



## Original article

ACTA FAC. MED. NAISS. 2004; 21 (2): 79-83

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## PERITONEAL DIALYSIS PERFORMANCE AND INCIDENCE OF PERITONITIS

## SUMMARY

Peritonitis is still a very serious complication in peritoneal dialysis. Among the technical factors associated to peritonitis rate, the Y disconnect system, double bag system, and automated peritoneal dialysis are established to reduce incidence of peritonitis. No data in literature deal with the information who performs dialysis procedure as a variable associated with the incidence of peritonitis.

In our study 67 PD patients (21 male, 46 female; mean age  $52.9 \pm 12.7$  years) were divided in two groups according to who performs dialysis: patient himself (34 pts) or helper (33 pts). All patients were randomly put on different dialysis system for CAPD: 35 pts on Fresenius single bag and 32 on Andy set and followed during five-year period for incidence of peritonitis and dialysis adequacy indices.

We compared the impact of dialysis performer on incidence of peritonitis. We also tried to give the answer on impact of dialysis system used compared to dialysis performance on peritonitis rate.

When patient himself is performing dialysis there was non significant difference in peritonitis rate weather single bag or disconnect system used. Dialysis performance by helper significantly increased the incidence of peritonitis weather on single bag or disconnect system. Patients in need for assistance are older and with numerous comorbid conditions, had the lower values of some of adequacy indices (RRF and Kt/V).

Besides using up-to-date technique in performing dialysis procedure, the role of subject that performs dialysis should be also taken into account when evaluating peritonitis rate on CAPD.

**Key words:** peritoneal dialysis, CAPD, peritonitis, dialysis performance, helper, adequacy

## INTRODUCTION

Peritonitis is still a very serious complication in peritoneal dialysis. Touch contamination and transluminal entry of bacteria is the commonest way of introducing infection to the peritoneum. Last ten years the incidence of peritonitis has been declining due to the use of modern connecting systems reducing the possibility of peritoneal infection. Among technical factors associated to peritonitis rate, Y dis-

connect system, double bag system and automated peritoneal dialysis (APD) are established to reduce incidence of peritonitis (1-4).

No data in literature deal with dialysis performer and incidence of peritonitis.

## PATIENTS AND METHODS

Sixty-seven patients starting CAPD in the five-year period and being on program for more than

6 months were analyzed. There were 46 female (68.6%) and 21 male (31.4%) patients, mean age  $52.9 \pm 12.7$  years (range 25-76 years). Cause of ESRD was: diabetic nephropathy (n=15), chronic interstitial nephropathy (n=11), nephroangiosclerosis (n=9), glomerulonephritis (n=8), obstructive nephropathy (n=5), APKD (n=5), Balkan endemic nephropathy (n=2), lupus nephritis (n=1), and unknown (n=1). Comorbid conditions were as follows: 98.5% arterial hypertension, 23.5% diabetes mellitus, 7.4% heart failure/coronary artery disease, 2.9% ischemic periphery artery disease, 2.9% cerebrovascular disease, 5.9% viral hepatitis, 33.4% other. All patients were on CAPD treatment modality with standard glucose (1.5%, 2.25% and 3.86%) containing dialysis solutions. Patients were divided in two groups according to dialysis system used: 35 on Fresenius single bag system (group SB) and 32 patients on Andy set system (group AS). In self-performing dialysis group (P group) there were 34 patients, and 33 in helper group (H group). The reasons for incapability of self-performance of CAPD in the helper group were: blindness/insufficient vision (4 cases), mental incompetence (3), im-

paired hand function (2), self-unconfident / inefficient (23 cases).

