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Research Article

Peritoneal Dialysis Penetration and Peritonitis Rate at a Single Centre during Last Decade

Jana Uhlinova, Ülle Pechter, Kadri Kermes, and Mai Ots-Rosenberg

Department of Internal Medicine, University of Tartu, 6 Puusepa Street, Tartu 51014, Estonia

Correspondence should be addressed to Mai Ots-Rosenberg, mai.ots@kliinikum.ee

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Peritoneal dialysis (PD) has been intensively offered at our centre to patients (pts) with end-stage renal disease (ESRD) from 2000, and the number of PD pts was noticed to raise. We aimed to analyse the PD population from the aspect of penetration and peritonitis rate during eleven years. Cumulative number of new RRT pts was 378 during the study period. We found high PD penetration rate: 53% (range 32–72%). The rate of peritonitis was as high as 9.8 during first study years, but it has declined progressively last year being 29.1 by September 2010 and 21.7 by December 2010. Most cases of peritonitis were due to gram-positive pathogens. We have demonstrated steady high single-centre PD penetration rate and improvement of management of patients during last decade probably because of the result of better pts education and a continued dedication of the staff.

1. Introduction

Penetration of peritoneal dialysis varies widely across the world. It ranges from about 80% in Hong Kong and Mexico to few percentage points in the United States and some developing countries [1–5]. Peritoneal dialysis appears to have some excellent properties as a first-line renal replacement therapy (RRT) [6]. The use of dialysis and transplantation as complementary therapies for RRT is well established in our country. RRT data at December 31, each year have been reported regularly to European Dialysis and Transplantation Association Registry [7] and detailed epidemiologic data available in Annual Report of Kidney Diseases in Estonia 2009 [8]. According to reports, the incidence and prevalence of RRT patients in our country remains lower than that reported from the other European countries. The incidence of RRT has a decreasing tendency during last three years in the country being 62.7 pmp at day 91 in 2008 [7]. Peritoneal dialysis (PD) was introduced to the clinical practice already 17 years ago at our university hospital which is the second largest centre in the country. Since 2000, after structural changes at our centre when nephrology division was connected with dialysis unit, we started to intensively offer PD treatment to every patient with end-stage renal disease (ESRD) without contraindications for PD, and the number of PD patients raised sharply. The number of peritoneal dialysis patients have been the highest in the country compared with other centres [8]. According to the Annual Report PD, patients formed 47% from dialysis prevalence patients at Tartu University Hospital at the end of 2009, whereas the percentage was lower in other centres: 21% at West-Tallinn Hospital and 44% at North-Estonia Regional Hospital [8]. Peritonitis remains a significant problem in peritoneal dialysis. It is the leading cause of technique failure in peritoneal dialysis. Therefore, we aimed to analyse our PD population in a single-centre cohort study with respect to penetration and peritonitis rate during last decade.

2. Materials and Methods

The report is based on retrospective data from patient's records, and comparable whole country data were obtained from Annual Report of Kidney Diseases 2009. PD penetration rate was defined as the percentage of new patients on PD in relation to all new dialysis patients each year. PD penetration rate, peritonitis rate, and microbiology of peritoneal fluid have been analysed for all pts in our program since 2000. In conjunction with epidemiological research study in the country, we recently expanded the

data set where individual RRT patients data together with clinical performance indicators (CPI) at the end of each year have been collected and analyzed beside the basic RRT epidemiological data collection. In the current investigation, we demonstrate our single centre PD patients CPIs that characterize anaemia, calcium phosphate, and lipids mean patients group levels. The following biochemical parameters (using the Hitachi 912 Analyzer until 2004 and COBAS INTEGRA 800 after 204) were studied: serum creatinine (S-Crea, μmol/L), serum albumin (S-Alb, g/L), C-reactive protein (CRP, mg/L), serum-ionized calcium (S-i-Ca, mmol/l), serum total calcium (S-total Ca, mmol/L), and serum phosphate (S-P, mmol/L). Studied lipid profile was the following: serum total cholesterol (S-Chol, mmol/L), serum HDL cholesterol (S-HDL chol, mmol/L), serum LDL cholesterol (S-LDL chol, mmol/L), and serum triglyceride (TG, mmol/L). Parathyroid hormone (PTH, pmol/L) levels were determined by immunoanalyzer IMMULITE 2000 using chemiluminescence method. Haemoglobin (Hgb g/L) levels were measured by photometric method. Peritonitis was defined as turbid fresh dialysis effluent containing polynuclear leukocyte cell count higher than 100/mm^3. Peritonitis rate was calculated as number of peritonitis episodes per number of patients-months. For the isolation of the organisms, blood culture media was used (BACTEC Microbiological Culture Analyzer). Two thirds of patients were on Baxter DUO connection system, and one third of patients remained on Fresenius stay-safe system.

