Factors Associated With Dialysis Withdrawal In Dialysis Patients

Hammad Qazi (hammadali400@hotmail.com)
University of Waterloo Faculty of Applied Health Sciences https://orcid.org/0000-0002-7160-2274

Helen Chen
University of Waterloo

Peter Varga
Headwaters Health care centre

Ashok Chaurasia
University of Waterloo

Mahsa Ebad
University of Waterloo

Research article

Keywords: ialysis, dialysis withdrawal, maintenance dialysis, hemodialysis, peritoneal dialysis, dementia.

Posted Date: December 10th, 2019

DOI: https://doi.org/10.21203/rs.2.10834/v2

Abstract

Background: Research on the factors associated with dialysis withdrawal in dialysis patients has been limited. Authors have used different definitions for dialysis withdrawal, resulting in inconsistent findings. The objective of this study was to determine the factors associated with dialysis withdrawal in dialysis patients.Methods: This retrospective study extracted patient information from the electronic renal patient management systems at the Grand River Hospital. A total of 723 patients who initiated renal dialysis therapy (> 30 days of duration) in the renal dialysis program at Grand River Hospital (GRH), Ontario, during the period from 1st January 2012 to 30th September 2017 were consecutively included in the study. Logistic regression was used to determine the factors: age, sex, modality, comorbidities, the cause of primary renal disease, dialysis modality, and duration of dialysis-associated with dialysis withdrawal. Dialysis withdrawal was defined as “patient declined further treatment or voluntary withdrawal from the dialysis program”.Results: The mean age of the sample was 64.86 ± 14.89 years, and 62.8% (n = 454) were males. The prevalence of dialysis withdrawal was 9.41% (n = 68). The logistic regression model showed that factors associated with dialysis withdrawal were as follows: cardiac disease [Adjusted Odds Ratio (AOR)= 1.921; 95% CI= 1.126–3.278], hypertension [AOR = 5.711; 95% CI = 1.322- 24.676], dementia [AOR = 3.042; 95% CI = 1.325–6.983], age [AOR = 1.035; 95% CI = 1.012– 1.058] and duration of dialysis [AOR = 0.999; 95% CI = 0.999–1.00].Conclusion: In this study we show that age, cardiac disease, hypertension, and dementia are significant predictors related to dialysis withdrawal. The findings might help in identifying patients who are more likely to withdraw from dialysis at the start of dialysis. Future researchers and nephrologists should design and conduct intervention studies focusing on strategies controlling the severity of comorbidities (cardiac disease and hypertension), regular assessment and monitoring of the progression of dementia, and other dialysis program changes to help patients make more informed decisions regarding dialysis withdrawal.

Keywords: dialysis, dialysis withdrawal, maintenance dialysis, hemodialysis, peritoneal dialysis, dementia.

Introduction

Globally, the incidence of ESRD (End-Stage Renal Disease) and dialysis therapy initiation has been relatively stable, but recently the prevalence of both Chronic Kidney Disease (CKD) and dialysis has been increasing, mainly because of long survival rates [1-3]. The highest treated ESRD incidence rate is reported in Thailand, the US and Mexico; whereas, the highest prevalence rate is found in the Taiwan, Japan and the US [4]. The incidence of ESRD in Canada is 200 (ppm [per million population]), which is higher than in many advanced countries [4].

Despite the importance of dialysis in ESRD, authors have reported a wide range (8-31%) of dialysis withdrawal [5-8]. Dialysis withdrawal is one of the main causes of mortality in CKD patients [9]. Few authors have explored factors associated with dialysis withdrawal. Authors have reported an inconsistent association between factors such as age, gender, comorbidities, the cause of primary renal disease, and duration and type of dialysis modality with discontinuation of dialysis, technique failure and dialysis withdrawal [5-8,10-16].

These contradictory and inconsistent findings might be account for in several ways. Authors have defined dialysis withdrawal as withdrawal due to different reasons and causes, such as discontinuation, withholding, treatment refusal by patients and caregivers, and technique failure [10-17]. Some studies have used small sample sizes, resulting in type II error (false negative) [10,11], and some have not addressed mental health factors, such as depression/anxiety, dementia, and bipolar disorder [18] related to dialysis withdrawal. Some studies have indicated that mental health diseases have a stronger association than physical comorbidities in relation to dialysis withdrawal [13,19].

Executive summary report of Kidney Disease Improving Global Outcomes (KDIGO) [20] has highlighted that there is no universal definition of dialysis withdrawal, and limited use of available data for healthcare resource management and for research purposes. The report recommended that dialysis withdrawal should be based on: patient voluntary choice, if not having decision making capacity then based on his previous discussion through Advance Care Planning (ACP) or on legal agents' requests or patients having irreversible neurologic impairment [20].

