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Abstract

Background: Hospitalized cancer patients are vulnerable to multiple wounds, which pose a significant burden in terms of care and clinical risk. The aim of this study was to estimate and analyze the prevalence of wounds in hospitalized adult oncology patients and the clinical factors associated with their prevalence.

Method: This was an epidemiological, observational, and cross-sectional study. The point prevalence of wounds was calculated among 396 patients at an oncology center in Bogotá, Colombia. Descriptive and inferential analyses were conducted using bivariate and multivariate methods, including a decision tree model (CART), to explore the factors associated with the presence of wounds, with a significance level of 5%.

Results: In this study, a total of 252 patients (63.6%) had wounds. The most common types of wounds were surgical wounds (39%), complicated surgical wounds (17.4%), and pressure injuries (8.8%). Regarding the CART decision tree models, surgery during the current hospitalization was associated with a 92.6% probability of wound prevalence and the use of antihypertensives (as a pre-existing condition) was also a significant factor. Additionally, in the CART model excluding surgical and neoplastic wounds, the factors associated with the presence of wounds of were the Braden score of 14.5 and was the reason for hospitalization.

Conclusions: Identifying the prevalence and characterizing hospitalized adult cancer patients with wounds are crucial for decision-making and treatment management. Additionally, the associated factors can be incorporated into preventive programs tailored specifically for local realities, with the aim of improving care quality, patient safety, and resource optimization.

Keywords: wounds, nursing, cancer, epidemiological studies, risk factors, stomatherapy.

Introduction

The hospitalized adult with cancer is physically and psychologically fragile, at risk of various wounds due to intrinsic and extrinsic factors. (1) Examples of these include the effects of tumor growth and therapeutic interventions. Among these, radiotherapy can lead to apoptosis of epithelial cells, causing an imbalance of cytokines that increases connective tissue, resulting in fibrosis with a reduction of lipids in the skin. (2) On the other hand, anticancer agents inhibit the proliferative phase, thereby impairing the healing capacity. (3) Other contributing factors include age, prolonged hospital stay, comorbidities, dehydration, and immobility. (4)

In terms of epidemiology, studies from different regions of the world have identified the types of wounds that hospitalized oncology patients may develop. In Asia, a study reported an 85.6% prevalence of radiodermatitis. (5) Meanwhile, in the United States, a study found a wound prevalence of 14.2%. (6) Finally, in Latin America, a Brazilian study reported an overall wound prevalence of 23.5% in an oncology center, (7) 3.2% of which corresponded to the prevalence of complicated surgical wounds. (8) As for Colombia, publications on this topic are still in their early stages.

Undoubtedly, access to updated studies related to wounds in the oncology population, which support clinical and preventive decision-making, is crucial in-patient care. Likewise, the quality and safety that health services strive for are achieved through well-structured protocols based on high-impact references. Accordingly, the objective of this study was to estimate and analyze the prevalence of wounds in hospitalized adult oncology patients and the clinical factors associated with their prevalence.

Method

This was an epidemiological, observational, cross-sectional study which report followed the STROBE guidelines. (9) It was approved by the Ethics Committee (INT-OFI-04793-2019).

The study population consisted of all adult patients hospitalized at various inpatient services and intensive care units at an oncology center in Bogotá, Colombia. This institution in Colombia is dedicated to comprehensive cancer control, and in 2021, it implemented a COVID-19 Action Plan, with an installed capacity of 207 available beds.

The sample comprised patients who met the inclusion criteria (hospitalized adult patients aged 18 years) and who agreed to participate in the study by signing an informed consent form. The exclusion criteria included outpatients, emergency room patients, recovery room patients, and those who were unable to be interviewed, either themselves or through a family member.

Sample calculation

The sample size was calculated using the StatCalc module of EpiInfo™(10) with the following parameters: population size (5,860), expected event prevalence (15%) (11), acceptable margin of error (3%), and confidence level (95%), resulting in a total sample size of 396. Subsequently, stratified random sampling was performed using Epidat, yielding the following distribution of hospitalization units: palliative/internal medicine (n=142); hematology leukemia (n=18); surgical 2 (n=55); hematology (n=40); surgical 1 (n=104); allogeneic bone marrow transplant (n=24); intermediate intensive care unit (n=11); intensive care unit (n=2).

