



Prevalence of complicated surgical wounds and related factors among adults hospitalized in public hospitals*

Prevalência de ferida operatória complicada e fatores associados em adultos internados em hospitais públicos

Prevalencia de heridas operatorias complicadas y sus factores asociados en adultos hospitalizados en instituciones públicas de salud

How to cite this article:

González CVS, Carvalho EO, Galvão NS, Nogueira PC, Santos VLCG. Prevalence of complicated surgical wounds and related factors among adults hospitalized in public hospitals. Rev Esc Enferm USP. 2022;56(spe):e20210477. <https://doi.org/10.1590/1980-220X-REEUSP-2021-0477en>

-  Carol Viviana Serna González¹
-  Evely Oliveira de Carvalho²
-  Nariani Souza Galvão³
-  Paula Cristina Nogueira⁴
-  Vera Lúcia Conceição de Gouveia Santos⁴

* Extracted from the thesis: “Prevalência de feridas agudas e crônicas e fatores associados em pacientes de hospitais públicos em Manaus-AM”, Universidade de São Paulo, Escola de Enfermagem, Programa de Pós-Graduação em Enfermagem na Saúde do Adulto, 2016.

¹ Universidade de São Paulo, Escola de Enfermagem, Programa de Pós-Graduação em Enfermagem na Saúde do Adulto, São Paulo, SP, Brazil.

² Universidade de São Paulo, Escola de Enfermagem, São Paulo, SP, Brazil.

³ Universidade Federal do Amazonas, Escola de Enfermagem, Manaus, AM, Brazil.

⁴ Universidade de São Paulo, Escola de Enfermagem, Departamento de Enfermagem Médico-Cirúrgica, São Paulo, SP, Brazil.

ABSTRACT

Objective: To estimate the prevalence of complicated surgical wounds and its related factors in hospitalized adults. **Method:** In this cross-sectional study, information from 251 patients hospitalized in seven public hospitals in Manaus, Brazil, and at risk of suffering surgical site complications after undergoing surgery was analyzed. Data were collected via interviews, physical examinations, and a medical record review from March to June 2015. Prevalence rate was estimated as the ratio between individuals with complications and patients at risk. To explore associated variables, individuals with and without complications were compared via 5% significant logistic regression and bivariate analyses. This study was approved by a research ethics committee. **Results:** Overall, 15 patients (6%) showed complicated surgical wounds. General hospitalization ($p < 0.003$), presence of ecchymosis, ($p < 0.001$), and men ($p = 0.047$) increased patients' probability of developing complications in 13.9, 10.1, and 8.2 times, respectively. **Conclusion:** Assessing the prevalence of complicated surgical wounds and its associated factors in adults contributes to their epidemiological understanding, highlighting prevention targets and making data available for scientific comparisons.

DESCRIPTORS

Prevalence; Surgical Wound Dehiscence; Surgical Wound Infection; Postoperative Complications; Nursing; Enterostomal Therapy.

Corresponding author:

Carol Viviana Serna González
Av. Dr. Enéas Carvalho de Aguiar
419, Cerqueira César
05403-000 – São Paulo, SP, Brazil
carolvsngonzalez@gmail.com

Received: 11/08/2021
Approved: 05/04/2022

INTRODUCTION

The surgical approach to pathologies with increasing incidence—such as trauma and non-communicable diseases—is an indispensable part of comprehensive health care. Surgical treatments are recognized for their high case management via techniques that are less and less invasive and technologies that achieve better clinical results, aiming at reducing mortality and disability rates⁽¹⁾.

According to the global initiative for safe and affordable surgery promoted by several institutions (among them, the World Health Organization), around 5 billion people worldwide still lack access to good quality surgical services, especially in low- and middle-income countries⁽¹⁾.

Estimates using the institutions in the public health system data registry suggest that approximately 27 million surgical procedures have been performed in the last five years in Brazil—a large, emerging, and greatly unequal country regarding health care⁽²⁾. According to a cross-sectional study conducted by the Brazilian College of Surgeons⁽³⁾, these procedures do not have standardized measures to prevent adverse perioperative events and complications.

Though the literature stills disagrees on the terminology, surgical site complications, events, or occurrences—also called complicated surgical wounds—are among the adverse and preventable outcomes during the rehabilitation of individuals undergoing surgery⁽⁴⁻⁵⁾. These complications are defined as alterations in the anatomical region of the surgical incision which influence healing and may or may not require intervention⁽⁴⁾. Surgical wound occurrences include infection, abscess, seroma, hematoma, cutaneous or subcutaneous tissue ischemia, necrosis, dehiscence, evisceration, fistula, absence, hypergranulation, perilesional skin maceration, frictional lesions associated with the use of adhesives, healing delay or change^(4,6-8). Literature reviews and critical analyses have established the need to standardize definitions for types of surgical wound complications⁽⁴⁻⁵⁾.

In most surgical wounds, especially those with close edges and little tissue loss, the primary intention may close them via sutures, biological adhesive, or other materials favoring tissue synthesis. In this case, healing occurs physiologically if tissue microenvironment conditions are maintained, such as temperature between 36.4° and 37.2°C; absence of pathogenic microbial load or in balance with hosts' response; balanced moisture in the wound bed (subjacent tissues without collections); distribution of mechanical forces without overloading the compromised tissue; and adequate tissue perfusion, oxygenation, and nutrition⁽⁶⁻⁸⁾.

The literature reports several risk factors associated with the development of surgical wound complications, among which are patients' systemic conditions, such as age, nutritional status, medication use, uncontrolled comorbidities, and habits such as smoking, which negatively affect healing⁽⁹⁾. Another category includes factors related to the surgical procedure, such as duration, closure techniques, hygiene and asepsis protocols, drain use, contamination degree, and emergency condition, among others^(7,10).

