



Original Article

The incidence and microbiological profile of surgical site infections following internal fixation of closed and open fractures[☆]



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ABSTRACT

Objective: To evaluate the incidence and microbiological profile of surgical site infections (SSIs) associated with internal fixation of fractures and to compare differences in the SSIs observed among patients with closed and open fractures.

Methods: Retrospective study. Analyzed data included information from all patients who underwent surgery for fixation of closed or open fractures from January 2005 to December 2012 and remained outpatients for at least one year following surgery. Incidence of surgical site infection (SSI) was compared between patients with closed and open infection, as well as polymicrobial infection and infection related to Gram-negative bacilli (GNB). Cumulative antibiograms were performed to describe microbiological profiles.

Results: Overall incidence of SSI was 6%. This incidence was significantly higher among patients with open fractures (14.7%) than among patients with closed fractures (4.2%). The proportions of patients with polymicrobial infections and infections due to GNB were also significantly higher among patients with open fractures. *Staphylococcus aureus* and coagulase-negative *Staphylococcus* (CoNS) species were the primary infectious agents isolated from both groups. The overall incidence of MRSA (methicillin-resistant *S. aureus*) was 72%. *A. baumannii* was the predominant GNB isolate recovered from patients with open fractures and *P. aeruginosa* was the most frequent isolate recovered from patients with closed fractures, both exhibited low rates of susceptibility to carbapenems.

Conclusions: Incidence of SSIs related to the internal fixation of fractures was significantly higher among patients with open fractures, indicating that an open fracture can be a risk factor for infection. Among the bacterial isolates, *S. aureus* (with a high prevalence of MRSA) and CoNS species were most prevalent. *A. baumannii* and *P. aeruginosa* isolates underscored the low rate of susceptibility to carbapenems that was observed in the present study.

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Infecção de sítio cirúrgico após fixação de fraturas fechadas e expostas – Incidência e perfil microbiológico

R E S U M O

Palavras-chave:

Infecção da ferida operatória
Fixação interna de fraturas
Fraturas expostas
Fraturas fechadas

Objetivo: Avaliar a incidência e o perfil microbiológico das ISC relacionadas a procedimentos de fixação de fraturas num hospital acadêmico ortopédico terciário em São Paulo, Brasil, e comparar as diferenças observadas entre os pacientes com fraturas fechadas e expostas.

Métodos: Estudo retrospectivo. Foram incluídos na análise os dados relativos a todos os pacientes que passaram por procedimento cirúrgico para fixação de fraturas fechadas ou expostas de janeiro de 2005 a dezembro de 2012 e que mantiveram seguimento por pelo menos um ano. Foi verificada a presença de associação entre o tipo de fratura, a incidência de ISC e as incidências de infecções polimicrobianas e por bacilos Gram-negativos. O perfil microbiológico foi estabelecido por meio da elaboração de antibiogramas cumulativos.

Resultados: A incidência geral de infecção de 6%. Essa incidência foi maior no grupo de pacientes com fraturas expostas (14,7%) do que naqueles com fraturas fechadas (4,2%), com diferença estatisticamente significativa. O número de pacientes com infecções polimicrobianas e com infecções relacionadas a BGN também foi significativamente maior no grupo de casos relacionados a fraturas expostas. *Staphylococcus aureus* e espécies de *Staphylococcus coagulase-negativo* (CoNS) foram os principais agentes isolados nos dois grupos. A incidência de MRSA (*S. aureus* resistente a metilina) dentre todos os isolados de *S. aureus* foi de 72%. *A. baumannii* foi o principal BGN isolado entre os pacientes com fraturas expostas e *P. aeruginosa* entre os pacientes com fraturas fechadas. Em ambos os casos, observaram-se baixos índices de sensibilidade a carbapenêmicos.

Conclusões: A incidência de ISC relacionada à fixação interna de fraturas foi significativamente maior nos pacientes com fraturas expostas, o que indica que esse tipo de fratura pode ser um fator de risco para a ocorrência desse tipo de infecção. Dentre os isolados bacterianos, predominaram no geral *S. aureus* (com elevada prevalência de MRSA) e *S. coagulase-negativo*. Dentre os BGN, houve predomínio de *A. baumannii* também entre os isolados de pacientes com fraturas expostas e *P. aeruginosa* entre os isolados daqueles com fraturas fechadas.

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Introduction

Surgical site infections (SSIs) associated with internal fixation of fractures are regarded as serious complications. An SSI constitutes a challenge for the entire staff involved in patient's care because it significantly increases recovery time and treatment costs and negatively impacts both functional results and long-term rehabilitation.^{1,2} Although incidence of SSIs is expected to be higher in patients with open fractures than in patients with closed fractures, few studies have confirmed this hypothesis.^{3,4} Regarding the microbiological profiles of SSIs, Gram-negative bacilli (GNB), most notably *Acinetobacter baumannii* and *Pseudomonas aeruginosa*, have been described as having increasingly important roles in these infections, particularly in cases involving high-energy trauma.⁵⁻⁸

The current study sought to evaluate the incidence and microbiological profile of SSIs associated with internal fixation of fractures and to compare differences in the SSIs observed among patients with closed and open fractures.

Methods

A retrospective study was conducted at the *Instituto de Ortopedia e Traumatologia*, a tertiary orthopedic academic hospital in

São Paulo, Brazil. Analyzed data included information from all patients who underwent surgery for fixation of closed or open fractures from January 2005 to December 2012 and remained outpatients for at least one year following surgery. These data were collected from the database maintained by the institution's Infection Control Board.

In accordance with the institution's protocol, patients with closed fractures who underwent surgery for the internal fixation of their fractures received 24 h of antimicrobial prophylaxis with cefazolin. Patients with type I open fractures according to the Gustilo classification received antimicrobial therapy with cefazolin for 14 days, beginning at their admission. Patients with open fractures of Gustilo types II and III received combination therapy with clindamycin and gentamicin for 14 days, beginning at admission. In addition, patients with open fractures initially had their fractures stabilized by external fixation; internal fixation was subsequently performed after improvement in the soft tissue adjacent to fracture.

Determinations of the incidence of SSIs only included patients who presented with an SSI within 1 year following surgery and were diagnosed based on the criteria established by the Centers for Disease Control and Prevention's National Healthcare Safety Network (CDC-NHSN).⁹ To determine the microbiological profile of infections, cumulative antibiogram reports were prepared using established Clinical and

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