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ORIGINAL ARTICLE

SURGICAL SITE INFECTION IN FEMORAL OSTEOSYNTHESIS: INCIDENCE AND ASSOCIATED FACTORS

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ABSTRACT

Objective: to determine the incidence and associated factors of surgical site infection in femoral osteosynthesis in a philanthropic hospital unit in the interior of Minas Gerais - Brazil. Method: cross-sectional, descriptive, retrospective study conducted from February 2, 2017, to March 31, 2019. Data were extracted from medical records and health care-related infection notification forms. Results: the incidence of surgical site infections was 5.5%. 46.7% of the patients were readmitted, 26.7% had surgical debridement and the mean length of stay was 13.5±6.2 days. No deaths were reported. Antimicrobial prophylaxis was observed in 80% of the patients. Conclusion: the study contributed to the generation of health and evaluation indicators that provided the tracking of surgical site infections and active surveillance for the construction of strategies to prevent institutional adverse events.

DESCRIPTORS: Femoral Fractures; Surgical Wound Infection; Orthopedics; Disease Notification; Public Health Surveillance.

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INTRODUCTION

Surgical site infection (SSI) in clean surgeries for open reduction of femoral and hip fractures is considered an adverse event that increases the rates of hospital readmission, antibiotic use, morbidity and mortality, hospital stay and financial costs of the institution[1-2]. International studies indicate a prevalence of SSI in femur fracture of 3.6% to 4.8%[2-5], while national studies show a prevalence of 4.0% to 4.9%[1,3].

SSI is one of the most prevalent complications in orthopedic surgery, and its incidence may vary greatly depending on infection definitions, fracture location and surgical patterns[6]. Infection increases the possibility of abscess formation, osteomyelitis, and bone union problems, which may have long-term negative effects on the mobility of uninjured limbs or joints[2-3,6].

Epidemiological studies generally point out the incidence of SSI in orthopedic patients in general[1,7], however, there is a lack of studies evaluating the incidence of SSI in patients who suffered femur fractures and the characterization of this population.

The identification of the descriptive profile, the therapeutic and prophylactic conduct, and the surveillance methods adopted may contribute to the prevention of SSI, which demands, besides effective leadership and institutional support, the participation of the multidisciplinary team, whose responsibility is to promote patient safety[8-9].

In addition, there is a lack of information on SSI in healthcare institutions due to the underreporting of cases[6-9]. In view of the above, this study aimed to determine the incidence and associated factors of SSI in femoral osteosynthesis in a philanthropic hospital unit in the interior of Minas Gerais.

METHOD

This is a cross-sectional, descriptive and retrospective study, carried out in a medium-sized hospital unit that is a reference in Orthopedics and Traumatology for the expanded health region of the Jequitinhonha Valley, Minas Gerais. The study included patients ≥18 years of both genders on the date of the surgical procedure, undergoing osteosynthesis for treatment of femoral fractures and subsequently notified with SSI. And as exclusion factors, patients who underwent conservative treatment for fracture resolution and submitted to surgical procedures in other bone structures.

Data were collected from secondary sources, referring to the period from February 2, 2017, to March 31, 2019. The data collection instrument was designed by the researchers themselves according to the parameters studied in the medical records and in the notification forms of health care-related infections, performed by the Hospital Infection Control Service (SCIH).

The instrument went through a pre-test in order to verify the difficulties of completion and the need for introduction or deletion of variables. At the end of the pre-test evaluation, the following variables were included in the data collection instrument: clinical (medical diagnosis, length of stay, length of surgery, readmissions in the period, WBC, hemoglobin, need for blood transfusion, axillary temperature variation and comorbidities); clinical evolution (discharge, transference or death); potential for contamination regarding the surgery (clean, potentially contaminated, contaminated or infected); American Society of Anesthesiologists (ASA) preoperative evaluation score; prescription at discharge; prostheses used in the synthesis; antibiotic use (prophylactic and therapeutic); microbiological data;

gender, and age. To quantify the total number of surgeries performed in the treatment of femoral fractures in the period, the Surgical Procedures Record Book and the hospital management software SPDATA® were analyzed.

