



UTILITY OF REMOTE MONITORING SOFTWARE IN PERITONEAL DIALYSIS



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One of the major challenges affecting the acceptance and outcomes of Peritoneal Dialysis (PD) is the perceived "inaccessibility" on the part of the patient to the nephrologist and to the Mother Unit (MU), more so in geographically large countries with remote and inaccessible habitations, as typified by India. Our PD Unit has worked to innovate with practical and cost effective solutions to overcome this barrier. Rapid strides in communications connectivity have been made across the world: with internet and mobile phone technology, now truly penetrating every geographical and socio-economic boundary there is, especially in India. We are using the mobile phone Short Messaging Service (SMS) (Figure 1), inexpensive digital cameras and the Internet to address specific patient needs. Patients are constantly in touch with their MU and nephrologist, communicating in real time, around the clock, with improved PD outcomes especially in the rural patients.

In essence, a total of 246 patients who started on PD at our center from May 2003, who had used this technology in their day to day care, were retrospectively analyzed. Every patient's primary caregiver and/or an additional skilled family member, are compulsorily trained to use a digital camera, mobile phone camera and the Internet to send images of the PD solution bags, exit sites and any other aspects of interest. Standard criteria were used to group the patients into rural and urban categories. The nephrologist oversees all of the PD operations of the MU. The clinical coordinator (CC), extensively trained in the field of PD, is in charge of approximately 20 PD patients. Working in shifts, around the clock, the CCs are the direct link between the MU and the patient at home. They report to the clinical head, who in turn reports to the nephrologist about the PD



Figure 1 SMS images transmitting patient data

FROM THE EDITORIAL OFFICE

Dear All,

In this issue, we are delighted to have Dr. K.S. Nayak from India share his experience of remote monitoring of PD patients. In addition, Dr. Sakthong from Thailand discusses his work on health utility of dialysis patients, and Dr. BH Goh from Malaysia shares his experience in dialysis catheter insertion.

You are most welcome to distribute this newsletter electronically, or in printed form to your colleagues or others who may be interested. If you or your colleagues would like to receive this newsletter directly from our editorial office, please send your e-mail address to: ispd@multi-med.com.

The 14th Congress of the ISPD will be held in September, in Kuala Lumpur! See you there!

Sincerely,

Dr. Cheuk-Chun SZETO
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patients. Well-structured home visit protocols ensure patient compliance and rehabilitation, adherence to proper technique, monitoring of nutrition status and early detection of evolving comorbidities and complications. Patients and their families are made aware that continued support is available. Home visits are scheduled by the clinical head and conducted by the CC. CCs are trained to follow a set protocol and are equipped with a standardized checklist for a step-by-step assessment of the patient's well-being during each visit. A detailed check of the patient's PD logbook are made and any conditions requiring the attention of the nephrologist are identified. All this information, along with a brief summary of the patient's most current lab results, are conveyed to the nephrologist by SMS from the patient's home. The CC is instructed to wait until a response is received from the nephrologist (typically within 15 minutes), and then counsel the patient accordingly. The CCs also assess and advise the patient on nutrition, their psychosocial well being and physical fitness/rehabilitation levels. Afterward, progress notes are entered into the MU computer records.

The internet-based remote monitoring system, PD-REMOTE® (patent pending) (Figure 2), aims to integrate all services necessary for PD, and making them easily accessible to the patient and primary caregivers, regardless of geographical distance from the MU. These services include the nephrologist, clinical head, CC, the urologist and if needed, the microbiologist, and nutritionist, and so on. The patient/caregiver logon to a website (with a user name and password, assigned at the end of the PD initiation period) and are directed to a personalized home page to enter personal details, health records, lab test results; maintain an online log of body weight, blood pressure, heart rate and biochemical parameters; access current health records, prescription and procedure history at any time; schedule appointments with the MU, nephrologist and laboratory; schedule home visits through the clinical head; raise concern and health complaints;