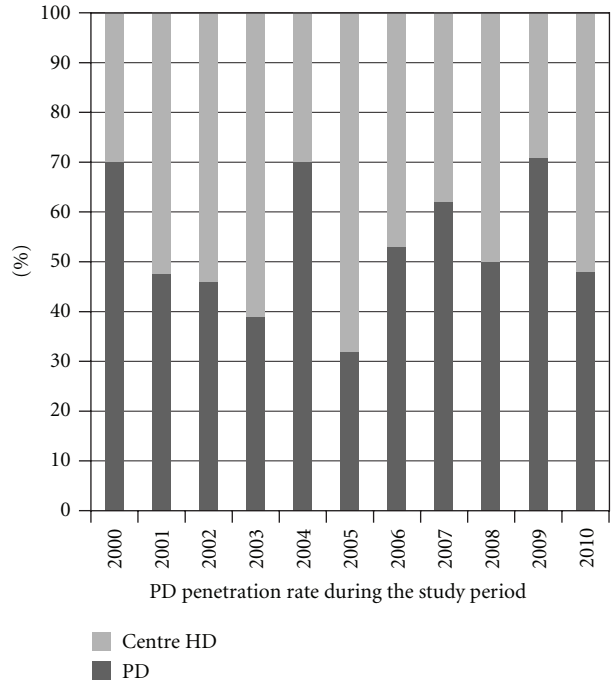

Figure 1: Peritoneal dialysis penetration rate at the Tartu University Hospital 2000–2010.

3. Results and Discussion

The retrospective study was carried out at the Department of Internal Medicine of Tartu University. Cumulative number of new RRT patients in our centre who started peritoneal dialysis between January 2000 and December 2010 was 378. Mean age of all incidence dialysis patients was 58.8 years in 2010 with male predominance of 57%. Demographic data are comparable with country RRT incidence data showed in Annual Report of Kidney Diseases 2009. According to the Report, the mean age of incidence patients was 60.5 years, percentage of males 58%. Diabetes is the main cause of ESRD in new dialysis patients in Estonia [8]. Table 1 shows the main causes of ESRD patients at our centre and comparable data of whole country. Because of small numbers, our centre incidence patients diabetes diagnosis percentage differs from year to year being still high every year.

Figure 1 showed the percentage of mean peritoneal dialysis penetration rate which was 53% (range 32–72%) in our centre during the eleven year-study period. With these results, we demonstrate a steady peritoneal dialysis penetration rate during long period. In our opinion, this is because of better patients education and a continued dedication of the staff. It is important that patients and nurses are well educated in the practice of peritoneal dialysis. Similarly, in other long-term studies, many centres report higher penetration rate after essential improvement of local skills [1–3].

Clinical and laboratory data are demonstrated in Table 2. Results show that many of our peritoneal dialysis patients have overweight, increased inflammatory status, hypoalbuminemia and dyslipidemia. Inflammation and dyslipidemia accelerate atherosclerosis and are often present in peritoneal dialysis patients [9, 10]. Normal range of haemoglobin according to guidelines [11] was found in our study patients.

Arterial calcification is common in adults with chronic kidney disease and progresses with time. On the other hand, peritoneal calcification, one of the major complications, can develop in peritoneal dialysis patients [12]. Therefore, the management of secondary hyperparathyroidism and avoidance of peritonitis should be important aims of the treatment. We found that, although, calcium and phosphate levels were almost in normal range, mean PTH was increased in our patients (Table 2). We conclude that further improvement of the management of mineral metabolism and secondary hyperparathyroidism as well as body composition measurements and calcification diagnostics are needed at our centre to avoid serious complications described by many authors [12–15].

Peritonitis remains a major complication in patients undergoing peritoneal dialysis and remains a major cause of patients discontinuing peritoneal dialysis and switching to haemodialysis. However, technique survival at year 1 has been almost 100% at our center during last years. Because of short period and small numbers survival, data are not included and will be shown separately. Our study analyzed peritonitis rate and pathogens responsible for the peritonitis. The incidence of peritoneal dialysis-related peritonitis was as high as 1 episode every 9.8 months in 2004, but it has progressively declined during the last years being 29.1 in September 2010 and 21.7 at the end of the year (Table 3).

Table 1: Aetiology of chronic kidney disease in dialysis incident and prevalent patients at Tartu University Hospital during 2008–2010 and in Estonia in 2009.