The sample size calculation was performed based on the central limit theorem, which describes the distribution of the mean of a random sample of a non-normal population with finite variance, calculated using a 95% confidence interval, resulting in 385 participants. The 385 records were obtained by simple random drawing. The sample loss was 32%, due to missing information in the records, and thus 123 records were replaced. Data collection was performed by two researchers who received previous training on the instrument and on the forms and records used by the institution for the notification of SSI.

The SCIH of the institution uses the instrument called phonetic search script: surgical exit for the tracking of SSI, which are performed by the SCIH nurse 30 days after hospital discharge and, in case of osteosynthesis with implant, up to three months after the surgical intervention. Notifications arising from phone calls were identified.

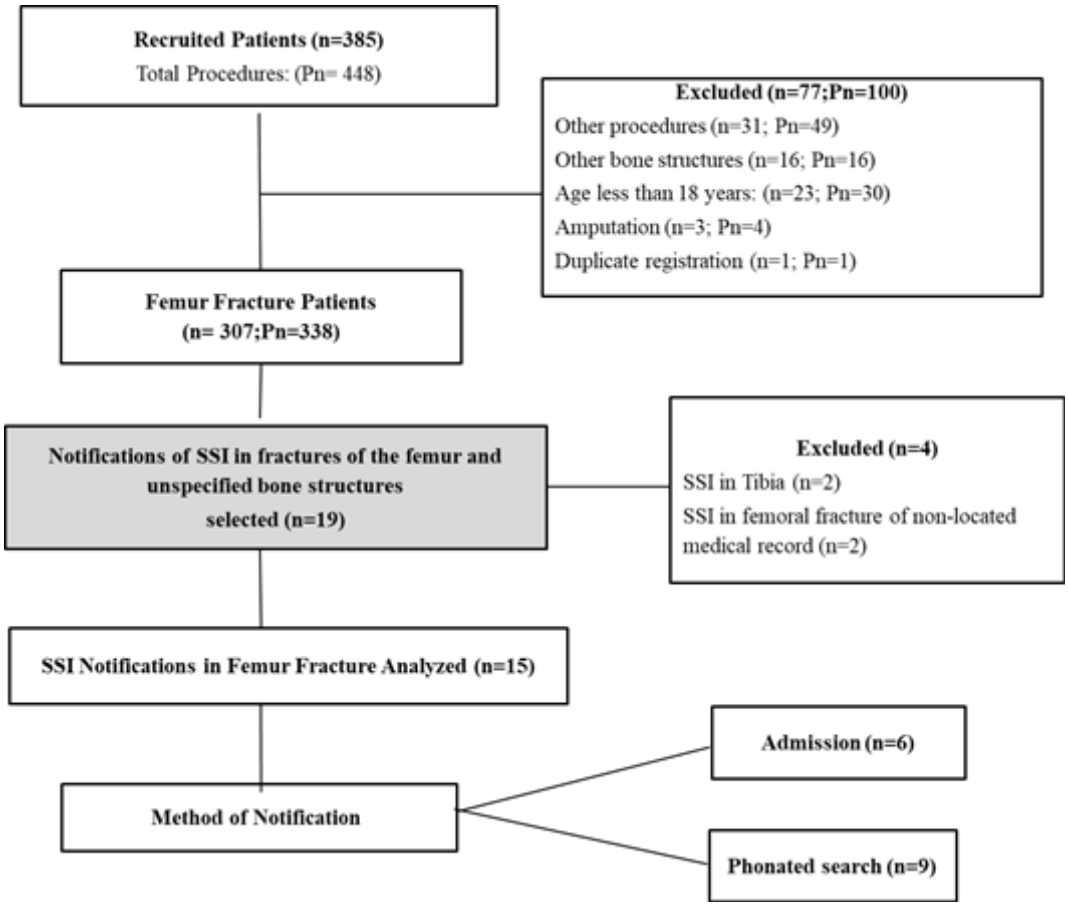
After identifying the clinical signs that may show possible involvement of the patient by SSI, in the phonetic search or medical diagnosis during hospitalization, the professional who makes the call is responsible for filling out the notification form of health care-related infections. This notification form was also used in this study to complement the data collection instrument.