Epidemiological studies on complicated surgical wounds have reported prevalence rates ranging from 3.2%—in an

oncological hospital⁽¹¹⁾—and 41.2%—in general, health institutions⁽¹²⁾—, and most studies choose infections as the assessed surgical site complication. Brazilian studies indicate that hospitals show infection rates from 9.4%⁽¹³⁾ to 17.2%⁽¹⁴⁾. Studies conducted in other countries (Nigeria and the USA) show prevalence or incidence values ranging from 4% to 15.6% in hospitalized patients⁽¹⁵⁻¹⁶⁾.

The occurrence of this type of postoperative complication may compromise patients' clinical status by increasing their metabolic, nutritional, and immunological demands. Moreover, it causes pain, suffering, anxiety, and longer hospital stays, nursing care time, and medication use increasing overall treatment costs, affecting the health system, and prolonging patients' return to their work and routine. It may even compromise surgery outcomes and entail further interventions. Thus, prevention and early detection are essential^(5-10,12,17).

Systematized nursing care for perioperative individuals diagnose "impaired tissue integrity" to intervene and promote physiological healing, with or without the minimum influence of intrinsic or extrinsic factors⁽¹⁸⁾. The North American Nursing Diagnosis Association defines this diagnosis as damage to mucous membranes and cornea, integumentary system, muscle fascia, muscle, tendon, bone, cartilage, joint capsule and/or ligament that requires specific care for the individual, aiming at efficient healing⁽¹⁸⁾. Thus, the attributions of specialized nursing and advanced practice nursing include epidemiological characterization and factor identification associated with the prevalence of complicated surgical wounds since they provide data for care management and preventive measure implementation aiming at patient safety⁽¹⁷⁾.

Thus, due to the relevance of the theme, the scarcity of epidemiological studies, and the overall rate of surgical wound complications (not only infections) in adults hospitalized in Brazil—specifically in the Amazon—this study aimed to assess the prevalence of complicated surgical wounds and its associated factors in hospitalized adults.

METHODOLOGY

DESIGN OF STUDY

This is a cross-sectional study derived from a doctoral thesis that found hospitalized patients' wound prevalence and the factors associated with it by specifically exploring data on pressure and diabetes injuries (diabetic foot), complicated surgical wounds, friction injuries, and incontinence-associated dermatitis⁽¹⁹⁾. Its primary outcome was estimating overall wound prevalence and its associated factors, whereas its secondary outcome was describing the occurrence rates for each type of wound within its sample. This study further developed the analysis of complicated surgical wound prevalence and its associated factors, considering it a possible outcome in patients who underwent surgery and/or at risk of it.

LOCAL

In total, seven public hospitals—surgical, clinical, and diagnostic references—were chosen for data collection, totaling 1,443 beds distributed in different places in the municipality of Manaus in the state of Amazonas, Brazil, of which only

two had teams specialized in enterostomal therapy and wound prevention protocols.

POPULATION AND SAMPLE

Our primary study population was composed of all patients hospitalized during data collection, from March to June 2015, in the selected institutions. The following selection criteria were adopted for this research: age equal to or above 18 years old, subjection to surgery (both elective and urgent) during hospitalization, and voluntary consent to participation.

SAMPLE DEFINITION

Out of the adults hospitalized during data collection, 251 met our inclusion criteria, thus composing the final sample of this study (Figure 1).

DATA COLLECTION PROCEDURES

Data from the doctorate thesis were collected via medical record reviews, interviews with patients or legal guardians, and physical examinations. For this purpose, a sociodemographic and clinical data instrument developed explicitly for this study was used.

The collected demographic data were gender, ethnicity, marital status, and schooling level (in complete years). The clinical variables assessed were current and past smoking and/or alcoholism and comorbidity diagnoses: venous and arterial insufficiency, arterial hypertension, stroke, acute myocardial infarction, and diabetes mellitus.

By reviewing participants' medical records, the type of surgery to which patients were subjected during hospitalization (urgent or elective), blood glucose (altered or normal, considering both hyperglycemia and hypoglycemia in the "altered" category), and use of drugs of interest to the research objective (such as nonsteroidal anti-inflammatory drugs, antibiotics, steroid anti-inflammatory drugs, and anticoagulants) were evaluated. Body mass index (BMI) was estimated from weight and height data extracted from clinical records, based on the equation $BMI = \text{Weight}/\text{Height}^2$, whose categorical classification followed the intervals established by the World Health Organization.

Cephalocaudal physical examinations were performed to identify complicated surgical wounds: surgical site infection, dehiscence, abscess, seroma, hematoma, cutaneous or subcutaneous ischemia, necrosis, evisceration, fistula, absence, and healing delay or alteration.

Additionally, the presence of drains, ecchymosis (change in skin color characterized as black, blue or purplish spots >1cm without blood collection), hematomas (skin or deep tissue alteration by blood collection, which may or may not appear as

black, blue, or purplish spots)⁽²⁰⁾, dressings, type-discriminating stomas, indwelling urinary catheters, diapers, lower and upper limbs edemas (via the Godet sign check), pain, stiffness, and spasticity (evaluated by rapid or slow passive movements in patients' upper and lower joints).

Finally, risk of pressure lesions was evaluated via the adapted Braden scale (validated for Brazil)⁽²¹⁾; and the concomitant presence and number of pressure lesions, diabetic ulcers, friction lesions, and dermatitis associated with incontinence were also considered.

DATA ANALYSIS AND TREATMENT

In this study, data were tabulated in an Excel[®] spreadsheet (Microsoft 365[®], 2019) and statistically analyzed via R or SPSS 26.0, depending on availability. Variables with data loss greater than 10% were eliminated, as with pain (91%), alcoholism (50%), smoking (57%), glycemia (50%), and stiffness (12%). Possible associations between complicated surgical wounds and the studied categorical variables were assessed via Pearson's chi-square or Fisher's exact tests, whereas those between wound prevalence and numerical variables were assessed by Student's *t*-, Wilcoxon-Mann Whitney or Brunner Munzel tests after assumption verification (data distribution, etc.). Significance levels were set at 5%.

