

Complications in Dermatologic Surgery: A Case Series Study

Complicações na Cirurgia Dermatológica: Estudo de Série de Casos

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ABSTRACT

Introduction: Dermatologic surgery is widely used in the treatment of cutaneous neoplasms, but early and late complications remain underreported despite their functional and aesthetic impact.

Objective: To analyze complications in dermatologic surgery and their correlation with the repair technique, anatomical location, and tumor subtype.

Methods: A retrospective study of 107 lesions from 86 patients who underwent resection of skin tumors under local anesthesia between May 2023 and March 2024. Clinical, histological, and technical variables were assessed. Early complications (≤ 4 weeks) and late complications (1-6 months) were analyzed using SPSS v.29 ($p < 0.05$).

Results: Mean patient age was 73.3 years, and 57% were women. Most lesions were located on the face (69.2%), and basal cell carcinoma was the most frequent subtype (64.5%). Primary closure was performed in 49.5% of cases, and flaps in 44.9%. Early complications occurred in 42.1%, mainly dehiscence; late complications occurred in 13.1%, predominantly unaesthetic scars. Flaps had higher rates of early (53.7% vs. 30.2%) and late complications (25.9% vs. 1.9%). Lower-limb lesions showed a high complication rate. Early complications strongly correlated with late events (33.3% vs. 2.1%).

Conclusions: Complications are frequent and influenced by technique and location. Complex techniques and early events increase the risk of late outcomes.

Keywords: Dermatology; Skin Neoplasms; Surgical Flaps; Medical Oncology; Postoperative Complications

RESUMO

Introdução: A cirurgia dermatológica é amplamente utilizada no tratamento de neoplasias cutâneas, mas complicações precoces e tardias seguem pouco relatadas, apesar do impacto funcional e estético.

Objetivo: Analisar complicações na cirurgia dermatológica, correlacionando-as com a técnica utilizada no reparo, a localização anatômica e o subtipo do tumor.

Métodos: Estudo retrospectivo com 107 lesões de 86 pacientes submetidos à exérese de tumores cutâneos sob anestesia local entre maio de 2023 e março de 2024. Variáveis clínicas, histológicas e técnicas foram avaliadas. Complicações precoces (≤ 4 semanas) e tardias (1-6 meses) foram analisadas (SPSS v.29; $p < 0,05$).

Resultados: A média de idade foi 73,3 anos, com 57% de mulheres. A face concentrou a maioria das lesões (69,2%) e o carcinoma basocelular foi o subtipo mais frequente (64,5%). O fechamento primário foi utilizado em 49,5% dos casos e retalhos em 44,9%. Complicações precoces ocorreram em 42,1%, sobretudo deiscências, e tardias em 13,1%, principalmente cicatrizes inestéticas. Retalhos apresentaram mais complicações precoces (53,7% vs. 30,2%) e tardias (25,9% vs. 1,9%). Lesões em membros inferiores tiveram alta taxa de eventos. Complicações precoces mostraram forte associação com intercorrências tardias (33,3% vs. 2,1%).

Conclusões: Complicações são frequentes e influenciadas pela técnica e localização. Técnicas complexas e eventos precoces aumentam o risco de desfechos tardios.

Palavras-chave: Dermatologia; Neoplasias Cutâneas; Retalhos Cirúrgicos; Oncologia; Complicações Pós-Operatórias

Original Article

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INTRODUCTION

Skin cancer is the most common malignant neoplasm worldwide, arising primarily from cumulative exposure to ultraviolet (UV) radiation.¹⁻³

Skin cancers are classified into melanoma and non-melanoma skin cancer (NMSC), the latter consisting primarily of basal cell carcinoma (BCC) and cutaneous squamous cell carcinoma (SCC), which together account for the majority of cases.⁴

Outpatient dermatologic surgery performed under local anesthesia is widely adopted and recognized for its safety and efficacy.⁵⁻⁸

Multicenter studies have reported complication rates ranging from 1.6% to 12.7%, depending on procedure complexity, anatomical location, and patient risk factors.^{5-6,9}