The objective of the study was to determine the physical and mental health predictors associated with dialysis withdrawal "patient declined further treatment or voluntary withdrawal from the dialysis program", in renal dialysis patients. This understanding of the direction and strength of association among predictors with dialysis therapy will help to improve clinical decision making by identifying patients who might have a higher risk of dialysis withdrawal, providing solutions, removing barriers, and facilitating the participation of patients in the decision making.

Methods

Study Design and Setting:

The study used a cross-sectional study design, retrospectively reviewing the electronic records of dialysis patients from 1st January 2012 to 30th September 2017 in a large tertiary care hospital in Ontario. The hospital provides a full spectrum of Chronic Kidney Disease services, including nephrology clinics, pre-dialysis, hemodialysis, peritoneal dialysis, home hemodialysis, and pre-transplantation for eligible patients living in Waterloo Region and Wellington County. The hospital's renal program is overseen by the provincial agency (Ontario Renal Network (ORN)). The ORN plays a key role in treatment and management policies for the delivery of CKD services in Ontario.

Patients:

All patients following the selection criteria during the study period were consecutively included in the study. The study cohort included incident adult (> 18-years-old) dialysis patients with at least 30 days or more of duration of dialysis, during the study period from 1st January 2012 to 30th September 2017. The total duration of dialysis was measured by the first day the patient was dialyzed at home or hospital and the last date of dialysis of any modality. Patients with dialysis duration less than 30 days were not included in the study. Since the study only include incident dialysis population, patients started dialysis

before February 2012 were excluded. The process of selection of the cohort until the end of the study period is shown in Figure 1.

The Tri-Hospital Research Ethics Board (THREB) and the University Human Research Ethics Committee approved the research project (THREB File # 2016-0619) along with the waiver of “the requirement to obtain patient informed consent”.

Data Collection:

The data were extracted from Nephrocare® (electronic patient record system for renal patient management) and supplementary information related to patients as part of a chart review. First, the data for the selected variables were extracted from NephroCare® from 1st January 2012 to 30th September 2017. Each of the selected variables was recorded in excel by the two graduate students. Some patients were randomly selected, and their medical records were reviewed for validation and quality of data entry by the two students. The third step was to complete the missing values by reviewing and supplementary information related to patients as part of a chart review by the three graduate students. Each patient has several clinical notes and assessments summaries (reports), and the logic for identifying most relevant reports included: reports near the start of the dialysis, referral letter, nephrologists assessments, discharge reports, and anesthesiologist reports.

During the review of clinical notes, if a diagnosis was found in relevant notes, that diagnosis was recorded in the dataset. For comorbidities, if there was any report of a diagnosis by the clinician at the start of dialysis, the patient was considered as having the comorbidity, irrespective of subsequent recovery or improvement in the condition of that disease.

Study Variables:

The dependent variable was dialysis withdrawal, defined as “patient voluntarily refused dialysis treatment and withdrew from the dialysis program, followed by the nephrologist’s consultation and confirmation”. The independent variables were: age, gender, cause of primary renal disease, coded as diabetes, renovascular disease, nephritis, others and unknown. Comorbidity included diabetes, cardiac disease, hypertension, malignancy, depression, dementia, bipolar disorder, and vascular accident. Cardiac disease was diagnosed on the basis of the presence of any of the disease: Coronary Artery Disease (CAD), cardiac arrhythmia, cardiac failure, cardiac valvular disease, pericardial disease, cardiomyopathy, and congenital heart disease. Modality was categorized as Hemodialysis (HD) or Peritoneal dialysis (PD) at the time of 30 days of starting the dialysis. Duration of dialysis was measured from the first day of dialysis to the last day of dialysis or any terminal event, such as withdrawal, death, transplant or lost to follow up, and reported in months.

Data Analysis

All the data were analyzed using SAS® studio University Edition. The descriptive data include means, standard deviations, and frequencies and percentages. The binary logistic regression was used to assess the determinants of dialysis withdrawal. For this approach, a p-value (level of significance) of 0.05 was considered significant. Firstly simple logistic regression analysis was conducted between each predictor: age, gender, the cause of primary renal disease, diabetes, cardiac disease, hypertension, malignancy, depression, dementia, bipolar disorder and vascular accident, modality and duration of dialysis with dialysis withdrawal. All predictors with a p-value < 0.2 were included in the final logistic regression model.

Given the goal of the study was to help renal programs to identify patients with high risk of withdrawal at the initiation of dialysis, this study aimed at determining what factors are associated with dialysis withdrawal at the start of the dialysis. We used logistic regression after taking into consideration the assumptions including independent observations no multicollinearity, large a priori calculated sample size and based on our objective and calculated the odds ratio. The odds ratio is defined as “the proportion of new dialysis withdrawal cases that developed in a given period of time that is cumulative incidence”.

