

Comparison of Gentamicin and Mupirocin in the Prevention of Exit-Site Infection and Peritonitis in Peritoneal Dialysis

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Exit-site infection (ESI) and peritonitis are the most frequent reasons for catheter removal and patient drop-out from peritoneal dialysis (PD). After a randomized double-blind study showed gentamicin to be superior to mupirocin for exit-site prophylaxis, several dialysis centers including ours switched from topical mupirocin to gentamicin. Our study examined whether the change from mupirocin to gentamicin affected ESI and peritonitis rates.

We retrospectively reviewed consecutive charts of patients seen at our PD clinic between January 2003 and December 2007. We noted the rates of ESI and peritonitis in patients who met the study entry criteria.

Chart data for the 100 patients that met study entry criteria were evaluated in depth. The ESI rate was 0.002 episodes/patient-month in the gentamicin group and 0.004 episodes/patient-month in the mupirocin group ($p = 0.45$). The peritonitis rate was 0.06 episodes/patient-month in the gentamicin group and 0.02 episodes/patient-month in the mupirocin group ($p = 0.07$). The rate of gram-positive peritonitis was 0.05 episodes/patient-month in the gentamicin group and 0.01 episodes/patient-month in the mupirocin group ($p = 0.08$). The rate of gram-negative peritonitis was 0.009 episodes/patient-month in the gentamicin group and 0.008 episodes/patient-month in the mupirocin group ($p = 0.83$).

We observed no statistically significant difference in the rates of ESI between patients using mupirocin and those using gentamicin for exit-site prophylaxis. Both groups had a very low ESI rate. A trend toward higher peritonitis rates was noted

in the gentamicin group, largely as a result of gram-positive bacteria (p value nonsignificant).

Key words

Exit-site infection, peritonitis, mupirocin, gentamicin

Introduction

Infection-related complications such as exit-site infection (ESI) and peritonitis remain the most frequent reasons for catheter removal and patient drop-out from peritoneal dialysis (PD) (1). Prevention of catheter-related infections is the primary goal of exit-site care (2). Topical antibiotics are used to prevent catheter-related infections, which are commonly caused by *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and coagulase-negative *Staphylococcus* (CoNS) (3–5).

Multiple studies have shown that mupirocin reduces the risk of *S. aureus* ESIs and peritonitis (6–10). The application of mupirocin at the exit site has therefore become the standard of care to prevent catheter-related infections (2). Mupirocin, however, is not active against gram-negative organisms (9,11). In 2005, Bernardini *et al.* (11) reported the results of a randomized double-blind study comparing mupirocin with gentamicin for exit-site prophylaxis. Use of gentamicin reduced the occurrence of ESIs and peritonitis caused by *P. aeruginosa* and other gram-negative organisms; at the same time, gentamicin was as effective as mupirocin in preventing *S. aureus* infections.

In 2005, based on the results of the Bernardini study, our PD clinic switched from mupirocin to gentamicin for topical exit-site prophylaxis. Our aim in the present study was to determine if the incidence of ESIs and peritonitis in our PD center changed after the switch from mupirocin to gentamicin.

Methods

Our study was conducted in the PD unit at a tertiary-care hospital in Oklahoma. The electronic health records of patients seen in the PD clinic were retrospectively reviewed for study eligibility. Eligible charts were those with encounters involving adult patients 18 years and older on PD from January 2003 to December 2007 who were using topical mupirocin or gentamicin and who had at least 6 months of follow-up data. From the 100 patient charts that met the eligibility criteria, we recorded all infection data from 3 months after catheter insertion (to allow for healing and to exclude surgical factors in an ESI).

All patients received surgically placed Kendall single-cuff silicon catheters and standard exit-site care. Patients on continuous ambulatory PD were using the twin-bag system. We defined ESI as the presence of two of the following manifestations: purulent or bloody drainage (or both) from the exit site; swelling surrounding the sinus; or erythema surrounding the sinus. When a diagnosis of ESI was charted, we included the ESI in our analysis only if the documented physical examination met our definition. We defined peritonitis as the presence of cloudy dialysate or abdominal pain (or both), with 100 or more white blood cells per milliliter of dialysate, 50% or more being polymorphonuclear cells.

We noted the prophylaxis regimen of the patients, rates of ESI and peritonitis, and the organisms causing the infections. Infection rates are expressed as episodes per patient-month. Data were analyzed using the unpaired *t*-test. A *p* value of less than 0.05 was considered statistically significant.

Results

Of 100 patients analyzed, 50 were using topical mupirocin, and 50 were using topical gentamicin. Among the 50 patients on gentamicin, 23 had initially been on mupirocin and were later switched to gentamicin. In the study population, the gentamicin group had 713 months of PD experience, and the mupirocin group had 590 months of PD experience. Table I details the patient characteristics. The two groups were similar in age and sex distribution. Of the patients in the gentamicin group, 40% had diabetes mellitus; in mupirocin group, 38% of patients had diabetes mellitus.

