactiae* were present [7,16,17].

In the study carried out by Agarwal et al., 69 patients had surgical site infection, but culture was performed in only 26 patients (37.68%). The most commonly isolated microorganism was *Staphylococcus* spp., being identified, on average, in 17 (64%) of the cultures. Additionally, two patients (7.7%) had extended-spectrum β-lactamase-producing gram-negative bacilli (ESBL) and two patients (7.7%) had methicillin-resistant *Staphylococcus aureus* (MRSA) [7].

This shows that the choice of antibiotics and the duration of prophylaxis can influence the profile of pathogens present in postoperative infections. In patients who received alternative antibiotics to β-lactams, for example, the presence of MRSA was identified. In this same group, the presence of genera of *Streptococcus* and *Proteus* was also observed, which were sensitive to first-generation cephalosporins [7,16].

It is important to highlight that early treatment of infections observed with broad-spectrum antibiotics may influence the non-identification of other pathogens in infected wounds.

3.2. Selection of the Prophylactic Regimen

All consulted guidelines recommend the use of prophylactic antibiotic agents during mammoplasty and mastectomy surgical procedures. However, a consensus on a single prophylactic regimen has not yet been established [10].

The fundamental principles that guide antimicrobial prophylaxis cover four essential components: the safety of the antimicrobial agent used; the selection of an antibiotic with a narrow spectrum of action for pathogens expected for the procedure (in the case of surgeries considered clean, the scope must include *Staphylococcus* spp.); prior administration of the antibiotic to ensure that concentrations in tissues and the bloodstream reach appropriate levels at the time of incision; and, finally, administration for the shortest period of effect, discontinuing its use when appropriate [11].

Therefore, prophylactic schemes are proposed to avoid infections in these surgical procedures. Guidelines from the National Institute for Clinical Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (2014) recommend the administration of a single dose of prophylactic antibiotics in all surgical procedures considered clean and involving the use of prostheses. However, in clinical practice, there is significant disagreement, with many surgeons choosing to adopt alternative prophylactic approaches involving multiple doses of antibiotics. This can be explained by reports in the literature that show an increase in the adherence of bacteria to the prosthesis and, consequently, an increase in infection rates related to the use of acellular dermal matrices in breast reconstruction procedures [10,12].

The World Health Organization's Surgical Safety Checklist (2009), as well as the guidelines from the American Society of Breast Surgeons (2017) and the American Society of Plastic Surgeons (2021), reinforce the importance of using adequate prophylactic antibiotics before surgery. performing surgeries. However, the choice of the appropriate antibiotic prophylaxis regimen for each procedure is often based on the surgeons' perceptions, which may be influenced by the local prevalence of resistant bacteria and the incidence of surgical site infections (SSI) in the region [7,13–16].

β-lactam antibiotics stand out as the preferred choice as first-line prophylactic agents. However, in situations where allergy to β-lactams is suspected, the use of other agents is recommended, such as clindamycin, belonging to the lincosamide class, or vancomycin, a glycopeptide [16]

This recommendation can be observed in the study conducted by Miller et al., in which an evaluation was carried out on a group of 320 patients undergoing immediate breast reconstruction procedures. Regarding preoperative prophylaxis, cefazolin was the most frequent choice, being administered to 235 patients (73.4%) and followed by the piperacillin-tazobactam association, which was adopted in 53 patients (16.6%). Regarding the prophylaxis of patients allergic to β-lactams (N = 64), clindamycin was the antibiotic of choice for patients allergic to penicillin (N = 47), being selected for 42 patients (89.36%). In a smaller proportion, vancomycin was administered to three patients (6.38%) who were also allergic to penicillin [16].

In the context of post-discharge antibiotic prophylaxis, 303 patients received antibiotic treatment. Cephalexin was the most used agent, prescribed to 265 patients (82.8%), while clindamycin was used in 33 patients (10.3%). Additionally, a small group consisting of 5 patients (1.6%) received other types of antibiotics as part of the prophylaxis strategy [16].

