Comparison of Peritonitis Episodes with Staphylococcus Oxacilliln Resistant or Susceptible

A. Dimitriadis, A. Sigalas, E. Kella, E. Damvopoulou, E. Polydorou*
CAPD Unit, 1st Dept Int Med, *Dept of Microbiology, "Ag. Dimitrios" Hospital, Thessaloniki

Continuous ambulatory peritoneal dialysis (CAPD) related peritonitis remains a major problem (1). Up to 75% of peritonitis episodes have Gram (+) pathogens and up to 40-60% of them are staphylococci species, mainly Staphylococcus aureus (Staph. aur) and Coagulase Negative Staphylococci (CNS) (2-4). Emergence of oxacillin-resistant staphylococci (ORS) species is of special importance, since they become resistant also to other antibiotics, such as cephalosporins and glycopeptides. The frequency of isolation of oxacillin resistant staphylococci (ORS) in hospitalized patients is growing and it is attributed to nasal or skin carriage status, and the commoner use of antibiotics (5-6). We tried to examine if there are some clinical or other parameters that could indicate some patients as high-risk ones to develop ORS peritonitis.

Methods

We studied retrospectively 109 consecutive peritonitis episodes during a six-year period (1/1/1997 to 31/12/2002) during which all CAPD patients were on a disconnect system. From a total of 51 patients, 45 (88.3%) developed one or more peritonitis episodes. Staphylococci species were isolated in 35 (77.8%) of them, and other microorganisms in the others. Relapses – recurrence of peritonitis with the same microorganism in less than 4 weeks – were considered as independent peritonitis episodes. Specimens were taken aseptically from dialysis bags Sediments from 100 ml dialysate centrifuged at 2500 g for 10 minutes were cultured on blood agar plates (aerobically and anaerobically) and on MacConkey agar. Also, 10 ml of dialysate were incubated on blood culture bottles (Signal System-Oxoid or Mini-Vital) with antimicrobial removal agents. The identification and susceptibility tests were done by Pasco Instrument (Difco).

The following demographic data were collected: age, sex, aetiology of end-stage renal disease (ESRD), duration on CAPD, peritonitis episodes and antibiotics use before and during the studied period. Serum albumin was used as indice for nutritional status, Kt/V for dialysis adequacy and residual diuresis for residual renal function.

The 35 patients with staphylococal peritonitis episodes were grouped according the existence of resistance of CNS to oxacillin (ORS, n=20) or not (OSS, n=15). Patients with at least one episode with oxacillin resistant CRS, during the studied period, were included in the group ORS. All patients were initially treated with cefuroxime ip and amikacin im according the standard protocol of our Unit. Treatment was modified according the susceptibility of microorganisms or the persistence of peritonitis afterwards.

The main demographic data are presented in Table 1. For statistical evaluation x^2 and unpaired student's t-test were used.

Table 1. Main demographic data of patients with one or more episodes of staphylococcal peritonitis

	ORS	OSS	Total
n	20	15	35
F/M	11/9	7/8	18/17
Age (M ± SD) *x ± SD* Range	 68.8 ± 9.2 45 - 85	 62.7 ± 13.5 31 - 87	 66.2 ± 37.3 31 – 87
Time on CAPD (months) *x ± SD* Range	 52.7 ± 31.9 6 - 137	 58.7 ± 43.2 11 - 163	 55.3 ± 37.3 6 – 163
Follow-up in the **studied period (months)** *x ± SD* Range	 32.9 ± 18.8 5 - 69	 38.7 ± 18.5 12 - 72	 35.4 ± 18.9 5 – 72
Etiology of ESRD *Diabetes* *Nephrosclerosis* PKD *GN* *Others*	 7 7 2 - 4	 4 4 - 5 2	 11 11 2 5 6

Results

During the six years period of the study, a total of 115 peritonitis episodes were registered n 41 out-of 51 patients. The 35 patients developed 105 peritonitis episodes, having at least one episode with Staph species. A total of 101 pathogens were isolated and 8 (7.3%) cultures were negative. In 73 cultures (72.3%) staphylococci were isolated (5 Staph. Aureus and 68 C.N.S), in 13 (12.9%) other Gram (+) bacterias and in 15 (14.8%) Gram (-) bacterias. In four peritonitis episodes 2 pathogens were isolated. The most common CNS species was Staph. Epidermidis (47.1%) followed by Staph. Warneri (17.6%), Staph Simulans (14.7%) and others (20.6%).