The ESI rate was 0.002 episodes/patient-month in the gentamicin group and 0.004 episodes/patient-month

TABLE I Patient characteristics

Characteristic	Gentamicin group	Mupirocin group
Patients (<i>n</i>)	50	50
Sex [<i>n</i> men (%)]	23 (46)	25 (50)
Age range (years)	30–90	30–90
With diabetes [<i>n</i> (%)]	19 (38)	20 (40)
Modality of PD		
CAPD	43	44
CCPD	5	4
NIPD	2	2

PD = peritoneal dialysis; CAPD = continuous ambulatory PD; CCPD = continuous cycling PD; NIPD = nightly intermittent PD.

in the mupirocin group ($p = 0.45$). The rate of gram-positive ESI was 0.002 episodes/patient-month in the gentamicin group and 0.001 episodes/patient-month in the mupirocin group ($p = 0.75$). The rate of gram-negative ESI was zero in the gentamicin group and 0.002 episodes/patient-month in the mupirocin group ($p = 0.22$, Table II, Figure 1). We observed no *P. aeruginosa* infections and 2 *S. aureus* infections in the gentamicin group. We observed no *S. aureus* infections and 2 *P. aeruginosa* infections in the mupirocin group (Table III).

The peritonitis rate was 0.06 episodes/patient-month in the gentamicin group and 0.02 episodes/patient-month in the mupirocin group ($p = 0.07$). The rate of gram-positive peritonitis was 0.05 episodes/patient-month in the gentamicin group and 0.01 episodes/patient-month in the mupirocin group ($p = 0.08$). The rate of gram-negative peritonitis was 0.009 episodes/patient-month in the gentamicin group and 0.008 episodes/patient-month in the mupirocin group ($p = 0.83$, Table II, Figure 2). In 2 patients on gentamicin and 3 on mupirocin, peritonitis was polymicrobial. We observed 6 *S. aureus* infections in the gentamicin group, and 3 in the mupirocin group. Notably, 12 of the 36 episodes of peritonitis in the gentamicin group and 5 of the 16 in the mupirocin were attributable to CoNS (Table IV).

Discussion

The Bernardini study showed superior results for gentamicin in preventing gram-negative infections, with gram-positive coverage similar to that of mupirocin (11). In contrast, our retrospective study showed a trend toward higher peritonitis rates with gentamicin,

TABLE II Exit-site infections and peritonitis

Infection type	n	Gentamicin group		n	Mupirocin group		p Value
		Rate ^a	95% CI		Rate ^a	95% CI	
Exit-site infections (ESIs)	2	0.002	0 to 0.006	4	0.004	0 to 0.009	0.45
Gram-positive ESIs	2	0.002	-0.001 to 0.006	2	0.001	-0.001 to 0.004	0.75
Gram-negative ESIs	0	0	0	2	0.002	-0.001 to 0.005	0.22
Peritonitis	36	0.06	0.02 to 0.11	16	0.02	0.01 to 0.03	0.07
Gram-positive peritonitis	24	0.05	0.008 to 0.09	8	0.01	0 to 0.024	0.08
Gram-negative peritonitis	6	0.009	0 to 0.018	5	0.008	0 to 0.016	0.83

^a Episodes/patient-month.
CI = confidence interval.

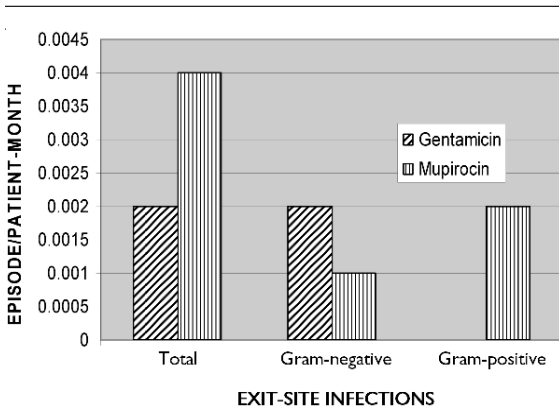


FIGURE 1 Exit-site infections per patient-month.

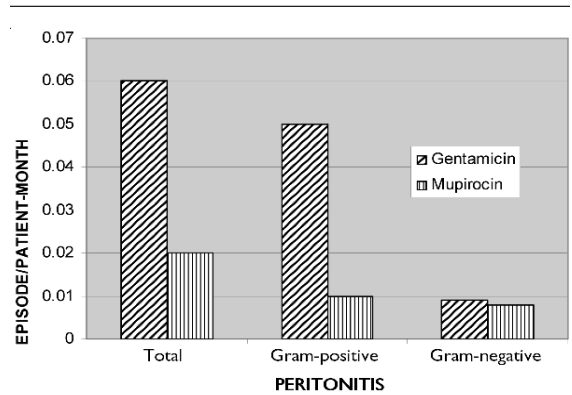


FIGURE 2 Peritonitis per patient-month.