Quantitative variables were presented by mean (M) ± standard deviation (SD). Categorical variables were represented by absolute (n) and relative (%) frequencies. The software Statistical Package for the Socia Sciencel® version 20 was used.

This study was approved by the Research Ethics Committee of the Universidade Federal dos Vales do Jequitinhonha e Mucuri, under opinion number 3,133,418.

RESULTS

From the analysis of the medical records and according to the exclusion criteria, we identified 307 patients who had undergone surgical treatment for femur fracture (Figure 1).



Legend: SSI: Surgical Site Infection; n: absolute number; Pn: procedures number.

Figure 1 - Flowchart of data collection and inclusion and exclusion criteria. Diamantina, MG, Brazil, 2019. Source: Authors (2019)

To calculate the incidence of SSI, 15 medical records with confirmed notifications of SSI resulting from femoral osteosynthesis were considered. The incidence of SSI was 5.5%. Of the samples analyzed, 60% (9) were men and 40% (6) were women. The age of women ranged from 54 to 98 years (55.9±24.6) and of men from 21 to 86 years (41.9±19.1). The mean length of stay was 13.5±6.2 days.

As for the hospitalization outcome, 73.3% (11) of the cases were discharged from the hospital and 27.7% (four) were transferred to more complex units. No deaths were recorded.

Prior comorbidities were identified in 60% of the sample and the surgical risk at surgery ranged from ASA I to III. The topographies of the fractures were diaphyseal, trans trochanteric, intercondylar, subtrochanteric and neck. The average surgical time for each type of fracture was 112 ± 46 minutes.

Table 1 presents the clinical and epidemiological profile of the research participants.

Table 1 - Clinical and epidemiological profile of patients with surgical site infection in femur fracture, according to method and notification. Diamantina, MG, Brazil, 2019 (continues)

Variables	Occurrences n (%)	Average Age M±SD
Comorbidities		
Systemic Arterial Hypertension	6 (40)	-
Heart disease	4 (26,7)	-
Diabetes Mellitus	3 (20)	-
Dyslipidemia	2 (13,3)	-
Chronic renal insuficciency	1 (6,7)	-
Fracture Mechanism		
Automobile Accident	7 (46,6)	34,7±5,4
Fall from One's Own Height	6 (40)	76,7±6,4
Fall from Bed	1 (6,7)	67,0±5,8
Fall from stairs	1 (6,7)	70,0±10,2
ASA		
I	6 (40)	-
II	3 (20)	-
III	5 (33,3)	-
IV and V	-	-
No record	1 (6,7)	-
Contamination potential		
Clean	8 (53,3)	-
Potentially contaminated	2 (13,3)	-
Contaminated	4 (26,7)	-
Infected	-	-
No record	1 (6,7)	-
Type of osteosynthesis		
Haste Intra Medullar	6 (40)	-
External Fixator	6 (40)	-
Plates and Screw	2 (13,3)	-
Total Hip Arthroplasty	1 (6,7)	-
Fracture topography		
Diaphyseal	6 (40)	-
Trans trochanteric	4 (26,7)	-
Intercondylar	2 (13,3)	-
Subtrochanteric	2 (13,3)	-
Colo	1 (6,7)	-
Hospitalization		
Hospital Discharge	11(73,3)	-

Transference	4 (27,7)	-
Death	-	-
Re-Hospitalization		
Surgical Wound Infection	4 (37)	
Surgical Wound Dehiscence	3 (27)	-
Refracture associated with Surgical Wound Dehiscence and Chronic Osteomyelitis	2 (18)	-
Surgical Wound Dehiscence associated with Chronic Osteomyelitis	1 (9)	-
Femoral Refracture	1 (9)	-
Prescription to Hospital Discharge		
Antibiotic Home Care	10 (67)	-
Deep Vein Thrombosis Prophylaxis	4 (27)	-
No record	1 (6)	-

Source: Authors (2019)

Regarding the mean number of surgical procedures performed, it was verified 4.0±3.6 for those with two or more hospitalizations and 1.1±0.4 for participants with one hospitalization. In the discharge summary, we identified antibiotic prescriptions at the time of discharge, for use at home, symptomatic medications, and for deep vein thrombosis (DVT) prophylaxis.

