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Surgical Site Infection Rate in Dermatologic Surgery and Associated Risk Factors: Single-Center Analysis

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1. Introduction

Less than 5% of dermatological surgeries reported in the literature have adverse effects that lead to infection, considered the most common complication in this type of surgery. Although uncommon, surgical site infections have a high impact on the hospitalization time and on the financial costs related to postoperative complications [1].

It is already established that the indiscriminate use of antibiotic therapy increases the risk of multiresistant bacteria [2], not being indicated in the absence of infection or inflammation of the skin and in non-contaminated wounds [3,4].

Usual skin preparation of the surgical site, guideline-based hand hygiene, and aseptic surgical techniques are by consensus what actually reduces the chance of surgical site contamination as a cause of surgical wound infections [6]. Use of wound infection prophylaxis in dermatological surgery varies greatly among surgeons, with some studies reporting the indiscriminate use of antibiotics. In general, antibiotics are not indicated in the absence of skin infection or inflammation and in uncontaminated wounds [3-5]. Even so, there are situations in dermatological surgery in which the rates of surgical wound infection are higher, and these should be observed [7-11]. Oral antibiotic prophylaxis for high-risk populations may be indicated to prevent serious adverse events, such as infective endocarditis of prosthetic joint infection, in consensus between the American Heart Association (AHA) and the American Academy of Orthopedic Surgeons (AAOS) [12-14]. Even today, there is a lack of studies that standardize prophylactic antibiotic treatment, peri- and postoperatively, in addition to a defined indication and duration of treatment. Therefore, this study aimed to evaluate the rate of surgical site infection in dermatological surgery, characterizing the incidence of infection by risk factors. Our findings may contribute to the identification of common

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factors associated with the incidence of surgical wound infection. Furthermore, our results will be relevant to the establishment of new guidelines used for the prevention of postoperative complications in dermatological surgery.

2. Objective

To analyze the rate of operative site infection in dermatological surgery, since it is considered a clean surgery, with data from the literature that estimate rates of 1%-3% of post-surgical infection. Evaluate the indication of antibiotic prophylaxis in dermatological surgery and whether there are risk factors such as patient age, location of the lesion, histological type or comorbidities that may be indicative of poor prognosis, thus indicating antibiotic prophylaxis.

3. Methodology

In order to identify and characterize the incidence of surgical wound infection after dermatological surgery, we will carry out a prospective evaluation of patients undergoing surgeries for the treatment of skin tumors, at the Dermatology Service of Santa Casa de Misericórdia de Porto Alegre between July 2017 and December 2020, performed by resident physicians under the supervision of a dermatological surgeon. A total of 489 patients (separate how many men x how many women), with a mean age of 66.5 years were included in the study, which had as exclusion criteria patients with incomplete data (e.g. information on location of the lesion, type of reconstruction or comorbidities), loss to follow-up or lesions treated by non-surgical methods such as cryotherapy or electrocoagulation, imiquimod or topical 5-fluorouracil, simple curettage or incisional skin biopsies. Based on the profile of the tertiary care service, the referred cases were predominantly of medium or high complexity, with small lesions or lesions in an extrafacial location, being referred to another sector for surgical treatment.

The infection criteria were evaluated by the team with standard medical records: hematic crusts, meliceric crusts, erythema, purulent secretion, hyaline secretion, phlogistic signs, collection and, without clinical infectious signs - no bacteriological samples were taken.

Classified as:

- <2 criteria: No infectious signs, if only hematic crusts or erythema were found in isolation;
- 2 criteria, one of which is purulent discharge or meliceric crust=superficial infection;
- >2 criteria being a collection or phlogistic sign=deep infection.

Variables were calculated using the chi-square test ($\chi 2$). The outcome was calculated by ANOVA test. The rate of risk of infection in relation to age was calculated using the odds ratio. And the program used was SPSS.

4. Results

In our study, we used the follow-up of 489 patients included from May 2017 to December 2020, with a mean age of 66.5 years. The face was the location of 88.9% of the excisions in the sample. The total infection rate including superficial and deep

infection criteria was 9.5% (TABLE 1), odds ratio=1.018 (95% CI 0.992-1.045). Still, according to the analysis, 90.5% of the sample did not present any infection criteria.

Primary reconstruction was performed in 49.6% of the sample, with complex reconstructions such as grafts (8.2%) and flaps (36.3%) accounting for a total of 44.5% of cases. Prophylactic antibiotic therapy was instituted in only 1.6% of the sample (8 patients). Factors associated with infection (>2criteria) are demonstrated in TABLE 2, as we see in the literature, age is an important factor for the risk of infection. In this study, every 10 years there was a higher risk of developing infection, but without statistical relevance. The retails closure increases the risk by 2.4 times.

