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ORIGINAL ARTICLE

Improvement in uremic symptoms after increasing daily dialysate volume in anuric peritoneal dialysis patients

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Background. Patients on peritoneal dialysis (PD) can develop uremic symptoms as their residual renal function declines and they finally become anuric. In this retrospective study, we assessed the effect of increasing the dose of dialysis in anuric patients who developed uremic symptoms.

Materials and Methods. We evaluated retrospectively the effect of increasing the dose of dialysis on the prevalence of uremic symptoms in 44 anuric PD patients in whom the dose of dialysis was increased during the last five years. We also reviewed the charts of 12 patients with no increase in their dialysis dose, despite the onset of anuria. We recorded data for fatigue, anorexia, insomnia, pruritus and nausea, urine and peritoneal clearances, serum creatinine, BUN, PO_4, Hb, EPO dose, blood pressure and weight for a period of 6 months before and 6 months after the change in the PD prescription.

Results. Of the 44 patients (mean age 52±16, with 43%males), 37 were on continuous ambulatory peritoneal dialysis (CAPD) and 7 on continuous cycler peritoneal dialysis (CCPD). Twenty three percent were diabetics; mean duration of PD before the change in dialysis dose was 27.8 ± 18 months. Daily dialysate volume was increased an average of 2.2 L in CAPD and 4.3 L in APD patients. Peritoneal Kt/V and weekly creatinine clearance increased from 1.91±0.04 to 2.44 ± 0.08 and from 49.8 ± 1.2 to 61.5 ± 2.1 L/week respectively. The prevalence of fatigue decreased from 80% to 38%, anorexia from 50% to 20%, insomnia from 45% to 11%, pruritus from 34% to 9% and nausea from 11% to 4%. All these changes were statistically significant. On the other hand, we observed a slight trend towards an increase, but certainly no decrease, in the prevalence of uremic symptoms in the 12 patients, whose dialysis dose remained unchanged. Of these patients with a mean age of 60±16 years (58% males and 58% diabetics) 9 were on CAPD. Their peritoneal Kt/V was 2.04 ± 0.25 and their weekly creatinine clearance 54.7 ± 7.8 L. Before the onset of anuria, the prevalence of fatigue was 50%, anorexia 25%, insomnia 33%, pruritus 33% and nausea 0%. After six months of established anuria these figures became 83%, 25%, 25%, 33% and 17% respectively.

Conclusion. After a little over two years on PD most anuric patients develop uremic symptoms. Fatigue is the most common symptom followed by anorexia. An increase in the dialysis dose leads to a decrease in the prevalence of all the symptoms. Such an increase in prescription should be considered if PD patients become symptomatic.

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In the majority of uremic patients dialysis is initiated after the development of the uremic syndrome with symptoms like fatigue, anorexia, nausea and pruritus. Adequate dialysis, particularly from a patient's perspective would be the volume that relieves the patient's symptoms, which led to initiation of dialysis in the first place. It is quite possible to lose sight of this fact while chasing numerical adequacy targets.

Adequacy of dialysis especially in (PD) patients has been a subject of much debate. In patients on peritoneal dialysis we have long recognized the significance of residual renal function for solute clearance and more importantly its contribution to patient survival [1,2]. Because residual renal function (RRF) declines in patients with end-stage renal disease on dialysis, it is not uncommon to see that some patients on PD develop uremic symptoms as they become anuric, necessitating an adjustment in their dialysis prescription. Several studies of PD patients have examined the effect of a decline in RRF on quality of life including development of uremic symptoms and also on mortality [1-4]. Other studies have looked at the improvement in the clearances of biochemical parameters, nutritional status and mortality after an increase in the dialysis dose [5-7]. However not many studies have examined the effect of increasing the dose of dialysis on uremic symptoms which might develop during the course of PD.

In this retrospective study, we determined whether increasing the dose of dialysis in anuric patients who developed uremic symptoms would lead to an improvement in these symptoms and a better quality of life while on dialysis.

