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Length of preoperative hospital stay: a risk factor for reducing surgical infection in femoral fracture cases

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ABSTRACT

Objective: To analyze infections of the surgical site among patients undergoing clean-wound surgery for correction of femoral fractures.
Methods: This was a historical cohort study developed in a large-sized hospital in Belo Horizonte. Data covering the period from July 2007 to July 2009 were gathered from the records in electronic medical files, relating to the characteristics of the patients, surgical procedures and surgical infections. The risk factors for infection were identified by means of statistical tests on bilateral hypotheses, taking the significance level to be 5%. Continuous variables were evaluated using Student's *t* test. Categorical variables were evaluated using the chi-square test, or Fisher's exact test, when necessary. For each factor under analysis, a point estimate and the 95% confidence interval for the relative risk were obtained. In the final stage of the study, multivariate logistic regression analysis was performed.
Results: 432 patients who underwent clean-wound surgery for correcting femoral fractures were included in this study. The rate of incidence of surgical site infections was 4.9% and the risk factors identified were the presence of stroke (odds ratio, OR = 5.0) and length of preoperative hospital stay greater than four days (OR = 3.3).
Conclusion: To prevent surgical site infections in operations for treating femoral fractures, measures involving assessment of patients' clinical conditions by a multiprofessional team, reduction of the length of preoperative hospital stay and prevention of complications resulting from infections will be necessary.

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Tempo de internação pré-operatório: um fator de risco para reduzir a infecção cirúrgica em fraturas de fêmur

Palavras-chave:
Infecção da ferida operatória
Fraturas do fêmur
Fatores de risco

RESUMO

Objetivo: Analisar as infecções de sítio cirúrgico em pacientes submetidos a cirurgias limpas para correção de fraturas de fêmur.
Métodos: Estudo tipo coorte histórica desenvolvido em um hospital de grande porte de Belo Horizonte. A coleta dos dados foi feita nos registros dos prontuários eletrônicos, de julho de 2007 a julho de 2009. Foram coletados dados referentes às características dos pacientes, dos procedimentos cirúrgicos e das infecções cirúrgicas. Os fatores de risco para infecção foram identificados por meio de testes estatísticos de hipóteses bilaterais, considerando nível de significância de 5%. As variáveis contínuas foram avaliadas por teste *t* de Student. As variáveis categóricas foram analisadas por meio de teste de qui-quadrado ou exato de Fisher, quando necessário. Para cada fator sob análise, foi obtida uma estimativa pontual e por intervalos de confiança de 95% para o risco relativo. Na última etapa do trabalho, foi feita uma análise multivariada (regressão logística).
Resultados: Foram incluídos neste estudo 432 pacientes submetidos a cirurgias limpas de correção de fratura de fêmur. A taxa de incidência de ISC foi de 4,9% e os fatores de risco identificados foram a presença de acidente vascular cerebral (razão das chances – OR = 5) e período de internação até a cirurgia acima de quatro dias (OR = 3,3).
Conclusão: Para a prevenção das infecções de sítio cirúrgico (ISC) das cirurgias de fraturas de fêmur serão necessárias medidas que envolvam a equipe multiprofissional na avaliação das condições clínicas dos pacientes, redução do tempo de internação até a cirurgia e prevenção das complicações decorrentes das infecções.

Introduction

Surgical site infection (SSI) is a disastrous adverse event for both patients and surgeons, especially in clean surgery for open reduction of fractures of the femur and hip. In Latin America, the financial costs involved in fractures of the proximal femur were assessed between 1980 and 2003 and were found to range from US$ 4500 to US$ 6000 per patient. In Brazil, these amounts may reach US$ 5500 per patient.[1] Every year, the Brazilian National Health System (Sistema Único de Saúde, SUS) undertakes greater numbers of treatments on femoral fractures in elderly patients. In 2009, the expenditure was approximately R$ 57.61 million on admissions versus R$ 24.77 million on medications for treating osteoporosis, which is an important cause of femoral fractures. In 2006, these expenditures had been R$ 49 million and R$ 20 million, respectively. Hannan et al.,[2] stated that the social and economic cost of femoral fractures becomes even greater because after a period of hospitalization, elderly patients need intensive medical care and long periods of rehabilitation, and also present a high mortality rate. The treatment for most femoral fractures is surgical. In using new materials for replacing prostheses, lower complication rates through better technology and design are sought. According to the potential of surgical procedures for wound contamination, they can be classified as clean, potentially contaminated, contaminated or infected. Arrowsmith[3] noted that clean surgical procedures ought to have lower incidence of surgical site infection (SSI) because they presented lower risk of contamination than other categories. Such procedures are considered to be markers of service quality and present better execution (elective, non-traumatic, tissues that are easily decontaminated and intact skin). The rate of incidence of SSI should be less than 2%.