TABLE 1. **Frequency of variables studied in the study.**

Variables		Freq	%
Age(n=487)	media DP	66,5	12,6
return review days (n=458)	median [IQR]	7	[7-14]
Hypertension	S	261	54,5%
	N	218	45,5%
	uninformed	10	2,045%
Diabetes	S	81	16,9%
	N	398	83,1%
	uninformed	10	2,045%
Smoking	S	75	15,7%
	N	403	84,3%
	uninformed	11	2,25%
Other comorbidities	S	185	38,6%
	N	294	61,4%
	uninformed	10	2,045%
type of tumor	Basal Cell Carcinoma (BCC)	367	75,7%
	Squamous cell carcinoma (SCC)	71	14,6%
	MM	22	4,5%
	Other	25	5,2%
	uninformed	4	0,818%
Localization	face	433	88,9%
	extra facial	54	11,1%
	uninformed	2	0,40%
Profilatic ATB	1.0	8	1,6%
	2.0	480	98,4%
	uninformed	1	0,20%
Reconstruction	primary reconstruction	235	49,6%

	grafting	39	8,2%
	retail	172	36,3%
	second intention closure flap	28	5,9%
	uninformed	15	3,06%
outcome	1=no infection=<2 criteria	427	90,5%
	2=isuperficial infection=2 criteria	20	4,2%
	3=more than two criteria, one of which is collection/phlogistic signs	25	5,3%
	uninformed	17	3,47%

TABLE 2. **Factors associated with infection (>2criteria).**

Factors associated with infection (>2criteria)				
	p-valor	OR	IC95%	
Age	0,176	1,02	0,99	1,05
Age (every 10 years)	0,176	1,20	0,92	1,55
Return revision days (every day)	**0,019**	**0,91**	**0,84**	**0,98**
Hypertension (ref. Absent)	0,430	1,29	0,69	2,41
Diabetes (ref. Absent)	0,582	1,24	0,57	2,70
Smoking (ref. Absent)	0,200	1,64	0,77	3,47
Other comorbities (ref. Absent)	0,124	1,62	0,88	3,01
Type CEC (ref: CBC)	0,078	1,95	0,93	4,09
Type MM (ref: CBC)	0,394	1,74	0,49	6,24
Others (ref: CBC)	---			
Localization face (ref: Extra facial)	0,629	1,30	0,45	3,79
Profilatic ATB (ref: Absent)	**0,016**	**6,01**	**1,39**	**26,05**
grafting (ref: primary)	0,432	1,59	0,50	5,08
retail (ref: primary)	**0,010**	**2,42**	**1,23**	**4,75**
second intention closure flap (ref: primary)	0,554	0,54	0,07	4,23

The highest infection rates were found in skin flaps and grafts (TABLE 3). Analyzing only the infection outcome in primary reconstructions, we observed 93.3% of the sample without infection, 2.6% with signs of superficial infection and 3.6% of deep infection (p>0.05). Of the cases treated with skin graft reconstruction, 89.7% had no infection, 2.6% had superficial infection criteria and 7.7% had signs of deep infection. In skin flaps, the rates were 85.2%, 6.5% and 8.3% respectively. As for closures by secondary intention, 96.3% did not show signs of infection, 3.7% had superficial infection and no case of deep infection, with p>0.05 in all the analyzes described above.

TABLE 3. **Outcome in relation to the variables considered in the study.**

		Outcome						
		No Infection		**Superficial infection**		**>2 criteria, one of which is collection/phlogistic signs**		
		Count	%	Count	%	Count	%	p-value
Age	Media DP	66,46	12,56	70,60	10,86	67,96	14,58	0,315
Review Days	median [IQR]	7	[7-14]	7	[7-14]	7	[7-7]	0,001
Hypertension	S	225	89,3%	11	4,4%	16	6,3%	0,611
	N	193	91,5%	9	4,3%	9	4,3%	
Diabetes	S	70	88,6%	5	6,3%	4	5,1%	0,625
	N	348	90,6%	15	3,9%	21	5,5%	
Smoking	S	62	86,1%	4	5,6%	6	8,3%	0,406
	N	355	91,0%	16	4,1%	19	4,9%	
Other comorbities	S	155	87,6%	11	6,2%	11	6,2%	0,227
	N	263	92,0%	9	3,1%	14	4,9%	
Type of tumor	CBC	324	91,3%	13	3,7%	18	5,1%	0,280
	CEC	59	84,3%	6	8,6%	5	7,1%	
	MM	18	85,7%	1	4,8%	2	9,5%	
	Outros	24	100,0%	0	0,0%	0	0,0%	
Localization	face	378	90,2%	18	4,3%	23	5,5%	0,869
	extra facial	48	92,3%	2	3,8%	2	3,8%	
Profilatic ATB	1.0	5	62,5%	2	25,0%	1	12,5%	0,008
	2.0	421	90,9%	18	3,9%	24	5,2%	
Reconstruction	Primary	209	93,3%	7	3,1%	8	3,6%	0,148
	Grafting	35	89,7%	1	2,6%	3	7,7%	
	Retail	144	85,2%	11	6,5%	14	8,3%	
	Second Intention Closure	26	96,3%	1	3,7%	0	0,0%	