As for antibiotic prophylaxis of SSI in the preoperative period, administration was observed in 80% (12) of patients. The standard antibiotic was Cefazolin. No prophylaxis was seen in 20% (three) of the patients. It was found that 66.6% (10) of the patients who were reported after hospital discharge had used antibiotics, that is, in 33.4% (five) of the patients there was no report of antibiotic use.

Debridement was performed in 26.7% (four) of the infected patients, the mean debridement was 2.3±1.8. In 73.3% (11) of the patients' debridement was not performed.

Clinical signs associated with SSI were divided according to the method of reporting (Table 2).

Table 2 - Clinical signs observed in patients with SSI in femur fracture, according to method and notification. Diamantina, MG, Brazil, 2019 (continues)

Clinical Signs	**Notification/ Hospitalization n (%)**	**Clinical Signs**	**Notification/ Phonate Search n (%)**
Serous or bloody exudate	6 (100)	Serous exudate	1(11,1)
Edema, hyperemia and local temperature increase	5 (83,3)	Local pain	2(22,2)
Purulent, yellowish or greenish exudate	2 (33,3)	Local pain	2(22,2)

Hardened or floating area in place	2 (33,3)	Local pain	2(22,2)
Sensory lowering and vomiting	1 (16,6)	Local pain	2(22,2)

Source: Authors (2019)

In the laboratory investigation, infection records were identified in 33.3% (five) of the patients. The culture records detected 20% *Staphylococcus aureus*, 20% *Staphylococcus ssp.*, 20% *Escherichia coli*, 40% *Enterobacter ssp.* and 20% *Edwardsiella ssp.*

Table 3 - Microbiological aspects of participants diagnosed and antimicrobial therapy adopted in patients with femur fracture. Diamantina, MG, Brazil, 2019

Patient	Microorganism	Antibiogram (resistance)	Antimicrobial Therapy
P1	*Staphylococcus aureus*	Erythromycin, Theicoplamine	Clindamycin, Gentamicin, Cefepime, Ciprofloxacin
P2	*Staphylococcus ssp* Coagulase Negativa	Penicillin,Cephalothin Erythromycin, Ciprofloxacin, Ampicillin	Clindamycin, Gentamicin, Oxacillin, Rifampicin
P3	*Escherichia coli*	Cephalothin, Clindamycin, Penicillin	Oxacillin, Clindamycin
	Enterobacter ssp		
P4	*Edwardsiella ssp*	Erythromycin , Ampicillin , Gentamicin, Sulfazotrim Aztreonam,Cephalothin Penicillin , Clindamycin , Cefuroxime	Clindamycin, Ciprofloxacin Vancomycin, Cefepime
	Escherichia coli	Penicillin, Cefotaxime, Tetracycline, Clindamycin, Nitrofurantoin	
P5	No Bacterial Growth	-	Ciprofloxacin, Clindamycin

Source: Authors (2019)

It was found that 53.3% (eight) of the patients required RBC concentrate transfusion (hemoglobin score ranged from 5.5 to 10.2 g/dL) and that 33% (five) had leukocytosis (total WBC between 11,100-16,200 mm3).

The investigation of inflammatory markers showed high values of C-reactive protein (greater than 192 mg/dL) in eight medical records. In 87.5% (seven) of the patients, high values (greater than 123 mm/hour) in the erythrocyte sedimentation rate were verified. In the analysis of body temperature variation, an increase in axillary temperature >37.8 °C was seen in 13.3% (two) of patients.