Several risk factors relating to the patient and to the surgical procedure have been correlated with the incidence of SSI in femoral fractures. The intrinsic factors relating to elderly patients comprise inadequate nutritional status, diabetes mellitus (DM), use of tobacco, obesity, surgical site infection, colonization of the skin, immune response and prolonged period of preoperative hospitalization.[1] The extrinsic factors associated with the operation and the patient comprise skin preparation, appropriate clothes, preparation of the surgical team's hands, duration of the operation, surgical technique, processing of materials and articles, preparation of the antibiotic and preparation of the surgical site. Control over these factors is essential for minimizing the contamination of the surgical site.[4] Studies have emphasized the need to prioritize care for patients with femoral fractures, especially in relation to the time that elapsed between the fracture and the surgical procedure.[5]

Here, we investigated the preoperative factors and the operational parameters that are associated with SSI after open reduction of femoral fractures. The aim of our study was to answer five questions: (1) What is the risk of infection of the operative wound among patients undergoing open reduction of femoral fractures? (2) What are the main etiological agents of SSI after open reduction of femoral fractures? (3) Does SSI

increase the patient's risk of death after the surgery? (4) Does SSI increase the patient's length of hospital stay? and (5) What are the risk factors associated with SSI after open reduction of femoral fractures?

Materials and methods

This was a prospective cohort study conducted to analyze SSI and its risk factors among patients who underwent correction of fractures of the hip and femur, between July 2007 and July 2009. The study was conducted in a large-sized hospital, with a capacity for around 350 beds, which is a referral center for accidents and emergencies in the state of Minas Gerais, Brazil. The sample was composed of 432 patients who underwent elective surgery to correct femoral fractures. The response variables comprised surgical site infection and hospital death. The preoperative and operative parameters were divided into categorical and continuous variables. The continuous variables studied were age, duration of preoperative hospitalization and duration of the operation. The categorical variables were sex, type of surgery, shift during which the operation was performed (morning, afternoon or night), type of anesthesia, preoperative assessment score of the American Society of Anesthesiology (ASA), Nosocomial Infection Surveillance index, fracture classification, type of injury, type of osteosynthesis and type of surgery (elective or emergency). The comorbidities studied were diabetes mellitus (DM), congestive heart failure (CHF), systemic arterial hypertension (SAH), chronic obstructive pulmonary disease (COPD), heart diseases, hypercholesterolemia, alcohol abuse, psychiatric disorders, cancer of metabolic disease, stroke and anemia. The type of anesthesia was classified according to the combination of two or more procedures with or without sedation. Hospitalization before surgery was defined as up to four days before it or more than four days before it.[6] The duration of the surgery was stratified as less than or equal to 138 min of more than this duration. The ASA score was categorized into levels I, II, III and IV: ASA I for healthy patients; II for patients with moderate systemic disease; III for patients with severe preexisting systemic diseases that were not incapacitating; and IV for patients with life-threatening systemic disease. Category V-5, for individuals with life expectancy of a maximum of 24 h, was not identified in any of the patients of this study. For the index of surgical risk of infection, the score zero was used and the grouped score of 1 or 2 was used only for clean surgery. The prophylactic antibiotic was tested for use before or during the surgery.

The classification of femoral fractures was based on regions of the femur: fractures of the femoral neck,[7] trochanteric fractures[8] or subtrochanteric fractures.[9] For fractures of the diaphysis, the AO classification was used.[10] For some operations, the classification was not shown. We used the ICD-10 to code and group this variable.[11] Five types of osteosynthesis were used: plate, nail, screw, cement and others. The patients included were hospitalized and underwent clean surgical correction of femoral fractures between July 2007 and July 2009.

Risk factors and protective factors for infection were identified by means of statistical tests on bilateral hypotheses, in which the significance level was taken to be 5% ($\alpha = 0.05$). Continuous variables were evaluated using Student's t test or a nonparametric test, and categorical variables were analyzed using the chi-square or Fisher exact test (when necessary). For each factor under analysis, a point analysis and 95% confidence interval (95% CI) for the relative risk were obtained. In the last phase of the study, multivariate analysis was conducted using logistic regression. The variables tested in the logistic model were selected when the univariate analysis generated a value of $p \leq 0.25$.