The most frequent complications include wound dehiscence (3.3%), surgical site infection (2.9%–8.7%), hematoma, and bleeding.^{5-6,10}

Wound dehiscence represents an important complication resulting from the interaction between mechanical factors (such as excessive tension, inadequate closure technique, and inappropriate undermining) and physiological factors, including local vascularization, comorbidities, and characteristics of the excised tumor.^{6,11,12}

Anatomical location plays a key role in determining the risk of complications. The risk of infection and overall complications in the lower limbs is up to three times higher due to reduced tissue perfusion, increased skin tension, and impaired lymphatic drainage.¹³⁻¹⁵ In contrast, the trunk exhibits the lowest complication rates, benefiting from better vascularization and reduced mobility.^{5,14} The face, although frequently subjected to complex reconstructions, has intermediate outcomes.^{10,16}

The size of the surgical defect constitutes an independent risk factor for complications. Defects larger than 10 mm are associated with a 1.52-fold higher risk of complications, whereas defects exceeding 10 cm² increase the risk of infection by 3.64-fold.^{5,13,15}

Tumor type also influences the risk of complications, with invasive and in situ SCC carrying a 2.96-fold greater risk of infection compared with other skin neoplasms.^{13,17,18}

Appropriate surgical techniques are essential for minimizing complications. Proper undermining can reduce closure tension by as much as 83%–92%, making it essential in closure under tension.¹⁹⁻²² Deep-layer suturing is responsible for most of the approximation and eversion of wound edges, significantly reducing tension on the epidermal suture and the risk of wound dehiscence.²³⁻²⁶

Patient-related factors also influence surgical outcomes. Advanced age is associated with impaired wound healing due to changes in skin composition and thickness, reduced microcirculation, and compromised immune response.²⁷⁻³² Immunosuppression and male sex, in turn, are risk factors for surgical site infection.^{13,33,34}

Prolonged operative time (≥ 38 minutes) is also associated with an increased risk of complications, possibly reflecting procedural complexity.⁵

There is a strong correlation between early and late complications. Patients who develop complications in the immediate postoperative period are significantly more likely to develop long-term sequelae, such as hypertrophic scars, retractions, and functional impairment, highlighting the importance of rigorous early management of these complications to prevent their progression into chronic conditions.^{10,35}

Given this context, the present study aimed to analyze postoperative complications, tumor control, functional preservation, and aesthetic outcomes in patients undergoing skin cancer resection, considering different reconstructive techniques and anatomical regions, based on data obtained from the outpatient Dermatology Department of a university hospital.

METHODS

A retrospective observational study was conducted using medical record data and image analyses from the database of the Dermatology Department of a university hospital. Patients who underwent skin cancer resection followed by reconstruction in a single surgical time, on an outpatient basis and under local anesthesia, between May 10, 2023, and March 27, 2024, were selected.

Patients of all age groups and both sexes were included, provided they had complete surgical records, including details regarding the surgical techniques used and the body areas affected, and attended follow-up evaluations during the 6 months following surgery.

Early complications, such as wound dehiscence, hematoma, infection, necrosis, and bleeding, were monitored during the first 4 weeks after the procedure. Late complications, assessed during the 6-month follow-up period, included abnormal wound healing (hypertrophic, incomplete, or keloid scars), aesthetic alterations (facial or body asymmetry, changes in skin texture, or loss of function), and altered sensitivity.

The data were organized in an Excel® spreadsheet and analyzed using IBM SPSS Statistics v.29.0 (Armonk, NY: IBM Corp.). Age data were described using means, standard deviations, medians, minimums, and maximums. Frequencies and percentages were presented for categorical variables. Associations between two categorical variables were assessed using Fisher's exact test or the chi-square test. A p -value < 0.05 was considered statistically significant (Figure 1).

RESULTS

A total of 107 lesions from 86 patients who underwent outpatient dermatologic surgery for resection of skin neoplasms were analyzed. Most participants (81.4%) had only one lesion, while a single patient had four lesions treated during the study period.