Data collection was carried out over 75 days and extended due to the COVID-19 pandemic, which affected logistic dynamic, institutional guidelines, contingencies, and hospitalizations. For example, the ICU services had restrictions on in-person visits, and data collection was delayed until these services returned to normal operations.

Data collection protocol

Data were collected by two nurses and a specialist in wound care. Before starting the data collection, presentations were given to the healthcare staff in each unit, and a census of the hospitalized patients was obtained. Patients who met the inclusion criteria were given a

presentation explaining the study objectives, and the informed consent form; all of the patients´ questions were addressed. After clarifications, those who voluntarily agreed to participate in the study were asked to sign the informed consent form (Figure 1) .

The wounds of interest in the protocol included: surgical wound; complicated surgical wound; traumatic wound; pressure injury; venous ulcer; arterial ulcer; mixed-origin vascular injury; diabetic foot ulcer; peristomal injury; moisture-associated skin damage; medical adhesive-related skin injury; skin tears; incontinence-associated dermatitis; mucositis; radiodermatitis; burns; malignant neoplastic wound.

The study protocol was carried out in three phases: the first phase involved interviews (sociodemographic data and medical history); the second phase consisted of assessments; and the third phase involved reviewing the clinical records. Data were collected in a single day and inserted directly into the Red Cap software. For photographic documentation of the wounds, a 16-megapixel compact digital camera was used to photograph only the wound. The photographs were coded with the same number as the informed consent form for participation in the protocol, and adopted the recommendations (12) were adopted to the wound photography instructions developed for this study were followed.

Eleven instruments were used for the data collection:

1. The form that evaluated the following variables (developed by the authors):
    - Sociodemographic: age, sex, place of residence, religion, educational level, Colombian socioeconomic stratum, marital status, and occupation.
    - Medical History: diabetes mellitus, systemic arterial hypertension, surgery performed in the last 12 months (including bariatric surgery), other current diseases, medications, conditions that affect healing (biliary disease, coagulopathies, vascular diseases, lupus, scleroderma, and others), alcohol consumption, tobacco use, and/or psychoactive substance use.

- Assessment: body mass index, ostomy, wounds (classification, number, location, and Pressure Ulcer Score for Healing - PUSH - score),(13) the Brief Pain Questionnaire (BPQ),(14) sensory alteration, diagnosed dermatological pathology, urinary incontinence evaluated using the ICIQ-UI SF scale,(15) the Braden Scale score,(16) involuntary faecal loss, positive Godet's sign, positive Stemmer's sign, and plantar Sensitivity through the complete 5 -point test (Measured By Semmes-Weinstein Single Monofilament. Brand of Sorri Bauru, 2019). (17)
- Clinical History: oncological diagnosis, TNM staging, (18) treatment, surgery, medications taken during the current hospitalization, radiotherapy and/or chemotherapy protocols, and reason for hospitalization (classified as metabolic emergency; haematological; treatment-associated;(19) structural; infectious; surgery; altered state of consciousness; SARS-CoV-2 viral pneumonia; and surgical wound complication).

2. Pressure injury, classification proposed by the National Pressure Injury Advisory Panel. (20)
3. Medical adhesive-related skin injury, assessment according to the consensus. (21)
4. Skin Tears, classification for International Skin Tear Advisory Panel. (22)
5. Peristomal injury, classification SACS 2.0. (23)
6. Malignant neoplastic wound, malignant wounds staging. (24)
7. Radiodermatitis, classification according to the toxicity criteria of the Radiation Therapy Oncology Group / European Organization for Research and Treatment of Cancer. (25)
8. Mucositis, classification proposed by the National Cancer Institute (NCI-CTCAE). 26)
9. Burns, severity grading for burns. (27)
10. Complicated surgical wound, classification for World Union of Wound Healing Societies. (28)