Moreover, multivariate regression models were constructed with a hierarchical variable entry to find the factors simultaneously and separately associated with complicated surgical wounds. Model predictive capacity was evaluated using Nagelkerke pseudo-R², which indicates the explanation percentage of the outcome (presence of complicated surgical wound) given by the resulting variables in the model. Pearson's chi-squared ($p < 0.05$) and Hosmer-Lemeshow ($p > 0.05$) tests were used as model adjustment diagnostic indices⁽²²⁾.

ETHICAL ASPECTS

The ethical requirements recommended by Resolution 466/12 of the National Health Council of Brazil were respected. The thesis project from which this study derives was authorized by the involved hospitals via the Amazonas State Health Department and was approved by the Research Ethics Committee of the School of Nursing at the Universidade de São Paulo under CAAE 38329114.6.0000.5392 and opinion 912,522 of December 2014⁽¹⁹⁾. This study also had an appreciation by the same ethics committee under CAAE 26518719.5.0000.5392 and opinion 3,780,97 of December 2019. Adults who agreed to participate or their guardians were invited to sign informed consent forms before data collection.

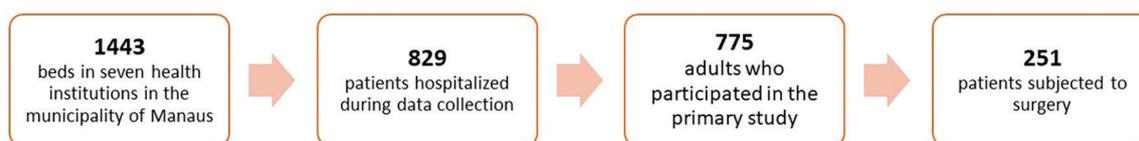


Figure 1 – Flow of patient inclusion in this study to estimate complicated surgical wound prevalence in adults hospitalized in public health institutions in Manaus, Amazonas, Brazil, 2015.

RESULTS

Data analysis showed that, out of the 251 patients included in our sample, 114 (45.4%) were hospitalized in surgical and 39 (15.5%) in orthopedic clinics and 29 (11.6%), in intensive care units. Moreover, 27 (10.8%) were hospitalized in neurological; 16 (6.4%) in vascular; 10 (4.0%), in general; 8 (3.2%) in cardiology; and 8 (3.2%), in medical clinics.

Mean age of 48.4 (SD 18.1) years with a minimum of 18 and a maximum of 100 years characterized our sample. In total, 76 (30.4%) patients were aged ≥ 60 years at the time of data collection. We found a predominance of brown-skinned (74/29.5%), men (162/64.5%), and individuals who had partners (150/59.8%) in our sample. Schooling level showed a mean of 9.3 complete years (SD 3.5; minimum 0, maximum 17). We observed that 72 (57.6%) patients self-reported as former alcoholics and 39 (31.2%) as current ones; 67 (61.5%) as former smokers and 24 (22.0%) as current ones. However, we found big data loss for both variables ($>50.0\%$ each).

In total, 84 (33.5%) patients had systemic arterial hypertension; 58 (23.1%), diabetes mellitus; 143 (5.1%), overweight or obesity; and 44 (17.5%), peripheral vascular disease; 21 (8.4%) of which had venous and 10 (4.0%), arterial insufficiency.

In total, 142 (56.7%) patients used antibiotics; 81 (32.3%), anticoagulants; 73 (29.1%), anti-inflammatory drugs; and 71 (28.3%), antihypertensive ones. Overall, 14 participants (5.6%) showed upper extremity edema and 18 (7.2%), lower extremity ones; 44 (18%) used indwelling urinary catheters and 97 (38.7%), diapers; 81 (32.3%) had dressings. Moreover, 38 (15.1%) showed ecchymosis; 16 (6.4%), hematomas; and 18 (7.2%), some type of ostomy, predominantly tracheostomy with 7 individuals (2.8%). Finally, 18 (8.1%) patients showed spasticity. Surgery was elective for 184 patients (73.3%).

We found complicated surgical wounds in 15 patients with a 6.0% prevalence rate, whose complications were mainly: dehiscence, seroma, and surgical site infection, as Figure 2 shows.

Of the patients with complicated surgical wounds in our sample, 14 (93.3%) were men and seven (46.7%), white; 11 (73.3%) had partners and eight (53.3%), ecchymosis; eight (53.3%) underwent elective surgery; six (40%) showed normal weight and six (40%) were overweight; 12 (80%) took

antibiotics, and none suffered from concomitant injuries. They averaged 50.7 (SD 16.5) years of age.

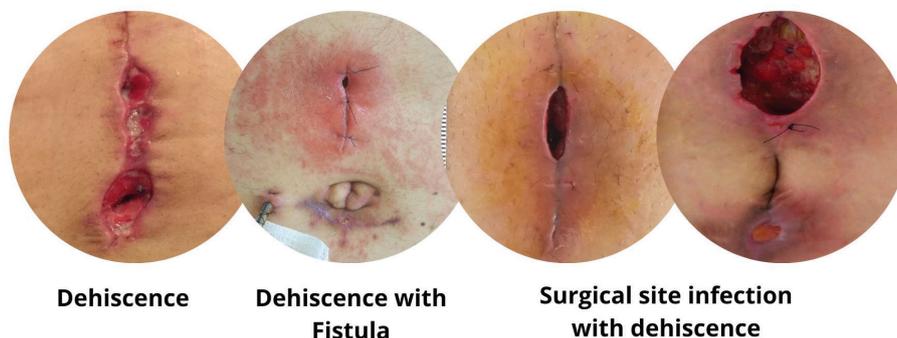
Table 1 shows the distribution of sociodemographic variables in patients with and without complicated surgical wounds and their statistical associations, especially in males with greater complication prevalence ($p = 0.016$). Table 2 shows the proportion of complicated surgical wounds among people with ecchymosis ($p < 0.001$) and hospitalized in general practice ($p = 0.039$). Ecchymosis was present in eight (53.3%) patients with complicated surgical wounds. This distribution in different wards, ignoring the presence of a complicated wound, had a significant difference ($p < 0.05$) in Fisher's exact test, with a three-case predominance (37.6%) in the clinical medical ward.