During observational period all patients were examined once a year on changes in dialysis adequacy parameters (residual renal function (RRF), Kt/V, ultrafiltration (UF), PET test results, dialysis protein loss), nutritional indices and peritonitis rate. Residual renal function was estimated as average value of creatinine and urea clearances. The PET was performed as described by Twardowski et al (5). Briefly, a standard 4-h dwell period was used and 2.27% glucose concentration for a 2 l volume exchange. The dialysate to plasma creatinine concentration ratio at the end of 4-h dwell was used for classification of patients as high, high average, low average and low peritoneal transporters.

### STATISTICAL ANALYSIS

All measurements done for dialysis adequacy were calculated using standard package (PD Adequest 1.4,1994: Baxter Healthcare Corporation, Deerfield, IL, U.S.A.).

Table 1. Adequacy parameters according to dialysis system used and dialysis performer

Parameter	Self performing dialysis group			Helper group			Level of significance
	SB	AS	SB+AS	SB	AS	SB+AS	
RRF	3.10 ± 3.97	4.57 ± 9	3.5 ± 4.08	1.53 ± 1.73	3.54 ± 3.5	2.81 ± 3.16	p<0.05
Kt/V	2.49 ± 0.91	2.54 ± 1.34	2.52 ± 1.19	2.14 ± 0.56	1.93 ± 0.61	2.06 ± 0.58	p<0.05
D/Pcr	0.72 ± 0.09	0.68 ± 0.13	0.69 ± 0.12	0.77 ± 0.13	0.80 ± 0.09	0.78 ± 0.11	p<0.05
D/Pur	0.86 ± 0.07	0.88 ± 0.07	0.87 ± 0.07	0.88 ± 0.09	0.89 ± 0.06	0.89 ± 0.08	ns
Uf (mV24h)	568 ± 454	788 ± 409	728 ± 418	512 ± 102	657 ± 375	557 ± 187	ns
BMI	24.8 ± 2.72	24.31 ± 3.65	24.49 ± 3.30	24.3 ± 4.25	22.9 ± 4.41	23.7 ± 4.29	ns
nPCR	0.92 ± 0.26	1.12 ± 0.38	1.04 ± 0.35	0.91 ± 0.33	0.87 ± 0.27	0.89 ± 0.30	ns
Serum albumin	38.9 ± 4.88	35.80 ± 5.69	36.89 ± 5.55	33.9 ± 5.62	36.5 ± 6.26	34.8 ± 5.89	ns
Protein losses (g/24hr)	6.48 ± 5.72	7.56 ± 1.4	7.08 ± 3.84	7.04 ± 6.12	10.4 ± 3.6	8.04 ± 5.64	ns

Statistical analysis was performed using the statistical software package SPSS for Windows, Release 6.0. Data are expressed as means ± standard deviation. The Student t-test and Mann-Whitney U-test, as appropriate, was used to compare means of linear and non-linear variables between groups. Chi square test was used for estimations of peritonitis rate between groups. Multiple regression analysis was used to identify the factors determining peritonitis rate. Results were found significant when  $p < 0.05$ .

RESULTS

Self-performing dialysis patients were younger ( $50.6 \pm 12.1$  years) than patients where helper is performing dialysis ( $55.3 \pm 13.0$  years) but the difference was not significant. The number of comorbidity conditions found, was statistically higher in the group of patients where helper was needed:  $2.91 \pm 0.54$  vs.  $1.84 \pm 0.88$ ,  $p < 0.001$ .

Dialysis adequacy parameters are shown in Table 1.

RRF, Kt/V and D/Pcr were significantly higher in the self-performing group of patients ( $p < 0.05$ ). Other parameters were similar in both groups.