DISCUSSION

The tracking of adverse events is important in the evaluation of the quality of care

by generating risk indicators. In this study, 15 (5.5%) reports of SSI in femur fractures were identified. Previous studies corroborated these results, when they also surveyed a large sample size of patients with femur fractures and identified a small percentage of notifications[4,6]. The phonetic search surveillance method has contributed significantly to the increased identification of SSIs. Screening decreases the possibilities of underestimating the incidence of SSI, since in cases of superficial infections, such as skin abscesses, the patient is usually followed up as an outpatient with oral antibiotics, not requiring new hospital admissions[3,6,9].

In the present study, males predominated, with a higher incidence of comorbidities. Previous studies have identified associations between SSI and the presence of chronic diseases[1,4]. Comorbidity may increase by up to 0.35% the chance of SSI occurrence[1,4]. Regarding the prevalence of the male gender, the literature addresses men had a five times higher risk of presenting SSI, however, it is still a gap in scientific knowledge and needs further studies to justify the association[9].

The mean hospitalization time in this study was shorter than that found in an observational case-control study, whose mean time was 29±4.3 days[4]. Another study also found higher values, with a mean of 24.6±5.7 days for infected patients; in the absence of infection, the mean was 15±3.4 days[7]. In this study, no deaths were recorded; however, the onset of infectious processes during hospitalization increases the risk of mortality[6]. The National Healthcare Safety Network (NHSN) reports that SSI have a mortality rate of 3%, and this adverse event corresponds to 75% of health care-related infections worldwide[10].

The most recurrent potential for contamination of surgeries in this study was clean surgeries and, as the potential for contamination increases, the incidence of SSI can increase significantly ($p<0.05$)[9]. Thus, the monitoring of SSI, especially in clean surgeries, is an indicator of quality of care, because it can show failures in the care and technique of surgical procedures, which compromises the recovery. The performance of multiple surgical procedures at the same site is directly associated with the level of compromise of bone structures, and increases the risk of developing SSI, as well as the performance of previous surgeries at the surgical site[9-11].

In the present study, it was found that the mean number of procedures reported post-discharge was lower when compared to those reported in the hospital setting. In this case, new hospital admissions and a higher number of surgical interventions were required for the treatment of SSI. This approach is justified because postoperative infection may be related to the need of surgical debridement[12-15].

The maximum surgical time of 158 minutes in fractures found in this study was considered a risk for SSI. A cohort study verified that a time longer than 120 minutes in hip arthroplasty presented a higher risk of SSI when compared to those between 60 and 89 minutes[9]. Another retrospective cross-sectional study indicated that every 60 minutes increased the risk of SSI by 64%[5]. The authors further highlighted that the surgical time may be influenced by several factors, such as team experience, equipment availability, fracture complexity, need for debridement and difficulty in prosthesis positioning[5]. Despite the difficulty in modifying these risk factors, they are essential and useful for preoperative counseling of patients and their families regarding their own risk profile for SSI.

Regarding prostheses, several authors have researched that the use of external fixation is a factor that increases the likelihood of developing SSI; however, its implantation is the best treatment option in many cases[3-4,6,13,15].

For the prevention of SSI, the National Health Surveillance Agency (ANVISA) recommends the administration of prophylactic antibiotics in orthopedic surgeries with implants or bone manipulation, which should occur up to 60 minutes before the surgical incision and discontinuation of use within 24 hours[16].

Although this study did not measure the time of prophylactic antibiotic application in

relation to the surgical act, Cefazolin administration was evidenced in 80% of the patients. Prophylactic Cefazolin is considered a drug of first choice in orthopedic prophylaxis[9,17-19]. Blood transfusion was required in 53% of patients, with hemoglobin values ranging from 7.1g/dL to 14.1g/dL. A history of anemia and preoperative hemoglobin less than 12g/dL for men and 11g/dL for women is a risk factor for SSI, in addition to increasing the risk of mortality, postoperative pneumonia, and length of hospital stay[2]. Blood transfusion increases the risk of SSI by three times, and its necessity must be evaluated considering infection prevention measures[2,9,20].