This study was approved by the hospital involved, under report no. 18 and by the research ethics committee, under CAEE report no. 0108.0.203.000-11, which was approved on May 5, 2011, in conformity with resolution 196/96.

Results

This study included 432 patients who underwent open reduction of femoral fractures between July 2007 and July 2009. Falling from a standing position, falling from a bed and falling from a staircase were the most frequent types of trauma among the patients with femoral fractures who were evaluated. These patients accounted for 59% of the cases and were followed by those involved in motorcycle accidents (15.5%). The patients' length of hospital stay ranged from one to 139 days, with a median of eight days. The mean time spent in hospital before the surgery was five days and 43% of the patients were in hospital for up to four days. The patients' mean length of stay in the surgical center was six hours. The mean duration of the operation was one hour and 50 min and more than 70% of the operations lasted for not more than 138 min. Most of the patients were over the age of 60 years; 36% came to the hospital via an emergency unit; and 5% presented more than two diagnoses at the time of hospital admission (Tables 1–3).

Among the 432 patients who underwent correction of clean fractures of the femur, 21 patients were recorded as presenting SSI. The risk of infection was 4.9%.

Stroke and length of stay greater than four days presented statistically significant associations with SSI (Table 4).

It was found that for the patients with stroke who remained in hospital for more than four days, the expected risk of acquiring infection was almost three times greater than the risk among those who had this disease but were in hospital for not more than four days. Stroke and length of hospital stay until the surgery were the variables associated with SSI (Table 5).

Regarding hospital mortality after surgical correction of the femoral fracture, SSI was not associated with the chance of death ($p = 0.125$) (Table 6).

In 10 of the 21 cases of infection registered, the etiological agent remained unidentified. *Staphylococcus aureus* and *Acinetobacter baumannii* were the microorganisms most frequently identified. Only 2% of the 432 patients presented preoperative colonization, which was mostly detected by means of nasal and axillary swabs (Table 7).

Discussion

The risk of SSI of 4.9% that was recorded in this study among patients who underwent clean surgery on femoral fractures was greater than what was cited by Camargo.[12] It is worth

Table 1 – Open surgery for correcting femoral fractures in a tertiary-level hospital: patients' characteristics and surgical characteristics (July 2007–July 2009).

Variable	Frequency	%	Mean	Median	Minimum	Maximum	SD
Sex							
Female	208	48.1					
Male	224	51.9					
Age (years)			57	66	4	102	27.3
Age (years)							
<20	55	12.7					
20–39	80	18.5					
40–59	55	12.7					
60–79	122	28.2					
≥80	120	27.8					
Length of hospital stay (days)			14	8	1	139	19.4
Length of hospital stay before surgery (days)			8	5	0	234	14.1
Length of hospital stay before surgery (days)							
Up to 4	185	42.8					
More than 4	247	57.2					
Duration of surgery (h)			1:50	1:40	0:10	8:20	1:01
Duration of surgery (min)							
Up to 138	320	74.1					
More than 138	112	25.9					
ASA – American Society of Anesthesiology (score)							
I	174	42.8					
II	156	38.3					
III	70	17.2					
IV	7	1.7					
Type of surgery							
Elective	373	86.3					
Emergency	59	13.7					
Time of day of the surgery							
Morning	216	50					
Afternoon	195	45.1					
Night	21	4.9					
Type of osteosynthesis							
Plate	224	52.2					
Nail	105	24.5					
Screw	51	11.9					
Other	27	6.3					
Cement	22	5.1					

SD, standard deviation.

emphasizing that the rate of SSI in clean surgery in this hospital over the same period of July 2007 to July 2009, taking into account all body areas and specialties, such as orthopedics, plastic surgery, general surgery and neurosurgery, was approximately 2.2%. It is necessary to investigate the rates of SSI per surgeon and to monitor the risk factors relating to patients and to the surgical procedure. Efficient monitoring systems and information for surgeons regarding their infection rates have demonstrated better prevention of SSI. The infection rates can be reduced by more than one third through programs and personnel who are trained in monitoring and infection control.[13]

The study population was composed of patients who were mostly male, including adolescents, young adults and elderly individuals over the age of 60 years, perhaps because this is a referral hospital for attending to emergencies. However, many authors consider that women are the group most subject to femoral fractures,[1] and that study showed a greater risk of SSI. Pereira[14] studied groups of elderly people and found that the rate of incidence of hip fractures among women was 72.76%.