There were 47 episodes of peritonitis (44.6% with Staph. epidermidis, 17.1% with Staph. aureus 4.2% with Gram neg. strains, 34% culture negative) and 82 episodes of peritonitis (57.3% with Staph. epidermidis, 24.3% with Staph. aureus 4.8% with Gram, neg. strains, 15.8% culture negative) in self-performing dialysis group and in helper group, respectively. When compared number of peritonitis/pts in P and H group there is an increase in inci-

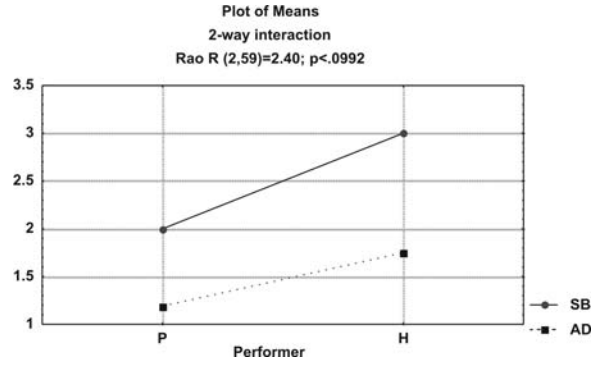


Figure 1. Number of peritonitis/pts according to dialysis system used and dialysis performance

dence of peritonitis in both groups (SB and AS) when dialysis was performed by helper. Although the system used has impact on rate of peritonitis, there is almost a similar increase in incidence of peritonitis/pts observed between P and H groups (fig. 1.)

Peritonitis rate was found higher in Helper group (0.80 vs. 1.65 per patient year,  $p < 0.001$ ) (Table 2). The timing of first peritonitis was postponed when patient was performing dialysis by himself:  $12.3 + 11.5$  months vs.  $7.3 + 9.5$  months in the helper group, ( $p < 0.05$ ).

Although with the single bag system the incidence of peritonitis was more than two times lower in self-performing patients than in the helper group this was not significant, due to the smaller number of cases.

Among all factors examined multiple regression analysis is performed to test the significance of dialysis performer and dialysis system used on incidence of peritonitis (table 3). Although fewer perito-

Table 2. Peritonitis as function of dialysis performance

PERFORMER	NO OF PERITONITIS	1ST PERITONITIS AFTER	INCIDENCE OF PERITONITIS (/ PATIENT YEAR)		
			SB	AS	SB+AS
Patient	47	12.3 months	0.80	0.81	0.80
Helper	82 <sup>a</sup>	7.3 months	1.91	1.18	1.65 <sup>b</sup>

Legend: SB: Fresenius single bag, AS: Andy set system; <sup>a</sup>vs. patient's group  $p < 0.05$ , <sup>b</sup>vs. patient's group  $p < 0.0001$

Table 3. Technical factors influencing peritonitis rate as dependent variable (multiple regression analysis)

	REGRESSION COEFF. (R2)	SE	95% CONF. INTERVAL (CI)	F	P LEVEL (>0.05)
performer	0.070	2.41	-0.073, 2.364	4.958	0.04
system	-0.195	0.024	-1.894, 0.545	-1.603	0.27

Independent variables were: dialysis performance-performer and dialysis system used-system

nitis episodes were noticed on Andy set system than on Fresenius single bag, the influence of dialysis performance has a significant impact on incidence of peritonitis.

There were 7 exit-site infections in both groups. All exit-site infections were treated as described elsewhere (4).

## DISCUSSION

It is well established that the use of disconnect and double bag system decreases the incidence of peritonitis (1,2). There is still sparse data on other technical aspects of dialysis performance beyond dialysis system used.

In our patients group on disconnect system the incidence of peritonitis was lower than in patients group on single bag system when dialysis was performed by patient himself. We found this difference non significant. Dialysis performance by helper was introduced in patients with blindness or insufficient vision, mental incompetence, impaired hand function or when self-unconfident / inefficient. Help is provided by family member or emotionally related person. Only one patient provided help for money. Patients in need for assistance are older and with numerous comorbid conditions. Lower values of RRF, Kt/V and D/Pcr in the H patients group could be explained due to significant impact of residual renal function on Kt/V.

