In a previous communication, we demonstrated that, in the prevention of exit-site infection (ESI) in children, the cleansing agent 50% Amuchina (electrolytic chloroxidizer: Amuchina SpA, Genoa, Italy) is more effective than 10% povidone iodine and as effective as 4% chlorhexidine, but with fewer adverse secondary effects. In the present study, we assessed, in an Argentine pediatric population, whether Amuchina 3% is as effective as Amuchina 50% in preventing ESI in children on chronic peritoneal dialysis.

In an open-label, single-center prospective study, 27 children (mean age: 7.2 years; range: 1.7 – 17 years) used 3% Amuchina as a cleansing agent for the daily care of a healthy exit site. Of the 27 children, 14 were switched from 50% Amuchina to 3% Amuchina, and 13 were using the 3% Amuchina for the first time. The control group consisted of 18 patients who had previously used 50% Amuchina as a cleansing agent. We followed the recommendations of the International Society for Peritoneal Dialysis with regard to exit-site care, which include keeping the cleansing agent out of the sinus and rinsing the exit site with sterile water. Amuchina was used from the first post-implantation care of the exit site.

No adverse secondary effects were seen with the use of Amuchina at either concentration. Patients using 3% Amuchina presented an ESI rate similar to that of patients using Amuchina 50%. The cost of 3% Amuchina was significantly lower than that of the 50% concentration, and it was even lower than the cost for 10% povidone iodine or 4% chlorhexidine.

Although more research trials are needed to assess the efficacy of 3% Amuchina, we conclude that 3% Amuchina is the best and most cost-effective cleansing agent for the daily care of a healthy exit site in children on chronic peritoneal dialysis.

Key words
Continuous ambulatory peritoneal dialysis, exit-site infection, Amuchina, children

Introduction
The presence of an exit-site infection (ESI) in children on peritoneal dialysis is associated with a two-fold risk of experiencing a peritonitis episode or a hospitalization because of an access complication. In pediatrics—where, for medical or psychosocial reasons, hemodialysis is a non equivalent option—the prevention of ESI is a key element in patient care. The recommendations for chronic care of the healed exit site include good hand washing before care of the exit site, daily or every-other-day care, and use of antibacterial cleansing agents (1). The use of chlorhexidine instead of povidone iodine is associated with a significant reduction in the frequency of catheter exit-site infections in children (2).

In a previous communication, we demonstrated that, for the prevention of ESI in children, the cleansing agent 50% Amuchina (electrolytic chloroxidizer: Amuchina SpA, Genoa, Italy) is more effective than 10% povidone iodine and as effective as 4% chlorhexidine (3). In the 1980s, Buoncristiani began to use in adult patients a new disinfectant that was highly efficient, easy to handle, and innocuous; that disinfectant was Amuchina (4).
Amuchina is an electrolytic chloroxidizer obtained by partial electrolysis from a sodium chloride solution. Amuchina has been demonstrated to have some important advantages as compared with other cleansing agents. For instance, it does not cause encapsulating peritoneal sclerosis; it was proved active against the entire spectrum of potential pathogens; it is nontoxic and not irritating; it improves tissue growth; and it cannot be contaminated by bacteria. In view of those advantages, and taking into account our previous results, we decided to use Amuchina in a lower concentration as a cleansing agent in an open-label, single-center prospective study to assess whether the 3% concentration would be as effective as 50% concentration in preventing ESI.

**Patients and methods**

Between July 2002 and July 2004, 27 children treated with chronic peritoneal dialysis (CPD) used 3% Amuchina as their cleansing agent for the daily care of a healthy exit site. Of the 27 children, 14 were switched from 50% Amuchina to 3% Amuchina, and 13 were using the 3% Amuchina for the first time. A cumulative experience of 424 patient–months was achieved. The mean age of the children was 7.2 years (range: 1.7 – 17 yrs) and the mean treatment time was 15.70 months. Of the 27 patients, 12 were on continuous ambulatory peritoneal dialysis, and 15 were on intermittent peritoneal dialysis. A group of 18 patients who had previously used 50% Amuchina as a cleansing agent acted as a control group.