The classification for the femoral fractures was established in accordance with the region affected: femoral neck, trochanter or subtrochanteric diaphysis. Muniz et al.[15] showed that the main types of fracture were transtrochanteric (58.73%) and femoral neck (38.20%), which are considered to be due to low-energy trauma. In the present study, trochanteric fractures had higher frequency, but diaphyseal fractures presented higher risk of SSI, albeit without statistical significance.

The length of hospital stay after the operation (four days) was statistically significant in our univariate analysis ($p = 0.018$). This association was maintained in the multivariate analysis, thus confirming the presence of this risk factor for SSI. Prolonged preoperative hospital stay has been correlated with a risk of SSI.[6] The duration of the operation was assessed based on the cutoff point of the NHSN/CDC methodology,[16] in

Table 2 – Univariate analysis on the categorical variables: length of preoperative hospital stay greater than four days and stroke were risk factors for SSI, after surgery to correct femoral fractures, at the 5% significance level ($p < 0.05$) (July 2007–July 2009).

Variable	Total number of patients	Total number of cases with SSI	Risk of SSI (%)	Relative risk	95% CI	*p* value
Length of hospital stay before surgery (days)						
Up to 4	185	4	2.2			
More than 4	247	17	6.9	3.2	[1.09–9.30]	0.018
Stroke						
Yes	22	4	18.2	4.4	[1.61–11.93]	0.017
No	410	17	4.1			
Sex						
Female	208	14	6.7	2.2	[0.89–5.23]	0.064
Male	224	7	3.1			
Type of trauma (ICD-10)						
V87	29	2	6.9	1	–	0.734
W01	230	12	5.2	0.8	[0.31–5.61]	
W06.0	14	1	7.1	1	[0.10–9.77]	
W10	11	0	0.0	0.	–	
Y30	20	2	10.0	1.5	[0.11–4.50]	
V23	67	3	4.5	0.6	[0.27–8.73]	
Other	61	1	1.6	0.2	[0.40–44.53]	
Fracture classification						
Tronzo	150	4	2.7	1	–	0.475
Garden	105	7	6.7	2.5	[0.12–1.33]	
AO	100	7	7	2.6	[0.11–1.27]	
Seinsheimer	32	1	3.1	1.2	[0.10–7.38]	
Other	45	2	4.4	1.7	[0.11–3.17]	
Duration of the operation (min)						
Up to 138	320	13	4.1	0.6	[0.24–1.34]	0.147
More than 138	112	8	7.1			
ASA						
I	174	6	3.4	1	–	0.169
II	156	12	7.7	2.2	[0.17–1.17]	
III	70	2	2.9	0.8	[0.25–5.84]	
IV	7	1	14.3	4.1	[0.03–1.74]	
Type of surgery						
Elective	373	20	5.4	3.2	[0.43–23.13]	0.191
Emergency	59	1	1.7			
Time of day of the surgery						
Morning	216	9	4.2	1	–	0.367
Afternoon	195	12	6.2	1.5	[0.29–1.57]	
Night	21	0	0	0	–	
Diabetes mellitus (DM)						
Yes	26	2	7.7	1.6	[0.40–6.68]	0.365
No	406	19	4.7			
Congestive heart failure						
Yes	9	0	0	0	–	0.635
No	423	21	5			
Cardiopathy						
Yes	16	0	0	0	–	0.444
No	416	21	5			
Hypertension						
Yes	148	9	6.1	1.4	[0.62–3.34]	0.264
No	284	12	4.2			
Chronic obstructive pulmonary disease (COPD)						
Yes	8	0	0	0	–	0.668

Table 2 – (*Continued*)

