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Outcome of Peritoneal Dialysis Training: A Case Control Intervention Study

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Abstract **Original Research Article**

Patients with kidney failure are treated with either peritoneal dialysis (PD) or hemodialysis (HD). With regard to clinical outcomes, peritoneal dialysis and hemodialysis are considered identical. However, PD is considered more significant due to its improved and enhanced effectiveness. Several studies showed various contradicted results regarding methods of peritoneal dialysis training and their benefits. Therefore, this study was conducted to fill the gap in previous studies. This study used a case-control interventional design to assess the clinical outcomes of Peritoneal Dialysis patient training curriculum. It formed an experimental group and a control group with end-stage renal disease patients (50 patients in each) for comparing effect of teaching methods. Interviews using standardized close-ended questionnaires were conducted, and data were statistically analyzed. Findings reveal that experimental group performance was highest at 1.16 baseline (19 months) and lowest at 13 months. Control group pre-performance was highest at 0.69. Overall, experimental group provided improved results with survival rates (78%), low death rate (8%), and referred to hemodialysis (10%) and transplanted (4%). The study confirmed that there is a need to introduce a standardized curriculum based on contemporary practices for training nurses. It is emphasized that educational intervention, which is patient-targeted, should be introduced for Peritoneal Dialysis (PD).

Keywords: End-Stage Renal Disease, Case Control Intervention, Peritoneal Dialysis Training.

INTRODUCTION

In today's world, the rate of chronic kidney disease is observed to have increased among the adult population [Bowe *et al.,* 2018]. Due to the shortage of advanced resources and organ donors, patients with kidney failure are treated with either peritoneal dialysis (PD) or hemodialysis (HD). With regard to clinical outcomes, peritoneal dialysis and hemodialysis are considered identical. However, PD is considered more significant due to its improved and enhanced effectiveness [See *et al.,* 2018]. For chronic kidney disease patients, reduced physical activities are highly related to the morbidity and mortality risks. Patient training is widely known to be one of the most crucial factors that could be generally applied to obtain optimal peritoneal dialysis outcomes; thus, reducing morbidity as well as mortality rates [Chan *et al.,* 2019].

However, it is observed that training PD patients is one of the most challenging tasks. This is because the staff or nurse training usually focuses on what they desire to teach rather than on the needs of patients [Larsen, 2019]. It is; therefore, important for the members of Task Force to understand the perspective about peritoneal dialysis training and learn new tactics to provide better training [Corbett, 2018]. Home-based training is identified as significant because most PD patients are adult learners. It is also necessary for the patients to play their role in this context by providing relevant information to obtain desired learning outcomes. Thus, based on the adult learning theory, peritoneal dialysis training curriculum can be established appropriately [Uchiyama *et al.,* 2019]. In most of the developed countries, peritoneal dialysis is a well-established option in place of renal replacement therapy. Peritoneal dialysis, which is related to peritonitis, is determined to be one of the most severe problems, as it commonly causes the failure of peritoneal dialysis (PD) technique [Pratsinis *et al.,* 2018]. While more than, 90% of the care obtained by PD patients is through home-based peritoneal dialysis program. Surprisingly, considerable diversification has been identified in the frequency of peritonitis rates across multiple countries and several centers in the same country or region.

Since the last few years, PD training is comprised of a variety of illustrations, methods, and videos to improve the techniques of peritoneal dialysis

[Morfín *et al.*, 2018]. Because of ineffective and inefficient PD training programs, the disparity in the rates of peritonitis across different countries or within the same countries is gradually increasing [Olszewski *et al.*, 2018]. With this regard, various clinical concerns have emphasized to determine the ideal PD training programs to minimize such discrepancies. Contrarily, certain studies have showed that certain PD training program such as continuous ambulatory peritoneal dialysis (CAPD), virtual reality, aerobic exercise, and online courses are significant and effective training methods [Bennett *et al.*, 2019, Szeto *et al.*, 2019]. The statistical significance of peritoneal dialysis training program observed that after numerous training sessions, the rate of peritonitis decreased to 28.2 per patient [Peikani *et al.*, 2018].