Correspondence to: Dimitriadis Athanasios, 2, Hel. Zografou, Thessaloniki 54634, Greece, Tel: 302310204741
Fax: 302310204741, e-mail: athdim@otenet.gr

The 20 patients characterized as ORS, had a total of 66 peritonitis episodes with 51 (77%) staphylococci (49 CNS and 2 Staph. aureus) (Table 2).

Table 2. Distribution of the causative pathogens in the 105 peritonitis episodes

	Gr. ORS n=20	Gr. OSS n=15	Total n =35
Microorganisms			
ORS	34 (51.5%)	-	34 (32.4%)
OSS	17 (25.8%)	22 (56.4%)	39 (37.1%)
Others	15 (22.7%)	17 (43.6%)	32 (30.5%)
Total	66	39	105

Table 3. Incidence of peritonitis rate in the two studied groups of patients

	Peritonitis rate (episodes / patient months)		
	Gr. ORS n=20	Gr. OSS n=15	Total n=35
From 1/1/97 to 31/12/02			
Total Nr of peritonitis (n=115)	1:10.15	1:15.2	1:12.0
Staph (+) peritonitis (n=105)	1:13.1	1:26.9	1:17.5
Before 1st Staph peritonitis	1:20.2	1:29.3	1: 23.5

According the resistance to oxacillin 34 cultures proved to be ORS and 17 OSS. From 39 peritonitis episodes in OSS patients, 22 (56.4%) were due to Staph. species (19 CNS and 3 Staph. aureus).

The number of staph (+) peritonitis per patient was higher in gr. ORS (2.55 vs 1.46 epis/patient). The 50% of peritonitis with CNS were ORS. Among the 5 Staph Aureus only one was ORS and it was isolated on the first peritonitis episode of the patient.

The overall peritonitis rate for the studied period was 1:12.0 epis/pts-mos while the peritonitis rate for staphylococcal peritonitis was 1:17.5 epis/pts-mos (Table 3). Patients with ORS had higher total incidence of peritonitis than those with OSS (1/10.2 pts.mos vs 1/15.2 pts.mos). This difference was more significant when we consider the rate of staphycoccal peritonitis (1/18.1 pts.mos for ORS vs 1/26.9 pts.mos for OSS).

Patients with ORS had 22 peritonitis episodes (1.1/patient) before their first staph (+) peritonitis, against 11 (0.73/pat) for patients with OSS. Consequently, ORS patients received more antibiotics before the first staph (+) peritonitis.

Patients of gr. ORS were older (68.85 ± 9.24 vs 62.7 ± 13.5 years, p:0.07). Diabetes and neprhosclerosis were more common in ORS and glomerulonephritis in OSS without statistical difference. Duration on CAPD modality and on follow-up in the studied period have no differences between the two groups. Also, residual diuresis, Kt/V and serum albumin have no differences between the groups at the start as well as at the end of the studied period.

Discussion

Staphylococcus species have been the predominant causative pathogens of CAPD-related peritonitis since its introduction (7).

Staphylococci resistant to oxacillin are major nosocomial pathogens in peritoneal dialysis centers. Resistance is mediated by alterations in membrane-bound enzymes called, penicillin binding proteins (PBSs), which are the target for beta-lactam antibiotics. The expression of a special cell-wall synthesizing enzyme, PBPRa, confers resistance to a majority of antibiotics 8).

It is of interest the low percentage of Staph aureus (4.34%) in our Unit and of negative cultures (7.3%) we found. Concerning negative cultures we suggest that the early sampling of contaminated dialysate and the applied methodology for sampling and culturing gave chance to higher number of positive cultures. Concerning the low frequency of Staph aureus we can also suggest that the use of Tenckhoff catheters with one-deep cuff has almost eliminate exit-site colonization and infection in our Unit. It is accepted that colonization of exit site is of greater pathogenic importance than colonization of other anatomic sites (5, 9).