11. Moisture-associated skin damage, classification for International Best Practice Recommendations. (29) and incontinence-associated dermatitis, classification Global Categorisation Tool. (30)

Statistical Analyses

The data were collected in RedCap and analyzed using the R software. (31) The prevalence of patients with wounds was calculated using the following formula: Occurrence Ratio = [(Number of patients with wounds) / (Total number of patients in the study)] × 100. (32)

The data were analyzed using measures of central tendency and distribution. To explore possible bivariate associations, the Wilcoxon-Mann-Whitney or Brunner-Munzel tests were applied for quantitative variables with non-normal distribution, and the Student's t-test was used for those with normal distribution. For categorical variables, Fisher's Exact Test was applied for those with non-normal distribution, and Pearson's Chi-square test was used for those with normal distribution. For descriptive and inferential analysis, the decision tree model (CART) was employed to explore the factors associated with the presence of wounds, with a significance level of 5%.

Results

For the 396 participants, the mean age was 56.4 years (SD = 16.5; range: 18-96), half of them (50.7%) being over 60 years old. Most of the patients were women 50.7% (n = 201), lived in Bogotá 54% (n = 214); 51.5% (n = 202) belonged to socioeconomic stratum, 2; 81.3% (n = 322) were Catholic; 26.7% (n = 106) had completed high school; 33.8% (n = 134) were married; and 38.8% (n = 154) were homemakers. The most frequent clinical variables were related to a history of abdominal surgery (25.7% ;n = 102), surgery as the reason for hospitalization (35.8%; n = 142), and a BMI with a mean of 23 kg/m² (SD 4.6). All variables

are presented in Tables 1 and 2 (according to sociodemographic and clinical variables, respectively).

The prevalence of hospitalized adult oncology patients with wounds was 63.6% (n = 252). Of these, the majority were women 54.7% (n = 138), the mean age was 55.9 years, 57% (n = 144) reported surgery within the last 12 months, with gastrointestinal surgery being the most frequent (59%). The mean Braden score was 16.8 (SD 3.2); 28.1% (n = 71) of the sample had urinary incontinence. The most frequent reason for hospitalization was surgery, accounting for 50% (n = 126), and the main oncological diagnosis was colon cancer (12.7%;n = 32).

The 252 participants with wounds presented a total of 483 wounds; the most frequent type was a surgical wound (38.8%), with the most common location being the abdominal region (43.7%). The prevalence of wounds and their anatomical distribution are presented in Figure 2. The mean wound assessment score using PUSH was 9.1 (SD = 4.3; range: 2-17). Additionally, 31.3% (n = 79) were patients with ostomies (63 elimination, 14 feeding, and 13 respiratory), and 51.2% (n = 129) reported pain related to the wound.

Two CART decision tree models were obtained to define variables associated with the presence of wounds in hospitalized adult oncology patients (Figure 3).

- CART Model 1 (including all patients with wounds): The variables associated with the presence of wounds were as follows: surgery during the current hospitalization, with a positive response in 92.6% of cases. For those with a negative response, the second variable was the reason for hospitalization, including surgery, treatment-related emergencies, mechanical emergencies, haematological emergencies, and viral pneumonia caused by SARS-CoV-2, accounting for 16.5% of wound cases. On the other hand, for cases where the reason for hospitalization was a metabolic emergency, a surgical wound complication, an infectious emergency, or altered consciousness, the next associated variable was the use of antihypertensive medication (as a pre-existing

condition), with 75% of wound cases showing a negative response to the use of this medication. This CART model had an accuracy of 88.1%, a Gwet's AC1 of 0.78, a sensitivity of 91.3%, and a specificity of 82.6%.