Patients and methods

This retrospective study was conducted in the Home Peritoneal Dialysis Unit of the Toronto Western Hospital of the University of Toronto. We reviewed the records

of all patients on CAPD or CCPD, who had an increase in their dialysis dose due to either the appearance of a uremic symptom or to worsening of biochemical parameters and their daily urine volume was less than 100 ml in two consecutive clinical visits. These patients had to have been on PD for at least six months before and after the increase in their dialysis dose. Patients with shorter follow-ups were therefore excluded form the study. We also excluded from the study patients in whom the dialysis dose was increased after the initial Adequest (done within 2-3 months after starting PD) results. Besides, those patients whose PD prescriptions were altered for reasons other than under-dialysis were also excluded. These reasons include patients with incomplete or missing data and fluid leaks. Those patients in whom symptoms could be attributed to severe acute illness such as sepsis, myocardial infarction, heart failure or amputation, also were excluded from the study.

The following symptoms were studied: fatigue, anorexia, insomnia, pruritus and nausea. As a part of our clinic protocol the primary nurse records the presence or absence of each of these symptoms in the chart at each clinical visit. Each primary nurse is responsible for 20-25 patients and each patient is assigned to the same nurse for all the time he/she remains on PD. Presence or absence of these symptoms is recorded in the chart by the patients' primary PD nurse during each clinic visit and the findings are cross-checked by the patient's primary physician. To ensure that a patient's symptoms were not due to a major clinical event or acute illness, we excluded patients where such a possibility existed or if they had a severe co-morbid condition. The presence or absence of these symptoms was recorded for a period of six months before and six months after the increase in dialysis dose. In addition a separate record was made for the presence or absence of each of these symptoms, during the clinic visit, when the dialysis prescription was changed ('last visit before'), and during the clinic visit 6 months after the increase in dialysis dose ('last visit after'). During all these time periods, in addition to the demographic data, we recorded: glomerular filtration rate (mean value of urinary urea and creatinine clearance), urine and dialysate volumes, patients' weight, blood pressure, serum creatinine, urea, phosphate, potassium, hemoglobin and the dose of erythropoietin. In 31 patients we had data on weekly creatinine clearance and Kt/V urea (peritoneal and urine), before and after the change in dialysis dose. Patients visit our clinic on a monthly basis for clinical assessment and laboratory workup, including measurement of urine creatinine clearance (normalized for body surface area). Once a year or after a peritonitis episode or an increase in dialysis dose a PET and Adequest® tests are conducted.

Statistical analysis

The analysis was done using SAS software (version 8.2). The baseline variables were described as means and standard deviations and standard error of mean, when appropriate. The means of continuous variables over six months before the increase in the dialysis dose were compared to the mean values over the six months after the change in dialysis dose using the Student's t-test. A similar analysis was done for these parameters between the last visit before the change and the last visit, six months after the dialysis dose was increased. The proportion of patients with each symptom, at these two time periods was compared using the McNemar's test. Fisher's exact probability test and x^2 test were used for comparison of different patient groups. A p-value of < 0.05 was considered statistically significant.

Results

Between 1996 and 2002, we identified 47 patients in whom the dialysis dose was increased after the onset of anuria. Three of these patients were excluded from the study due to short follow-up (n=2) or presence of severe acute illness (n=1). The demographic data on the remaining 44 patients are given in Table 1. These patients were on peritoneal dialysis for 27.8 ± 18 months. Thirty-seven (84%) of them were on CAPD while the remaining were on CCPD. All of these patients developed one or more uremic symptoms as they became anuric, fatigue being the most common. The presence of these symptoms led to an increase in dialysis dose. The change in dialysis prescription aimed to the increase in peritoneal clearance in every patient. In CAPD this was achieved either by increasing the number of exchanges or the dialysate volume of each change. In CCPD the night volume was increased or a day change was added. In some cases (9 patients) it was achieved by converting the patient from CAPD to CCPD with an extra day exchange (Tables 2a and 2b). The proportion of patients with these symptoms before and after the increase in dialysis dose is listed in Table 3. The prevalence of all five symptoms decreased significantly after the increase in dose of dialysis. This was true for both time cohorts

Table 1. *Demographic profile of the 44 patients.*

Mean age	52 ± 16 years*
Male/Female	19/25
Diabetes	10 (23%)
PD duration	27.8 ± 18 months*
CAPD/CCPD	37/7

**Values expressed as mean ± SD*

Table 2a. *PD modality and dialysate volume of the 44 patients (CAPD)*

	n (%)	Volume (L/day)
BEFORE	37 (84%)	8.4 ± 1.3
AFTER	28 (63%)	10.6 ± 1.4

Table 2b. *PD modality and dialysate volume of the 44 patients (CCPD)*

	n (%)	Night volume (L)	Day volume (L)	Total volume (L)
BEFORE	7 (16%)	11 ± 3.6	1.2 ± 1	12.2 ± 2.3
AFTER	16 (37%)	13 ± 2.4	3.5 ± 2.5	16.5 ± 2.5

vizit over the whole period of six months and at the last visit.

