Chronic Peritoneal Dialysis in Lebanese Children of Families with Low Socioeconomic Status

The associations between economic status (ES) and clinical outcome in health and disease are complex and multifaceted (1). When peritoneal dialysis (PD) evolved in the 1970s it was believed that only the most educated and well-off patients would be eligible for PD. In adults, educational level and geographic factors have been associated with peritonitis incidence independent of socioeconomic status (2). At present, it is unclear whether this holds true in pediatric PD patients.

Especially in young patients, PD-associated complications such as peritonitis, exit-site infections, hernia, and leakage are frequent (3). Low treatment adherence, family structure, poor socioeconomic status households, and depression in children were associated with poor adjustment to dialysis (4). We analyzed the outcome of chronic PD in Lebanese children of families with poor socioeconomic status living in remote areas.

PATIENTS AND METHODS

The retrospective analysis was performed in the principal pediatric nephrology center in Beirut, Lebanon, taking care of children with end-stage renal disease (ESRD) on chronic automated PD (APD). The children presented between January 2010 and January 2012. The inclusion criteria were: a) being on APD for at least 3 months; b) parents having a low educational level (i.e. unable to read and write); and c) having a low socioeconomic status, (i.e. families with less than 600 US\$ income per month). The dollar equivalent of the Lebanese poverty line is US\$2.40 per capita per day (5). Four children, age 1–13 years, 3 males, fulfilled the inclusion criteria. They were all living in large families with 5 children or more, in remote areas 130 – 150 km from the pediatric dialysis center, precluding frequent follow-up. None of the children were excluded from our PD program due to these circumstances. Permission of the Rafic Hariri University hospital IRB was obtained. The underlying diseases were Prune Belly Syndrome, autosomal recessive polycystic kidney (ARPKD) with normal liver function, steroid resistant nephrotic syndrome (SRNS), and nephrocalcinosis of undetermined etiology. All patients had monthly home visits by a qualified nurse and center follow-up every 6 months. Three of the patients had monthly visits to local dieticians and followed a low protein, phosphorous, and salt diet. One patient had regular phone calls with the dietician and was seen in the referral center every 2 months by a local physician. In case of technical difficulties, parents had access to 24-hour technical support provided by Baxter Company. Blood was taken at 1 and 6 months. All children received oral calcium, cholecalciferol, calcitriol, and iron and erythropoietin subcutaneously. The child with SRNS was anuric and required a calcium channel blocker. Treatment targets were according to Kidney Disease Outcomes Quality Initiative (KDOQI) recommendations for serum calcium and phosphorus. Parathyroid hormone (PTH)

target range was 200 – 300 pg/mL and the hemoglobin target range was 11 – 13 g/dL. Intensified training of the parents was performed by nurses and technicians from the Baxter group during 1 week while the patients were hospitalized for insertion of the double-cuffed Tenckhoff catheter. This training included technical aspects of the cyclor, possible causes of alarm during the infusion and drainage phase, modification of treatment according to body weight and blood pressure, and signs of peritonitis, exit-site infection and leakage. Nasal swabs for *Staphylococcus aureus* screening were taken from the patients and all caregivers. During the monthly home visits, the children were checked for clinical status, body weight and height, blood pressure, estimated residual urine output, clinical signs of infection, in particular of peritonitis and exit-site infections, and for the presence of hernia and leakage by a qualified PD nurse. Issues related to technical problems were handled by the technicians in charge. Vigorous caregivers' adherence to the aseptic recommendations was checked. The cyclor card was used to verify PD treatment. In case of secretions from the exit site, a culture swab was taken. Cultures of the peritoneal fluid were performed monthly, even in asymptomatic children.

RESULTS

The 6-month follow-up of the PD treatment was unremarkable in all children. Physical findings are given in Table 1. Two of the 4 children improved their age-related body weight and length standard deviation (SD) scores. Hemoglobin levels improved in all children by 1 to 4.5 g/dL to 11.5 – 13 g/dL, whereas no consistent effect was seen regarding serum creatinine, electrolytes and PTH. At baseline, serum creatinine was 2.5 – 10 and 3 – 6.5 after 6 months, calcium 6.2 – 9.5 and 9 – 9.5, phosphate 3.1 – 8.2 and 5.5 – 7.0 mg/dL, and PTH 238 – 1085 and 300 – 520 ng/mL at baseline and after 6 months, respectively.

Fourteen phone calls were received by the technical service. Four of these were by the same parents and related to drain alarms. These were resolved by transiently setting the drain alarm to the off mode. The other calls were due to abnormal sleeping position of the child with compression of the catheter. All problems were solved by phone calls, except for 1 that needed a home visit to reprogram the machine. No peritonitis

TABLE 1
Physical Findings at Baseline and at 6 Months Follow-Up

Patient	Age (months)	BW1 (kg)	BW6 (kg)	HT1 (cm)	HT6 (cm)	BP1 (mmHg)	BP6 (mmHg)
1	12	4.5 (-3)	7 (-0.5)	48 (-3)	56 (-1.5)	105/45	100/50
2	45	8 (-4)	11 (-2)	82 (-4)	90 (1.5)	100/50	100/50
3	72	18 (+0.5)	21 (+0.5)	112 (0)	115 (0)	120/75	110/80
4	126	52 (+0.5)	54 (+0.5)	158 (+1)	160 (+1)	130/95	120/75

BW = body weight; HT = height; BP = blood pressure.