As shown in Table 2, 13 (34.2%) patients with ecchymosis used anticoagulants, a datum without evidence of a statistical association by the Pearson's chi-square test ($p = 0.851$). We also found no statistical difference between patients using anticoagulants with and without a complicated surgical wound.

The binary logistic regression model to assess the factors associated with the presence of complicated surgical wounds (Table 3) was significant for the presence of ecchymosis, when adjusted to include the variables "male gender" and "general patient ward." These variables increased the presence of the complication by 10.1; 8.2, and 13.9 times, respectively, when simultaneously present, in addition to explaining the presence of surgical wound complication 28.3% of the times (Nagelkerke Pseudo- R^2), with good fit, according to Pearson's chi-square test ($p < 0.001$).

Moreover, we applied the previous regression model only for anticoagulated patients, obtaining an adequate adjustment according to Pearson's chi-square ($p = 0.001$). The results of this stratification indicated that the presence of ecchymosis increases the chances of complication by 29.8 times in anticoagulated patients (95% CI 2.99–296.75; $p = 0.004$), resulting in 34.4% prevalence of complicated surgical wounds.

On the other hand, the same model obtained an appropriate adjustment by Pearson's chi-square ($p = 0.009$) when it analyzed only those aged over 60 years. Presence of ecchymosis and general ward hospitalization caused 42% of the complications, increasing chances in 19 (95% CI 1.39–258.95 $p = 0.027$) and 38 times (95% CI 1.56–1,149.64 $p = 0.037$), respectively, without significance for men ($p = 0.998$).



Images used with the permission of the patients

Figure 2 – Example of complicated surgical wound types found in adults hospitalized in public health institutions in Manaus, Amazonas, Brazil, 2015.

Table 1 – Sociodemographic variables of surgical patients hospitalized in public health institutions in Manaus, with and without complicated surgical wounds – Manaus, AM, Brazil, 2015.

Characteristic		Total	Absent complicated surgical wound		Present complicated surgical wound		p
		Median	Mean	SD	Mean	SD	
Age		48	48.3	18.3	50.7	16.5	0.612 ^a
Years of education		9	9.3	3.5	9.3	2.8	0.784 ^b

Characteristic	Category	Total	Absent complicated surgical wound		Present complicated surgical wound		p ^c
			N	%	N	%	
	Male	162	148	91.4	14	8.6	
Ethnicity	Asian	65	61	93.9	4	6.2	0.206
	White	64	57	89.1	7	11.0	
	Black	48	47	97.9	1	2.1	
Marital status	Mixed race	74	71	96.0	3	4.1	0.270
	With a partner	150	139	92.7	11	7.3	
	Without a partner	101	97	96.0	4	4.0	

^aStudent t-test, ^bWilcoxon-Mann-Whitney test, ^c Pearson's chi-squared test.
Significance: **p < 0.05.

Table 2 – Clinical variables of surgical patients hospitalized in public health institutions in Manaus, with and without complicated surgical wounds – Manaus, AM, Brazil, 2015.

Characteristic	Category	Total	Absent complicated surgical wound		Present complicated surgical wound		p
			N	%	N	%	
Patient ward	Surgical	114	107	93.9	7	6.1	0.039^d**
	Cardiac	8	8	100	0	0	
	General	10	7	70	3	30	
	Medical	8	7	87.5	1	12.5	
	Neurological	27	27	100	0	0	
	Orthopedic	39	37	94.9	2	5.1	
	Intensive Care Unit	29	29	100	0	0	
	Vascular	16	14	87.5	3	12.5	
Venous insufficiency	No	230	218	94.8	12	5.2	0.094 ^e
	Yes	21	18	85.7	3	14.3	
Arterial insufficiency	No	241	227	94.2	14	5.8	0.466 ^d
	Yes	10	9	90	1	10.0	
Systemic Arterial Hypertension	No	167	157	94.0	10	6.0	0.991 ^e
	Yes	84	79	94.1	5	6.0	
Stroke	No	226	212	93.8	14	6.2	0.661 ^e
	Yes	25	24	96.0	1	4.0	
Acute myocardial infarction	No	230	215	93.5	15	6.1	0.622 ^d
	Yes	21	21	100.0	0	0.0	
Diabetes Mellitus	No	193	182	94.3	11	5.7	0.736 ^e
	Yes	58	54	93.1	4	6.9	

continue...