Regarding hospital readmissions, there were SSIs due to surgical wound dehiscence; new fracture associated with dehiscence and chronic osteomyelitis. A retrospective study showed that diseases of the musculoskeletal system and connective tissue system accounted for 8.5% of readmissions due to surgical complications, including osteomyelitis, post-procedure musculoskeletal disorders and bone continuity[12].

A low number of records of laboratory tests for microbiological investigation in SSI was identified[5]. It is important to highlight that many of the infections were reported after discharge, which contributed to the low percentage of this laboratory record. A study also identified a small number of these exams and justified those superficial infections do not require microbiological exams[9].

As to etiological agents, the results of this study were divergent from those found in the literature, which revealed a high prevalence of *Staphylococcus aureus* in infections from orthopedic surgeries[3-6,9,21]. Of the microorganisms identified, *Edwardsiella ssp* species was found to be a bacterium found in the aquatic environment of freshwater or brackish water environments. A retrospective international case-control study identified that *Edwardsiella tarda* presented a 44.6% mortality rate in patients with soft tissue infection, associating bacteremia with the ingestion of contaminated aquatic animals[22].

Antimicrobial resistance has been observed to a wide class of antibiotics, constituting a public health problem[16,23-24]. It is estimated that in the United States of America, 39% to 51% of SSI-causing microorganisms are resistant to standard prophylactic antibiotics in clinical practice[8]. Antimicrobial resistance is related to the inappropriate use of antibiotics, especially the duration and time interval of antibiotic therapy[16,23].

It was identified in this study, through the discharge summary, that 67% of patients were prescribed antibiotics at home, and 27% were prescribed only symptomatic medications and deep venous thrombosis (DVT) prophylaxis. The Ministry of Health emphasizes that DVT prophylaxis should be performed in patients who have undergone major surgery and its prescription should be extended after hospital discharge for a period of 28 to 30 days in the elderly[17]. Recent studies also alerted to the encouragement of early ambulation during hospitalization as a preventive measure against DVT, pressure injuries and atelectasis[21,24].

Authors highlighted that early ambulation increases the chances of early hospital discharge and, consequently, less exposure to hospital infections[24]. Regarding the prescription of antimicrobials, ANVISA recommends that prophylaxis should be discontinued 24 hours after surgery, however, this study evidenced the maintenance of prescriptions until the time of discharge and extended until use at home[16].

The limitations of this study refer to the difficulties in collecting data from the medical records because they were incomplete or illegible.

CONCLUSION

The results of this study suggested that the incidence of SSI may not have defined

the real incidence of infections in femoral osteosynthesis, mainly due to underreporting and inconsistencies in post-discharge surveillance. It is suggested that factors associated with SSI, such as potential for contamination, type of osteosynthesis, topography of the fracture, use of prostheses, antibiotics, microbiological data, fracture mechanisms and comorbidities be inserted into the institution's pre-, intra- and post-surgical protocols. Such variables included in the safe surgery protocol may contribute not only to the generation of indicators for the institutional practice, but also to the resolution of gaps related to SSI, as it is still a challenge for the scientific community.

Check sheets, as a quality tool, are suggested to complement the surgical checklist in the safe surgery protocol of the institution, since the tracking of SSI and active surveillance contribute to the construction of prevention strategies, based on the identification of adverse events occurring in the institution. This study can also contribute to support future analytical studies, which can deepen the knowledge and impact of SSI associated with femur fracture.

REFERENCES

1. Pereira HO, Rezende EM, Couto BRGM. Tempo de internação pré-operatório: um fator de risco para reduzir a infeção cirúrgica em fraturas de fêmur. Rev Bras Ortop [Internet]. 2015 [accessed 12 nov 2019]; 50(6). Available from: https://doi.org/10.1016/j.rbo.2015.04.011.

2. Ji C, Zhu Y, Liu S, Li J, Zhang F, Chen W, et al. Incidence and risk of surgical site infection after adult femoral neck fractures treated by surgery A retrospective case–control study. Medicine [Internet]. 2019 [accessed 15 dez 2019]; 98(11). Available from: http://doi.org/10.1097/MD.0000000000014882.