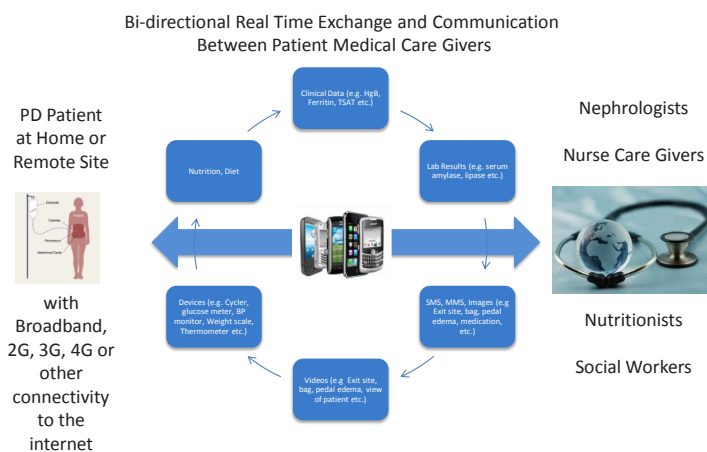


Figure 2 Process overview of PD-REMOTE™

upload relevant photographs of the exit site, PD effluent bag, ankle edema (after indenting over the medial malleolus), to the site; be alerted of appointments, test results and replies from the nephrologist and clinical head.

Patients also use this site to raise concerns and receive immediate responses. They are directed to a page where they are instructed to complete a basic description of their current concerns and answer certain pertinent questions. Patients are taught to check the condition of their exit site in terms of its color, dryness, presence or absence of pain, swelling, leakage, and visibility of the external cuff, and to enter relevant information. The two main infectious complications encountered are peritonitis and exit site infections. During their initial PD period the patient and their caregiver/attendants are trained to take relevant photographs of the PD effluent bag and exit site, (using their own mobile phone cameras or digital cameras), and then upload them onto their personal home computer at the nearest Internet café, along with their health concern. Most standard phones and computers are compatible to use this technology.

For peritonitis and the exit site, a zoom application that is incorporated in the software, helps us examine the exit site in greater detail. Training is also given to patients on how to take proper photographs of the PD effluent bags. The bags must be placed on a white sheet of paper which has black 'Times Roman Font' printed on it. The paper is kept under the patient's PD effluent bag which is visualized, recorded and uploaded as a baseline image for future follow up. Generally a 14pt to 16pt size font seen clearly through the bag fluid indicates clarity and no peritonitis. The complaint is then sent to the nephrologist/CC, who receives an alert on his e-mail and cell phone. An immediate assessment and response are sent to the patient, as well as to the clinical head/CC, who schedules a home visit to follow up with the patient. A horizontal and vertical image gallery of the exit site and PD bag are created and stored in each patient's electronic medical record (EMR). With every health complaint, this gallery is updated, thus providing comprehensive and the most current information about the patient's clinical status.

There were a total of 115 rural and 131 urban patients in this patient cohort who used this remote monitoring system on a day to day basis. Mean follow-up was 4296 patient months (2008 and 2288 patient months in rural and urban groups respectively). Mean age was 51.49 ± 12.8 years in the rural versus 52.32 ± 12.59 years in the urban population. Technique failure rates were 25.3% in rural versus 20.6% in urban patients; peritonitis rates being 1 in 40.3 patient months in rural versus 1 in 34.8 patient months in urban populations. Exit site infections were 1 in 56.6 patient-months in the rural group versus 1 in 51.2 patient months in the urban group. Patient survival at 5 years was significantly better in rural patients with a 42.6% survival at 5 years compared to 29.8% in the urban group. Overall, rural patients performed well on PD and had significantly better survival rates

than did their urban counterparts, contrary to what might have expected. Our monitoring strategies allow for earlier diagnosis of infectious PD complications, thus helping prompt treatment initiation and response.

Studies comparing the outcomes of chronic kidney disease patients have consistently shown poorer results in rural than urban patients, though there is paucity of data comparing the two groups on PD. Our center targeted the major bottle necks affecting penetrance and technique survival rates in rural patients, lack of connectivity and health awareness; with our remote monitoring strategies. That our rural patients achieved results as good as the urban group if (not better), on PD therapy is testimony to the utility of the remote monitoring system. Health care providers, and the Industry with a strong commercial incentive, will have to 'reach out' to the PD patients, increasing the interaction between patients and the MU in a bid to remove the 'perceived inaccessibility' that the PD patient may have. We believe that our PD remote monitoring tool may be a ground breaking driving force in promoting PD as the preferred dialysis modality.

HEALTH-UTILITY MEASURED WITH EQ-5D IN THAI PATIENTS UNDERGOING PERITONEAL DIALYSIS



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End stage renal disease (ESRD) is an important public health problem worldwide, including Thailand which has a current incidence of 10,000 patients per year.⁽¹⁾ Three major renal replacement therapy modalities include hemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation. Due to the inadequate number of donated kidneys, dialysis, especially HD, is the main therapy for ESRD. However, the annual cost of HD is about \$12,100 USD per year or \$18,500 USD per quality-adjusted life year (QALY), which is greater than three times the annual income per capita of Thai people.⁽²⁾ Moreover, PD was proved to be more cost-effective than HD.⁽³⁾ Because of this, the Thai government has financially supported ESRD patients undergoing PD under the universal health care coverage through the National Health Security Office (NHSO) since 2008. It is called the "PD first" policy.

