THE COST BARRIER TO PERITONEAL DIALYSIS IN THE DEVELOPING WORLD—AN ASIAN PERSPECTIVE

Philip K.T. Li, Kai Ming Chow

Department of Medicine and Therapeutics, Prince of Wales Hospital, The Chinese University of Hong Kong, Shatin, Hong Kong SAR, P.R. China

Countries in Asia vary significantly in culture and socioeconomic status. Dialysis costs and reimbursement structures are significant factors in decisions about the rates and modalities of renal replacement therapy. From our survey of Asian nephrologists conducted in 2001, a number of observations can be made.

In many developing countries, the annual cost of continuous ambulatory peritoneal dialysis (CAPD) is greater than the per-capita gross national income (GNI). The median cost of a 2-L bag of peritoneal dialysis (PD) fluid is around US$5. The absolute cost of PD fluid among countries with significant differences in per-capita GNI actually varies very little. Thus, most renal failure patients can be expected to have problems accessing PD therapy in developing countries in Asia.

In countries with unequal reimbursement policies for PD versus hemodialysis, a lack of incentive to prescribe PD also exists. Automated PD is nearly non existent in many developing countries in Asia.

Some possible ways to reduce the cost barriers to PD in those countries include

• individual governments providing more public funding for treating dialysis patients;
• dialysate-producing companies reducing the cost of their products;
• physicians using appropriately smaller exchange volumes (3 × 2 L) in some Asian patients with smaller body sizes and with residual renal function; and
• reducing the complication rate for PD (for example, peritonitis) thereby reducing the costs required for treatment and hospitalization.

KEY WORDS: Asia; cost.

Resource allocation has to deal with painful decisions of who will die and who will live and scarce resources have to be used selectively to maximise duration and quality of life

— A.K. Maynard*

Correspondence to: P.K.T. Li, Department of Medicine and Therapeutics, The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, Hong Kong SAR, P.R. China. philipli@cuhk.edu.hk

The dilemma in pursuing dialysis in developing countries worldwide is well captured by the aforementioned view held by a health economist. It has been suggested that 75% of the world’s dialysis resources are reserved for just 15% of its population, and everywhere the sole alternative to dialysis or transplantation is death (1).

Continuous ambulatory peritoneal dialysis (CAPD) has come a long way since its introduction 25 years ago: it has become a viable alternative means of renal replacement therapy in developing countries. The CAPD modality was adopted in Hong Kong, China, Korea, and Taiwan in the 1980s (2–5), and by India, Sri Lanka, and Pakistan in the 1990s (6–8). On the whole, growth of CAPD remains modest in Asia (9), with the treatment modality being used in much less than half of the dialysis population (Figure 1) (2,3,10–18). Little growth has occurred in the percentage use of peritoneal dialysis (PD) in most countries—except for Hong Kong (because of its reimbursement policies). Malaysia and India have showed modest increases over the past decade (Figure 1).

The treatment rate for dialysis in Asian countries in general shows a definite relationship with the wealth of the nation: the wealthier the nation, the higher the treatment rate (2). Limited access to PD in developing countries worldwide (10,19) has been publicized since the 1980s (20,21). The barrier of financial constraint has nevertheless continued to prevail (22–24). For that reason, the cost of PD remains the main concern for nephrologists as care providers. In the present article, we attempt to analyze the cost barriers to PD in the developing world, concentrating on Asian countries.

To gain a better understanding of the current costs and reimbursement structures for dialysis in Asia, we sent a questionnaire to nephrologists in the region in January 2001. Nephrologists from Bangladesh,

China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Singapore, Sri Lanka, and Taiwan responded.

For the analysis in the present article, developing countries were defined using World Bank criteria (25) and per-capita gross national income (GNI). Based on per-capita GNI, the incomes of those countries are classified into three categories: low income (per-capita GNI US$755 or less: Bangladesh, India, Pakistan, and Indonesia); middle income, which is subdivided into lower-middle income (per-capita GNI US$756 – US$2995: China and Sri Lanka) and upper-middle income (per-capita GNI US$2996 – US$9265: Korea and Malaysia); or high income (per-capita GNI US$9266 or more: Hong Kong, Japan, Singapore, and Taiwan). According to World Bank definitions, countries with middle-income and low-income economies are said to be developing countries.

We address the cost issue under three headings: costs of PD treatment, costs incurred by complications of PD, and costs compared with other treatment options.

COST OF PD TREATMENT

The conventional single-bag system, once the predominant CAPD system in Asian countries, has gradually been replaced by the disconnect system. Straight catheters are now less frequently used than are Swan-neck catheters, with a resulting increase in the cost of PD. The cost of PD fluid and of monthly expenditures, including consumables, varies from country to country according to our recent survey (Figures 2 and 3).

