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Original article

Subcutaneous and intravenous ceftriaxone administration in patients more than 75 years of age

Ceftriaxone par voie sous-cutanée et intraveineuse en première intention chez les patients de plus de 75 ans

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Abstract

Objective. – We wanted to compare the first line intravenous administration of ceftriaxone to a subcutaneous administration in patients more than 75 years of age.

Method. – We performed a retrospective monocentric study on all patients more than 75 years of age admitted to the Ales hospital between January 1 and December 31, 2011, having received at least two doses of ceftriaxone intravenously (IV) or subcutaneously (SC).

Results. – One hundred and forty-eight patients (70 females/78 males patients) were included, 110 received ceftriaxone IV and 38 SC. They were a mean age of 84.7 years, older in the SC group (86.9 years) than in the IV group (83.9 years) ($P = 0.0052$). The SC group patients presented more frequently with dementia (57% *vs*. 25% $P = 0.001$), were more often bedridden (22% *vs*. 7% $P = 0.023$), had a higher mean World Health Organization status (3.13 *vs*. 2.76, $P = 0.0181$), and higher ADL score (7.79 *vs*. 5.76, $P = 0.0056$). There was no statistical difference for isolated bacteria, site of infection, death rate, and patients cured.

Conclusion. – Subcutaneous ceftriaxone administration seems to be preferred for fragile elderly patients independently of disease severity. This administration is not associated to an impaired effectiveness or to an increased death rate.

Keywords: Ceftriaxone; Subcutaneous administration; Geriatric patients

Résumé

Objectif. – Décrire l'utilisation de la ceftriaxone en première intention par voie sous-cutanée comparativement à la voie veineuse chez les patients âgés.

Méthode. – Étude rétrospective monocentrique. Inclusion des patients âgés de plus de 75 ans hospitalisés au centre hospitalier d'Ales entre le 1er janvier et le 31 décembre 2011 et ayant reçu au moins deux injections à 24 heures d'intervalle de ceftriaxone par voie sous-cutanée (SC) ou intraveineuse (IV).

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Résultats. – Cent quarante-huit patients (70 femmes pour 78 hommes) ont été inclus, 110 avaient eu la ceftriaxone par voie intraveineuse et 38 par voie sous-cutanée. La moyenne d'âge était de 84,7 ans, plus élevée dans le groupe SC (86,9 ans) qu' IV (83,9 ans) ($p = 0{,}0052$). Le groupe administration SC comprenait plus de patients déments (57 %, contre 25 % $p = 0{,}000$), plus de grabataires (22 % contre 7 % $p = 0{,}023$), une moyenne du score OMS plus élevée 3,13 versus 2,76 ($p = 0{,}0181$), le score ADL montrait des patients plus dépendants (7,79 contre 5,76, $p = 0{,}0056$). Il n'y avait pas de différence significative concernant les germes isolés, les sites d'infection, les décès ni la proportion de patients guéris.

Conclusion. – La voie sous-cutanée semble être préférée en première intention à la voie intraveineuse chez les patients les plus fragiles sans lien évident avec la gravité. Cette voie ne semble pas associée à une diminution d'efficacité thérapeutique ni à une surmortalité significative.

Mots clés : Ceftriaxone ; Voie sous-cutanée ; Patients âgés

1. Introduction

Subcutaneous administration is frequently used in geriatric medicine, especially for hydration, antalgics, and antibiotics [1–4]. This approach is convenient, with less risk of local complications, especially in patients with few available veins for infusion [5,6]. Ceftriaxone is one of the few antibiotics to be approved for subcutaneous administration. This approach, frequently used in geriatric practice, is not supported by much published data [7–9]. More specifically, its use has never been studied in patients more than 75 years of age. The aim of our study was to describe the subcutaneous administration of ceftriaxone in geriatric patients, to compare the profile of patients having received ceftriaxone in first intention subcutaneously to patients having received it intravenously, and secondarily to compare the effectiveness of these two approaches for this population.

2. Method

The Ales hospital center pharmacy computerized database, relying on the pharmaceutical management software Pharma© (edited by Computer Engineering^{TM}) allowed identifying all patients having received ceftriaxone treatment during their hospital stay.

We included all patients more than 75 years of age hospitalized in the Ales Hospital center between January 1 and December 31, 2011, having received at least two injections of ceftriaxone with a 24-hour interval, either subcutaneously or intravenously.

A letter of information was sent to every included patient to document a possible refusal to participate in the study, and the French Data Protection Authority was notified.

The following data was collected retrospectively: mode of administration, housing, a diagnosis of dementia, being bedridden, behavioural disorders, agitation, confusion, wandering, palliative care, WHO score [10], Katz autonomy scale (activities of daily living, ADL) [11], Charlson comorbidity score [12], hemostatic disorders or treatment, renal function with calculation glomerular filtration rate estimated by the "modification diet in renal disease" (MDRD) formula [13], site of infection, type of bacteriological samplings performed, identified bacteria, healthcare associated infection or not [14], severity of sepsis (simple sepsis, severe sepsis, or septic shock) [15,16], pharmacological data (dose, duration, number of injections), empirical or documented indication, clinical outcome, and death.

A descriptive statistical analysis was first made. The normality of quantitative variable distribution was investigated with the Shapiro-Wilks normality test. The statistical results were presented as means ± SD for quantitative variables. The number of patients and the associated percentages were used for qualitative variables. Secondly, qualitative variables were compared by a Chi^2 test. Fisher's exact test was used if conditions were not adequate for the Chi^2 test. Quantitative variables were compared between the two groups with Student's *t* test (ANOVA [analysis of variance] for several groups) in case of Gaussian variables or with Wilcoxon-Mann-Whitney's test (Kruskal-Wallis for several groups) in case of non-Gaussian variables. The threshold of significance was set at 5% for all the tests performed. The statistical analysis was made with the SAS software, version 9 (SAS Institute, Cary, N.C.).

3. Results

The Ales hospital center is an 810-bed hospital center including 292 medical-surgical short-stay beds, with an ICU and a continuing care unit, a short-stay geriatric unit, medical units (oncology, pneumology, internal medicine, cardiology and cardiology ICU, etc.) and surgery including orthopedics and visceral surgery. One hundred and sixty-one patients more than 75 years of age having received ceftriaxone between January 1 and December 31, 2011 were identified. Four of these patients who had received ceftriaxone intramuscularly and nine who had received less than two injections were excluded. One hundred and forty-eight patients more than 75 years of age were finally included; among these, 110 had received the first ceftriaxone injection intravenously (76 in medical units, 39 in geriatric short-stay units, four in surgery, and one in an ICU) and 38 subcutaneously (26 in geriatric short-stay units, 12 in medical units, and 1 in an ICU). The subcutaneous mode of administration could not be documented retrospectively. The available drug presentation in the hospital center contains a solvent without lidocaine. No lidocaine prescription was found in the computer-based patient pharmaceutical records. The administration protocol for nurses was not found in the patient medical records.