Health utility (HU) is health-related quality of life (HRQOL) that can be incorporated into cost-effectiveness analysis (CEA) or cost-utility analysis (CUA) whose most commonly used outcomes are QALYs gained.^(4,5) The QALY is a measure of life expectancy weighted by a HU score which is usually between 0 (death) and 1 (full health). Therefore, HU has both advantages: measuring HRQOL and use for economic evaluation in health care. However, little was known about the HU of Thai patients undergoing PD. EuroQOL (EQ-5D) is the most frequently used HU instrument for calculating QALYs based on the actual measurement of patients' HRQOL and is the recommended HU method in Thailand.⁽⁶⁾ Therefore, we were interested in measuring HU using EQ-5D in Thai PD patients and to examine the factors related to it.

The EQ-5D includes 5 domains: mobility, self care, usual activity, pain/discomfort and anxiety/depression. Each domain has three levels: no problems, some problems and major problems. Patients were asked to select the level that best described their current health today for each of the

five domains. Responses to the five domains were expressed as an EQ-5D utility index score originally using the value set from the United Kingdom (UK).⁽⁷⁾ Since there is currently a Thai value set available⁽⁸⁾, it was employed to calculate EQ-5D scores in this study. The EQ-5D score is between -0.45 – 1.00, where 1.00 and 0 represent perfect health and death, respectively, with negative values indicating states worse than death.

This study was conducted in 102 PD patients who received treatment from 10 hospitals located in every part of Thailand and registered with the NHSO. We found that about 80% of the sample had no problem with mobility and self-care and 20% had some problems. Approximately 60% reported that they had some problems doing usual activities and had pain or discomfort. About 50% had anxiety or depression. Mean EQ-5D utility score was 0.65 ± 0.23 , meaning that the Thai PD patients rated their current health at 65% of perfect health. Compared to other PD nations, the Thai PD sample yielded higher EQ-5D score (0.65) than those from a meta-analysis study (0.58).⁽⁹⁾ Three possible explanations for this difference are the following: Firstly, the mean age of Thai PD patients (42 years), was lower than those from other nations (~59 years). Secondly, the duration of PD of Thai patients was shorter (0.6 years versus 1-2 years) since Bakewell and colleagues reported that quality of life in PD patients declined over time.⁽¹⁰⁾ Thirdly, the difference may have been due to social desirability because this study used face-to-face interviews, whereas most studies from the meta-analysis employed self-administration.

Regarding the relationship between EQ-5D utility scores, and patient characteristics, univariate analyses showed that higher EQ-5D scores were significantly associated with younger ages ($p < 0.01$), higher education ($p < 0.01$), employed status ($p < 0.05$), the absence of diabetes ($p < 0.01$), lower number of comorbidities ($p < 0.05$), and fewer ESRD symptoms ($p < 0.01$). After multivariate adjustment by a regression analysis, significant predictors of EQ-5D included education, work status, diabetes and ESRD symptoms. The adjusted R^2 was 54% ($F = 27.00$; $P < 0.001$). In conclusion, this Thai PD sample yielded higher HU measured with EQ-5D than other PD populations. Education, work status, diabetes, and ESRD symptoms were associated with EQ-5D utility scores. In order to improve HU of Thai PD patients, these factors should be addressed. Since our PD sample had a short PD duration, the long-term HU should be evaluated in future research.

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NEPHROLOGIST INITIATED PD CATHETER INSERTION PROGRAMME: A NEW PARADIGM SHIFT



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Even though peritoneal dialysis (PD) has established itself as an effective mode of renal replacement therapy (RRT), the worldwide penetration rate for PD remains low at 10% of all modes of RRT. PD is often considered by patients and caregivers alike as the inferior cousin of haemodialysis (HD). This is despite the overwhelming evidence of the advantages of PD in terms of preservation of residual renal function and consequent improved middle molecule clearance, reduced incidence of left ventricular hypertrophy, cost-effectiveness and reduced cardiovascular events. The PD catheter is the life line of patients and PD catheter survival remains the "Achilles' heel" of the PD programme. Hence, the timely, and effective insertion of the PD catheter, as well as prompt management of complications arising from catheter insertion remains crucial in the success of the PD programme. In most countries, PD catheters were implanted by surgeons using mini-laparotomy or open technique. This invariably resulted in long wait times where potential patients were exposed to haemodialysis and lost interest in PD while waiting for the procedure to be done. There was also a lack of continuity of care and a lack of respect for the catheter as the lifeline of the patient by surgical colleagues compared to nephrologists. Patients who ran into complications such as catheter dysfunction were often forced into longer wait times before catheter related problems could be solved.