Under general anesthesia in an operating room, all of the patients had been implanted with double-cuff, swan-neck, coiled catheters by a surgeon using the same surgical technique (5). Before implantation, placement of the exit site was marked by the peritoneal dialysis nurse and the nephrologist. Immediate post-implantation exit-site care was performed following the recommendations of the International Society for Peritoneal Dialysis:

- The procedure was always done by the peritoneal dialysis nurse.
- Dressing changes were performed weekly for 3 weeks or whenever the exit site presented drainage.
- Sterile technique with masks and gloves was used until the exit site healed.
- The cleansing agent was always kept out of the sinus.
- The exit site was rinsed with sterile water and dried with sterile gauze before an occlusive sterile gauze dressing was applied.
- The catheter was always immobilized.

At the beginning of dialysis, trained family members performed the daily dressing changes. They had previously been trained to recognize signs and symptoms of exit-site or tunnel infection (inflammation, induration, crust, pain, swelling, and drainage). In addition, the peritoneal dialysis nurse examined the exit site when the patient visited every month for clinical and laboratory control.

Exit-site infection was defined by the exit-site scoring system, in which infection is assumed when the cumulative exit-site score reached 4 or higher (6). Any purulent drainage present after compression of the tunnel was cultured and sent for Gram stain, culture, and sensitivity.

The Fisher exact test was used for statistical studies. A p value equal to or less than 0.05 was considered significant.

**Results**

During the study period all patients used 3% Amuchina, and no adverse side effects were observed with its use. The incidence of ESI was similar with the use of 50% Amuchina and 3% Amuchina (1 episode/38 patient–months vs. 1 episode/35.3 patient–months; Table I).

In the 3% Amuchina group, 12 episodes of ESI occurred, 2 of them with purulent discharge from the sinus tract. Cultures of the discharge revealed 1 *Staphylococcus aureus* infection and 1 *Pseudomonas aeruginosa* infection. The former infection developed into a peritonitis episode within 1 month of treatment for the ESI. A second *P. aeruginosa* peritonitis episode

<table>
<thead>
<tr>
<th>TABLE 1 Study results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Patients (n)</strong></td>
</tr>
<tr>
<td><strong>Mean time on PD (months)</strong></td>
</tr>
<tr>
<td><strong>Mean age (years)</strong></td>
</tr>
<tr>
<td><strong>ESI (episodes/patient–month)</strong></td>
</tr>
</tbody>
</table>

(*p = 0.97, nonsignificant*)

PD = peritoneal dialysis; ESI = exit-site infection.
was observed, but it did not follow an episode with a cultured ESI.

In the control group, 6 episodes of ESI occurred. One was positive for *P. aeruginosa*, with subsequent development of sterile-culture peritonitis. Another ESI episode could not be cultured, and a peritonitis episode secondary to *S. aureus* was observed.

**Discussion**

In regard to exit-site care, no consensus has been reached about specific procedures, cleansing agents, dressings, or method of immobilization, only recommendations based on general principles (1).

The literature contains evidence that antiseptics—including hydrogen peroxide and povidone iodine—are cytotoxic, causing tissue damage and delaying clean wound healing (7). In contrast, chlorhexidine gluconate is an effective cleansing agent that can occasionally cause skin irritation. In a pediatric dialysis peritoneal population, Jones *et al.* (2) found that, compared with povidone iodine, chlorhexidine was associated with a significant reduction in the frequency of ESI.

In a previous study, we compared the incidence of ESI with the use of three different cleansing agents. Our results demonstrated that 50% Amuchina and 4% chlorhexidine gluconate were more effective than 10% povidone iodine. No side effects were seen in the Amuchina group, but 1 patient presented with local skin irritation while using povidone iodine (3). Based on those results, we reduced the concentration of Amuchina to 3% and found rates of ESI that were similar to those with the 50% concentration. Moreover, the cost of 3% Amuchina is lower than that of the 50% concentration and even cheaper than 4% chlorhexidine.

**Conclusions**

Although more research trials are needed to assess efficacy, Amuchina seems to be the best and most cost-effective cleansing agent for the daily care of the healthy exit site in children on CPD.

**References**


**Corresponding author:**
Mònica D. Grosman, RN, Nephrology Department, Garrahan Pediatric Hospital, Pichincha, 1850 Capital Federal, Argentina.

**E-mail:**
Monicagrosman@uolsinectis.com.ar,
Ernidoc@intramed.net