Of the 44 patients, 31 had adequacy test (creatinine clearance and Kt/V) results before and after the increase in dialysis dose. The weekly peritoneal creatinine clearance increased from 49.8 ± 1.2 L to 61.5 ±2.1 L ($p < 0.0001$) and the weekly Kt/V increased from 1.9 ± 0.04 to 2.43 ± 0.08 ($p < 0.0001$). The daily urine volume and GFR decreased from 155 ± 17 ml/d to 11 ± 7 ml/d ($p=0.002$) and 1.1 ± 0.3 ml/min to almost zero ($p=0.002$) respectively during the same period. Comparison of various biochemical and clinical parameters over the six-month period, before and after the change and at last visits, ('last visit before' and 'last visit after' the increase in the dialysis dose) are summarized in Table 4. On comparing the six-month period before and after increasing the dialysate volume, levels of blood urea and serum phosphate decreased significantly. However when only the last visit was taken into account (before and after the increase in the dialysate volume), serum creatinine, serum phosphate and blood urea decreased significantly.

We also reviewed the charts of 12 patients with no increase in their dialysis dose, despite the onset of anuria. Of these patients with a mean age of 60±16 years (58% males and 58% diabetics) 9 were on CAPD. Their peritoneal Kt/V was 2.04 ± 0.25 and their weekly creatinine clearance 54.7 ± 7.8 L. Before the onset of anuria, the prevalence of fatigue was 50%, anorexia 25%, insomnia 33%, pruritus 33% and nausea 0%. After six months of established anuria these figures became 83%, 25%, 25%, 33% and 17% respectively (Table 5). There is an obvious slight trend towards an increase, but certainly no decrease, in the prevalence of uremic symptoms in these 12 anuric patients, whose dialysis dose remained unchanged.

Discussion

Uremia affects all systems and often is accompanied by one or more symptoms which all together result in what is called uremic syndrome. The presence of such symptoms can be very tantalizing for our patients and they are usually relieved when dialysis is initiated. However it is not uncommon for dialysis patients to develop uremic symptoms in the course of dialysis therapy. This could be a sign of underdialysis and leads to a severe deterioration of their quality of life.

Table 3. *Proportion of patients with symptoms before and after increase in dialysis dose.*

S.No	Symptom	Over 6 months			At last visit		
		Before (%)	After (%)	p-value	Before (%)	After (%)	p-value
1	Fatigue	84	57	0.002	80	38	<0.0001
2	Anorexia	64	34	0.004	50	20	0.001
3	Insomnia	54	27	<0.0001	45	11	<0.0001
4	Pruritus	41	25	0.02	34	9	0.001
5	Nausea	16	2	0.03	11	3	NS

Table 4. *Biochemical and clinical parameters before and after increase in dialysis dose.*

S.No	Parameter	Over 6 months			At last visit		
		Before	After	p-value	Before	After	p-value
1	Serum Creatinine (umol/L)	1002±289	959±274	NS	1051±305	969±277	0.001
2	Blood Urea (mmol/L)	20.5±5.9	17.4±4.7	<0.0001	21.3±7.3	17.1±4.8	<0.001
3	Phosphate (mmol/L)	1.8±0.5	1.7±0.4	0.01	1.8±0.5	1.6±0.5	0.03
4	Hemoglobin (gm/L)	108.3±19.1	109.3±19.5	NS	105.7±19.9	110.2±19.9	NS
5	Albumin (g/L)	40.7±4.7	40.2±4.9	NS	40.9±5.6	40.7±5.4	NS
6	Weight (Kg)	66.8±12.5	67.3±12.7	NS	67.2±12.7	67.8±12.9	NS
7	*Urine volume (ml/24 hr)	155±17	11±7	0.002	-	-	
8	*GFR (ml/min)	1.1±0.3	0	0.002	-	-	
9	*Weekly Kt/V urea §	1.9±0.04	2.43±0.08	<0.0001	-	-	
10	*Wkly perit clearance (L/wk) §	49.8±1.2	61.5±21	<0.0001	-	-	

* Values represent means ± Std errors. § - Have 31 observations.