Interestingly, no extensive research has been conducted to study the outcomes of any of this peritoneal dialysis training on the patients' quality of life. This study is also driven due to increased demand for PD training resulting in the success for minimizing the rate of kidney failure among patients [Crews *et al.*, 2019]. Also, a deviation is found for the different aspects' PD training and its clinical outcomes. Therefore, this study is conducted to assess the clinical outcomes of PD patient training curriculum. In addition, the current study also evaluates the existing knowledge of patients towards the home-based continuous ambulatory peritoneal dialysis patient training curriculum.

LITERATURE REVIEW

The significance of emerging and executing suitable CKD education programs should not be exaggerated. Mostly patients, who are approaching ESRD, have unexpectedly no information about CKD and ESRD treatment possibilities [Schanz *et al.*, 2017; Alhaji *et al.*, 2019]. This can contain a specific problem for patients anticipating a home-based therapy as suitable attention can have some consideration, believe and discussions with family. It is proposed that the efforts can imitate absence of recommendation to nephrologists for maintenance [Schanz *et al.*, 2017]. Though, the current studies have advocated the patients, who visit nephrologists, the patients have limited knowledge CKD and therapeutic options [Alhaji *et al.*, 2019]. It is suggested by the author of this research that the education providing procedure needs to be reconsidered for CKD patients. But there can be seen challenges in educating patients for the CKD. It is quite difficult in many countries which get funds to backing such programs. However, it is not discussed thoroughly but training educators for CKD patients can be a problem. Handling CKD patients can be complex which gives the multitude of fields which is required to be addressed [Tonelli *et al.*, 2020; Crosby *et al.*, 2020].

The reason which describes the CKD education combination into patient management can be an area which needs further investigation [Crosby *et al.*, 2020]. When medical problems are elevated the threat of dramatic changes in lifestyles and roles, patients frequently don't focus on what the physician discusses, since it can occur with advanced renal failure and the beginning of dialysis therapy. More consideration is established in the additional zones of medical practices regarding training physicians and educators on how to make conversation with the patients, including drugs and alcohol abuse, but not in CKD care [Luyckx *et al.*, 2020; Chironda *et al.*, 2019]. It can be really astonishing that some studies have observed the effect of educational programs on patient consequences and modality selection. Similarly, there are substantial evidences that can be accessible now on the internet for patients. Some of that can be educational, exact and suitable, and some can be deceptive and inaccurate; the reason of assimilation into outdated education programs requires more investigation [Chironda *et al.*, 2019]. It can be significant to reminisce that the massive majority of CKD patients cannot have contraindications for executing PD [Morfín *et al.*, 2018].

The massive majority of ESRD patients have done PD successfully which can be seen from the experience in Hongkong and Thailand [Elzorkany *et al.*, 2017]. It is observed that in patients can be provided with CKD education in western countries then between 30% - 40% would opt for PD [Jahanpeyma *et al.*, 2017]. It can also be recollected that, CKD education can be significant with respect to enabling modality selection, since they can postpone the onset of ESRD and advance results after patients opt for dialysis [Havas *et al.*, 2017; Devins *et al.*, 2003].

It has been noted and discussed that there is a problem of providing education to nephrology trainees and nephrologists [Manera *et al.*, 2020; Mechery *et al.*, 2018]. PD can be the home-based therapy, and patients can usually visit dialysis facility regular for routine follow up maintenance, which limits the access for renal trainees. Mixing PD training with a severe nephrology curriculum that offers challenges which can be conversed through program directors in many countries and through the International Society of Peritoneal Dialysis [Wang *et al.*, 2018; Samimi *et al.*, 2017]. Ideas that can be projected contain emerging an online PD curriculum, instilling designated training sites as cores of excellence, where focused training courses is provided to the trainees, that enlarges brief 2-3 days PD training sessions (so called 'PD universities'), and can produce firm minimum standard that would be measured suitable for trainees. However, even if these educational experiences are substituted by the certain 'hands-on' understanding of working in a well-functioning PD facility can remain to be determined [Samimi *et al.*, 2017].