Mean age at the time of surgery was 73.3 years (range: 40–94 years), with a predominance of individuals older than 60 years (91.9%). There was a slight predominance of female patients, accounting for 57% of participants.



FIGURE 1: Postoperative infection and necrosis of scalp flap



FIGURE 2: Postoperative hematoma of periocular flap

Regarding the reconstructive techniques employed, primary closure was the most commonly used, being performed in 49.5% of lesions (53 cases). Skin flaps were used in 44.9% of cases (48 lesions), whereas skin grafts were employed in 3.7%

(4 lesions). Two reconstructions involved a combination of techniques, including a flap associated with a graft or healing by secondary intention.

The anatomical distribution of lesions showed a predominance of facial involvement, with 74 cases (69.2%), followed by the trunk (10.3%), hands (5.6%), and lower limbs (4.7%). Other locations included the scalp, upper limbs, and cervical region, each accounting for less than 4% of cases.

From a histopathological perspective, BCC was the most prevalent tumor type, diagnosed in 69 cases (64.5%), followed by SCC in 26 cases (24.3%). Melanoma was identified in 6 cases (5.6%). Collision tumors (BCC + SCC) accounted for 2.8% of cases, while basosquamous carcinoma, sebaceous carcinoma, and eccrine spiradenoma accounted for one case each.

Positive surgical margins were observed in 7.5% of lesions. Among these, two lesions showed simultaneous involvement of both deep and lateral margins, whereas three had isolated lateral margin involvement and three had isolated deep margin involvement.

Early complications

Early complications occurred in 42.1% of lesions (45 cases). Wound dehiscence was the most frequent complication, occurring in 25.2% of cases, followed by hematomas (16.8%) and infections (9.3%). Bleeding was the least frequent complication, occurring in only 3.7% of lesions (Figure 2).

Early complications showed a variable distribution, depending on the surgical technique employed. Flaps presented the highest rate of complications (54.2%), followed by grafts (50.0%), whereas primary closure had the lowest rate (30.2%). When techniques were grouped into primary closures and complex closures (flaps, grafts, and combined techniques), the rate of early complications was 30.2% for primary closures compared with 53.7% for complex closures. This difference was statistically significant ($p = 0.019$) (Table 1).

Regarding anatomical location, lower limbs exhibited complications in 100% of treated lesions, whereas the trunk showed the lowest rate of early complications (18.2%) (Table 1).

Among tumor subtypes, BCC was most frequently associated with early complications (44.9%), followed by SCC (38.5%) and melanoma (16.7%). However, comparison among these variables did not find a statistically significant association ($p = 0.376$) (Table 1).

Late complications

Late complications were less frequent, occurring in 14.0% of lesions (15 cases). Among these, abnormal scarring was the most common outcome (46.7%), followed by aesthetic complications (40.0%) and altered sensitivity (6.7%).

Late complications also showed statistically significant differences among the techniques used ($p < 0.001$), with rates of 25.9% for complex closures compared with 1.9% for primary closures. Among reconstructive techniques, flaps continued to

Table 1: Lesion with early complication (n = 107)

Variable	Classification	Total	Early complication				p*
			No		Yes		
			N	%	N	%	
Technique (n = 107)	Primary closure	53	37	69.8%	16	30.2%	0.019
	Flap	48	22	45.8%	26	54.2%	
	Combined closure (flap + graft)	1	0	0%	1	100%	
	Combined closure (flap + secondary intention)	1	1	100%	0	0%	
Technique (n = 107)	Primary closure	53	37	69.8%	16	30.2%	
	Complex closure	54	25	46.3%	29	53.7%	
Area (n = 107)	Face	74	42	56.8%	32	43.2%	
	Squamous cell carcinoma	26	16	61.5%	10	38.5%	
	Melanoma	6	5	83.3%	1	16.7%	
	Basal cell carcinoma + squamous cell carcinoma	3	1	33.3%	2	66.7%	
	Basosquamous carcinoma	1	0	0%	1	100%	
	Sebaceous carcinoma	1	1	100%	0	0%	
	Eccrine spiradenoma	1	1	100%	0	0%	
Pathology (n = 107) (3 most frequent classifications)	Basal cell carcinoma	69	38	55.1%	31	44.9%	0.376
	Squamous cell carcinoma	26	16	61.5%	10	38.5%	
	Melanoma	6	5	83.3%	1	16.7%	

* Fisher's exact test or chi-square test, $p < 0.05$

exhibit the highest prevalence of late complications (27.1%), followed by grafts (25.0%) (Table 2).