Table 5. *Proportion of patients with symptoms before and after the onset of anuria in the 12 patients without an increase in dialysis dose.*

S.No	Symptom	Onset of anuria	
		Before (%)	After (%)
1	Fatigue	50	83
2	Anorexia	25	25
3	Insomnia	33	25
4	Pruritus	33	33
5	Nausea	0	17

We set out to examine the effect of increasing the daily dialysate volume on the prevalence of uremic symptoms in peritoneal dialysis patients. The most common symptom leading to an increase in a patient's dialysis prescription was fatigue, followed by anorexia. In a cross-sectional survey of Canadian patients, Curtis et al also found that at initiation of dialysis fatigue was the most common symptom, followed by anorexia [8]. Similar results were found in another study from our own group [9]. Merkus and colleagues observed fatigue and pruritus in 87% and 68% patients respectively, after three months of starting PD. They also found that these symptoms contribute significantly towards a poor quality of life on dialysis [10].

Although patient-reported symptoms are subjective and could be influenced by several factors, some workers have suggested that a checklist of such symptoms could serve as a guide to dialysis adequacy [11]. It is however not universally accepted that these symptoms correlate with the biochemical indices of adequacy. Holley reported that nausea, vomiting, fatigue and weakness were the best predictors of a creatinine clearance of < 48 L/wk [11], whereas Blake and colleagues, while testing the value of urea kinetics, found no correlation between the Kt/V and subjective indices of fatigue, pruritus and insomnia [12]. In our unit, the patients' primary nurses are experienced in recording the presence or absence of these symptoms for several years now, which lends credibility to the accuracy of this parameter. In addition, each one of our nurses looks after the same patients (the case being the same for the physicians) for as long as they are treated with PD. Also, we excluded those patients in whom the symptoms could have been due to or aggravated by acute illness or a severe co-morbid condition. By doing this, we further eliminated confounding factors. Davies and co-workers demonstrated the effect of co-morbid conditions on one such symptom when they found that co-morbid conditions caused suppression of appetite, independent of dialysis dose [13].

We observed a significant reduction in the prevalence of all the uremic symptoms, after we increased the daily dialysate volume. This finding was interesting especially for pruritus because many studies have reported that dialysis and several other measures did not relieve this symptom. Although it has been reported that optimal dialysis relieves pruritus, the limited success reported in treating this symptom may reflect the fact that this symptom has been attributed to various pathophysiological mechanisms [14-16].

Fatigue is a common and incapacitating symptom in dialysis patients [8-10]. Several factors such as anemia, malnutrition, inadequate dialysis and presence of co-morbid conditions contribute towards this [9,17-19].We observed a significant decrease in the prevalence of fatigue after increase in the dialysate volume. Chang et al reported a significantly lower fatigue score in patients who had a weekly creatinine clearance of =60 l/kg/wk (CAPD) and = 63 l/kg/wk (CCPD). However this was a cross-sectional study and not aimed at assessing the effect of any intervention [17]. Although anemia and its correction have been reported to influence occurrence of fatigue in dialysis patients, it is unlikely that the small increase in hemoglobin after the increase in dialysis dose might be responsible for some of the improvements we observed [20]. The hemoglobin levels although were higher when measured after increasing the dialysate volume, were not too low to start with (110.2 ± 16.3 g/L over 6 months), neither did we observe any changes in erythropoietin dose and intravenous iron administration.

Anorexia in PD patients has been attributed to the large volume of dialysate and the glucose load absorbed from the dialysate. However, despite an increase in dialysate volume, we saw a significant improvement in appetite of our patients. Similarly, after they increased the delivered dialysis dose by 25% in malnourished PD patients, Davies et al observed an increase in dietary calorie intake after six months. However they could not determine the effect of increased dialysis on other symptoms because of the small number of patients [7]. In a randomized trial comparing patients on 6L/day exchanges to those dialysed with 8L/day, Mak and co-workers also observed an improvement in nutrional indices as measured by nPNA. Despite a significant increase in Kt/V and weekly creatinine clearance in the treatment group, they did not find any change in clinical assessment score, which included anorexia, nausea, vomiting, tiredness and itching, fluid related problems, weight loss and serum albumin level [5]. However they assessed only patients on CAPD and also included those with cardiovascular disease and congestive heart failure, which may explain the persistence of malnutrition, irrespective of dialysis dose [13].