	Incident RRT pts at TUH, N (%)	Incident PD pts at TUH, N (%)			Prevalent PD patients in Estonia, N (%)*			Incident RRT pts at TUH, N (%)	Prevalent PD patients at TUH, N (%)
Diagnosis	2010	2008	2009	2010	2008	2009	2010	2009	2009
Diabetes mellitus	4 (14)	4 (25)	9 (33)	1 (7)	6 (22)	13 (32)	7 (20)	30	24 (33)
Hypertension	5 (17)	0 (0)	5 (19)	2 (14)	4 (15)	8 (20)	5 (15)	14	18 (25)
Glomerulonephritis	5 (17)	2 (12)	3 (11)	2 (14)	5 (19)	6 (16)	6 (18)	13	6 (8)
Chronic pyelonephritis	7 (24)	5 (32)	4 (14)	5 (37)	6 (22)	8 (20)	8 (23)	19	12 (16)
Polycystic kidney disease	2 (7)	2 (12)	1 (4)	2 (14)	3 (11)	1 (2)	2 (6)	3	3 (4)
Other	6 (21)	3 (19)	5 (19)	2 (14)	3 (11)	4 (10)	6 (18)	21	10 (14)

* Data from Annual Report of Kidney Diseases in Estonia 2009.
Abbreviations: TUH, Tartu University Hospital; RRT, renal replacement therapy; PD, peritoneal dialysis; N, number.

Table 2: Clinical and laboratory mean data in prevalent peritoneal dialysis patients group at the end of year 2010.

Variables	PD pts group mean	SD*	Min	Max
Patients total **n = 34**				
BMI (kg/m^2)	28.8	1.1	19	43.6
Haemoglobin (g/L)	113.4	2.6	94	157
S-creatinine (μl/L)	705.5	45.6	316	1112
S-albumin (g/L)	34.3	0.9	19	42
C-reactive protein (mg/L)	9.5	1.5	1	32
S-ionized calcium (mmol/L)	1.2	0.0	1.0.	1.4
S-total calcium (mmol/L)	2.4	0.0	1.7	2.8
S-phosphate (mmol/L)	1.8	0.1	0.6	4.4
PTH (pmol/L)	52.2	10.9	1.6	197
S-total cholesterol (mmol/L)	5.7	0.2	3.0	7.8
S-HDL cholesterol (mmol/L)	1.2	0.1	0.6	1.8
S-LDL cholesterol (mmol/L)	3.9	0.2	1.9	6.2
S-triglycerides (mmol/L)	1.9	0.2	0.8	5.4

* SD- standard deviation.

Table 3: Peritonitis rate at Tartu University Hospital.

Year	2004	2006	2008	2010*	2010
Pts total nr	42	46	45	42	45
Pts nr at the end of the year	29	34	27	35	34
Treatment months	354	303	409	408	500
Peritonitis nr	36	19	19	14	23
Peritonitis rate (episodes/nr pts-months)	9.8	16	21.5	29.1	21.7
Peritonitis rate (episodes/pts-year)	1.2	1.3	1.8	2.4	1.8

* January–September 2010.

Table 4: Etiology of peritonitis at Tartu University Hospital.

Pathogen	2009-2010, N (%)	2006-2007, N (%)
Coagulase-negative staphylococci	21	15
Staphylococcus aureus	11	10
Streptococci	2	6
Gram-positive rod-shaped bacteriae	5	3
Enterococci	4	2
Enterobacteria	7	3
Acinetobacter baumannii	1	0
Pseudomonas aeruginosa	0	1
Yeasts	2 (3%)	0
Gram-positive organisms	43 (74%)	36 (84%)
Gram-negative organisms	8 (14%)	4 (9%)
Culture-negative peritonitis	5 (9%)	3 (7%)
Total	58 (100%)	43 (100%)

The improvement that we noticed between 2004 and 2006 may be the result of change in the connection systems at that time. Currently, during last years, almost two thirds of patients were on Baxter DUO connection system and one third of patients remained on Fresenius stay-safe system.

Many centres have been reported that, over time, the microbiology at those institutions has been changing [16]. We cannot confirm this because the aetiology of peritonitis have been similar many years. Table 4 demonstrates that coagulase-negative staphylococcus has been the most common pathogen during 2006–2010 followed by *Staphylococcus aureus*. In two effluents in 2009 and three in 2010, more than one pathogen was isolated. Thus, most cases of peritonitis were due to Gram-positive pathogens, accounting around 35% of all peritonitis episodes, and Gram-negative infections were presented with a variety of different organisms, predominantly *E. coli*.

4. Conclusions

This is a first report on long-term peritoneal dialysis experience at a single centre in Estonia. We have demonstrated

steady high single-centre peritoneal dialysis penetration rate and declining tendency of peritonitis rate after essential improvement of local skills.

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