Regarding anatomical location, the lower limbs again stood out, with a 100% rate of late complications. In contrast, the scalp, upper limbs, and cervical region showed no late complications (Table 2).

Among tumor subtypes, although the difference was not statistically significant ($p = 0.396$), melanoma had the highest rate of late complications (33.3%), followed by BCC (14.5%) and SCC (11.5%) (Table 2).

Furthermore, patients who experienced early complications were more likely to develop late complications (33.3%) than those without early complications (2.1%), and this difference was statistically significant ($p < 0.001$) (Table 3).

DISCUSSION

This study reinforces the safety and effectiveness of outpatient dermatological procedures for the treatment of skin neoplasms while identifying critical factors associated with the development of postoperative complications.

The demographic profile observed, with 91.9% of patients older than 60 years and a slight female predominance (57%), is consistent with the global epidemiological pattern of skin cancers, which predominantly affect older individuals due to the cumulative effects of sun exposure and the physiological changes associated with aging.¹⁻⁶

Profile and magnitude of early complications

The incidence of immediate postoperative complications was 42.1%, a value considerably higher than the 1.6%–12.7% range reported in large multicenter series.⁶⁻⁸ Wound dehiscence

(25.2%) was the most common complication and substantially exceeded the previously reported rates of 0.5%–3.3%.⁵⁻⁷ This discrepancy may be attributed to the greater complexity of the reconstructions performed, the unfavorable anatomical distribution of the lesions, and the specific clinical characteristics of the study population, including advanced age, multiple comorbidities, and limited access to health care.

This complication occurs when there is an imbalance between the mechanical forces applied to the tissue—including excessive tension, suboptimal undermining technique, and inadequate suture method—and the physiological capacity for wound healing, which is influenced by tissue perfusion, associated clinical conditions, and the nature of the excised lesion.^{4,7,9,10} Layered closure transfers most of the mechanical load to the subdermal layers, significantly relieving tension on the superficial suture line and reducing the risk of wound edge separation.^{8,10,13,14}

Other early complications included hematomas (16.8%), infections (9.3%), and bleeding (3.7%), all occurring at frequencies higher than those usually reported in the literature.^{5-7,12,14,15}

Impact of reconstructive complexity and anatomical location

Comparative analysis revealed that complex reconstructions (flaps, grafts, and combined techniques) resulted in a 53.7% rate of early complications, compared with 30.2% for primary closures ($p = 0.019$).⁵⁻⁷ This disparity reflects the greater tissue trauma, longer operative times, and more demanding technical requirements needed to ensure adequate perfusion and satisfactory functional outcomes (Figure 3).^{5,6}

Lesion topography had a substantial influence on outcomes. The lower limbs exhibited complications in 100% of cases,

Table 2: Lesion with late complication (n = 107)

Variable	Classification	Total	Late complication				p*
			No		Yes		
			N	%	N	%	
Technique (n = 107)	Primary closure	53	52	98.1%			
	Flap	48	35	72.9%	1	1.9%	
	Graft	4	3	75.0%	13	27.1%	
	Combined closure (flap + graft)	1	1		1	25.0%	
	Combined closure (flap + secondary intention)	1	1		0		
Technique (n = 107)	Primary closure	53	52	98.1%	0		< 0.001
	Complex closure	54	40	74.1%	1	1.9%	
Area (n = 107)	Face	74	66	89.2%	14	25.9%	
	Trunk	11	10	90.9%	8	10.8%	
	Hand	6	5	83.3%	1	9.1%	
	Lower limbs	5	0	0%	1	16.7%	
	lower limbs	4	4	100%	5	100%	
	Upper limbs	4	4	100%	0	0%	
	Scalp	3	3	100%	0	0%	
Pathology (n = 107)	Basal cell carcinoma	69	59	85.5%	0	0%	
	Squamous cell carcinoma	26	23	88.5%	10	14.5%	
	Melanoma	6	4	66.7%	3	11.5%	
	Basal cell carcinoma + squamous cell carcinoma	3	3	100%	2	33.3%	
	Basosquamous carcinoma	1	1		0	0%	
	Sebaceous carcinoma	1	1		0		
	Eccrine spiradenoma	1	1		0		
Pathology (n = 107) (3 most frequent classifications)	Basal cell carcinoma						
	Squamous cell carcinoma						
	Melanoma						