Sleep disturbances are common in patients with end-stage renal disease [21]. We observed insomnia in 46% of these patients before the increase in daily dialysate volume. Stepanski et al and Hui et al both report that 73% of their patients on PD complained of insomnia [22,23]. Although our patients were middle-aged or elderly (mean age 54 ± 15 years and median 43 years) – groups in whom sleep apnea and other sleep disorders are more common, the frequency of this symptom declined significantly after we increased the daily dialysate volume[24].

Again this was interesting because sleep promoting substances have been detected in the dialysate effluent of PD patients with insomnia [25]. However we would need formal sleep studies with polysomnography to determine whether sleep quality and sleep apnea do improve after an increase in dialysis dose.

In our patients, the urine volume and residual GFR decreased significantly until they reached anuric levels. This result is not unexpected, because residual renal function is known to decrease in patients on dialysis. The improvement in symptoms despite this decline in residual function emphasizes the effect of increased dialysate volume, which produced a significantly higher peritoneal creatinine clearance and Kt/V after the change in the PD prescription. This finding agrees with the study of Szeto et al in anuric PD patients [26].

An interesting finding is the increase in the number of patients on APD as a result of the need to increase daily dialysate volume. Achieving similar clearances with the use of CAPD would require an increase in either the number of exchanges or the instilled volume. More than five exchanges per day or volumes larger than 2.5 L would lead to patients' discomfort or deterioration of their quality of life. To achieve better clearances one has to increase the use of APD.

It may be important to have certain objective criteria and predetermined targets while we assess adequacy of PD from time to time, but their weakness has been highlighted by the ADEMEX study [27]. This landmark study may tempt the clinician to keep every patient on a particular PD prescription (for example 2L exchanges X 4 times a day) irrespective of patient's symptoms. Our study is of considerable significance because it suggests that one can achieve significant reduction in the prevalence of uremic symptoms after increasing the dialysis dose.

In addition to patient and technique survival, which are the common outcome measures, increasingly, quality of life is being recognized as an equally important endpoint. However quality of life was not assessed in the ADEMEX study. Although we did not use objective criteria and scales to assess the quality of life of our patients, our findings indicate that increasing dialysate volume was associated with improvement in the patients' symptoms and would contribute towards improvement in the quality of life of patients on dialysis.

In conclusion, loss of residual renal function may be associated with development of uremic symptoms in patients on peritoneal dialysis. We have observed that fatigue is a prominent symptom that led the clinician to increase the dialysis prescription. We found that an increase in daily dialysate volume was associated with a significant reduction in the uremic symptoms that we studied.

Although survival on dialysis is an important outcome, longer life may not be worthwhile for many patients if the longevity is associated with troublesome uremic symptoms that reduce the patient's quality of life. Hence it is important to observe how well these patients do on dialysis and determine if their symptoms can be relieved by increasing their dialysis dose. Our study, even when the usual weaknesses of all efforts for retrospective evaluation are taken into account, suggests that increasing the daily dialysate volume does alleviate uremic symptoms. Thus we recommend that the clinician give an equal – if not a higher weight to the patients' presence (or absence) of symptoms when setting adequacy targets.

Περίληψη

Β. Λιακόπουλος, Μ. Krishnam, Ι. Στεφανίδης, Δ. Ωραιόπουλος*. Βελτίωση των ουραιμικών συμπτωμάτων μετά από αύξηση του ημερήσιου όγκου περιτοναϊκού υγρού σε ανουρικούς ασθενείς που υποβάλλονται σε περιτοναϊκή κάθαρση.** ***Ιπποκράτεια 8(4):182-187

Εισαγωγή. Με το πέρασμα του χρόνου η υπολειπόμενη νεφρική λειτουργία ασθενών που υποβάλλονται σε Περιτοναϊκή Κάθαρση (ΠΚ) ελαττώνεται, πολλοί ασθενείς γίνονται ανουρικοί και η εμφάνιση ουραιμικών συμπτωμάτων δεν είναι σπάνιο φαινόμενο. Η παρούσα αναδρομική μελέτη διεξήχθη για να αξιολογήσει τη συσχέτιση μεταξύ της αύξησης της δόσης κάθαρσης και της συχνότητας εμφάνισης αυτών των συμπτωμάτων.