- CART Model 2 (excluding patients with surgical wounds considered intentional and non-preventable, as well as patients with malignant neoplastic wounds): The associated variables were the Braden score with a cohort cutoff point of 14.5. Among those with a score ≥14.5, the second associated variable was the reason for hospitalization, including surgery; treatment; structural emergencies; haematological emergencies; metabolic emergencies; infectious emergencies; altered consciousness; and viral pneumonia caused by SARS-CoV-2, accounting for 20.52% of the wound cases. On the other hand, the complication of a surgical wound as the reason for hospitalization had a prevalence of 83.3%. Finally, the Braden score <14.5 had a prevalence of 61% for the presence of wounds. This CART model had an accuracy of 76%, a Gwet's AC1 of 0.6, a sensitivity of 47.5%, and a specificity of 88.4%.

Discussion

The prevalence of wounds found in hospitalized cancer patients in this study was 63.6%. This included surgical wounds (38.8%), complicated surgical wounds (17.4%), pressure injuries (8.8%), malignant neoplastic wounds (7.1%), medical adhesive-related skin injuries (4%), moisture-associated skin damage (3.3%), peristomal injuries (3%), skin tears (1%), mucositis (1%), extravasation (1%), incontinence-associated dermatitis (0.8%), radiodermatitis (0.5%), burns (0.3%), and other injuries (1.8%). The reasons for hospitalization, including surgery during the current hospitalization, and the use of antihypertensive medication were factors associated with the presence of wounds in the first CART model. In the second CART model, which excluded surgical wounds and malignant neoplastic wounds, the associated variables were the Braden score and the reason for hospitalization.

A Web of Science, PubMed, and CINAHL search identified only one study conducted in an oncology hospital in São Paulo, Brazil, reporting the general prevalence of wounds in hospitalized cancer patients. (7) Therefore, in addition to this, reports of prevalence and/or associated factors for certain wounds in this population are presented. In the present study, a higher overall prevalence of wounds in hospitalized adult patients was observed compared to the Brazilian study, which reported a general prevalence of 23.5%, with higher statistics for malignant neoplastic wounds (3.8%) and complicated surgical wounds (3.2%) and lower statistics for pressure injuries (10%), skin tears (6.5%), and incontinence-associated dermatitis (6.7%). (7)

A study in Jordan reports a prevalence of pressure injury at 15.5%, (33) and various other studies in Brazil reported a prevalence of pressure injury at 10%; (7) an occurrence of complicated surgical wounds at 3.2%; (8) an incidence of 31% in medical adhesive-related skin injuries; (34) a prevalence of skin tears at 3.3% (35) and a prevalence of 21.4% for surgical wounds and 14.8% for malignant neoplastic wounds. (6) Radiodermatitis occurs in 93% to 99% of patients (36), and mucositis occurs in 59.4% to 100% of patients. (37) Radiotherapy and chemotherapy are primarily outpatient treatments, which justifies the low prevalence of these in our study, with 0.5% for radiodermatitis and 1% for mucositis in hospitalized adult patients.

The analysis of the differences between these studies and the present one may be attributed to our general report of all the wounds found, which included 13 categories, and the findings on the associated factors. Finally, as per Castro., et al in 2022, (7) pressure injuries are the most frequently encountered preventable chronic wounds in the oncological hospital setting.

Regarding the first factor associated with the presence of wounds in this study, surgery during the current hospitalization was highlighted in the CART model 1. Surgical procedures are one of the pillars of cancer treatment, playing an essential role in global care. (38) Up to 80% of patients will require some kind of surgery during the course of their oncological

disease, and by 2030, 45 million oncological surgical procedures will be needed. (39) Multidisciplinary treatment with surgery remains the most effective in the majority of cancers (40) and is the most important treatment for gastric cancer. (38) Surgeries are used for curative, palliative, and reconstructive purposes, in oncological emergencies, for tumor debulking, prevention, diagnosis, and staging of cancer. (38) Additionally, all types of surgery would result in a surgical wound, except for natural orifice transluminal endoscopic surgery, which does not involve skin incisions. (41) This is consistent with the results of the present study, in which 55.3% of participants underwent surgery during hospitalization, with gastrointestinal surgery being the most frequent at 46.1%, epidemiologically justified, and the highest prevalence of patients with wounds corresponding to surgical wound at 38.8%.