...continuation

Characteristic	Category	Total	Absent complicated surgical wound		Present complicated surgical wound		p
			N	%	N	%	
Ecchymosis	Absent	213	206	96.7	7	3.3	<0.001 ^c ***
	Present	38	30	79.0	8	21.1	
Hematoma	Absent	235	222	94.5	13	5.5	0.246 ^d
	Present	16	14	87.5	2	12.5	
Dressings	Absent	170	159	93.5	11	6.5	0.633 ^c
	Present	81	77	95.1	4	4.9	
Upper extremity edema	Absent	237	223	94.1	14	5.9	0.588 ^d
	Present	14	13	92.9	1	7.1	
Lower extremity edema	Absent	233	220	94.4	13	5.6	0.341 ^c
	Present	18	16	88.9	2	11.1	
Ostomy	No	233	218	93.6	15	6.4	0.610 ^d
	Yes	18	18	100.0	0	0.0	
Ostomy type	Without ostomy	233	218	93.6	15	6.4	1.000 ^d
	Colostomy	6	6	100.0	0	0.0	
	Urinary diversion	2	2	100.0	0	0.0	
	Ileostomy	3	3	100.0	0	0.0	
Surgery	Tracheostomy	7	7	100.0	0	0.0	0.072 ^c
	Elective	184	176	95.7	8	4.3	
	Non-elective	67	60	89.6	7	10.5	
Spasticity	Absent	204	191	93.6	13	6.4	0.444 ^c
	Present	18	16	88.9	2	11.1	
	Very underweight	1	1	100.0	0	0.0	
	Underweight	15	14	93.3	1	6.7	
Body mass index	Healthy	92	86	93.5	6	6.5	0.934 ^d
	Overweight	94	88	93.6	6	6.4	
	Obesity	49	47	95.9	2	4.1	
Indwelling urinary catheter	No	207	193	93.2	14	6.8	0.255 ^c
	Yes	44	43	97.7	1	2.3	
Diaper	No	154	143	92.9	11	7.1	0.327 ^c
	Yes	97	93	95.9	4	4.1	
Antihypertensive	No	180	171	95.0	9	5.0	0.300 ^c
	Yes	71	65	91.5	6	8.5	
Non-steroidal anti-inflammatory	No	178	169	94.9	9	5.1	0.338 ^c
	Yes	73	67	91.8	6	8.2	
Antibiotic	No	109	106	97.3	3	2.8	0.060 ^c
	Yes	142	130	91.6	12	8.5	
Anticoagulant	No	170	160	94.1	10	5.9	0.928 ^c
	Yes	81	76	93.8	5	6.2	

continue...

...continuation

Characteristic	Category	Total	Absent complicated surgical wound		Present complicated surgical wound		p
			N	%	N	%	
Steroidal anti-inflammatory	No	230	216	93.9	14	6.1	0.807 ^c
	Yes	21	20	95.2	1	4.8	
Pressure injury	Absent	237	222	93.7	15	6.3	1.000 ^d
	Present	14	14	100.0	0	0.0	
Friction injury	Absent	249	234	94.0	15	6.0	1.000 ^d
	Present	2	2	100.0	0	0.0	
Incontinence-associated dermatitis	Absent	250	235	94.0	15	6.0	1.000 ^d
	Present	1	1	100.0	0	0.0	
Diabetic Ulcer	Absent	232	217	93.5	15	6.5	0.613 ^d
	Present	19	19	100.0	0	0.0	

Characteristic	Median	Absent complicated surgical wound		Present complicated surgical wound		p ^e
		Mean	SD	Mean	SD	
Braden score	19	17	5.4	17.5	3.2	0.757

^aStudent-t test, ^bWilcoxon-Mann-Whitney test, ^cPearson's Chi-squared test, ^dFisher's Exact test, ^eBrunner-Munzel test. Significance: ***p < 0.001; **p < 0.05.

Table 3 – Logistic regression for factors associated with the presence of complicated surgical wounds in public health institutions in Manaus – Manaus, AM, Brazil, 2015.

	Odds Ratio	Lower 95% confidence interval	Higher 95% confidence interval	p
Intersection	0.004			<0.001***
Presence of ecchymosis	10.097	3.011	33.854	<0.001***
Male gender	8.231	1.026	66.020	0.047**
General practice	13.850	2.425	79.098	0.003**

Variable input method: *Hierarchical*.

Significance: ***p < 0.05; **p < 0.001 Odds Ratio: Probability ratio

Pearson's chi-squared test for the model p < 0.001.

Nagelkerke Pseudo-R²: 0.283; Hosmer-Lemeshow test p = 0.747 (good model fit if p > 0.05).

DISCUSSION

This study analyzed the prevalence of complicated surgical wounds and their related factors among hospitalized patients in seven public hospitals in the municipality of Manaus, the capital and main urban center of the state of Amazonas, Brazil.

Despite the few studies on the global indicators of complicated surgical wounds, the prevalence rate we found (6%) is within the rate range reported in other Brazilian studies (from 3.2 to 15.2%^(11,23)) assessing surgical site infections, one type of such complication.

Cross-sectional studies reported a 3.2% complicated surgical wound prevalence rate among cancer patients in a specialized hospital in the municipality of São Paulo⁽¹¹⁾ and a 15.2% in patients with obesity undergoing bariatric surgery in a university hospital in Recife⁽²³⁾.

Internationally, a retrospective U.S. study mapped complicated surgical wounds in 86 patients undergoing herniorrhaphy and found a 47.7% complication prevalence, mainly associated with the surgical technique⁽²⁴⁾. Another U.S. retrospective study, conducted in a cohort of 258 patients subjected to abdominal wall reconstruction, showed a 25% prevalence of complicated surgical wounds⁽²⁵⁾. We infer that these rates were higher than ours due to sample specificity and surgical specialty.

By exploring factors associated with complicated surgical wounds, we found that ecchymosis increased the chances of this complication by 10.1 times (19 times in patients aged over 60 years old). Ecchymosis is a primary skin lesion that fails to cause loss of skin integrity and shows color alteration greater than one cm and subsequent rupture of blood vessels due to local trauma but without blood collection (as with hematomas). Its appearance is often a black, blue, or violet blot⁽²⁰⁾.

Studies with older adults have reported this vascular tissue alteration. This population may show other purplish lesions (a dermatological alteration of skin color due to microbleeds) and ecchymosis, indicating skin fragility; as reported by a study with cancer patients aged between 40 and 73 years old, for whom it was also a factor associated with complicated surgical wounds (p = 0.044)⁽¹¹⁾.

Surgery may cause microbleeds in surgical patients under 60 years of age due to tissue trauma, depending on surgical techniques and compromised regions and on anticoagulant or platelet antiaggregant use, which alters physiological coagulation and may predispose individuals to microbleeds resembling petechiae (purple spots <1 cm), ecchymosis (spots > 1 cm) or hematomas (blood collection on the skin or deep tissues)⁽²⁰⁾. Other possible etiologies include coagulation disorders and genetic or acquired autoimmune diseases⁽²⁶⁾.