Variable	Total number of patients	Total number of cases with SSI	Risk of SSI (%)	Relative risk	95% CI	*p* value
No	424	21	5			
Hypercholesterolemia						
Yes	3	0	0	0	–	0.860
No	429	21	4.9			
Alcohol abuse						
Yes	19	1	5.3	1.1	[0.15–7.68]	0.620
No	413	20	4.8			
Psychiatric disorders						
Yes	18	1	5.6	1.2	[0.16–8.10]	0.599
No	414	20	4.8			
Metabolic disorders						
Yes	9	0	0	0	–	0.635
No	423	21	5			
Cancer						
Yes	12	0	0	0	–	0.545
No	420	21	5			
Type of osteosynthesis						
Plate	224	15	6.7	1	–	0.246
Nail	105	2	1.9	0.3	[0.82–15.09]	
Screw	51	1	2	0.3	[0.46–25.27]	
Other	27	1	3.7	0.6	[0.03–8.14]	
Cement	22	2	9.1	1.4	[0.04–4.20]	
Anesthesia: spinal anesthesia with sedation						
Yes	224	14	6.3	1.9	[0.76–4.71]	0.120
No	208	7	3.4			
Surgical infection risk index						
Score 0	246	11	4.5	0.7	[0.31–1.66]	0.585
Score up to 2	161	10	6.2			
Anemia						
Yes	178	10	5.6	1.4	[0.59–3.43]	0.288
No	228	9	3.9			
Hematocrit less than 36 mg/dL						
Yes	259	15	5.8	2.1	[0.72–6.29]	0.120
No	147	4	2.7			
Skin colonization						
Yes	17	1	5.9	1.2	[0.17–8.57]	0.578
No	415	20	4.8			
General anesthesia						
Yes	41	2	4.9	1	[0.24–4.16]	0.620
No	391	19	4.9			

ASA, American Society of Anesthesiology; 95% CI, 95% confidence interval; SSI, surgical site infection; RR, relative risk; ICD-10, international classification of diseases.

which the number of minutes defined for this type of operation was 138. Although this is a variable classically associated with SSI, it was not associated with surgical infection in the present study. Long duration of an operation in a contaminated environment favors surgical contamination and, consequently, development of infection.[17]

The ASA variable, which assesses the patient's preoperative clinical state was not considered to be a risk factor for SSI in the present study. Although the patients were predominantly graded as ASA I, those with ASA IV presented a risk of SSI that was four times higher. Many authors have considered that the ASA score is a risk factor for SSI that relates directly to the severity of the patient's condition and the risk of infection.[18] Plates were the synthesis material most used, in 224 cases (51%). Sakaki et al.,[1] stated that the treatment for the majority of femoral fractures should be surgical. Conservative treatment should be reserved only for some incomplete or non-displaced fractures. The aim of the surgery is to reduce the fracture and fix it in a stable manner, using a variety of osteosynthesis methods. Spinal anesthesia with sedation is the anesthetic procedure most used and the risk of infection in relation to patients for whom this was not used has been found to be 1.9%. Ercole and Chianca[19] showed that patients who underwent associated anesthesia

Table 3 – Univariate analysis on the continuous variables: only the length of hospital stay before the operation (days) was associated with SSI after the operation to correct femoral fractures (July 2007–July 2009).

Variable	SSI	Number of patients	Mean	Median	Standard deviation	*p* value
Length of hospital stay before operation (days)	Yes	9	31	21	24.9	0.008
	No	193	13	8	18.8	
Age (years)	Yes	21	63	73	27.5	0.329
	No	411	57	66	27.3	
Duration of operation (h)	Yes	21	2:14	1:44	0.1	0.365
	No	411	1:49	1:39	0	
Hemoglobin	Yes	19	11.0	10.6	1.2	0.298
	No	387	11.4	11.3	2	
Hematocrit	Yes	19	33.0	32.5	4.1	0.323
	No	387	34.3	33.9	6	
Glycemia	Yes	11	122.2	106.0	34.7	0.913
	No	167	126.9	114.0	62	

SSI, surgical site infection.

Table 4 – Analysis of variance: in the final model, the length of hospital stay before the operation and stroke were independently associated with surgical site infection after the operation to correct femoral fractures. Preoperative length of hospital stay greater than four days increased the chance that a patient would be infected almost threefold (OR = 3.3; *p* = 0.037) (July 2007–July 2009).

Variable	Regression coefficient	Standard error of the regression coefficient	Odds ratio	*p* value
Preoperative length of hospital stay greater than 4 days	1.19	0.57	3.3	0.037
Stroke	1.60	0.62	5	0.009
Constant	−3.96	0.52		

Table 5 – Simulation of risk of SSI: length of hospital stay before the surgery and stroke.

Type of patient	Expected risk of SSI (%)	Number of patients	Observed SSI	Observed risk of SSI (%)
No stroke and length of stay up to 4 days	1.9	177	2	1.1
No stroke and length of stay more than 4 days	5.9	233	15	6.4
Previous stroke and length of stay up to four days[a]	8.6	8	–	–
Previous stroke and length of stay more than four days[a]	23.6	14	–	–

[a] Small sample size.