Levy et al. (6) found that technical aspects of peritoneal dialysis (number of helpers, sterile dressings vs. shower technique, amount of training time, living arrangements) as well as type of dialysis (CAPD vs. CCPD) did not affect the rate of peritonitis in pediatric population. The authors concluded that pediatric patients with low motivation and low compliance or without social support were in increased risk for peritonitis. Other authors (7), beside

up-to-date connectology in CAPD/APD treatment and perfect exit-site care in pediatric patients, recommend long-training period of 6-7 weeks for caregivers. The reasons for smaller residual renal function in helper group than in self-performing group could be attributed to inflammation (8) (data not shown).

Dialysis performance by helper significantly increased the incidence of peritonitis whether on single bag or disconnect system. The reasons for such increase may be numerous. Shorter duration of education for helpers, than for patients (data not shown) could be one of the factors. In our patients need for dialysis assistance is pronounced in older patients with many comorbid conditions. Poor compliance of blind or mentally impaired patient, as well as loose emotional connections (no close relatives, part time job etc.) of helper with the patient could present additional problem and raise a possibility of getting peritonitis.

## CONCLUSION

Although much work has been done in improving technical aspects of peritoneal dialysis procedure, there are still some issues that should not be neglected. Besides using up-to-date technique in performing dialysis procedure, the role of subject that performs dialysis should be also taken into account. In older patients groups with more comorbidities there is constant need for assistance in performing dialysis and often almost complete inability for self-performance of CAPD. So, the factors beyond patient himself could attribute to patient well being and outcome on CAPD. Further work is needed for precise evaluation of dialysis performance contribution to the peritonitis rate and patients outcome on CAPD.

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## IZVOĐAČ PERITONEALNE DIJALIZE I INCIDENCA PERITONITISA

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### SAŽETAK

Peritonitis je i dalje jedna od najozbiljnijih komplikacija peritonealne dijalize. Među tehničkim faktorima koji utiču na incidencu peritonitisa, pokazano je da Y sistem, sistem sa dvostrukim kesama i automatska peritonealna dijaliza snižavaju incidencu peritonitisa. U literaturi za sada nema podataka o izvođaču dijalize kao faktoru koji može imati uticaj na incidencu peritonitisa.

Naša studija pratila je tokom petogodišnjeg perioda 67 bolesnika na peritonealnoj dijalizi (21 muškarac, 46 žena; srednje starosti  $52.9 \pm 12.7$  godina) na različitim sistemima za dijalizu: 35 bolesnika na Fresenius sistemu bez skidanja dijalizne kese i 32 na Andy setu (kao vrsti prekidnog Y sistema). Bolesnici su podcijeni u dve grupe: oni koji su sami sebi izvodili dijalizne promene (34 bolesnika) i bolesnici kojima je dijalizne promene izvodio pomagač (član porodice ili neko drugi) - 33 bolesnika.

Upoređivali smo uticaj izvođača dijalize na incidencu peritonitisa, ali i uticaj dijaliznog sistema na broj epizoda peritonitisa.

Naši rezultati pokazuju da ukoliko bolesnik sam sebi izvodi dijalizne promene, iako se peritonitis! javlja nešto češće na neprekidnom dijaliznom sistemu no na prekidnom (Andy set), nema statistički značajne razlike u incidenci peritonitisa bez obzira na primenjen dijalizni sistem. Kada dijalizu izvodi pomagač značajno se povećava incidenca peritonitisa bez obzira na primenjen dijalizni sistem. Pacijenti kojima je potrebna pomoć u izvođenju dijaliznih promena su stariji, sa brojnim komorbidnim stanjima i imaju niže vrednosti pokazatelja adekvatnosti dijalize (rezidualna renalna funkcija i indeks Kt/V).

Pored savremenih tehnika u izvođenju dijalizne procedure, uloga osobe koja izvodi dijalizu mora se uzeti u obzir pri evaluaciji incidence peritonitisa na CAPD.

**Ključne reči:** peritonealna dijaliza, CAPD, peritonitis, izvođač dijalize, pomagač, adekvatnost