As for the comorbidities analyzed in this study, none was statistically relevant in terms of surgical site infection. The infection criterion was analyzed postoperatively by resident physicians who alternated during the study period (with the responsible preceptor present). No cultural analysis of the operative site was performed, and no patient presented surgical complications that resulted in hospitalization or some serious outcome, such as permanent deformity or death.

5. Discussion

Dermatologists prescribe more courses of oral antibiotics than any other specialty, and in addition to clinical use, they also use them perioperatively and postoperatively to prevent surgical complications [1]. The risk of surgical site infections resulting from dermatological procedures is low [1,3,4], which is why it is important to have defined criteria that justify the use of antibiotic prophylaxis in dermatological surgeries, in order to optimize results and reduce risks, including in inducing bacterial resistance.

The Centers for Disease Control (CDC) defined surgical site infection (SSI) when meeting at least one of four characteristics: purulent drainage, positive wound culture, clinical criteria, or diagnosis by the surgeon or attending physician. However, this definition is rarely used in the literature [1-4,6]. A meta-analysis by Hanly et al [7] reviewed the criteria used in the literature and these varied widely between studies: one study used the full CDC criteria to define surgical site infection, seven studies required a positive wound culture, seventeen studies used criteria alone as sufficient to diagnose (SSI) and eight studies did not define their criteria for SSI [7]. In this analysis, only clinical criteria were used to define SSI. The lack of a consensus on the definition of operative site infection makes the true prevalence unknown, hindering the development of infection control guidelines.

Published data on postoperative infections in skin surgery suggest that the majority are caused by Staphylococcus aureus, the resident flora of the skin, and the flora present on mucosal surfaces. In this context, appropriate local antiseptics belong to one of the most effective prophylactic measures against postoperative skin infections [1].

In the review of similar articles evaluating only dermatological surgeries, infection rates >5% were found in grafts (8.7%), wide ear or lip incisions (8.57%), in addition to resections in anatomical locations such as below the knee (6.92%) and groin (10%) (2.3). Another study demonstrated rates of 5% in the auricular region and 6.5% in the nasal region, with a threefold increase in the risk of infection for complex surgery to excise skin cancer from the nose and ears compared to any other site on the face [8].

Single-dose antibiotics in the perioperative period may help to reduce the risk of surgical site infection in cases with a higher risk estimated preoperatively [3,5].

The infection rates found in our study were 9.5%, including superficial and deep infections. In most of the series of cases analyzed, the division between superficial and deep infections differs, in one of them [3] only deep infections, with purulent secretion, edema, abscess, infectious necrosis, lymphadenopathy, cellulitis or septicemia were considered. When evaluating

only deep infection criteria (>2 criteria being a collection or phlogistic sign), the rate found was 5.3%, similar to some studies evaluated in our review.

In this series of cases, complex surgeries, being reconstructions and flaps constituting 44.5% of the sample, show lesions being skin tumors on the face performed by residents under supervision. Simple procedures such as biopsies, electrosurgery, cryotherapy and curettage were not included in this sample, only excisions and enlargement of margins.

Several prospective studies [1,3-6] of head and neck procedures, including those that disrupt the mucosa, have not identified increased efficacy between 24 hour and longer (3 to 7 day) regimens. In addition, a 2008 advisory statement [9] on antibiotic prophylaxis recommends single-dose perioperative antibiotics for patients at increased risk of surgical site infection.

Our study sought to identify risk factors related to higher rates of postoperative infection, and as a consequence, to identify in which patients prophylactic antibiotic therapy is indicated, establishing rules for the rational use of antibacterial prophylaxis in skin surgery.

6. Conclusion

In our study, the face was the location of 88.9% of the excisions in the sample, according to the profile of the tertiary referral service for medium or highly complex injuries, the findings are compatible with other studies when analyzing groups of patients with a similar profile [3]. The total infection rate, including superficial and deep infection criteria, was 9.5% (TABLE 1), odds ratio=1.018 (95%CI 0.992-1.045). Also, according to the analysis, 90.5% of the sample did not present any infection criteria, consistent with the evaluated studies [3,5,10].