Regarding the standardization of breast surgery practice in the United Kingdom, the Association of Breast Surgery (ABS) and the British Association of Plastic Reconstructive and Aesthetic (BAPRAS) have developed guidelines to standardize medical conduct, practices to prevent infections related to procedures and the provision of quality patient care. To evaluate the adherence of 80 hospital units that perform breast reconstruction surgery to the guidelines proposed by these associations, Mylvaganam et al. showed that, in addition to antibiotic prophylaxis, only 25 units (31%) were screened for methicillin-sensitive *Staphylococcus aureus* (MSSA) before the surgical procedure. However, about the methicillin-resistant strain (MRSA), screening was carried out in 66 units (83%) [13].

It was also observed that preoperative antibiotic prophylaxis was widely used in these units, but the type and duration were variable. Among the sixty units that perform implant reconstruction assisted by biological mesh, the antibiotics used were: amoxicillin-clavulanate (N = 33; 55%), flucloxacillin (N = 6; 10%), flucloxacillin associated with gentamicin (N = 5; 8.3%), amoxicillin-clavulanate in combination with another antibiotic (e.g., gentamicin) (N = 3; 5%), teicoplanin associated with gentamicin (N = 3; 5%), cefuroxime (N = 2; 3, 3%), flucloxacillin associated with ciprofloxacin (N = 1; 1.6%), flucloxacillin associated with teicoplanin (N = 1; 1.6%), teicoplanin alone (N = 1; 1.6%), benzylpenicillin associated with flucloxacillin (N = 1; 1.6%), in addition to benzylpenicillin associated with gentamicin (N = 1; 1.6%). Some units did not specify the antibiotics used (N = 5; 8.3) [17].

Regarding synthetic mesh-assisted reconstruction, 24 units perform the procedure. In these units, the chosen antibiotic prophylaxis was: amoxicillin-clavulanate (N = 13; 54.1%), flucloxacillin in combination with gentamicin (N = 2; 8.3), amoxicillin and clavulanate in combination with another antibiotic (for example, gentamicin) (N = 2; 8.3%), teicoplanin associated with gentamicin (N = 2; 8.3%), teicoplanin alone (N = 1; 4.1%), flucloxacillin, metronidazole or gentamicin (N = 1; 4.1%). For this type of surgery, only one unit (N = 1; 4.1) stated that the choice of antibiotic was surgeon-dependent [17].

In Brazil, a study carried out by Kuhnen et al., using a questionnaire applied to 859 members of the Brazilian Society of Plastic Surgery (SBCP), identified the antibiotics most used in practice. During the hospital stay, including the preoperative period, the

antibiotics of choice were: cefazolin (N = 816; 95%), ciprofloxacin (N = 10; 1.2%), ceftriaxone (N = 5; 0.6%) and cefuroxime (N = 2; 0.2%). Surgeons who use other antibiotics accounted for 1.4% of members, and 1.6% of those who did not use any type [11].

Regarding antibiotics administered after hospital discharge, 199 (N = 23.2%) surgeons stated that they did not perform postoperative prophylaxis. The other 660 surgeons undergo prolonged prophylaxis, with the antibiotics chosen being: cefadroxil (N = 363; 42.3%), cephalexin (N = 216; 25.1%), ciprofloxacin (N = 31; 3.6%), amoxicillin (N = 11; 1.3%), azithromycin (N = 9; 1.0%), cefuroxime (N = 9; 1.0%) and 21 (2.4%) surgeons reported using other antibiotics [11].

It was observed that prolonged antibiotic prophylaxis can lead to intense bacterial selection, which consequently reduces therapeutic options in case of infection. Therefore, the importance of choosing the appropriate antibiotic prophylaxis regimen is confirmed, to contribute to reducing the number of infections that progress to failed reconstruction or complications that harm mastectomized patients.

