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PERITONEAL DIALYSIS IN CATS WITH COMPLETE URETERAL OBSTRUCTION

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In this study, the efficacy of peritoneal dialysis conducted at 6 hour intervals in the excretion of metabolites from the body for surgical intervention or stabilization of the patients condition as well as determination of the levels of accumulation of the metabolites in cats with complete ureteral obstruction was investigated.

Materials and Methods

In this study 3 female and 3 male cats, from various races weighing between 3-4 kg and aged 2-4 years were used. The cats were kept under supervision at the clinic for 15 days before the study. They were subjected to general health check up and parasite control. The BUN and creatinine levels in the pre-operation period and every 6 hours within the first 24 hours post operative period were determined. At the end of the 24 hours peritoneal dialysis (PD) was initiated. After commencement of the PD the blood serum parameters were determined at the beginning and end of every dialysis session. For the haemogram, the blood samples were taken immediately post operative and 24 hours later. In the PD, a 1.5% glucose containing dialysate (358 mOsm/L, pH 5,5; Fresenius Medical Care®) was used. For the infusion and drainage of the dialysate, a permanent Tenckhoff catheter (Tyco Health Care®) was employed. To carry out the ligation of ureter and placement of the catheter under partial omentectomy the cats were anesthetized. Clips from the Integral ureter stent set (Rusch®, Cat.No. 335000) were used for obstruction of the ureters. Against any possible infections postoperatively, cefalosporine injections at doses of 25 mg/kg i.m. bid and 50 mg/kg metamizol as an analgestic were administered prophylactically. Peritoneal dialysis was conducted in the following stages: administration of dialysate for 10 minutes, waiting for 40 minutes before drainage lasting 10 minutes and repeated every 6 hours for a total of 8 sessions withinh the entire 2 days of studies. At the beginning and end of every dialysis session the serum biochemical parameters were measured. During the dialysis process heparin at a dosage of 500 IU/kg was added to the dialysate to prevent plugging of the catheter (Lai *et al.*, 2000). At the end of the study, all the cats underwent a second surgical operation to remove the catheter and the clips. For the statistical evaluation of the data Friedman and Wilcoxon signed ranks tests were used (Conover, 1999).

Results and Discussion

Following the ligation of the ureters,

all the cats showed depression, malaise, apathy, and vomitting. During the entire duration of the study, the pulse rate, respiration rate and body temperature were within the normal ranges. Before the PD, none was seen to consume any food, while 2 cats were observed to take in plenty of water, the remaining 4 did not. After initiation of dialysis the clinical symptoms were observed to abate in 4 cats and together with little food intake they were observed to take in a little amount of water too, while the clinical symptoms of 2 cat remained unchanged. At the end of the study the cats were found to regain their normal kidney functions within 1-3 days after their ureters were reopened.

On the first day of ligation, the WBC count rose significantly. Except for the changes in the WBC count, haemogram values were within the normal reference limits. The values of some serum parameters, are shown in the Table.

The criteria for determining the efficacy of peritoneal dialysis was the disappearance of the symptoms of uremia and return of the biochemical values close to their reference levels (Cowgill, 1995; Arik, 2001). In this study all the BUN values remained significantly high at the end of the session period than before the operation and could not be lowered to the normal range. However, the end of session values were significantly lower than those at the beginning of session. In some studies conducted (Thornhill *et al.*, 1984, Turgut *et al.*, 1987) the BUN and creatinine values were reported to be within the normal limits. In these studies it was possible to achieve these values because the inter-sessional period was kept short (at 1-4 hours). The present study was planned to accommodate four sessions per day for practical convenience. Though the BUN and creatinine values could not be reduced to levels found in normal animals, it was still possible to achieve notable clinical improvements in the animals as well as stabilization of most of the biochemical parameters.

Hypoalbuminemia, a complication encountered frequently in PD is the direct result of the loss of albumin into the dialysate (Labato, 2001). Protein loss shows the tendency of being greater in the first few sessions but later it was stabilized. Albumin loss is more severe than that of globulins (Katirtzoglou *et al.*, 1980). In this study, a similar fall in the total protein level due primarily to loss of albumin was recorded. However, the total protein and albumin levels were still within the normal reference limits.

Since routinely used peritoneal dialysis solutions do not contain K^+(Cowgill 1995) it is appropriate for the management of ureteral obstruction (Shaw and Ihle, 1997, Turgut, *et al.*, 2000). In this study, the K^+ level showed a consistently high trend due to ureteral obstruction, although mild falls were seen after some sessions above the normal limits.

Some investigators do not support the use of permanent Tenckoff catheters, which is used widely in human medical practice, in cats and dogs because of the high risk for coagulation and resultant occlusion of the omentum (Crisp *et al.*, 1989, Dzyban *et al.*, 2000). In this study, a permanent Tenckoff catheter was employed in the presence of partial omentectomy with no problem encountered as far as drainage of fluid was concerned.