After surgery, and given perilesional skin and subcutaneous tissue ecchymosis or hematomas, low resistance to mechanical

traction can rupture the first intention surgical closure, causing dehiscence and fistulas if deep organ/space tissues are compromised. Larger and deeper bleeds, i.e., hematomas, are another type of surgical wound complication⁽⁷⁻⁸⁾.

The International Skin Tear Advisory Panel published a clinical practice guide to promoting skin integrity, referring to ecchymosis, hematoma, and senile purpura as indicators of skin fragility, and recommending its early identification and prevention⁽²⁷⁾.

This study found that the male gender represented 8.2 times higher chances of complications for patients in general hospitalization with ecchymosis — a fact Fusco et al.⁽²⁸⁾ also report —, constituting a four-fold higher risk of infection ($p = 0.005$), which a study conducted in patients undergoing orthopedic surgery⁽¹⁵⁾ also corroborates. However, this finding disagrees with other studies which found no association between surgical wound complication and gender^(11,16,23) or, conversely, in which the highest complication rate occurred in women^(9,29). Thus, it remains a controversial factor that may be considered a confounding variable that depends on both the demographic profile of the assessed health institution and on surgical pathology gender disparities.

We can justify the higher occurrence of complicated surgical wounds in adults hospitalized in general wards by their lack of specific prevention protocols (since they care for a highly diverse number of situations). Place of hospitalization may also be a confounding variable dependent on the local conditions of the health institution.

Comparing our results with those in the literature show the heterogeneity of the available epidemiological findings and the associated risk factors for the occurrence of complications in hospitalized adults. Results show not only the clinical and demographic profile of the sample but can also be analyzed in light of the financial and organizational condition of health institutions toward good and safe care. Their infrastructure often lacks programs to prevent skin lesions, surgical site complications, and unsafe surgery protocols.

Since they are part of multidisciplinary teams, preventing perioperative surgical wound complications should be a fundamental element in nursing therapeutic plans to be conducted via systematized and individualized activities following protocols based on the best available scientific evidence⁽³⁰⁾.

Knowledge about the epidemiological characteristics of complicated surgical wounds and their associated factors is of

interest to nursing management as a documentary basis for the creation of prevention protocols. For practicing nurses, the characteristics of patients who developed such complications offer evidence for the improvement of clinical evaluation and its early detection. Finally, for nursing research, this study shows data that can be used for future comparison with local prevalence rates, which focuses not only on surgical site infections but also on other types of surgical wound complications.

When using data previously collected in a larger study, there is the possibility of limitations regarding the quality of the results obtained since it is impossible to complete them when necessary. Lack of specific data on complicated surgical wounds, such as size and location, classification according to contamination potential (clean, potentially contaminated, and contaminated), and description of the type of complication are other limiting factors of this study. This study suffered from the absence of already recognized variables, such as risk factors for surgical site infection (type of surgical wound complication), hospitalization length, time elapsed since surgery, postoperative hospitalization length, transoperative hypothermia, the American Society of Anesthesiologists, physical status score, among others, which would be important for establishing associations in our sample.

Despite these limitations, this study offers important epidemiological information on complicated surgical wounds in Brazil (especially in its northern region) and details their associated factors, contributing to prevention strategy planning and reducing their rates in the country. We recommend the development of new multicenter studies in other Brazilian regions which still lack these data, as well as incidence studies that could better explain the causality of these complications.

CONCLUSION

The prevalence rate of complicated surgical wounds in adults hospitalized in seven public hospitals in Manaus, Amazonas, was 6% and significantly associated with general practice hospitalization ($p < 0.003$), the presence of ecchymosis ($p < 0.001$), and the male gender ($p = 0.047$), which increased the probability of patients developing complications in 13.9, 10.1, and 8.2 times, respectively. Assessing the prevalence of complicated surgical wounds and its associated factors in adults contributes to their epidemiological understanding, highlighting prevention targets and making data available for scientific comparisons.

RESUMO

Objetivo: Estimar a prevalência de Ferida Operatória Complicada e seus fatores associados, em adultos hospitalizados. **Método:** Estudo transversal, aprovado por comitê de ética. Foram analisadas informações de 251 pacientes submetidos à cirurgia e com risco de complicação do sítio cirúrgico, internados em sete hospitais públicos em Manaus (Brasil); cujos dados foram coletados por meio de entrevista, exame físico e revisão de prontuários, no período de março a junho de 2015. A taxa de prevalência foi calculada como a razão entre os indivíduos com complicação e os pacientes em risco. Para exploração de variáveis associadas, foram comparados indivíduos com e sem complicação por meio de análises bivariadas e regressão logística, com significância de 5%. **Resultados:** 15 pacientes (6%) apresentaram ferida operatória complicada. A presença de equimose ($p < 0,001$), ajustada pelo sexo masculino ($p = 0,047$) e a internação na clínica geral ($p < 0,003$) aumentaram a probabilidade de desenvolver uma complicação em 10,1; 8,2 e 13,9 vezes, respectivamente. **Conclusão:** A identificação da prevalência da ferida operatória complicada em adultos e seus fatores associados contribuem para a sua compreensão epidemiológica, destacando alvos de prevenção e disponibilizando dados para comparação científica.

DESCRITORES

Prevalência; Deiscência da Ferida Operatória; Infecção da Ferida Cirúrgica; Complicações Pós-Operatórias; Enfermagem; Estomaterapia.