Primary reconstruction was performed in 49.6% of the sample, with complex reconstructions such as grafts (8.2%) and flaps (36.3%) accounting for a total of 44.5% of cases. Prophylactic antibiotic therapy was instituted in only 1.6% of the sample (8 patients) (in cases of potentially contaminated lesions or mucosal invasion). The highest infection rates were found in skin flaps and grafts (TABLE 2). Analyzing only the outcome of infection in primary reconstructions, we observed 93.3% of the sample without infection, 2.6% with signs of superficial infection and 3.6% of deep infection ($p>0.05$). Regarding the cases treated with skin graft reconstruction, 89.7% had no infection, 2.6% with superficial infection criteria and 7.7% with signs of deep infection. In skin flaps, the rates were 85.2%, 6.5% and 8.3% respectively. As for closures by secondary intention, 96.3% did not show signs of infection, 3.7% had superficial infection and no case of deep infection, with $p>0.05$ in all the analyzes described above. Comparison with studies carried out in other centers demonstrates similarities in relation to the general incidence of infections, especially when evaluating tumors located on the face, skin grafts and flaps [3,10], however, unlike some studies, patients treated with curettage were not included [3], in addition to having a low prevalence of lesions in the trunk or limbs, due to the characteristics of the reference center, surgeries performed by residents under supervision are factors that can increase the rates of contamination of the surgical bed. Another hypothesis for a global infection rate above 9% may be related to the inclusion of superficial infection in our analysis, which does not occur in some studies. As for the population served, we observed cases of lack of hygiene in several cases in postoperative care, despite written and verbal guidelines on dressings and cleaning the surgical wound, a factor that can influence the risk of surgical contamination.

As for the comorbidities analyzed in this study, none was statistically relevant in terms of surgical site infection.

The infection criterion was analyzed postoperatively by resident physicians who alternated during the study period (with the responsible preceptor present). No surgical site cultural analysis was performed, and no patient had surgical complications that resulted in hospitalization or any serious outcome, such as permanent deformity or death.

Considering the lack of protocols regarding antibioprophylaxis in dermatological surgery, these data may contribute to the creation of a protocol at the institution, which may be extended to other centers.

REFERENCES

1. Kulichová D, Geimer T, Mühlstädt M, et al. Surgical site infections in skin surgery: a single center experience. J Dermatol. 2013;40(10):779-85.
2. Barbieri, John S., et al. Trends in oral antibiotic prescription in dermatology, 2008 to 2016. JAMA Dermatol. 2019;155(3):290-7.
3. Dixon AJ, Dixon MP, Askew DA, et al. Prospective study of wound infections in dermatologic surgery in the absence of prophylactic antibiotics. Dermatol Surg. 2006;32(6):819-27.
4. Rosengren H, Dixon A. Antibacterial prophylaxis in dermatologic surgery: an evidence-based review. Am J Clin Dermatol. 2010;11(1):35-44
5. Dixon AJ, Dixon MP, AskewDA, et al. Prospective study of wound infections in dermatologic surgery in the absence of prophylactic antibiotics. Dermatol Surg. 2006;32(6):819-26; discussion 826-7.
6. Johnson-Jahangir H, Agrawal N. Perioperative Antibiotic Use in Cutaneous Surgery. Dermatol Clin. 2019;37(3):329-40.
7. Hanly AM, Daniel VT, Mahmoud BH. Controversies in Defining a Surgical Site Infection Following Mohs Micrographic Surgery: A Literature Review. J Am Acad Dermatol. 2021;84(6):1719-20.
8. Sylaidis P, Wood S, Murray DS. Postoperative infection following clean facial surgery. Ann Plast Surg. 1997;39(4):342-6.
9. Wright TI, Baddour LM, Berbari EF, et al. Antibiotic prophylaxis in dermatologic surgery: advisory statement 2008. J Am Acad Dermatol. 2008;59(3):464-73.
10. Heal C, Buettner P, Browning S. Risk factors for wound infection after minor surgery in general practice. Med J Aust. 2006;185(5):255-8
11. Levin EC, Chow C, Makhzoumi Z, et al. Association of Postoperative Antibiotics With Surgical Site Infection in Mohs Micrographic Surgery. Dermatol Surg. 2019;45(1):52-7.
12. American Academy of Orthopedic Surgeons. Appropriate use criteria for the management of patients with orthopaedic implants undergoing dental procedures. Rosemont (IL): American Academy of Orthopaedic Surgeons; 2018. Available at: https://www.aaos.org/uploadedFiles/PreProduction/Quality/AUCs_and_Performance_Measures/appropriate_use/auc-patients-with-orthopaedic-implants-dental- procedures.pdf. Accessed August 8, 2018.

13. American Academy of Orthopaedic Surgeons. Systematic literature review on the management of surgical site infections. 2018. Available at: https:// www.aaos.org/ssi. Accessed August 8, 2018.
14. Infective Endocarditis. American Heart Association. Available at: https://www.heart.org/en/health-topics/ infective-endocarditis. Accessed August 8, 2018.