Individual values and respective standard deviation scores in parenthesis.

episodes developed and only 1 exit-site infection caused by *Staphylococcus aureus* was noted. The latter was probably caused by non-adherence to the recommended monthly nasal mupirocin treatment and successfully treated with daily local fusidic acid cream administration for 14 days. A follow-up swab remained negative.

After the 6-month follow-up visit, 1 child had to switch to hemodialysis due to shortage of PD fluid paid and delivered via the ministry of health. One child moved to another country. The children with ARPKD and the SRNS underwent successful living related transplantation.

DISCUSSION

Although low socioeconomic status has been considered a relative contraindication to PD, no published data clearly link it to poor outcomes. In Lebanon, the situation is more difficult than in developed countries since only limited patient access to the health system is available, especially for those living outside the urban areas. In our 4 patients, the socioeconomic and educational status was low, and they all lived in remote geographic areas, precluding regular center follow-up. Despite such limitations, all children performed PD without any major complication during the 6 months following PD initiation. According to the international pediatric PD network, longitudinal growth strongly depends on gross national income (6). In our study, the physical development was good with catch-up growth in 2 of the 4 children. They were below 5 years of age and grew well despite their unfavourable economic status. None of the children was on growth hormone treatment. This catch-up growth might be explained by the absence of infectious complications, dialytic toxin removal and the repeated dietary counselling at home. Likewise, the limited biochemical findings indicate that PD efficacy and dietary means were adequate. The single clinic blood pressure measurements suggest blood pressure in the upper normal range and slightly above.

Peritonitis and exit-site infections are frequent in children on PD in wealthy (7) and in developing countries (8). The low incidence of infectious complications in our children may be due to the thorough training during the initial hospitalization, but also due to the monthly surveillance at home. The preventive effect of extended PD training on peritonitis incidence in children has been described (9). On the other hand, our observation time is short. Lower adherence to the PD procedures and more PD-related infections may have occurred with prolonged PD treatment.

Important prerequisites for the successful dialysis treatment in our children were the continued 24-hour phone support, which allowed immediate resolution of all PD-related problems, and the monthly follow-up at home by nurses and by dietitians. All families were able to adequately perform PD according to the instructions and to manage the acute problems by phone. This might open a wider question about the relation between poverty, low educational status, and PD in children. Rubin *et al.* (4) suggest ruling out poverty and low educational levels prior to commencing PD, since both

were associated with worse technique outcome. In contrast, in adult Brazilian PD patients the economic status was not independently associated with outcomes (1). This is in line with our observation of the feasibility of chronic PD in an infant and 3 children despite very low educational and economic status and living in remote areas, precluding regular center follow-up. Such conditions should not be considered a general barrier for PD, if respective home care and phone or online internet support can be provided. Adequate local support can overcome major geographic and financial restrictions and may be feasible in other countries too.

DISCLOSURES

The authors have no financial conflicts of interest to declare.

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REFERENCES

1. Leanos-Miranda A. Factors predicting survival in patients on peritoneal dialysis. *Rev Invest Clin* 1997; 49:355–60.
2. de Andrade Bastos K, Qureshi AR, Lopes AA, Fernandes N, Barbosa LM, Pecoits-Filho R, *et al.* Family income and survival in Brazilian Peritoneal Dialysis Multicenter Study Patients (BRAZPD): time to revisit a myth? *Clin J Am Soc Nephrol* 2011; 6:1676–83.
3. Warady BA, Feneberg R, Verrina E, Flynn JT, Muller-Wiefel DE, Besbas N, *et al.* Peritonitis in children who receive long-term peritoneal dialysis: a prospective evaluation of therapeutic guidelines. *J Am Soc Nephrol* 2007; 18:2172–9.
4. Rubin J, Kirchner K, Ray R, Bower JD. Demographic factors associated with dialysis technique failures among patients undergoing continuous ambulatory peritoneal dialysis. *Arch Intern Med* 1985; 145:1041–4.
5. Laithy H, Abu-Ismael K, Hamdan K. Poverty, growth and income distribution in Lebanon. International Poverty Centre, United Nations Development Programme. Country Study number 13, January 2008.

6. Schaefer F, Borzych-Duzalka D, Azocar M, Munarriz RL, Sever L, Aksu N, *et al.* Impact of global economic disparities on practices and outcomes of chronic peritoneal dialysis in children: insights from the International Pediatric Peritoneal Dialysis Network Registry. *Perit Dial Int* 2012; 32:399–409.
7. Furth SL, Donaldson LA, Sullivan EK, Watkins SL. Peritoneal dialysis catheter infections and peritonitis in children: a report of the North American Pediatric Renal Transplant Cooperative Study. *Pediatr Nephrol* 2000; 15:179–82.
8. Abu-Aisha H, Elhassan EA, Khamis AH, Fedail H, Kaballo B, Abdelraheem MB, *et al.* Rates and causes of peritonitis in a National Multicenter Continuous Ambulatory Peritoneal Dialysis program in Sudan: first-year experience. *Saudi J Kidney Dis Transpl* 2007; 18:565–70.
9. Holloway M, Mujais S, Kandert M, Warady BA. Pediatric peritoneal dialysis training: characteristics and impact on peritonitis rates. *Perit Dial Int* 2001; 21:401–4.

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