RESUMEN

Objetivo: Estimar la prevalencia de herida quirúrgica complicada y sus factores asociados en adultos hospitalizados. **Método:** Estudio transversal, aprobado por el comité de ética. Se analizaron los datos de 251 pacientes, sometidos a cirugía y con riesgo de complicación del sitio quirúrgico, hospitalizados en siete hospitales públicos de Manaus (Brasil); la recolección de datos se dio por entrevistas, examen físico y revisión de historias clínicas, en el periodo de marzo a junio de 2015. La tasa de prevalencia se calculó como la razón entre los individuos con complicaciones y los pacientes de riesgo. Para explorar las variables asociadas, se compararon individuos con y sin complicaciones mediante análisis bivariado y regresión logística, con un nivel de significancia del 5%. **Resultados:** Fue identificada herida operatoria complicada en quince pacientes (6%). La presencia de equimosis ($p < 0,001$), ajustada por sexo masculino ($p = 0,047$) y la hospitalización en clínica general ($p < 0,003$) aumentaron en 10,1; 8,2 y 13,9 veces, respectivamente, la probabilidad de desarrollar complicaciones. **Conclusión:** La identificación de la prevalencia de herida quirúrgica complicada en adultos y sus factores asociados contribuye a su comprensión epidemiológica, destacando focos potenciales de prevención y proporcionando datos para la comparación científica.

DESCRIPTORES

Prevalencia; Dehiscencia de la Herida Operatoria; Infección de la Herida Quirúrgica; Complicaciones Posoperatorias; Enfermería; Estomatoterapia.

REFERENCES

- Meara JG, Leather AJM, Hagander L, Alkire BC, Alonso N, Ameh EA, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386(9993):569-624. DOI: [https://doi.org/10.1016/S0140-6736\(15\)60160-X](https://doi.org/10.1016/S0140-6736(15)60160-X)
- Brasil. Ministério da Saúde. AIH aprovadas por grupo de procedimento (procedimentos cirúrgicos) por região e unidade da federação de 2016-2021 [Internet]. Brasília; 2022 [cited 2022 Feb 18]. Available from: <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sih/cnv/qiuf.def>
- Correia MITD, Tomasich FDS, de-Castro Filho HF, Portari Filho PE, Colleoni Neto R. Safety and quality in surgery: surgeons' perception in Brazil. *Rev Col Bras Cir*. 2019;46(4):e2146. DOI: <https://doi.org/10.1590/0100-6991e-20192146>
- DeBord J, Novitsky Y, Fitzgibbons R, Miserez M, Montgomery A. SSI, SSO, SSE, SSOPI: the elusive language of complications in hernia surgery. *Hernia*. 2018;22(5):737-8. DOI: <https://doi.org/10.1007/s10029-018-1813-1>
- Haskins IN, Horne CM, Krpata DM, Prabhu AS, Tastaldi L, Perez AJ, et al. A call for standardization of wound events reporting following ventral hernia repair. *Hernia*. 2018;22(5):729-36. DOI: <https://doi.org/10.1007/s10029-018-1748-6>
- Morgan-Jones R, Szczepanik A, Gunther T, Debre J, Dolezel R, Banasiewicz T, et al. Incision care and dressing selection in surgical wounds: Findings from an international meeting of surgeons from Eastern Europe [Internet]. London: Wounds International; 2022 [cited Feb 18]. Available from: <https://www.woundsinternational.com/resources/details/incision-care-and-dressing-selection-surgical-incision-wounds-findings-international-meeting-surgeons-eastern-europe>
- Ciprandi G, Djohan R, Dohmen P, Sibai B, Sugrue M, Tanner J. Closed surgical incision management: Understanding the role of NPWT WUWHS Consensus Document [Internet]. London; 2016 [cited 2022 Feb 18]. Available from: <https://www.wuwhs.net>
- Ousey K, Djohan R, Dowsett C, Ferreira F, Hurd T, Romanelli M. Surgical wound dehiscence: improving prevention and outcomes [Internet]. London: Wounds International; 2018 [cited 2022 Feb 18]. Available from: <https://pure.hud.ac.uk/en/publications/surgical-wound-dehiscence-improving-prevention-and-outcomes>
- Spira JAO, Borges EL, Silva PAB, Abreu MNS, Guedes ACM, Pires-Júnior JF. Factors associated with complex surgical wounds in breast and abdomen: a case-control observational study. *Revista Lat Am Enfermagem*. 2018;26:e3052. DOI: <https://doi.org/10.1590/1518-8345.2274.3052>
- Scalise A, Calamita R, Tartaglione C, Pierangeli M, Bolletta E, Gioacchini M, et al. Improving wound healing and preventing surgical site complications of closed surgical incisions: a possible role of Incisional Negative Pressure Wound Therapy. A systematic review of the literature. *Int Wound J*. 2016;13(6):1260-81. DOI: <https://doi.org/10.1111/iwj.12492>
- Serna González CV, Carvalho VF, Kim SHP, Silva CVB, Amaral AFS, Castro DLV, et al. Complicated Surgical Wounds and Associated Factors in Oncology Patients. *Plast Surg Nurs*. 2020;40(2):91-9. DOI: <https://doi.org/10.1097/PSN.0000000000000307>
- Chetter IC, Oswald AV, Fletcher M, Dumville JC, Cullum NA. A survey of patients with surgical wounds healing by secondary intention; an assessment of prevalence, aetiology, duration and management. *J Tissue Viability*. 2017;26(2):103-7. DOI: <https://doi.org/10.1016/j.jtv.2016.12.004>
- Bellusse GC, Ribeiro JC, Campos FR, Poveda VB, Galvão CM. Risk factors for surgical site infection in neurosurgery. *Acta Paulista de Enfermagem*. 2015;28(1):66-73. DOI: <https://doi.org/10.1590/1982-0194201500012>
- Ribeiro JC, Santos CB, Bellusse GC, Rezende VF, Galvão CM. Occurrence and risk factors for surgical site infection in orthopedic surgery. *Acta Paulista de Enfermagem*. 2013;26(4):353-9. DOI: <https://doi.org/10.1590/S0103-21002013000400009>
- Claessen FMAP, Braun Y, van Leeuwen WF, Dyer GS, van den Bekerom MPJ, Ring D. What Factors are Associated With a Surgical Site Infection After Operative Treatment of an Elbow Fracture? *Clin Orthop Relat Res*. 2016;474(2):562-70. DOI: <https://doi.org/10.1007/s11999-015-4523-3>
- Olowo-Okere A, Ibrahim YKE, Sani AS, Atata RF, Olayinka BO. Prevalence of Surgical Site Infection in a Nigerian University Teaching Hospital. *Journal of Pharmaceutical and Allied Sciences [Internet]*. 2017 [cited 2021 Sept 30];14(1):2430-8. Available from: <https://www.ajol.info/index.php/jophas/article/view/160431>
- Silva AL, Pontes TBC, Farias MS, Muniz Filha MJM, Alexandre SG, Ribeiro S. Characterization of children submitted to cardiac surgery that developed surgical site infection. *ESTIMA, Brazilian Journal of Enterostomal Therapy [Internet]*. 2020 [cited 2022 Apr 4];18:e1820. Available from: <https://www.revistaestima.com.br/estima/article/view/888/324>
- Herdman TH, Kamitsuru S, Lopes CT. NANDA International Nursing diagnoses: definitions and classification 2021-2023 [Internet]. 12th ed. New York; Thieme Medical Publishers; 2020 [cited 2021 Sept 30]. Available from: https://books.google.com.br/books?id=ilcbEAAAQBAJ&pg=PT23&source=gbs_toc_r&cad=3#v=onepage&q&f=false
- Galvão NS. Prevalência de feridas agudas e crônicas e fatores associados em pacientes de hospitais públicos em Manaus-AM [Tese] [Internet]. São Paulo: Universidade de São Paulo; 2016 [cited 2022 June 27]. Available from: https://www.teses.usp.br/teses/disponiveis/7/7139/tde-19052017-093929/publico/NARIANI_SOUZA_GALVAO_VERSAO_CORRIGIDA.pdf