Similar challenges can relate to providing suitable training for nurses. PD units can usually function on a primary nursing care model. The nursing staff can administer the critical interface with the patients, giving them the home training, staying available for the daily problem that ascends, giving constant patient assessments, arranging retraining sessions, and operating as the boundary between the patient, the nephrologists, and the dialysis facility. In the recent studies, the focus can be on the noticeable differences that come across during the training of nurses and in the behaviors the nurses train patients [Briggs *et al.,* 2019]. Though important variation can be observed, the significance of having well-trained and skilled nurses which is quite strong. It is significant to have rational nurse to patient ratios as this can allow the nurses to contribute in other facilities activities, like continuous quality improvement (CQI), educational programs, and research projects.

The PD unit can perform with a 'team' approach to handling the patient. Social work and dietary input can be the critical components for an effective program. Psychosocial evaluations and intrusions can be mainly significant for patients kept on home therapies [Zuñiga-San, 2020]. Many psychosocial features are unpleasantly effecting patient's outcomes, along with patient's depression, anxiety and caregiver stress [Jain *et al.,* 2017; Sajadi *et al.,* 2017]. Recently, the US is authorized that health-related quality of life should be evaluated regularly and suitable intrusion are planned. It can be important that every facility which is developed and incarnate with a regular evaluation tool to examine fields of psychosocial problems for patients and then strategize involvements after the fields will be recognized.

The dietary input can also be important. The significance of sodium constraints in terms of monitoring blood pressure and restricting the dextrose experience which needs to uphold the fluid balance through PD that is required to be focused [Liu *et al.,* 2018; Crosby *et al.,* 2020]. In addition, 80% of PD patients can be hypertensive, which needs one or more antihypertensive medications. Sodium restriction can be observed to aid ameliorate hypertension- which needs a chief educational exertion. However, 45% of PD patients can take phosphate levels 15.5 mg%.[Genovesi *et al.,* 2017] Because of the relation of raised phosphate levels with mortality, cautious dietary directives regarding phosphate consumption and regarding education related significance of phosphate binder which needs substantial consideration.

Recently, many researches have shown documented the effect of center size on the results of PD patients in terms of peritonitis rates and technique failure rates [Martin *et al.,* 2020]. The cause of this effect can be unclear, and then expectedly relate to nursing and physician experience, the skill of developing a 'support team', and the progress in actual CQI programs. One feature that possibly can restrict the growth of PD in some countries (like US) can be the expansion of minor dialysis programs instead of merging minor PD programs into greater centers. Positively, it can be proposed with the experience of Far East that greater programs can be tremendously effective. Several programs in China, Taiwan, and Hong Kong can care for over 300 PD patients and they can also define exceptional outcomes of the therapy, having low peritonitis and technique failure rates. CQI programs can be crucial to the accomplishment of the program, which is described in the K/DOQI guidelines. The changes of the domains can be recommended in the K/DOQ guidelines for CQI. The significance of conversing about these domains constantly should not be exaggerated effective PD programs, either achieved in the advanced or emerging world, required to track their results and discuss the significant fields which can have an effect on the results of PD patients [Elkheir *et al.,* 2020]. The areas of struggle can be accessible in supervising a PD unit which differs from facility to facility, and every facility can essentially categorize and contract with the problematic areas which can be exceptional to their program [Martin *et al.,* 2020; Elkheir *et al.,* 2020]

METHODOLOGY

Study Design

The current study has used case-control interventional research design. Two groups namely, experimental group (PG) of patients and a control group (CG) of patients were compared who were provided with new teachings and trainings, respectively. Different peritoneal dialysis centers and patients' home located in one of the largest cities of Sudan, known as Khartoum, were investigated. End-stage renal disease patients, receiving peritoneal dialysis (PD) training were recruited in the current study, to assess the learning outcomes of patients such as changes in prior knowledge and cognitive functioning.