Figure 2 summarizes the annual cost of CAPD, including consumables and PD fluid, as compared with per-capita GNI in the various countries. Countries with higher per-capita GNIs are shown at the bottom. The annual cost of CAPD is seen to be greater than the per-capita GNI in Bangladesh, China, India, Indonesia, Malaysia, Pakistan, and Sri Lanka. In fact, in some countries, the annual CAPD cost can vastly exceed the per-capita GNI—for example, 3 times the per-capita GNI in Malaysia and 46 times the per-capita GNI in Sri Lanka. In fact, the annual PD cost exceeds the per-capita GNI in all of the developing countries listed, with the exception of Korea, whose per-capita GNI of US$8490 puts it in the upper-middle income group.

Figure 3 shows the cost of a 2-L bag of CAPD fluid in Asian countries. The cost ranges from US$2.60 (Malaysia) to US$22 (Japan). The median cost of a 2-L bag PD fluid is around US$5, and, in fact, the absolute cost of PD fluid actually varies very little among the developing and developed countries in Asia. Sri Lanka has a per-capita GNI of US$820. There, a 2-L bag of PD fluid costs about US$8. In Asian countries, PD fluids are mostly imported, and the problem of cost has previously been reported (26). Given that cost, most renal failure patients in the region can be expected to have problems accessing PD.

Survival data from our center and others indicate that certain Asian patient populations—especially those with small body size and with residual renal function—can benefit from a lower number of daily CAPD exchanges (3 x 2-L exchanges as compared with 4 x 2-L exchanges or more in Caucasians) (2,27,28). Provided that dialysis adequacy is addressed, the lower exchange volumes are considered a potential cost advantage in the light of economic constraints in most Asian developing countries.

Overall, the percentage balance between PD and hemodialysis (HD) use varies with the national wealth, also reflected by per-capita GNI. Figure 4 summarizes the PD utilization rate as compared with per-capita GNI. Hong Kong has a PD utilization rate of more than 80% because of a government policy mandating that all patients be put on CAPD as an initial dialysis regimen unless a medical contraindication exists. Singapore, Korea, and Malaysia, being high-income and upper-middle-income countries, have PD utilization rates of 20% – 25%. In Japan, PD utilization varies with the center. On average, the rate is about 15%. Other developing countries—Bangladesh, India, Indonesia, Pakistan, and Sri Lanka—all have PD utilization rates below 10%. Japan and Taiwan, although in the high-income group, have rather low PD utilization rates (below 10%). That situation may reflect the fact that the dialysis facilities...
and the physicians receive a higher payment for HD than for PD (23). The tendency to biphasic distribution of PD utilization rate has also been previously noted (2).

The disparity in PD utilization across developing countries is often inextricably linked to local government and insurance reimbursement policies or to the health care system. Incentive to prescribe PD is lacking in countries with unequal reimbursement for PD and HD, as has been discussed at length in the past (29–31). That situation is again reflected in our survey (Figure 4, Table 1).
Financial reimbursement policies have been demonstrated to be the most important non medical factor contributing to dialysis modality selection worldwide (29). According to our survey, government reimbursement rates in Asia tend to be lower in the developing countries as compared with countries...
having a high-income economy (Table 1). Many countries will reimburse dialysis costs only to government officials or public servants. Bangladesh, India, Pakistan, and Sri Lanka have no government support for PD at all. In India, in the public sector, HD is the predominant therapy and government hospitals will not perform maintenance dialysis, but only dialysis for acute renal failure or pretransplant stabilization.

Automated peritoneal dialysis (APD) is even more expensive for most of the developing countries surveyed in our questionnaire (Table 1). Consequently, APD is nearly nonexistent in Bangladesh, India, Indonesia, Pakistan, and Sri Lanka. Underdevelopment of APD is clearly related to socioeconomic conditions in most Asian countries (32).

COSTS INCURRED FOR COMPLICATIONS OF PD

Peritonitis remains an important barrier to long-term CAPD in developing countries (3). That situation is reflected in the high drop-out rate from the complication, not to mention the cost implications of its treatment.

Conventional single-bag CAPD, though less costly, is associated with an increased incidence of peritonitis. Our studies show that the peritonitis rate has improved, on average, to 1 episode per 33.5 patient-months with a double-bag system (33) from 1 episode per 11.4 patient-months with the conventional straight set (34). We previously demonstrated that the extra cost of the Y-set disconnect system could be offset by the savings resulting from fewer infections and hospitalizations (34). In those developing countries that can afford to continue PD using only the conventional spike system, peritonitis rates remain high.

Other important reasons for the increased incidence of CAPD peritonitis in developing countries include poor hygiene and living standards, limited access to microbiologic facilities, and lack of proper treatment of peritonitis.