It is referred that there is a synergistic effect on peritonitis rate of race, level of education and peritoneal dialysis system (6). Our patients of both groups were of the same race, they used the same system, and they had almost the same educational status. The only difference, even not significant, we found was their age. Patients with ORS peritonitis were older.

The prevalence of diabetes was somewhat higher in ORS patients but without significance. On the other hand, it is not referred that diabetics patients are more prone to develop peritonitis than non-diabetics ones.

There were not differences for the adequacy of dialysis between the two groups at the start, despite the higher incidence of peritonitis in patients with ORS before the studied period. We have to mention that at the end of follow-up adequacy of dialysis remained stable in both groups. The observation seems to be more important for ORS patients as it is against the opinion that repeated infections lead to failure of peritoneum as dialysis membrane (10).

Our patients were in a quite well nutritional status, expressed by serum albumin levels. The serum albumin was used as index of nutritional status because it is a reliable parameter, less influenced by technical or methodological interventions. Nutritional status remained unchanged for both groups.

It seems that in our patients with ORS peritonitis adequacy of dialysis and nutritional status remained stable for the greater number of patients.

Patients developing ORS peritonitis had a greater number of peritonitis episodes before the first staph positive culture in the studied period, compared to patients who never acquired ORS. It is probably due to the greater use of antibiotic

treatments and the consequent emergence of resistance of Staph species.

We think that it is of special concern the observation that patients with ORS peritonitis had a significantly higher staphylococcal (ORS + OSS) peritonitis rate than patients with OSS. This difference was less pronounced for the total peritonitis rate during the follow-up period, due to a quite higher incidence of non-staph peritonitis in OSS patients. Does this observation means anything?

Among CNS species staph. epidermidis was the most common and at a percentage that is similar to that referred by others (2, 6). We didn't found any difference for oxacillin-resistant species among the different CNS.

In conclusion, in CAPD patients who developed peritonitis with ORS species , there was notsome special clinical or demographic parameter, predictive of an increase susceptibility to such pathogens except the older age. It seems that the main reason for the growth of oxacillin-resistant staphylococci is the history of previous multiple peritonitis episodes with any kind of pathogens and as a consequence the greater use of antibiotics.

References

1. Keane WF, Vas S. Peritonitis. In: Gokal R, Nolph KD, eds. The textbook of peritoneal dialysis. Dordrecht: Kluwer Academic 1994, 473-501.
2. West TE, Walshe JJ, Krol CP, Amsterdam D. Staphylococcal peritonitis in patients on continuous ambulatory peritoneal dialysis. J Clin Microbiol 1986, 23: 809-12.
3. Tran&aelig A, Heimb&uuml O, Lindholm B. Peritonitis in continuous ambulatory peritoneal dialysis (CAPD): Diagnostic findings, therapeutic outcome and complication. Perit Dial Int 1989, 9: 179-90.
4. Peacock SJ, Howe PA, Day NPJ et al. Outcome following staphylococcal peritonitis. Perit Dial Int 2000, 215-9
5. Amato D, Ventura MJ, Miranda G, et al. Staphylococcal peritonitis in CAPD: colonization with identical strains at exit-site, nose and hands. Am J Kidney Dis 2001, 37: 43-8
6. Korbet WF, Vonesh EF, Firanek CA. Peritonitis in an urban peritoneal dialysis program: An analysis of infecting pathogens. Am J Kidney Dis 1995, 26: 47-53.
7. Maiorca R, Vonech EF, Cavalli PL, De Vecchi A, et al. A multicenter selection – adjusted comparison of patient and technique survivals on CAPD and hemodialysis. Perit Dial Int 1991, 11: 118-27.
8. Gold HS and Moellering RC. Antimicrobial-drug resistance. N. Engl J Med 1996, 335: 1445-53
9. Mupirocin Study Group: Nasal mupirocin prevents staphylococcus aureus exit site infection during peritoneal dialysis. J Am Soc Nephrol 7: 2403-2408, 1996
10. Davies SJ, Bryan J, Phillips L, Russell GI. Longitudinal changes in peritoneal kinetics: The effects of peritoneal dialysis and peritonitis. Nephrol Dial Transplant 1996, 11: 498-506