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Original article

Appropriateness of aminoglycoside prescriptions in a French university hospital

Conformité des prescriptions d'aminosides dans un centre hospitalier universitaire français

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Abstract

Introduction. – Aminoglycosides are a major class of antibiotics. Their use is particularly interesting in the treatment of severe infections but their toxicity is well known. They are mostly prescribed combined with other agents and as first-line treatments. We aimed to assess the appropriateness of aminoglycoside prescriptions in a French university hospital on the basis of the latest French recommendations published in 2011.

Method. – We conducted a prospective study between January 17th and February 4th, 2014 to assess prescription modalities of aminoglycosides on the basis of the following criteria: indication, duration of treatment, dosing schedule, administration modalities, and drug level monitoring. Prescriptions were then compared to the 2011 national guidelines.

Results. – A total of 68 consecutive prescriptions were analyzed and only 47.8% complied with guidelines. Most physicians complied with recommendations, particularly with the indication for severe infections (95.6%), the administration of a single daily dose (92.6%), and the slow intravenous infusion (30 minutes) administration (84%). However, physicians tended to prescribe lower doses than recommended (40.3%), especially to patients presenting with renal insufficiency, and drug level monitoring was not optimal.

Conclusion. – Although new and accurate national recommendations were recently published, aminoglycoside prescription is still not optimal, in particular for dosing and plasma concentration monitoring.

Keywords: Aminoglycosides; Antibiotic stewardship

Résumé

Introduction. – Les aminosides sont une classe majeure d'antibiotiques, d'intérêt considérable dans le traitement des infections sévères, mais à la toxicité bien connue. Ils sont le plus souvent utilisés en association et en début de traitement. Le but de ce travail était d'évaluer le bon usage des aminosides dans un centre hospitalier universitaire par rapport aux dernières recommandations françaises diffusées en 2011.

Méthode. – Enquête prospective, réalisée entre le 17 janvier et le 4 février 2014, évaluant les modalités de prescription des aminosides à l'aide des critères suivants : indication, durée de traitement, posologie, fréquence et mode d'administration, et dosages des concentrations plasmatiques. Les prescriptions étaient comparées au référentiel national de 2011.

Résultats. – Sur les 68 prescriptions consécutives analysées, seulement 47,8 % étaient entièrement conformes. La plupart des recommandations étaient respectées par les prescripteurs, notamment l'indication limitée aux infections sévères (95,6 %), l'administration en dose unique journalière (92,6 %) et en perfusion intraveineuse lente de 30 minutes (84 %). En revanche, les cliniciens ont tendance à prescrire des posologies plus faibles que celles recommandées (40,3 %), en particulier aux patients insuffisants rénaux, et le dosage des concentrations plasmatiques n'est pas optimal.

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Conclusion. – Malgré la diffusion de nouvelles recommandations précises, les aminosides ne sont toujours pas prescrits de manière optimale, notamment en ce qui concerne la posologie et le suivi des concentrations plasmatiques.

Mots clés : Aminosides ; Bon usage des antibiotiques

1. Introduction

Aminoglycosides are a major class of antibiotics due to their fast and broad-spectrum bactericidal activity. Their use is particularly interesting in the treatment of severe infections, notably those caused by Gram-negative bacilli, *Staphylococcus*, and *Enterococcus*. Their PK/PD features and their low therapeutic index justify the strict compliance with prescription and monitoring recommendations to maximize their efficacy and limit their toxicity [1]. The multidrug-resistant bacteria (MDRB) observed in Europe are very often resistant to aminoglycosides. Antibiotic pressure by aminoglycosides can select MDRB and favor their spread. Hence, controlling MDRB from spreading requires the surveillance of antibiotic consumptions and the assessment of prescription quality [2,3]. Such measures are particularly needed in France as the country's antibiotic consumption is one of the highest in Europe [3,4]. Given that the inappropriate use of antibiotics is one of the major reasons for the spread of MDRB, implementing an antibiotic stewardship is one of the priority actions in the control of resistance [5–7]. In this context, French national recommendations have been updated in March 2011 to improve the use of aminoglycosides [8].

We aimed to assess the appropriateness of aminoglycoside prescriptions in the treatment of infections as compared with national guidelines in a French regional university hospital. This evaluation was part of the French national study AMI-SPA managed by the French infectious diseases society (French acronym SPILF) and the French National Observatory for Epidemiology of Bacterial Resistance to Antibiotics (ONERBA) [9].

2. Method

The study was conducted in the regional university hospital of Besançon, a 1200-bed facility offering the full range of medical and surgical specialties. We conducted a prospective observational study during 20 days (January 17th–February 4th, 2014) in all hospitalization wards, with the exception of the day-care units. We only took into consideration prescriptions of injectable aminoglycosides. Aminoglycosides used for prophylaxis were excluded. Amikacin, gentamicin, and tobramycin were the three aminoglycosides available in our hospital at the time of the study. We included all patients who received one or more aminoglycoside injection during the study period. We only considered the first prescription when a patient received multiple aminoglycoside treatments. The daily list of patients treated with aminoglycosides was obtained from the prescription database. The patients' medical record, nursing record, prescription software, and biological results provided us with data to fill in the SPILF and ONERBA questionnaires [10].

The analysis of prescriptions was performed by comparison with the French national recommendations published in March 2011 [8].

The proper use of aminoglycosides was assessed by a group of experts including pharmacists, infectious disease specialists, and biologists in light of the criteria detailed in Table 1 (i.e., suitability of the indication, duration of treatment, dose, frequency of administration, administration mode, and drug level monitoring).

We assessed every criterion one at a time. We then assessed the overall compliance using an algorithm modified from Gyssens et al. [11] on the basis of all the above-mentioned criteria, with the exception of drug level monitoring. Each criterion was analyzed one after the other, and when the prescription under review did not comply with one of the criteria, the prescription was assigned to the corresponding non-compliance class (class V: inappropriate indication for an aminoglycoside; class IV: inappropriate duration of treatment; class III: inappropriate dose; class II: inappropriate frequency of administration; class I: inappropriate route of administration). When a prescription was not assigned to any of the classes listed above, it was considered compliant with the recommendations. Non-compliance with at least one criterion resulted in the non-conformity of the prescription.

3. Results

We included 68 consecutive prescriptions, corresponding to 68 patients. Overall, 40 patients were men (sex ratio 1.43) and median age was 55.5 years (0–91 years). The median time between hospitalization and the first aminoglycoside administration was one day (0–140 days). Overall, 49% of patients (33/68) had already been hospitalized and 31% (21/68) had received an antibiotic therapy within three months prior to the hospitalization under study; 44% (30/68) had received antibiotics between their admission and the first aminoglycoside injection.

Treatments were mostly empirical (85%) and 10 patients (15%) had documented bacteriological results, of which eight single-bacterium infections and two polymicrobial infections (Table 2).

Aminoglycosides were mainly prescribed for the treatment of pulmonary infections, digestive infections, urinary tract infections, and febrile neutropenia. They were always prescribed in combination with at least one other antibiotic from another class, with a beta-lactam in 94% of cases (Table 2).