Υλικό και Μέθοδοι. Αξιολογήθηκε αναδρομικά η επίδραση της αύξησης της συνταγογραφούμενης δόσης κάθαρσης στη συχνότητα εμφάνισης ουραιμικών συμπτωμάτων σε 44 ανουρικούς ασθενείς που υποβάλλονταν σε ΠΚ και στους οποίους η δόση της αποδιδόμενης κάθαρσης αυξήθηκε κατά τη διάρκεια των τελευταίων πέντε ετών. Μελετήθηκαν επίσης οι ιατρικοί φάκελοι 12 ανουρικών ασθενών στους οποίους η δόση κάθαρσης παρέμεινε σταθερή, παρά την εμφάνιση της ανουρίας. Καταγράφηκαν στοιχεία για την κόπωση, την ανορεξία, την αϋπνία, τον κνησμό και τη ναυτία, την υπολειπόμενη νεφρική λειτουργία, την κάθαρση από την εφαρμογή της ΠΚ, την ουρία και κρεατινίνη, το φώσφορο, την αιμοσφαιρίνη, τη δόση ερυθροποιητίνης, την αρτηριακή πίεση και το σωματικό βάρος για μια περίοδο 6 μηνών πριν και 6 μηνών μετά από την αύξηση της δόσης κάθαρσης.

Αποτελέσματα. Από τους 44 ασθενείς (μέση ηλικία 52±16, με 43%άνδρες), 37 υποβάλλονταν σε Συνεχή Φορητή Περιτοναϊκή Κάθαρση (ΣΦΠΚ) και 7 σε Αυτοματοποιημένη Περιτοναϊκή Κάθαρση (ΑΠΚ). Ποσοστό 23% ήταν διαβητικοί και η διάρκεια υποβολής σε ΠΚ πριν την αλλαγή στη δόση κάθαρσης ήταν 27,8 ± 18 μήνες. Ο ημερήσιος όγκος των περιτοναϊκών διαλυμάτων αυξήθηκε κατά μέσο όρο 2,2 lt στους ασθενείς υπό ΣΦΠΚ και κατά 4,3 lt στους ασθενείς υπό ΑΠΚ. Στους ασθενείς αυτούς παρατηρήθηκε αύξηση του Kt/V και της εβδομαδιαίας κάθαρσης κρεατινίνης από 1,91 ± 0,04 lt σε 2,44 ± 0,08 lt και από 49,8 ± 1,2 lt έως 61,5 ± 2,1 lt αντίστοιχα. Η συχνότητα εμφάνισης της κόπωσης μειώθηκε από 80% σε 38%, της

ανορεξίας από 50% σε 20%, της αϋπνίας από 45% σε 11%, του κνησμού από 34% σε 9% και της ναυτίας από 11% σε 4%, Όλες αυτές οι αλλαγές ήταν στατιστικά σημαντικές. Από την άλλη μεριά, παρατηρήθηκε μια μικρή τάση προς αύξηση, και σε καμιά περίπτωση μείωση, στη συχνότητα εμφάνισης των ουραιμικών συμπτωμάτων στους 12 ασθενείς, των οποίων η δόση κάθαρσης παρέμεινε αμετάβλητη. Από τους ασθενείς αυτούς με μέση ηλικία 60±16 έτη (άνδρες 58% και διαβητικοί 58%) 9 υποβάλλονταν σε ΣΦΠΚ. Το Kt/V ήταν 2,04 ± 0,25 και η εβδομαδιαία κάθαρση κρεατινίνης 54,7 ± 7,8 lt. Πριν από την εμφάνιση της ανουρίας παρουσίαζαν κόπωση σε ποσοστό 50%, ανορεξία 25%, αϋπνία 33%, κνησμό 33% και ναυτία 0%. Έξι μήνες αφότου έγιναν ανουρικοί τα ποσοστά ήταν 83%, 25%, 25%, 33% και 17% αντίστοιχα.

Συμπέρασμα. Μετά από περίπου δύο έτη ένταξης σε ΠΚ οι περισσότεροι ανουρικοί ασθενείς αναπτύσσουν ουραιμικά συμπτώματα. Η κόπωση είναι το πιο συχνό από αυτά, ακολουθούμενη από την ανορεξία. Η αύξηση στη δόση της αποδιδόμενης κάθαρσης οδηγεί στη μείωση της συχνότητας εμφάνισης όλων των ουραιμικών συμπτωμάτων. Μια τέτοια αύξηση πρέπει να επιδιώκεται σε κάθε περίπτωση που οι ασθενείς που υποβάλλονται σε ΠΚ γίνονται συμπτωματικοί.

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