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Original Article

Comparative accuracy assessment of the Gustilo and Tscherne classification systems as predictors of infection in open fractures☆

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ABSTRACT

Objective: The aim of this study is to analyze the accuracy of the two classification systems for open fractures most commonly used in current medical practice, Gustilo and Tscherne, as predictors of infection.
Methods: A retrospective observational study was performed, including 121 patients suffering from open fracture of the appendicular skeleton treated at an emergency hospital. The fractures were classified according to Gustilo and Tscherne systems during the initial treatment, and ratings were subsequently confirmed or rectified during hospitalization. Sensitivity, specificity, positive and negative predictive values, and accuracy were calculated according to each classification adopted.
Results: The results of this study demonstrated that both classifications of Gustilo and Tscherne are associated with the clinical outcome of infection in open fractures. The Gustilo classification achieved sensitivity of 76.7%, specificity of 53.8%, and accuracy of 59.5%. Tscherne's classification had a sensitivity of 56.7%, specificity 82.4%, and accuracy of 76.1%.
Conclusion: The Tscherne system showed better accuracy, including specificity as a predictor of infection in open fractures, when compared with the Gustilo system.

Análise comparativa da acurácia das classificações de Gustilo e Tscherne como preditoras de infecção em fraturas expostas

Palavras-chave:
Fraturas expostas
Classificação
Confiabilidade dos dados
Avaliação

RESUMO

Objetivo: Analisar comparativamente a acurácia dos dois sistemas para classificação de fraturas expostas mais usados na prática médica atual, Gustilo e Tscherne, como preditores de infecção nas fraturas expostas.
Métodos: Foi feito um estudo observacional retrospectivo com 121 indivíduos acometidos por fratura exposta do esqueleto apendicular atendidos em uma unidade de emergência

☆ Study conducted at Escola Bahiana de Medicina e Saúde Pública and at Hospital Geral Roberto Santos, Salvador, BA, Brazil.

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hospitalar. As fraturas expostas foram classificadas segundo os dois sistemas durante o atendimento inicial; as classificações eram posteriormente confirmadas ou retificadas durante o internamento. Foram calculados sensibilidade, especificidade, valores preditivos positivos e negativos e acurácia, segundo cada classificação adotada.

Resultados: Os resultados demonstraram que ambas as classificações, de Gustilo e de Tscherne, apresentam associação com o desfecho clínico infecção em fraturas expostas. A classificação de Gustilo obteve sensibilidade de 76,7%, especificidade de 53,8% e acurácia de 59,5%. A classificação de Tscherne obteve sensibilidade de 56,7%, especificidade de 82,4% e acurácia de 76,1%.

Conclusão: O sistema de classificação de Tscherne demonstrou maior acurácia, apresentou melhor especificidade como preditor de infecção em fraturas expostas quando comparado com o sistema de Gustilo.

Introduction

Open fractures of long bones occur with an incidence of 11.5 to 30.7 per 100,000 people per year.[1,2] In the United States, it is estimated that such fractures represent an annual cost of USD 230 million, which indicates the high socioeconomic impact of these injuries.[3] Open fractures occur most frequently in the tibia, its prevalence ranging from 20% to 40% of the cases,[1,4–7] followed by those occurring in the femur (12%), metacarpals, and ulna.[1,4]

The initial management of open fractures has been based on the same principles for 60 years,[7] and include surgical cleaning and debridement, wound closure, antibiotic therapy, and fracture fixation. The main goals of treatment include avoiding infection and re-establishing function.[1–7] In clinical practice, the orthopedist needs to establish different protocols, being more aggressive in cases of fractures with a higher chance of infection.[5,7–10] Therefore, stratification of the various fractures according to their degree of risk is paramount.[7,10]

The open fracture classification system most used in clinical practice is that proposed by Gustilo,[11] with its subsequent modification by Gustilo et al.[12] This system is based on the size of the skin lesion, the degree of contamination, the capacity of bone coverage, and the vascular lesion of the limb. The classification of Tscherne and Gotzen[13] was proposed for closed and open fractures, and takes into account the lesion of adjacent soft tissue, regardless of the size of the skin lesion. More detailed classification systems have also been proposed, such as that of the Arbeitsgemeinschaft für Osteosynthesefragen (AO) group[14] and the Orthopedic Trauma Association (OTA)[15]; however, these are still not widely used in orthopedic practice.

The prognosis of open fractures in general and specifically in relation to the infection outcome has dramatically improved since the Gustilo and Tscherne classification systems were elaborated. However, these two most commonly used systems date back over 30 years. Recently, Gustilo's classification has been criticized regarding its validity and reproducibility,[16–19] whereas the accuracy of the Tscherne's system has not yet been adequately validated.[8,9]

To be scientifically sound and justify their widespread use, systems for classifying open fractures must be reliable, reproducible, clinically relevant, and validated. Nonetheless, the data in the literature demonstrate the need to confront the prognostic accuracy of the two main classification systems in force, especially regarding the infection outcome.[8,9] Therefore, the present study is aimed at comparing the accuracy of the Gustilo and Tscherne classifications as predictors of infection in open fractures, and to discuss the use of both systems.

Material and methods

A retrospective observational study was conducted based on data from the hospital's orthopedic department. The target population was represented by patients admitted to the hospital who presented open fractures of the appendicular skeleton. The study assessed all patients admitted to the ward in 2009 and 2010. The research protocol was submitted to and approved by the Institution's Research Ethics Committee (opinion No. 121/2009).

The study included all patients who were admitted in the adult emergency department of the hospital with a diagnosis of open fracture and were treated according to the standardized protocol established at the Medical Service. The following were excluded: open fractures treated initially in other hospitals; open fractures of the axial skeleton (face, skull, thorax, spine); patients who did not remain in the hospital for at least eight days after the initial surgical procedure, due to death, discharge, or transfer, which implied in loss to follow-up, and patients with incomplete records. Patients with polytrauma or more than one fracture per anatomical segment were also excluded.

The calculated sample size was 94 patients. This number was based on the infection prevalence of 28% in open tibial fractures, using an alpha value of 0.05 and a sample error of 0.1.[8] The sample size obtained was 78 individuals; this number was increased by 20% to compensate for eventual losses, for a total of 94 patients. In the present study, the sample was larger than that estimated, since it had 121 individuals, increasing the statistical power.

All patients were treated in accordance to the previously established surgical protocol of the orthopedic department

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