20. Brasil. Ministério da Saúde. Dermatologia na Atenção Básica de Saúde. Cadernos de Atenção Básica n. 9 [Internet]. Brasília; 2002 [cited 2022 Apr 19]. Available from: <https://bvsmms.saude.gov.br/bvs/publicacoes/guiafinal9.pdf>
21. Paranhos WY, Santos VLCC. Avaliação de risco para úlceras de pressão por meio da escala de Braden, na língua portuguesa. Rev Esc Enferm USP [Internet]. 1999 [cited 2017 Nov 5];33(Spe):191-206. Available from: <http://www.ee.usp.br/reeusp/upload/pdf/799.pdf>
22. Plichta SB, Kelvin E. Munro's Statistical Methods for Health care research. 6th ed. New York: Lippincott Williams and Wilkins; 2013.
23. Aguiar PV, Gomes ET, Santos IN, Cavalcanti ATA. Pacientes submetidos a cirurgias bariátricas: fatores associados a complicações pós-operatórias de sítio cirúrgico. Revista SOBECC. 2018;23(1):28-35. DOI: <https://doi.org/10.5327/Z1414-4425201800010006>
24. Warren JA, Epps M, Debrux C, Fowler JL, Ewing JA, Cobb WS, et al. Surgical Site Occurrences of Simultaneous Panniculectomy and Incisional Hernia Repair. Am Surg. 2015;81(8):764-9. DOI: <https://doi.org/10.1177/000313481508100813>
25. Seaman AP, Sarac BA, ElHawary H, Janis JE. The effect of negative pressure wound therapy on surgical site occurrences in closed incision abdominal wall reconstructions: a retrospective single surgeon and institution study. Hernia. 2021;25(6):1549-55. DOI: <https://doi.org/10.1007/s10029-021-02427-3>
26. Levin M, Ziai H, Roskies M. Modalities of Post-Rhinoplasty Edema and Ecchymosis Measurement: A Systematic Review. Plast Surg (Oakv). 2021;30(2):164-74. DOI: <https://doi.org/10.1177/22925503211003836>
27. Beeckman D, Campbell J, LeBlanc K, Harley C, Holloway S, Langemo D, et al. Best practice recommendations for holistic strategies to promote and maintain skin integrity [Internet]. London: Wounds International; 2020 [cited 2022 Mar 04]. p. 31. Available from: <https://www.woundsinternational.com/resources/details/best-practice-recommendations-holistic-strategies-promote-and-maintain-skin-integrity>
28. Fusco SFB, Massarico NM, Alves MVMFF, Fortaleza CMCB, Pavan ÉCP, Palhares VC, et al. Surgical site infection and its risk factors in colon surgeries. Rev Esc Enferm USP. 2016;50(1):43-9. DOI: <https://doi.org/10.1590/S0080-623420160000100006>
29. Aguiar APL, Prado PR, Opitz SP, Vasconcelos SP, Faro ARMC. Fatores Associados à infecção de sítio cirúrgico em um hospital na Amazônia Ocidental Brasileira. Revista SOBECC [Internet]. 2012 [cited 2022 Feb 22];17(3):60-70. Available from: <https://revista.sobecc.org.br/sobecc/article/view/168/pdf-a>
30. Santos RM, Joaquim FL, Souza DF, Souza CJ. Infection of the surgical site in cardiac surgeries: factors that influence the prevention and control of infection and the attributions of Nursing; an integrative review. Res Soc Dev. 2020;9(8):e71985213. DOI: <https://doi.org/10.33448/rsd-v9i8.5213>

ASSOCIATE EDITOR

Vanessa de Brito Poveda

Financial support

Unified Scholarship Program (PUB) of the Pro-Rectorcy of Undergraduate Studies at the Universidade de São Paulo; Coordination of Improvement of Higher Education Personnel – Brazil (CAPES) – Financing Code 001.



This is an open-access article distributed under the terms of the Creative Commons Attribution License.