Table 6 – Hospital mortality after surgery to correct femoral fractures: surgical site infection was not associated with the chance of death (*p* = 0.125) (July 2007–July 2009).

SSI	Number of patients	Hospital mortality	Risk of hospital death (%)	Relative risk	95% confidence interval	*p* value
Yes	21	3	14.3	2.6	[0.83–7.83]	0.125
No	411	23	5.6			
Total	432	26	6			

presented 3.4 times greater risk of infection than those who underwent blocking. The data from the present study were insufficient to characterize antibiotic as a protection factor, although these data signaled that there were patients who received cefazolin and who presented a risk of SSI that was around four times lower. In a meta-analysis, it was observed that in surgery to fix closed fractures, prophylaxis with a single dose of antibiotics reduced the severity of deep-wound, surface-wound, urinary-tract and respiratory-tract infections. That analysis also showed multiple-dose prevention had a similar effect on the size of deep-wound infection, but no significant effect on urinary or respiratory infections was confirmed.[20]

The etiological agents identified in SSI cases were *Staphylococcus aureus*, *Acinetobacter baumannii* and *Enterococcus* sp. In some cases, more than one microorganism was identified from cultures. It should be noted that etiological agents were only identified in 11 of the 21 cases that presented SSI. This low proportion of findings from the cultures performed explains the absence of treatments guided by laboratory results.

The multivariate analysis confirmed that stroke before the clean surgical correction of femoral fractures was characterized as a risk factor for SSI. In a cohort study involving 1379 victims of proximal femoral fractures, Feng et al.[21] reported that the higher ASA scores found in cases of hemiplegia signified that these patients would be more likely to have three

Table 7 – Open surgery to correct femoral fractures in a tertiary-level hospital: skin colonization and etiological agents of the surgical site infection (July 2007–July 2009).

Variable	Frequency	%
Etiological agent identified for SSI		
Yes	11	52
No	10	48
Total	21	100
Etiological agent for SSI		
Acinetobacter baumannii	2	18
Staphylococcus aureus	2	18
Enterobacter cloacae + *Acinetobacter baumannii*	1	9
Enterococcus sp.	1	9
Escherichia coli + *Acinetobacter baumannii*	1	9
Escherichia coli + *Enterococcus* sp. (ESBL-producing)	1	9
Proteus mirabilis	1	9
Proteus mirabilis + MRSA	1	9
Staphylococcus aureus + *Enterococcus* sp.	1	9
Total	11	100
Skin colonization?		
Yes	9	2
No	423	98
Total	432	100
Skin microorganisms identified		
Staphylococcus aureus	5	55.0
Staphylococcus aureus + *Enterobacter* sp.	2	22.0
Proteus mirabilis	1	11.0
Staphylococcus aureus + *Streptococcus pyogenes*	1	11.0
Total	9	100.0

ESBL, extended-spectrum beta lactamase; MRSA, methicillin-resistant *Staphylococcus aureus*; SSI, surgical site infection.

or more comorbidities, lower cognitive capacity, weaker pre-fracture outpatient status, longer hospital stay and higher mortality rate.

In the present study, patients with previous stroke presented four times greater risk of developing SSI. A prospective study for evaluating the effect of the anterior passage after occurrences of femoral neck or intertrochanteric fractures showed that patients with histories of stroke were more likely to be male, have ASA grades III or IV, have three or more comorbidities, be limited to moving around at home and be dependent in activities of daily living (ADLs) and instrumental activities, before the time of the fracture. The length of hospital stay was significantly greater for these patients.[22]

The limitation of the present study was that it was retrospective, with lack of information on the patients' evolution over the course of administration of the prophylactic antibiotics and lack of definition and adherence criteria for the clinical evaluation and detailed history-taking.

Conclusion

The risk factors for SSI in cases of correction of femoral fractures through clean surgery that were identified in the present study were the presence of stroke before the surgery and length of hospital stay before the operation of more than four days. The combined action of these two factors contributed toward raising the rate of SSI among the patients who underwent surgery to three times the expected risk. Control over the risk factors and the time that elapses until the operation is highly desirable for reducing the risk of infection in these patients. The incidence of SSI identified in cases of clean surgery on femoral fractures presented levels greater than the infection rate recorded in the hospital. Clean surgery performed on the femur should be monitored and kept under surveillance because this is a marker for infection associated with quality control in healthcare services.

Conflicts of interest

The authors declare no conflicts of interest.

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