Importance of Infusion Volume and Pump Characteristics in Extended Administration of β -Lactam Antibiotics[▽]

The introduction of a new protocol at Ghent University Hospital (Ghent, Belgium) for the extended administration of piperacillin-tazobactam (TZP) and meropenem drew attention to a potential pitfall that is well-known in daily clinical practice but often neglected, i.e., the contribution of infusion line dead space to the incomplete administration of the drug.

The Antibiotic Policy Working Party at the institution implemented an extended 3-h protocol for TZP and meropenem administration in both intensive care units (ICU) and regular wards. The protocol specified that TZP is to be infused as a loading dose of 4.5 g over 30 min, followed by a 3-h infusion of 4.5 g every 6 h, with dosage adjustments according to renal function. For meropenem, a 1-g loading dose over 30 min is to be followed by a 3-h infusion of 1 g every 8 h. Dose regimens are based upon the Belgian version of the Sanford guide (5). Extended administration was chosen since recent research has highlighted the possible benefits (1–4). For the extended administration of both antibiotics, a smaller volume of 50 ml of 0.9% saline was used, compared to the standard 100-ml solutions used previously. The reduction in volume enabled the protocol to be used hospital-wide, including for patients with fluid restrictions.

This implementation involved a switch to a new volumetric pump system (Alaris GP volumetric pump and GP 59-type infusion set). It was observed that every replacement of the infusion line resulted in a 40% loss of the prescribed antibiotic dose if the infusion line was not cleared with a compatible solution after the antibiotic infusion. On the other hand, non-replacement of the infusion line dead space increased the risk of infusion of the degraded product, in particular in view of the issue of stability of meropenem in solution, as the residual volume was infused in the first 75 min of the subsequent 3-h infusion. Indeed, the package leaflet of the Alaris system states that a priming volume of 24 ml is required, which unfortunately was not considered before implementation of the protocol. Dead-space volume replacement is a critical issue (6) that needs to be addressed when the dead space exceeds 10% of the infused volume. The problem described is not dependent on the drug or infusion duration.

The detection of this potential problem resulted in a prompt adaptation of the protocol with the requirement of higher solution volumes for non-ICU patients (at least 250 ml) and

the use of the more expensive pressurized pumps, where the infusion dead space is less than 1 ml, for ICU patients and patients with fluid restrictions. In parallel, tests are running with a volumetric pump set that enables users to consider the line space at the end of the infusion and deliver the overflow.

We wish to draw the attention on the importance of infusion volume and pump characteristics. We hence encourage the inclusion of this information into study method sections in publications on extended infusions.

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Barbara Claus*
Franky Buyle
Hugo Robays
Pharmacy Department

Dirk Vogelaers
Department of Internal Medicine and Infectious Diseases
Ghent University Hospital
De Pintelaan 185, Ghent 9000, Belgium

*Phone: 32 (0)9 332 29 78
Fax: 32 (0)9 332 49 74
E-mail: Barbara.claus@uzgent.be

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