We have shown that in our center, the nephrology placement of PD catheter and "Integrated Care Approach" has improved PD penetration. We feel that such an approach, where nephrologists and the PD team are involved in every stage of patient care, from counselling for RRT to insertion of the PD catheter to continued care post insertion, greatly benefits the patient and care providers. This approach encourages patients and their family members to make PD a preferred mode of RRT. As nephrologists, we have a vested interest in promoting PD as the preferred mode of dialysis. Due to staffing shortages, limited and expensive "office space", there is a natural cap on the number of HD patients one can support in any country.

The next concern is who should be the rightful operator to place PD catheters; a similar question arose recently by Crabtree in his review article. In our opinion, it would be someone who is credentialed to perform the procedure and who would be able to fulfil the nephrologists' wish list for peritoneal access. Items on the list include: ability to perform catheter insertion in timely fashion (at least 2 weeks before starting PD); the implanted catheters have excellent or acceptable primary function regardless of the implantation technique; access team has the ability to manipulate or re-implant the catheters whenever necessary; access team is able to remove the catheters urgently when necessary as in the case of peritonitis or when indicated; catheter insertion not to be delegated to inexperienced,

unsupervised operators in the team and low peri-operative complications. Our experience had demonstrated that the PD catheter insertion programme by nephrologists could fulfil these wishes, and it can also co-exist with the pre-existing programme by surgical colleagues. Our experience is unique as we employed an "integrated care approach" from the outset of our PD programme to promote PD as the preferred mode of RRT in our patients. We also introduced peritoneoscope PD catheter insertion technique at the beginning of our PD programme. Our experience showed that:

1. PD catheter insertion should not only be in the domain of a particular discipline. PD catheter insertion should be performed by operators who are able to ensure the following (what we termed as nephrologist's wish list): ability to perform catheter insertion in a timely manner (<2 weeks waiting time); implanted catheters have excellent or acceptable primary function regardless of the implantation technique (85% one-year survival for first catheter); access team must have the ability to manipulate or re-implant the catheters whenever necessary in a timely manner; catheter insertion must not be delegated to inexperienced and unsupervised operators and it must have a low rate of peri-operative complications. In other words, regardless of who the operator is, or which technique one chooses, the most crucial element is the outcome! IT IS THE RESULT THAT MATTERS.
2. Nephrologist initiated PD catheter insertion programme is an important avenue to improve PD utilization/penetration. This programme may exist in a variety of models and even complementing pre-existing access providers.
3. It was not our original intention to promote peritoneoscope technique alone, but by adopting this technique of PD catheter insertion, we noted several added advantages, such as its beauty of simplicity and hence shorter learning curve for new operators to master this technique. Also the technical knowledge of this technique is transferable through well-conducted workshops, with eventual reproducible positive impact in enhancing PD penetration.

The next crucial questions frequently raised were, How many procedures one needs to perform before being considered competent; Who can be credentialed to perform or supervise a trainee performing this procedure. To answer the questions, we proposed the adoption of a more appropriate monitoring tool such as cumulative summation (CUSUM) chart. CUSUM analysis is a statistical and graphical tool that can be used to track the success and failure of a technical skill and examines trends over time. It can be used to demonstrate proficiency in a newly learned technical skill or as a measure of quality assurance once a technical skill has been mastered, such as determining whether or not a trainee has achieved competency in a particular skill.

We demonstrated that a successful Tenckhoff catheter insertion programme can be run by nephrologists. However, the fact that this procedure, peritoneoscope PD catheter implantation by interventional nephrologists, is still perceived to be a relatively new investigational with many nephrologists and surgeons alike remaining sceptical of the value of this recent option. We advocate that quality control of PD catheter insertion should be performed using CUSUM charting to monitor for primary catheter dysfunction (i.e. failure of catheter function within 1 month of insertion), primary leak (i.e. within 1 month of catheter insertion) and primary peritonitis (i.e. within 2 weeks of catheter insertion). The proposed acceptance/failure rate for primary dysfunction in our centre is currently 10% (25% previously), primary catheter leak 10% and primary peritonitis rate <5%. We propose that future PD catheter insertion programmes should adopt the same Quality Assurance (QA) programme and standards set.

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