Sampling

The sample was collected from six top centers operating in Khartoum from 2014 to 2017. Random Sampling technique was used for recruiting 100 participants. Two different groups; experimental/case group (PG) and control group (CG) were compared, based on their training methods. Table 1 presents the inclusion and exclusion criteria.

Table 1: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Patients of End stage renal disease Continuous ambulatory peritoneal dialysis (CAPD) center.	Patients who were receiving non-standardized conventional training methods. Peritoneal dialysis (PD) center.

Data Collection

Interviews were conducted using a standardized close-ended questionnaire. Follow up visit were held after every six months to observe the learning outcomes in each patient. The participants' responses for both the groups were coded (for experimental group EG1 to EG75 and control group CG1 to CG2) to sustain participants anonymity and confidentiality. The minimum period of the training was set as five days a week. The training was held in the PD centers located in Khartoum, namely Ibn Sina Medical Center, Alribat Center, Nora Center, Military Center, Omer Bilal Center, and Khartoum Teaching hospital. Prior to the interview, informed consent was taken from each patient. An official letter was also submitted to the authorities of Gezira University, and approval was received from the board of directors for conducting the research.

Data Analysis

The data collected was then analyzed statistically using Statistical Package for the Social Sciences (SPSS ver 20) program. Chi-test was used to compare the outcomes of peritoneal dialysis training of both the EG and CG patients. The data was then presented in the form of graphs and tables.

RESULTS

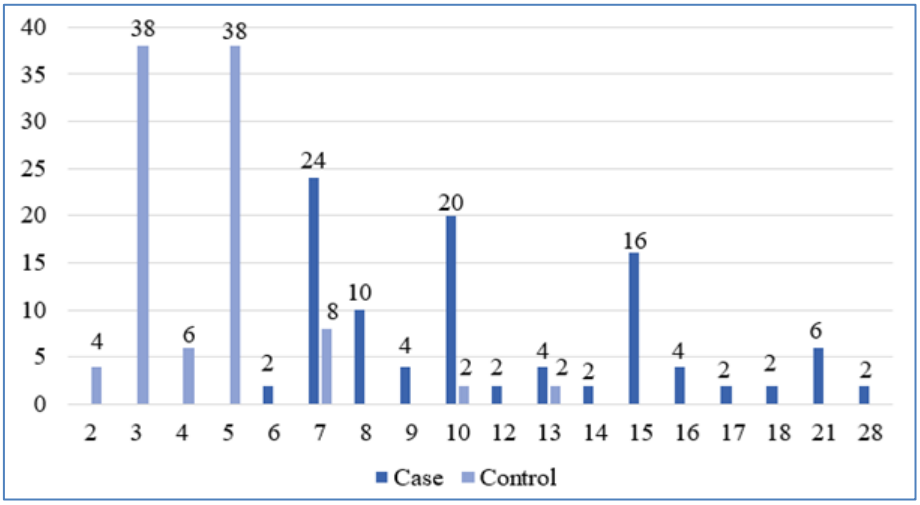


Figure 1: The findings showed that majority of the participants in the case group took 7 to 10 days, while for the control group, the training days range from 3 to 5 days