Table - Blood serum parameters of cats

Sessions		BUN (mmol/L) x±Sx	Creatinine (mmol/L) x±Sx	T. Prot. (g/L) x±Sx	Albumin (g/L) x±Sx	Na+ (mmol/L) x±Sx	K+ (mmol/L) x±Sx	Ca^{+2} (mmol/L) x±Sx	Cl- (mmol/L) x±Sx	P^{-2} (mmol/L) x±Sx
0		7.01 ±0.37	97.2 ±5.3	70 ±2.0	33 ±0.5	155 ±1.4	5.0 ±0.3	2.44 ±0.02	119.3 ±0.8	1.8 ±0.09
1	a	36.8 ±2.42	371.2 ±2.12	67 ±2.1	32 ±0.9	161 ±1.8	6.5 ±0.2	2.12 ±0.1	110.5 ±1.0	4.0 ±0.13
	b	34.9 ±2.29	344.7 ±16.8	65 ±2.6	30 ±1.2	154 ±3.1	5.6 ±0.2	2.07 ±0.1	107.1 ±1.3	3.6 ±0.06
2	a	39.2 ±2.37	424.3 ±22.9	66 ±2.0	30 ±0.9	159 ±0.6	6.6 ±0.1	2.12 ±0.07	108.1 ±1.9	3.9 ±0.16
	b	38.05 ±2.1	406.6 ±25.6	66 ±2.0	30 ±1.0	156 ±1.1	6.0 ±0.2	2.14 ±0.07	107.3 ±1.6	3.5 ±0.13
3	a	43.2 ±3.3	503.8 ±30.0	69 ±3.3	31 ±1.3	163 ±3.1	7.3 ±0.5	2.19 ±0.07	109.3 ±1.4	3.87 ±0.19
	b	41.0 ±2.94	477.3 ±33.6	66 ±2.3	30 ±1.0	156 ±2.1	6.1 ±0.3	2.22 ±0.07	107.3 ±1.2	3.48 ±0.16
4	a	44.9 ±2.93	548.1 ±30.0	65 ±1.9	29 ±1.1	158 ±0.8	6.7 ±0.2	2.22 ±0.07	105.8 ±1.6	3.84 ±0.7
	b	42.5 ±2.5	530.4 ±31.8	64 ±1.6	28 ±1.0	154 ±1.1	6.3 ±0.3	2.24 ±0.05	104.3 ±2.0	3.39 ±0.19
5	a	45.0 ±2.78	574.6 ±41.5	63 ±1.8	28 ±1.2	158 ±3.5	6.5 ±0.4	2.22 ±0.05	104.0 ±2.5	3.64 ±0.22
	b	43.0 ±2.89	539.2 ±36.2	63 ±1.4	28 ±0.7	154 ±2.9	6.0 ±0.4	2.32 ±0.05	104.8 ±2.7	3.32 ±0.19
6	a	46.9 ±2.15	627.6 ±43.3	63 ±1.2	28 ±0.7	155 ±2.5	6.3 ±0.4	2.24 ±0.05	103.8 ±2.3	3.77 ±0.16
	b	44.6 ±2.2	592.2 ±43.3	63 ±1.1	27 ±0.6	153 ±1.8	6.0 ±0.3	2.29 ±0.05	102.8 ±2.0	3.39 ±0.16
7	a	48.9 ±2.57	698.3 ±45.0	62 ±1.3	27 ±0.6	155 ±1.2	6.7 ±0.4	2.27 ±0.02	102.1 ±3.1	3.87 ±0.16
	b	46.1 ±2.3	663.0 ±45.0	62 ±1.1	27 ±0.7	154 ±1.8	6.4 ±0.4	2.27 ±0.02	102.5 ±2.8	3.45 ±0.16
8	a	50.3 ±2.6	742.5 ±47.7	62 ±0.6	27 ±0.6	156 ±2.2	7.1 ±0.4	2.27 ±0.02	101.8 ±3.2	4.03 ±0.09
	b	47.5 ±2.46	689.5 ±47.7	62 ±0.5	27 ±0.6	154 ±1.8	6.8 ±0.6	2.27 ±0.02	101.8 ±3.0	3.68 ±0.13
Statistical Evaluation P<0,05		0<All a and b. b<a	0<All a and b, b<a	All b<0	All b<0. 1b<1a	1,2,3,4b<a	1,2,3,5b<a All b>0	No statistical Difference	All b<0 1,4b<a	All b>0 All b<a

0: before the ureteral ligation; a : beginning of the session; b : end of the session

Excessive elevation of the WBC count on the next day after the ligation can be attributed to the operational trauma and the shock induced by the occluded kidneys rather than to an infectious cause. The physical examination and the bacteriological investigations did not reveal any infection. In this study, ligation of the ureters was done with plastic clips instead of the conventional suture materials like catgut used in other studies. At the end of the study no adhesion was observed in the ureters of any cat after patency was restored and normal excretory functions were regained.

Summary

Twenty four hours after the transient complete urethral obstruction, there was a significant increase in the BUN, creatinine, Na^{+}, K^{+} and P^{-2} levels. The total protein, albumin and Ca^{+2} values remained unchanged. Peritoneal dialysis was carried out for 2 days at 6 hour intervals for a total of 8 sessions. With every session there was a significant decrease in the BUN, creatinine, Na^{+}, K^{+} and P^{-2} values. Despite the dialysis at the end of the study the BUN, creatinine Na^{+}, K^{+} and P^{-2} values were higher than that at the beginning of dialysis while those of total protein, albumin and Cl^{-} were lower. It was concluded that, the peritoneal dialysis carried out at 6 hour intervals for 2 days, though not enough to completely remove harmful metabolites, was still found to be effective in stabilizing the general condition of the animals as well as most of the biochemical parameters.

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