On the other hand, the Braden score was the first factor associated with the presence of wounds in the CART model 2, with a cutoff point of 14.5. The literature indicates that hospitalized cancer patients with skin tears had lower Braden scores (p=0.026). (35) Similarly, low Braden scores were also a risk factor in a prospective cohort study on skin injuries related to medical adhesives. (34) These results confirm the findings of the present study, where 61% of patients with wounds had a Braden score <14.5 (cutoff score - medium risk). Other studies have used the Braden score to assess oncological patients with medical adhesive-related skin injuries (34) or postoperative complications (OR 1.30, 95% CI: 1.06, 1.60). (42) Although each wound has its own aetiology, careful prevention of common risk factors can lead to a reduction in other types of wounds. (43)

The next factor associated with both CART decision tree models was the reason for hospitalization; surgery; treatment; structural urgency; metabolic urgency; haematological urgency; infectious urgency; surgical wound complication; altered consciousness; viral pneumonia due to SARS-CoV-2. Some of these may be insidious and take months to develop, while others can manifest in hours and cause devastating outcomes. (44) Therefore, it is recognized that these reasons for hospitalization contribute to greater vulnerability and risk in hospitalized oncological adults for developing wounds such as pressure injuries, medical

adhesive-related skin injuries, moisture-associated skin damage, skin tears, burns, and peristomal injuries, which can be related to the intrinsic and extrinsic factors of the oncological patient.

Finally, the use of antihypertensive medication (a common medication used at home) was the third factor associated with the CART model 1. The number of patients who take this medication daily is increasing due to the rising prevalence of lifestyle-related diseases; however, knowledge about the effects of these medications on wound healing is limited. (45) They can influence keratinocytes and fibroblasts, (45) as well as cause dermatological reactions. (46) Lastly, it is important to clarify that the present study did not explore the appropriate and safe use of medications at home.

Conclusion

Through this study, it was possible to map specific data on the most frequent wounds in hospitalized adults at a Colombian oncology center, and it is hoped that the analysis of methodological data will favor the implementation of care strategies both in prevention and specialized care based on evidence-based clinical practice and specific nursing interventions, thereby improving the quality of care, patient safety, and resource optimization.

Two CART models were developed and validated, identifying factors associated with the presence of wounds in hospitalized adult patients using a large set of clinical variables. This can assist in selecting at-risk patients for focused prevention and effective intervention strategies.

Limitations and recommendations

This study was conducted in a single oncology center, the patient sample was relatively limited, and the data collection period was extended due to the COVID-19 pandemic, with wounds related to this cause not being included. The results of the CART models should be verified through additional studies with larger sample sizes.

Ethics approval

This research was approved by the Cancer Center's Research Ethics Committee (04793-201). All data collection, transmission, and management methods were carried out in accordance with relevant guidelines and regulations.

Author contributions

YJRT, CVSG, EOR, VLCGS and SGG contributed to the conception or design of the work. SGG and CVSG directed the study's implementation. YJRT and DSPH contributed to the methodology development and the acquisition, processing, interpretation, or management of study data. CVSG, VLCGS and SGG designed the analytical strategy and YJRT and CVSG conducted the analysis, supervised by VLCGS, PCN and SGG. DSPH and EOR helped interpret the findings. YJRT, CVSG, EOR, PCN, VLCGS and SGG contributed to the original draft. All authors reviewed and revised the manuscript critically and approved the final version for publication.

Conflict of interest

CVSG, DSPH, PCN, VLCGS declare to be members of SOBEST.

YJRT, SGG declare to be members of ASCECOHE

CVSG declares having received a doctorate scholarship from Coordination for the Improvement of Higher Education Personnel CAPES and personal fees for speaking on behalf of 3M-KCI®, LR®, and Essity®. Not related to the present study.

EOR declare that he has no conflict of interest.

Research Data Availability Statement

The entire dataset supporting the findings of this study has been published in the paper itself.

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