3. Oliveira PR, Leonhardt MC, Carvalho VC, Kojima KE, Silva JS, Rossi F, et al. Incidence and risk factors associated with infection after intramedullary nailing of femoral and tibial diaphyseal fractures: Prospective study. Injury Int. J. Care Injured. [Internet]. 2018 [accessed 18 jan 2020]; 49(10). Available from: https://doi.org/10.1016/j.injury.2018.07.024.

4. Bai Y, Zhang X, Tian Y, Tian D, Zhang B. Incidence of surgical-site infection following open reduction and internal fixation of a distal femur fracture: an observational case–control study. Medicine [Internet]. 2019 [accessed 18 mar 2020]; 98(7). Available from: http://doi.org/10.1097/MD.0000000000014547.

5. Xu H, Yu L, Li Y, Gong Z. Prolonged surgical duration, higher body mass index and current smoking increases risk of surgical site infection after intra-articular fracture of distal femur. ANZ J Surg. [Internet]. 2019 [accessed 13 abr 2020]; 89(6). Available from: https://doi.org/10.1111/ans.15263.

6. Lu K, Zhang J, Cheng J, Liu H, Yang C, Yin L, et al. Incidence and risk factors for surgical site infection after open reduction and internal fixation of intra-articular fractures of distal femur: a multicentre study. Int Wound J [Internet]. 2019 [accessed 14 abr 2020]; 16(2). Available from: https://doi.org/10.1111/iwj.13056.

7. Heitzmann LG, Battisti R, Rodrigues AF, Lestingi JV, Cavazzana C, Queiroz RD. Osteomielite crônica pós-operatória nos ossos longos – O que sabemos e como conduzir esse problema? Rev Bras Ortop [Internet]. 2019 [accessed 19 maio 2020]; 54(6). Available from: http://doi.org/10.1016/j.rbo.2017.12.013.

8. World Health Organization (WHO). Protocol for surgical site infection surveillance with a focus on settings with limited resources. [Internet]. Geneva: WHO; 2018 [accessed 11 dez 2019]. Available from: https://www.who.int/infection-prevention/tools/surgical/SSI-surveillance-protocol.pdf.

9. Franco LM de C, Ercole FF, Mattia A de. Infecção cirúrgica em pacientes submetidos a cirurgia ortopédica com implante. Rev. SOBECC [Internet]. 2015 [accessed 20 nov 2019]; 20(3). Available from: https://revista.sobecc.org.br/sobecc/article/view/87.

10. Centers for Disease Control and Prevention (CDC). National Healthcare Safety Network (NHSN).

Patient Safety Component Manual. [Internet]. 2020 [accessed 12 set 2020]. Available from: https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf.

11. Ibrahim S, Meleppuram JJ. Uma análise retrospectiva de fraturas complexas do fêmur proximal tratadas cirurgicamente com placa de compressão bloqueada do fêmur proximal. Rev Bras Ortop [Internet]. 2017 [accessed 27 abr 2019]; 52(6). Available from: https://doi.org/10.1016/j.rboe.2016.12.012.

12. Paula F de L, Cunha GM da, Leite I da C, Pinheiro RS, Valente JG. Readmissão e óbito de idosos com alta após internação por fratura proximal de fêmur, ocorrida nos hospitais do Sistema Único de Saúde entre os anos de 2008 e 2010, Rio de Janeiro. Rev Bras Epidemiol [Internet]. 2015 [accessed 20 jun 2020]; 18(2). Available from: https://doi.org/10.1590/1980-5497201500020012.

13. Metwaly RG, Zakaria ZM. Single-Incision Double-Plating Approach in the Management of Isolated Closed Osteoporotic Distal Femoral Fractures. Geriatr Orthop Surg Rehabil. [Internet]. 2018 [accessed 12 set 2020]; 9. Available from: https://doi.org/10.1177/2151459318799856.

14. Amaral JAB, Spiri WC, Bocchi SCM. Indicadores de qualidade em enfermagem com ênfase no centro cirúrgico: revisão integrativa da literatura. Rev. SOBECC [Internet]. 2017 [accessed 13 set 2020]; 22(1). Available from: https://revista.sobecc.org.br/sobecc/article/view/117.

