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Original article

Microbiology of French military casualties repatriated from overseas for an open traumatic injury[☆]

Microbiologie des blessés militaires français rapatriés depuis l'outre-mer ou l'étranger pour un traumatisme ouvert

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Abstract

Background. – This study aimed to describe the microbiological epidemiology of repatriated French soldiers with an open traumatic injury, and to measure the proportion of multidrug-resistant bacteria (MDRB).

Methods. – Retrospective study including all French soldiers repatriated in 2011 and 2012 in Parisian military hospitals for open traumatic injury. Results of clinical samples and MDRB screening were collected. The antibiotic susceptibility was assessed using the agar disk diffusion method. Characterization of resistance mechanisms was performed using PCR. Genotyping of extended-spectrum beta-lactamase-producing Enterobacteriaceae (ESBL-E) isolates was performed using rep-PCR.

Results. – A total of 139 patients were included; 70% of them were repatriated from Afghanistan. At admission, 24/88 were positive for MDRB (28%), mainly ESBL-E but no carbapenemase-producing Enterobacteriaceae and vancomycin-resistant *Enterococcus faecium* were identified. Forty-five patients had lesion sample collection, and 28/45 had a positive culture. The most frequently isolated pathogens were *Enterobacter cloacae*, *Pseudomonas aeruginosa*, and *Escherichia coli*. For eight patients, a MDRB was isolated from the wound, mainly ESBL-E (7/8) but also one methicillin-resistant *Staphylococcus aureus* and one imipenem-resistant *Acinetobacter baumannii*. Among ESBL-E, the PCR evidenced the high prevalence of CTX-M15 enzymes. Rep-PCR performed on the 23 ESBL-producing *E. coli* isolates highlighted numerous profiles.

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Conclusions. – Controlling the spread of ESBL-E is currently challenging for French Armed Forces. Despite any evidence of an epidemic clone, a high-level compliance with hygiene precautions is required throughout the chain of care to avoid cross contamination.

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Keywords: Combat injuries; ESBLE; Rep-PCR

Résumé

Objectifs. – Décrire l'épidémiologie microbiologique des militaires français rapatriés pour traumatisme ouvert et évaluer la part des bactéries multirésistantes (BMR).

Patients et méthodes. – Une étude rétrospective a inclus tous les militaires rapatriés pour traumatisme ouvert en 2011 et 2012 dans les hôpitaux militaires parisiens. La sensibilité aux antibiotiques a été étudiée par antibiogramme (diffusion en gélose). La caractérisation des gènes de résistance a été réalisée par PCR. Le génotypage des isolats d'entérobactéries productrices de bêtalactamase à spectre étendu (E-BLSE) a été réalisé par rep-PCR.

Résultats. – Cent trente-neuf patients ont été inclus dont 70 % rapatriés d'Afghanistan. À l'admission, 24/48 avaient un dépistage de BMR positif (28 %) : principalement des E-BLSE mais aucune entérobactérie productrice de carbapénémase ni aucun *Enterococcus faecium* résistant à la vancomycine. Quarante-cinq patients ont eu des prélèvements lésionnels, dont 28 avec culture positive. Les principaux agents pathogènes isolés étaient *Enterobacter cloacae*, *Pseudomonas aeruginosa* et *Escherichia coli*. Chez huit patients, une BMR a été isolée sur la plaie, essentiellement des E-BLSE (7/8). Parmi les E-BLSE, une large prévalence d'enzymes de type CTX-M15 a été retrouvée. La rep-PCR réalisée sur 23 isolats d'*E. coli* producteurs de BLSE a retrouvé une diversité importante de génotypes.

Conclusion. – La maîtrise de la diffusion des E-BLSE représente un défi pour le Service de santé des armées françaises. Malgré l'absence de clone épidémique, le respect des mesures d'hygiène demeure essentiel tout au long de la chaîne de prise en charge pour éviter la transmission croisée de BMR.

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Mots clés : EBLSE ; Plaies de guerre ; Rep-PCR

1. Introduction

Infections of combat injuries are a significant cause of mortality and morbidity among soldiers in modern conflicts. Combat injuries are complex, soiled, and associated with extensive tissue destruction. They are thus at high risk of infectious complications [1].

The infection rate was estimated at 5–27% in American military casualties during Operations Iraqi Freedom (OIF) in Iraq and Enduring Freedom (OEF) in Afghanistan. This rate reached more than 40% in those who required admission to the intensive care unit (ICU) [2,3]. Infection is the leading cause of death in combat after the 24th hour post-injury [4]. Although post-injury antimicrobials, hygiene precautions, and early surgery have largely reduced the incidence of wound infections, a significant challenge remains in terms of prevention and management of infections due to multidrug-resistant bacteria (MDRB) [5]. The US Army observed an increase in these infections during OIF and OEF [6,7], including infections due to multidrug-resistant *Acinetobacter calcoaceticus-baumannii* (ACB) [8].

In France, repatriated soldiers from overseas are considered at high-risk for MDRB carriage and/or infection but little data on the incidence is available [9–11]. The present study, conducted at the three French military teaching hospitals admitting repatriated soldiers directly after aeromedical evacuation, focused on repatriated soldiers with open traumatic injuries. We aimed to describe the microbiological epidemiology of injuries, the prevalence of MDRB in these patients, and the genotype of the isolates to adapt or strengthen the preventive infection control strategy.

2. Methods

This retrospective study included all French military casualties repatriated from overseas to French military teaching hospitals for an open traumatic injury in 2011 and 2012. This study was reviewed and approved by the ethical commission of the French Military Health Service. Epidemiological and clinical data was gathered. Soft tissue injuries associated with open fractures of the extremities were characterized based on the Gustilo and Anderson (G/A) classification. All microbiological results obtained between January 2011 and December 2013 were examined. We distinguished “early samples” which were collected within 48 hours following admission from “delayed samples” which were obtained after the 48th hour. Bacterial cultures of wounds were performed at the discretion of the physicians. Plates were incubated at 35 °C for 48 hours for soft tissue samples and for at least 10 days for bone samples. Targeted MDRB active surveillance included detection of methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus faecium* (VRE), extended-spectrum beta-lactamase producing Enterobacteriaceae (ESBL-E), carbapenemase-producing Enterobacteriaceae (CPE), carbapenem-resistant *Acinetobacter baumannii* (CRAB), ceftazidime-resistant *Pseudomonas aeruginosa* and *A. baumannii*. This strategy relied on the collection of nasal and rectal swabs spread onto selective chromogenic agar plates. A colony of each morphotype was identified using the API[®] system (bioMérieux, Marcy l'Étoile, France) or MALDI-TOF mass spectrometry (Microflex Brüker). Antibiotic susceptibility was tested using the disc diffusion method according to the recommendations and interpretative

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