Apart from the usual bacterial infections, tuberculous peritonitis is a unique problem commonly encountered by CAPD populations in developing countries where tuberculosis is endemic (35). The cost of tuberculosis chemotherapy and the disease-related consequences of malnutrition and ultrafiltration problems add a further financial burden.

COSTS BY TREATMENT MODALITY COMPARED

Typically, the cost of treatment for end-stage renal failure has been estimated by comparing the direct costs (including salaries of renal unit staff, hospital fees, equipment, drugs, and so on) of HD and PD. In general, the PD utilization rates in Asian countries correlate with the relative cost difference between PD and HD. Figure 5 plots, for the public sector, the ratio of the monthly costs for the two modalities (PD:HD) against the PD utilization rate. In countries to the right of the dotted vertical line, PD is more costly than HD. Those countries include Bangladesh, India, Pakistan, and Sri Lanka. In Bangladesh, PD costs 1.2 times more than HD; in Pakistan, it costs 2.7 times more. Obviously, PD is underutilized in those countries. In China, PD and HD are similar in cost. In all the other locales, PD is 10% – 40% cheaper than HD—except in Hong Kong, where PD is more than 55% cheaper than HD. That advantage, together with the government policy mentioned earlier, helps to account for the 80% PD utilization rate in Hong Kong.

Costs can be fixed or variable. Fixed costs include overhead and personnel; variable costs include supplies and drugs. For HD in developed countries, personnel costs represent 43% of the total, overhead costs represent 34%, and supplies represent 23%. For CAPD, the parallel percentages would be 24%, 66%, and 10% respectively (31). Overall, in the United States, HD is about 30% more costly than PD (31). In developing countries, on the other hand, labor costs are much cheaper, and supplies, being imported, account for a larger proportion of the final cost of dialysis treatment. Thus PD may be more expensive than HD.

Moreover, an analysis should try to look at the relevant costs of each modality of renal replacement therapy from the perspective of patients, instead of simply calculating the cost charged to caregivers. Assessing the productivity costs related to a patient’s ability to work and the nonfinancial, intangible costs related to pain, suffering, and fear is even more difficult.

Cost estimation in dialysis can vary widely among centers and countries. Estimates should be interpreted with caution, because the definition of “cost” varies from one center to another. Peeters et al (36) recently analyzed and interpreted the cost comparisons of PD and HD in 25 studies. The studies suggested a positive cost advantage for PD over HD. However, the magnitude of the difference was difficult to evaluate, because many of the studies contained information inadequate for a cost analysis (36).

Another aspect to look into is the concept of cost-effectiveness (in contrast to cost per se), by including health outcomes as part of the cost analysis. One method of measuring cost effectiveness considers this ratio: the cost per life-year saved and the quality-adjusted life-years saved. Quantity and quality of life are equally important for dialysis patients, no matter where in the world they live.
POSSIBLE WAYS TO OVERCOME COST BARRIERS TO PD

The cost of PD consumables is determined by the cost per unit of PD fluid and the volume of fluid used. In most Asian countries, PD fluids are imported. If dialysate-producing companies could reduce the cost of their products, a positive effect might be seen on PD utilization. Individual governments could be advised to provide more public funding for treating dialysis patients. As mentioned earlier, the appropriate use of smaller exchange volumes (6 L daily) in some patients with smaller body size and with residual renal function could reduce the daily cost of PD without jeopardizing adequate dialysis (28). A reduction in the complications of PD—either by implementing the new connectology that decreases peritonitis rates (34,33), or by using newer, more biocompatible PD solutions that improve peritoneal defense—will reduce the associated treatment and hospitalization costs. However, if new technologies are to be widely used in developing countries, the price differential between the current and the newer products should not be too wide.

SUMMARY

Financial constraints influence PD utilization rates in developing countries. A CAPD cost analysis involves calculating both the PD treatment cost and the cost of managing PD complications. Nephrologists and industry should work closely together on research that, by influencing either technology or clinical decisions concerning PD prescription, will allow PD to be used more widely to benefit more patients in developing countries throughout Asia—and elsewhere.

ACKNOWLEDGMENTS

The authors are indebted to doctors M. Rahman (Bangladesh), T. Wang (China), P. Keshaviah (India), W. Prodjosudjadi (Indonesia), Y. Tomino (Japan), H.B. Lee (Korea), Z. Morad (Malaysia), B. Jamil (Pakistan), W.C. Lye (Singapore), R. Sheriff (Sri Lanka), and C.W. Yang (Taiwan) for providing data quoted in this paper.

This study was supported in part by The Chinese University of Hong Kong Research Grant account 6900570.

REFERENCES


Figure 5 — Relationship between peritoneal dialysis (PD) utilization and its cost relative to hemodialysis (HD).