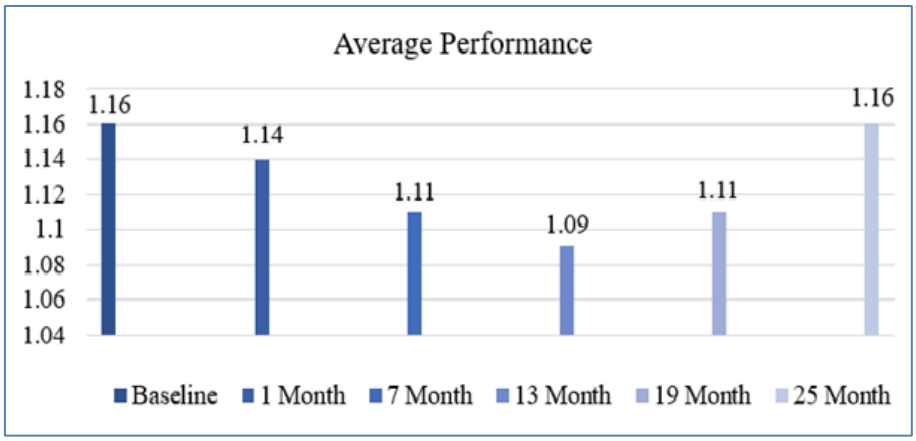
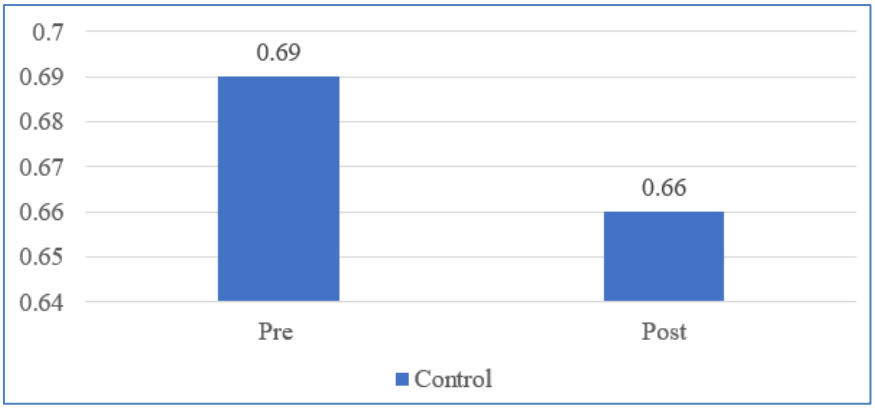
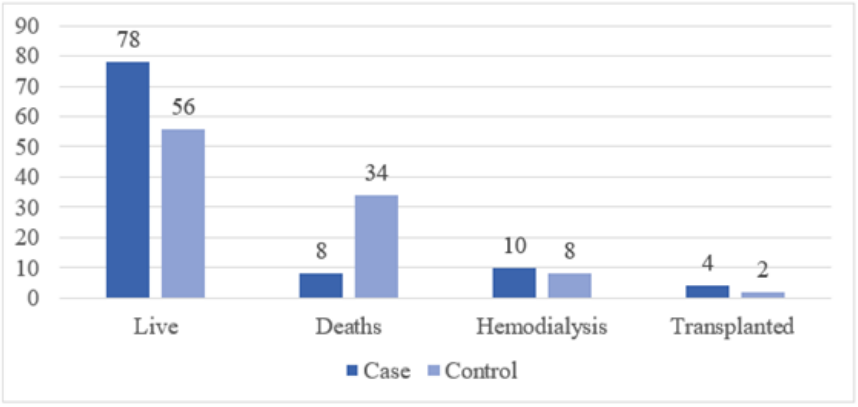


Figure 2: shows that case group performance was highest at 1.16 baseline; while it was lowest at 13 months. However, the performance continued to increase at 19 months and reaches the same initial level of performance, i.e., 1.16



The control group performance is shown in figure 3. It shows that pre-performance was highest at 0.69, which decreased at the end to 0.66 (i.e., patients did not receive any more training)



The analysis of the groups shows that case group was better, which showed the survival rates of 78%, low death rate 8%, and referred 10% to hemodialysis while 4% transplanted. Whereas for the control group, outcomes of survival were 56%, for deaths were 34%, hemodialysis was 8% and 2% for transplanted.

Table 2 presents the training time of the groups. The mean training time for case group is 11.56 while for the control group; it was found to be 4.47. This shows that the control group training days were less as compared to the experimental/case group.

