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Original article

Susceptibility to the main antibiotics of *Escherichia coli* and *Staphylococcus aureus* strains identified in community acquired infections in France (MedQual, 2004–2007)

*Sensibilité aux principaux antibiotiques pour les souches d'*Escherichia coli *et* Staphylococcus aureus *isolées en milieu communautaire en France (MedQual, 2004–2007)*

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Abstract

Background. – The aim of this study was to determine the susceptibility of bacterial strains identified in community-acquired infections. Surveillance was made by a network of 32 medical analysis laboratories in the five departments of the French Region "Pays de la Loire".

Methods. – All *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*) strains isolated in these laboratories over a 4-year period, from January 2004 to December 2007, were included in the investigation.

Results. – Eighty-four thousand and twenty-nine strains were collected: 90.6% of *E. coli* and 9.4% of *S. aureus*. *E. coli* isolates were mainly isolated from urine (97.2%). *S. aureus* isolates were more frequently isolated from pus (42.30%), from urinary samples (19.53%), or genital tract samples (14.36%). This study confirms the worrying *E. coli* evolution of resistance to quinolones. Indeed, during the study period, ofloxacin or norfloxacin susceptibility decreased gradually and the susceptibility rate to ciprofloxacin decreased slightly during and after 2006 (94.01% in 2005; 92.81% in 2006, and 91.62% in 2007). One thousand four hundred and thirty-five methicillin-resistant *S. aureus* (MRSA) strains were isolated. We observed a decrease of resistance to oxacillin: 20.73% in 2004 and 16.65% in 2006 ($p < 0.01$). In 2007, this resistance to oxacillin seemed to increase (18.26%).

Conclusions. – Our data confirms the serious need to monitor transmission of these strains between community and hospitals. A better knowledge of the epidemiological behavior of these BMR will contribute to better-adapted antibiotics strategies.

Keywords: Antibiotic resistance; Community ecology; *Staphylococcus aureus*; *Escherichia coli*; MRSA

Résumé

Objectif. – L'objectif de cette étude était de déterminer la sensibilité des souches bactériennes isolées à partir d'infections en milieu communautaire. La surveillance a été effectuée par un réseau de 32 laboratoires d'analyse médicale situés dans les cinq départements de la région « pays de la Loire » en France.

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Méthodes. – Toutes les souches d'*Escherichia coli* (*E. coli*) et de *Staphylococcus aureus* (*S. aureus*) isolées dans ces laboratoires sur une période de quatre ans, de janvier 2004 à décembre 2007, ont été incluses dans l'étude.

Résultats. – Quatre-vingt-quatre mille vingt-neuf souches ont été recueillies : 90,6 % d'*E. coli* et 9,4 % de *S. aureus*. Les souches d'*E. coli* ont été principalement isolées de prélèvements urinaires (97,2 %). Les souches de *S. aureus* ont été plus fréquemment isolées de prélèvements de pus (42,30 %), urinaires (19,53 %) ou génitaux (14,36 %). Cette étude confirme bien le caractère inquiétant de l'évolution de la résistance aux quinolones d'*E. coli*. En effet, pendant la période d'étude, la sensibilité à l'ofloxacine ou la norfloxacine a diminué graduellement et le taux de sensibilité à la ciprofloxacine a légèrement diminué depuis 2006 (94,01 % en 2005 ; 92,81 % en 2006 et 91,62 % de 2007). Mille quatre cent trente-cinq souches de *S. aureus* résistantes à la methicilline (SARM) ont été isolées. Nous avons observé une diminution de la résistance à l'oxacilline : 20,73 % en 2004 et 16,65 % de 2006 ($p < 0{,}01$). En 2007, cette résistance à l'oxacilline a semblé augmenter (18,26 %).

Conclusions. – Nos données confirment la nécessité de surveiller la transmission de ces souches entre la communauté et les hôpitaux. Une meilleure connaissance du comportement épidémiologique de ces BMR contribuera à adapter les stratégies thérapeutiques à adopter vis-à-vis des antibiotiques.

Mots clés : Résistance antibiotique ; Écologie communautaire ; *Staphylococcus aureus* ; *Escherichia coli* ; SARM

1. Introduction

For more than 20 years, hospital and community-acquired resistance to antimicrobial agents have been regularly increasing and resistance to antibiotics has become one of the leading problems in modern management of infections.

The study and the monitoring of resistance to antibiotics are mainly used in hospitals but few similar studies were made in the community practice [1–4].

The two most frequent bacteria isolated in community infections are *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*).

E. coli is the most frequent microorganism implicated in community-acquired urinary infections [3]. *E. coli* is usually susceptible to amoxicillin-clavulanate, but with the increased use of this antimicrobial agent, resistance has begun to emerge [5].

S. aureus is a common human pathogen responsible for a significant number of infections worldwide, which has long been considered as hospital-acquired. However, the epidemiology of *S. aureus* is changing and new community-acquired strains have appeared that differ from nosocomial strains in their susceptibility to various antibiotics.

Methicillin-resistant *S. aureus* (MRSA) has recently emerged and is at present the most commonly identified antibiotic-resistant pathogen.

Despite adjustment for disease severity and initially appropriate antibiotic treatment, the infections due to MRSA are associated with significantly increased morbidity and mortality, longer hospital stays, and increased costs, compared with infections due to methicillin-susceptible *S. aureus* [6].

Since 2004, the regional epidemiological survey has been made by MedQual, which created a network of medical analysis laboratories in the five departments of the French Region "Pays de la Loire", representative of the bacteriological laboratory activity.

The aim of this regional study was to determine the susceptibility to commonly prescribed β-lactam family and fluoroquinolones of bacterial strains isolated from community-acquired infections.

2. Materials and methods

2.1. Collection of bacterial strains

Thirty-two private French analysis laboratories were included in this study in January 2004. These laboratories are located in the five departments of the "Pays de la Loire". Region: 15 in Loire-Atlantique, five in Maine-et-Loire, three in Mayenne, four in Vendée, and five in Sarthe.

All the *E. coli* and *S. aureus* strains identified in these laboratories over a 4-year period, from January 2004 to December 2007, were included in the investigation.

The monthly results were sent to MedQual.

2.2. Antimicrobial susceptibility testing

Susceptibility tests were performed in each laboratory, with the disk diffusion methods or by using the VITEK 2 or the API systems (bioMérieux, France).

Antibiograms were determined according to the recommendations of the Antibiogram Committee of the French Society for Microbiology, and the results were interpreted as indicating "susceptibility" (S), "intermediate susceptibility" (I) or "resistance" (R) [7].

The results of the susceptibility tests and the simplified identification forms (patient's birth date, sex, type and date of sampling, and bacterial species isolated) were forwarded to the coordinating MedQual Center.

Each laboratory checked the patient's address at the time of sampling and only those coming from community practice (i.e. for patients living at home or in nursing homes) were forwarded to MedQual, those coming from private hospitals were excluded.

Data was analyzed after exclusion by each laboratory of duplicate isolates, defined as strains isolated from the same patient and belonging to the same bacterial species and for which no major discrepancy in antibiotic susceptibility (S versus R, or the reverse) was found during the study period.

In 2004, it was decided to study the susceptibility of *S. aureus* to methicillin and fluoroquinolones and of *E. coli* to amoxicillin (AMX), AMX + clavulanic acid, and fluoroquinolones.