3.3. Effectiveness of Antibiotic Prophylaxis

Regarding the outcomes of antibiotic prophylaxis regimens, Mazari et al. evaluated regimens used in 105 patients. To this end, the prophylaxis time and the number of breasts that would be reconstructed were taken into account, without informing the agents used. Regarding the type of regimen, patients were divided into four groups, namely: patients who received a single dose (group 1: 20; 16.4%), who received three doses (group 2: 19; 15.6%), who used prophylaxis for five to seven days (group 3: 51; 41.8%) and those who received antibiotic prophylaxis until the drain was removed (group 4: 32; 26.2%) [10].

Comparative analysis between groups revealed no significant differences in infection-related outcomes. In group 1, four patients (20%) developed wound infection, and one patient (5.0%) experienced implant loss due to infection. In group 2, five patients (26.3%) had an infection and three patients (15.8%) suffered implant loss due to infection. In group 3, seven patients (13.7%) had an infection and three patients (5.9%) had implant loss due to infection. Finally, group 4 had three patients (9.4%) with infection and two patients (6.2%) with infection-related implant loss [10].

The findings of this study suggest that the duration of antibiotic prophylaxis does not appear to have a substantial influence on infection outcomes in patients undergoing breast reconstruction. However, it is important to consider that the absence of major differences in outcomes may be due to several factors, including the heterogeneity of the study population, variation in the antimicrobial agents used, and adherence to asepsis and infection control practices [10].

In the study conducted by Miller et al., an analysis of the effectiveness of alternative antibiotics to β-lactams was carried out. The results of this study revealed that patients who did not receive β-lactam antibiotics had an association with unfavorable outcomes when compared to patients who received β-lactams. A 2.1-fold increase in the chances of developing a postoperative infection was observed in patients who used alternative antibiotics. In addition, there was also a 3.2-fold increase in the chances of having an infection that required surgical intervention and the probability of reconstruction failure was 2.7 times greater in these patients [16].

The study carried out by Phillips et al. investigated the effects of the duration of antibiotic prophylaxis in patients undergoing breast reconstruction using acellular dermal matrix (ADM). In total, 112 patients were included and randomized into two groups: a group with antibiotic prophylaxis for 24 h (62 patients) and a group with prolonged antibiotic prophylaxis until drain removal (50 patients). In the 24-h group, twelve patients (19.35%) developed surgical site infection, while in the prolonged group, eleven patients (22%) presented this complication. Regarding the need for intravenous antibiotics, in the group with prolonged antibiotic prophylaxis, seven patients (14%) used intravenous antibiotic prophylaxis due to complications, and there was a global loss of the implant in all

of them. In the 24-h group, four patients (6.45%) required intravenous antibiotics, and three (75%) of them had the implant removed [8].

The study also revealed an interesting distinction between the types of infection in the two treatment groups. In the group that received antibiotic prophylaxis for 24 h, the majority of infections were classified as superficial infections. On the other hand, in the group that received extended antibiotic prophylaxis, the majority of infections were categorized as deep infections. From this, it can be suggested that the prolonged duration of antibiotic therapy may be associated with a delay in the manifestation of symptoms of these infections or the search for appropriate treatment [8].

This situation can be considered an adverse outcome, considering that deep infections can have a more significant impact on the patient's health, requiring more complex interventions that can lead to more serious complications.

4. Conclusions

Antibiotic prophylaxis is an effective measure to significantly reduce the infection rate in mammoplasty and mastectomy surgeries. Among the antibiotics chosen as the first line, β-lactams stand out as the main choice and most effective. In cases of impossibility of use, clindamycin and vancomycin were recommended as alternative antibiotics.

Regarding the dose of antibiotics, guidelines support the use of a single dose of antibiotic prophylaxis, although there is disagreement in clinical practice. The approach to each patient must be individualized, taking into account factors such as the type of infection, the patient's profile, and possible adverse outcomes.

Therefore, the use of a collaborative approach between surgeons, infectious disease specialists, and other healthcare professionals is essential to ensure the appropriate choice of antibiotics, the duration of prophylaxis, and adequate postoperative monitoring. Treatment must be based on solid and up-to-date scientific evidence, adapted to the individual characteristics of each patient and the local reality.

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