Table 2: Training Time

Variable	Mean	Significance (P-value)
Case Group	11.56	0.034
Control Group	4.47	

The peritonitis rate for CAPD is presented in table 3, which shows that infected peritonitis rate was higher for the control group as compared to the case group. It shows that the interval for the occurrence of peritonitis infection was longer for the case group as compared to the control group.

Table 3: Peritonitis Rate among CAPD

Groups	Number of Peritonitis infection		
	None (n, %)	1:18 (n, %)	Above 18 (n, %)
Case Group	39 (78%)	7 (14%)	4 (8%)
Control Group	28 (56%)	20 (40%)	2 (4%)

Table 4 demonstrates that in the control group 4 patients dropped out to hemodialysis secondary to peritonitis, where for the case group, the number of patients was 2. Moreover, 13 patients in the control group dropped out to death secondary to peritonitis while 1 in the case group.

Table 4: Patients Dropout Rate to Hemodialysis or Death Secondary to Peritonitis among Continuous ambulatory Patients

Variable	Case Group		Control Group	
	Yes (n, %)	No (n, %)	Yes (n, %)	No (n, %)
Death	1 (25.0%)	3 (75%)	13 (26%)	4 (24%)
Hemodialysis	2 (4%)	3(60.0%)	4 (8%)	0 (0.0%)

DISCUSSION

The study assessed the outcomes of the peritoneal dialysis training using a case control intervention. The present study findings revealed that performance of the case group was highest, which continued to increase to 19 months following which it reached the initial level of performance. This is corroborated by Chang *et al.,* [Chang *et al.,* 2018] who conducted a randomized study to examine the conventional retraining group (CG) or the frequent retraining group (FG). This emphasis that effective peritoneal outcomes necessitate the periodic and continued training on a regular basis. It is reasoned that patients mostly forget their initial PD training, which may lead to changes in the taught procedures.

The present study findings showed that most of the patients in the control group transferred to hemodialysis, which, in general, is considered as a technique failure [Htay *et al.,* 2017; Ng *et al.,* 2018]. In the case-control intervention, patients in the case group showed better results as compared to the control group. This is consistent with the study findings of Chironda *et al.,* [Ng *et al.,* 2018], who documented a significant improvement in peritonitis outcomes following contemporary training. It is observed that the lengthy training experience is associated with a decline in the peritonitis rate [Yang *et al.,* 2012]. This is also consistent with the findings across the world, which varies based on the individual characteristics of the patient. Accordingly, studies have also reported that patients in case group didn't suffer from any handicap, and then PD training is held for an extended period.

The current study results suggest that there a need for developing a PD training curriculum centered on the need of the patients as recommended by the International Society for Peritoneal Dialysis (ISPD) guidelines. Accordingly, for enhancing the PD outcomes, the institutes must practice standardized training curriculum, retraining protocols, as well as protocol for home visits. Therefore, at the end of the training, the patients should complete the training successfully to ensure that all the procedures are safely performed. Consequently, the study recommends that PD training must also ensure that patients are able to identify the contamination and produce an adequate response. Thus, new modes of communication must be assessed using texting, telehealth, and e-mail, given the fact that patients have accessed to their medical records.

CONCLUSION

The study used the case-control intervention for examining the PD outcomes. The case group that received contemporary dialysis training was found to be more effective as compared to the control group, which followed a conventional training curriculum. Therefore, results revealed that case group was better as compared to the control group in terms of survival rates, lower death rate, and referral to hemodialysis and transplantation. Similarly, the infected peritonitis rate for continuous ambulatory peritoneal dialysis (CAPD) was more for the control group as compared to the case group. While the occurrence of peritonitis infection was more in the control group as compared to case. It suggests the PD function careful monitoring as well as observation for training complications. Furthermore, it directs future studies to examine the PD training outcomes based on the size of the center, characteristics of the patients, and other institutional characteristics. Consequently, the errors made in training should also be evaluated, which would assist in determining extra measures that could be taken.

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