* Fisher's exact test or chi-square test, $p < 0.05$

TABLE 3: Association between early and late complications

Variable	Classification	Total	Patient has late complication in a lesion				p★
			No		Yes		
			N	%	N	%	
Patient has early complication in a lesion (n = 86)	No	47	47	97.9%	1	2.1%	< 0.001
	Yes	39	26	66.7%	13	33.3%	

confirming previous reports indicating the risk of infection and other complications is three times higher in this region, attributed to limited blood supply, increased skin tension, and impaired lymphatic drainage.¹⁴⁻¹⁶ In contrast, the trunk had the lowest rate of early complications (18.2%).^{6,15} The facial region exhibited intermediate outcomes, likely benefiting from its rich vascular network (Figure 4).^{5,17}

Late complications and their relationship with early events

Late complications occurred in 14% of postoperative cases, predominantly abnormal scarring (46.7%) and aesthetic impairment (40%). Analysis by reconstructive technique revealed a statistically significant difference, with late complication rates of 25.9% in complex reconstructions versus 1.9% in primary closures.⁵



FIGURE 3: Postoperative graft necrosis of the medial canthus



FIGURE 4: Postoperative partial necrosis of nasal wing flap.

The robust association between early and late complications represents a finding of particular clinical relevance. Patients who developed early postoperative complications were markedly more likely to experience persistent sequelae (33.3% vs. 2.1%; $p < 0.001$), underscoring the importance of prompt and rigorous intervention to prevent their progression into chronic conditions.^{4,5} Events such as wound dehiscence, blood pooling, and infection during the early postoperative period may compromise the healing process, ultimately resulting in permanent sequelae such as hypertrophic scars, tissue contractures, and functional deficits.^{4,9,10}

Once again, the lower limbs have a 100% rate of late complications, reinforcing the particular vulnerability of this anatomical region.¹⁴⁻¹⁶

Influence of histological type and other risk determinants

Although no statistically significant association was identified between tumor subtype and complications, melanoma presents unique challenges. Its wide resections, often performed across skin tension lines, increase the risk of late complications, present in 33.3% of melanoma cases, compared with BCC (14.5% late complications; 44.9% early complications) and SCC (11.5% late complications; 38.5% early complications).

Study limitations

This study has limitations inherent to its retrospective design, single-center setting, and potential variability in technical expertise among surgeons. The limited number of cases involving rare neoplasms or severe complications restricted statistical analyses in specific subgroups. Future prospective multicenter studies with larger sample sizes will be necessary to validate and expand upon these findings.

CONCLUSION

The outcomes of dermatologic surgery for skin cancer result from the interaction of anatomical, technical, and oncological factors. Differences between anatomical sites and the use of complex reconstructions were associated with increased complication rates, whereas early postoperative events were predictive of late complications. Differences among tumor subtypes imposed distinct technical demands and risk profiles. Therefore, the choice of reconstructive technique should consider not only tumor removal but also anatomical factors, tumor subtype, and functional and aesthetic impact. ●

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Statistical analysis, Approval of the final version of the manuscript, Conception and design of the study, Preparation and writing of the manuscript, Acquisition, analysis and interpretation of data, Effective participation in the conduct of the study, Intellectual participation in the propaedeutic and/or therapeutic approach to the cases studied, Critical review of the literature, Critical revision of the manuscript

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