15. Fernandes M de C, Peres LR, Queiroz Neto AC de, Lima Neto JQ, Turíbio FM, Matsumoto MH. Open fractures and the incidence of infection in the surgical debridement 6 hours after trauma. Acta Ortop Bras. [Internet]. 2015 [accessed 14 set 2019]; 23(1). Available from: http://dx.doi.org/10.1590/1413-78522015230100932.

16. Agência Nacional de Vigilância Sanitária (ANVISA) Gerência de Vigilância e Monitoramento em Serviços de Saúde. Gerência Geral de Tecnologia em Serviços de Saúde. Plano Nacional para a Prevenção e o Controle da Resistência Microbiana nos Serviços de Saúde. [Internet]. Brasília; 2017 [accessed 24 ago 2019]. Available from: http://www.riocomsaude.rj.gov.br/Publico/MostrarArquivo.aspx?C=m6vpZEgtbjw%3D.

17. Ministério da Saúde (BR). Comissão Nacional de Incorporação de Tecnologias no SUS. Protocolo Clínico e Diretrizes Terapêuticas para Fratura de Colo de Fêmur em Idosos. [Internet]. CONITEC/SUS: Brasília; 2017 [accessed 15 abr 2020]. Available from: http://conitec.gov.br/images/Consultas/Relatorios/2017/Relatorio_PCDT_Fratura_Colo_Femur_em_idosos_CP_29_2017.pdf.

18. Pereira BRR, Medoza IYQ, Couto BRGM, Ercole FF, Goveia VR. Artroplastia do quadril: prevenção de infecção do sítio cirúrgico. Rev. SOBECC. [Internet]. 2014 [accessed 12 set 2020]; 19(4). Available from: https://revista.sobecc.org.br/sobecc/article/view/95.

19. Gallardo-Calero I, Larrainzar-Coghen T, Rodriguez-Pardo D, Lung M, Carrera L, Corona PS. Increased infection risk after hip hemiarthroplasty in institutionalized patients with proximal femur fracture. Injury Int. J. Care Injured. [Internet]. 2016 [accessed 24 nov 2020]; 47(4). Available from: http://doi.org/10.1016/j.injury.2015.12.032.

20. World Health Organization (WHO). Health care-associated infections Fact Sheet. [Internet]. Geneva: WHO; 2014 [accessed 18 abr 2020]. Available from: https://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf.

21. Norris GR, Checketts, JX, Scott JT, Vassar H, Norris BL, Giannoudis PV. Prevalence of deep surgical site infection after repair of periarticular knee fractures: a systematic review and meta-analysis. JAMA Netw Open. [Internet]. 2019 [accessed 18 jun 2020]; 2(8). Available from: http://doi.org/10.1001/jamanetworkopen.2019.9951.

22. Hirai Y, Asahata-Tago S, Ainoda Y, Fujita T, Kikuchi K. Edwardsiella tarda bacteremia. A rare but fatal water- and foodborne infection: review of the literature and clinical cases from a single centre. Can J Infect Dis Med Microbiol. [Internet]. 2015 [accessed 18 set 2020]; 26(6). Available from: https://doi.org/10.1155/2015/702615.

23. Loureiro RJ, Roque F, Rodrigues AT, Herdeiro MT, Ramalheira E. O uso de antibióticos e as resistências bacterianas: breves notas sobre a sua evolução. Rev Port Sau Pub. [Internet]. 2016 [accessed 21 nov

2020]; 34(1). Available from: http://dx.doi.org/10.1016/j.rpsp.2015.11.003.

24. Fahad S, Khan MZN, Khattak MJ, Umer M, Hashmi P. Primary Proximal femur replacement for unstable osteoporotic intertrochanteric and subtrochanteric fractures in the elderly: a retrospective case series. Ann Med Surg. [Internet]. 2019 [accessed 28 nov 2020]; 44. Available from: http://doi.org/10.1016/j.amsu.2019.07.014.

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