TABLE III Microbiology of exit-site infections

Organism	Gentamicin group (n=2)	Mupirocin group (n=4)
<i>Staphylococcus aureus</i>	2	0
<i>Pseudomonas aeruginosa</i>	0	2
Other/culture-negative	0	2

TABLE IV Microbiology of peritonitis

Organism	Gentamicin group (n=36) ^a	Mupirocin group (n=16) ^b
<i>Staphylococcus aureus</i>	6	3
Gram-negative	6	5
CoNS	12	5
Streptococci	6	0
Other/culture-negative	8	6

mainly as a result of a greater number of gram-positive infections. One third of the gram-positive infections in the gentamicin group were attributable to CoNS. It is important to remember that most CoNS peritonitis are the result of touch contamination and not periluminal spread of an ESI (12,13). With both gentamicin and mupirocin, ESIs and gram-negative peritonitis episodes were infrequent. None of the results are statistically significant.

Our study has several limitations. One major drawback is that the study was retrospective and therefore

^a In the gentamicin group, 2 patients had polymicrobial infections.

^b In the mupirocin group, 3 patients had polymicrobial infections.

CoNS = coagulase-negative *Staphylococcus*.

not controlled for certain major factors that play a role in catheter infection, such as standardized aseptic exit-site care techniques. Our results are further limited by the small number of patients and relatively low infection rates. When a diagnosis of ESI was charted,

only instances that met our definition were included in our analysis. However, physicians and nurses may have been inaccurate in their documentation of the physical findings used to diagnose ESIs, and underreporting or overreporting of ESIs may have occurred in this retrospective review.

In addition to developing because of pericatheter spread, peritonitis can also develop because of spread of infection by the transluminal, endogenous, and hematogenous routes. Given the nature of the organisms isolated from patients with peritonitis, it is likely that other routes of infection were important in our patients. The selection of patients from a single site may also limit the generalizability of the findings.

Conclusions

Gentamicin cream was not superior to mupirocin in exit-site prophylaxis. Large prospective studies are needed to determine the best protocols for prevention of ESIs and peritonitis in PD patients.

References

- Churchill DN, Taylor DW, Keshaviah PR, and the CANUSA Peritoneal Dialysis Study Group. Adequacy of dialysis and nutrition in continuous peritoneal dialysis: association with clinical outcomes. *J Am Soc Nephrol* 1996;7:198–207.
- Piraino B, Bailie GR, Bernardini J, *et al.* Peritoneal dialysis-related infections recommendations: 2005 update. *Perit Dial Int* 2005;25:107–31.
- Gupta B, Bernardini J, Piraino B. Peritonitis associated with exit site and tunnel infections. *Am J Kidney Dis* 1996;28:415–19.
- Piraino B, Bernardini J, Sorkin M. The influence of peritoneal catheter exit-site infections on peritonitis, tunnel infections, and catheter loss in patients on continuous ambulatory peritoneal dialysis. *Am J Kidney Dis* 1986;8:436–40.
- Mujais S. Microbiology and outcomes of peritonitis in North America. *Kidney Int Suppl* 2006;(103):S55–62.
- Thodis E, Passadakis P, Panagoutsos S, Bacharaki D, Euthimiadou A, Vargemzis V. The effectiveness of mupirocin preventing *Staphylococcus aureus* in catheter-related infections in peritoneal dialysis. *Adv Perit Dial* 2000;16:257–61.
- Bernardini J, Piraino B, Holley J, Johnston JR, Lutes R. A randomized trial of *Staphylococcus aureus* prophylaxis in peritoneal dialysis patients: mupirocin calcium ointment 2% applied to the exit site versus cyclic oral rifampin. *Am J Kidney Dis* 1996;27:695–700.
- Mahajan S, Tiwari SC, Kalra V, *et al.* Effect of local mupirocin application on exit-site infection and peritonitis in an Indian peritoneal dialysis population. *Perit Dial Int* 2005;25:473–7.
- Casey M, Taylor J, Clinard P, *et al.* Application of mupirocin cream at the catheter exit site reduces exit-site infections and peritonitis in peritoneal dialysis patients. *Perit Dial Int* 2000;20:566–8.
- Uttley L, Vardhan A, Mahajan S, Smart B, Hutchison A, Gokal R. Decrease in infections with the introduction of mupirocin cream at the peritoneal dialysis catheter exit site. *J Nephrol* 2004;17:242–5.
- Bernardini J, Bender F, Florio T, *et al.* Randomized, double-blind trial of antibiotic exit site cream for prevention of exit site infection in peritoneal dialysis patients. *J Am Soc Nephrol* 2005;16:539–45.
- Vas S. Microbiological aspects of peritonitis. *Perit Dial Bull* 1981;1:S11–14.
- Holley JL, Bernardini J, Piraino B. Infecting organisms in continuous ambulatory peritoneal dialysis patients on the Y-set. *Am J Kidney Dis* 1994;23:569–73.

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