Active Chloride Concentration in CAPD Systems Containing In-Line Disinfectant Electrolytic Chloroxidizer Solution

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Dear Sir,

Amuchina is a disinfectant electrolytic chloroxidizer solution [1] largely used as in line disinfectant in some Y-systems to prevent exogenous peritonitis [2]. This disinfectant can be inactivated by light, by the organic compounds contained in peritoneal fluid and by glucose solutions [1], but no data are available on the in vivo inactivation of Amuchina in the Y-systems. Forty-six in- and outpatients were invited to record the type of dialysis solution used for the last CAPD exchange and were requested to come to the hospital at different times after the last CAPD exchange. They used three different Y-set systems: the long-branched Baxter Y-set [3,4], the short-branched Baxter Y-set [5] and the Bieffe L3 disposable double-bag system [6]. Before the bag exchange, expert nurses drained the whole amount of Amuchina from the Y-set branches (long and short Y-set), from the cap of the long Y-set spike or from the cap of the patient connection (L3 system) into a sterile dry glass. The glass was immediately closed to prevent evaporation and taken to the laboratory.

The content of the set was weighed with a precision scale. Active chloride was measured by iodometric titration. Five milliliters of KJ 10% solution and 5 ml of 1 TV acetic acid were added to the sample; the mixture was titrated by 0.1 JV sodium thiosulfate, using starch indicator. The amount of active chloride was calculated by the formula: $(A \times C \times 35.45)/B$, where A = ml of sodium thiosulfate, B = ml of initial sample, C = normality of sodium thiosulfate.

In a first step of the study we studied the concentration of active chloride in different

The mean volume of disinfectant was 15.3 ± 0.5 ml in the branches of the long Y-set, 0.6 ± 0.2 ml in the cap of the Y-set spike, 0.8 ± 0.4 ml in the short-branched Y-set, and 2.1 ± 1.1 (large cap) or 1.1 ± 0.5 (small cap) ml in the cap of the L3 double-bag system. The mean level of active chloride at different times after the exchange is shown in figure 1. Mini-Y-systems at different times after the last exchange, performed with 1.36% glucose solutions. In the second step of the study, samples of Amuchina were collected at different times after CAPD exchanges, performed with 1.36% glucose solution and after exchanges with 2.27 or 3.86% glucose solutions.

3.86%
 1.36%
 2.27%

Fig. 2. Active

chloride concentration in the L3 system (large cap) and in the short Y-set, according to the concentrations of glucose in the last exchange. Bold numbers in columns indicate the number of patients studied.

mal inactivation of Amuchina occurs in the cap of the long Y-set spike, while different amounts of active chloride concentrations were measured in the other samples. The decrease in active chloride concentration was more evident and rapid in samples taken from the systems containing the lower amount of disinfectant.

The inactivation of Amuchina is larger in samples taken after exchanges performed with hypertonic glucose (fig. 2).

In-line Amuchina is considered an important tool in preventing peritonitis and a major reason for a decrease in the rate of peritonitis observed when using the long Y-set [1-3]. Light, glucose solutions and organic compounds like peritoneal dialysate can reduce the bactericidal effect of Amuchina [1].

In the following years, the branches of the Y-set were shortened to make this device less cumbersome and to improve its esthetic appearance [5], consequently the volume of Amuchina was reduced about 20 times and the concentration of active chloride was increased to reduce the risk of inactivation. In double-bag disconnect systems, disinfectant should not be necessary due to the sterile disposable Y-set and to the large amount of flush before filling in the connection point, but in many of these devices, like L3 considered in the present paper, some disinfectant is recommended to kill bacteria entering the system during the disconnection.

Our data indicate that in the long Y-set the amount of active chloride is almost unchanged after 8-10 h. This result is due to the large amount of disinfectant contained in the set, which is in contact with a very small amount of dialysate contained in the common branch of the Y. The cover of the spike contains a small amount of Amuchina, but it is not in contact with the dialysate and therefore no inactivation occurs. The larger the amount of disinfectant used, the higher the risk of symptomatic accidental introduction into the peritoneal cavity [7].

Active chloride concentration rapidly decreases in the short branched Y-set and in the L3 cap due either to the small amount of Amuchina and to its contact with a relatively large amount of dialysate, however, residual active chloride could still have bactericidal effects [1, 8].

Nonetheless, this activity is largely lower than that obtained in the long-branched Y-set, especially if high glucose solutions are used.

At present there is little information on the rates of peritonitis in patients using the short Y-set [5] or double-bag systems [6,9]. In addition there are neither controlled studies comparing double-bag systems and standard Y-sets with disinfectant nor data comparing the effect of flush alone or flush plus disinfectant in systems having the same set shape.

We can conclude that the short-branched Y-set might theoretically be associated to a higher risk of bacterial growth between the exchanges or at the beginning of the exchange, when the concentration of active chloride is minimal. In the L3 system, Amuchina is active mainly during the disconnection phase, but the additional effect of a 2-liter flush before filling should further reduce the risk of peritonitis. Therefore the clinical role of active chloride concentration in this system remains uncertain.

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