Many studies on dialysis have used survival analysis methods such as proportional hazards regression, also called cox regression and models the hazard rate. These studies were interested in the impact of a risk factor on the *time to the occurrence of an event.* They provide the number of new cases of disease per population at-risk per unit time. *Our study objective was different from these studies, such that we did not explore the time to the occurrence of the event, i.e. withdrawal. Instead, we aimed to determine the cumulative incidence of dialysis withdrawal in the study, so logistic regression was deemed the most appropriate method.*

Nevertheless, one of the limitations of our analysis was not able to determine the impact of factors on the time to the dialysis withdrawal including the right and left censoring issues which are important in the survival analysis. The other limitations of the analysis, such as not having repeated measures for independent variables at different time points during dialysis and progression of comorbidities, along with missing other potentially impactful variables are discussed later in this paper.

Results

Baseline Characteristics of Dialysis Population

The study included 723 dialysis patients. The mean age of the sample was 64.86 ± 14.89 years, with minimum and maximum values of 19 and 94 years respectively. The majority (54.1%) of the patients were between 61 to 80 years of age, and 62.6% (n = 453) were male. The most common comorbidity was hypertension (88.8%), followed by Diabetes (63.8%). The mean duration of dialysis was 17.911 ± 16.005 with minimum and maximum values of 1 and 66 months. The majority (47.2%) of the patients have a

duration of dialysis for less than one year. Table 1 provides a detailed description of the patient characteristics.

Characteristics of the Dialysis Withdrawal Group

We found that, out of 723 dialysis patients, 9.41% (n = 68) had dialysis withdrawal. The majority of the dialysis withdrawal patients were males (66.18%) with a mean age of 71.72 ± 13.90 years. Considering the majority of dialysis patients had one year or less duration of dialysis, the duration of dialysis was mentioned in months rather than years to better determine the association for logistic regression model. The mean duration of dialysis within the dialysis withdrawal group was 13.54 ± 15.322 months. Table 1 provides a detailed description of the dialysis withdrawal group characteristics. The primary causes of renal disease in the dialysis withdrawal group are shown in Table 2.

Logistic Regression:

The final regression model is shown in Table 3 with model estimates and adjusted odds ratios of the predictors. The results indicated that cardiac disease [p = 0.016], hypertension [p = 0.019], dementia [p=0.008], age [p = 0.002], and duration of dialysis [p = 0.0092] were significantly associated with dialysis withdrawal. The adjusted odds ratio (AOR) estimates shown in Table 3 suggest that:

1. the odds of dialysis withdrawal is higher in patients with cardiac disease [AOR= 1.921; 95% CI= 1.126–3.278] in comparison to patients without cardiac disease while holding other variables held fixed;
2. the odds of dialysis withdrawal is higher in patients with hypertension [AOR = 5.711; 95% CI = 1.322-24.676] in comparison to patients without hypertension while holding other variables held fixed;
3. the odds of dialysis withdrawal is higher in patients with dementia [AOR = 3.042; 95% CI = 1.325–6.983] in comparison to patients without dementia while holding other variables held fixed;
4. one-unit increase of duration of dialysis, decreases the odds of dialysis withdrawal by a factor of 0.999 [95% CI = 0.999–1.00], while holding other variables fixed;
5. one-unit increase of age increases the odds of dialysis withdrawal by a factor of 1.035 [95% CI = 1.012–1.058] while holding other variables fixed.

Discussion

Despite the higher prevalence of dialysis withdrawal and its significant association with death in ESRD patients, the phenomenon of dialysis withdrawal remains unclear [17]. There is a gap in the literature with regards to factors associated with dialysis withdrawal, mainly because of the scarcity of available literature and inconsistent findings across various studies [17].

The results of this study show that only 9.41% (n = 68) of patients have dialysis withdrawal. This finding is supported by Chan et al. (2012) who reported a 5-year incidence rate of dialysis withdrawal as 13.4% in Australia and New Zealand [6]. However, authors have also shown higher rates of dialysis withdrawal in

other studies conducted in the US (24.9%) and Japan (31%). The difference between the study findings may be attributed to religion, cultural beliefs, and ethnicity, as these factors can also influence dialysis withdrawal [5,19,21].

We found the cardiac disease [p = 0.016] and hypertension [p = 0.019] were significantly associated with dialysis withdrawal. Comorbidities such as hypertension and cardiac disease are chronic diseases that gradually deteriorate patient health status, leading to complications that initiate a cascade of health issues [22]. These health issues increase the burden of disease and might lead patients to discontinue dialysis treatment. Similarly, Ellwood et al. (2013) and Fissell et al. (2005) found that vascular diseases and coronary artery disease were positively associated with dialysis withdrawal [7,14]; however, congestive heart failure [7,14] and other cardiovascular diseases were not associated with dialysis withdrawal [9].

The differences between the results in the present study with the previous studies [7,9,14] might be attributed to the definition of dialysis withdrawal. The present study defines dialysis withdrawal as “patient-elected withdrawal” vs. dialysis discontinuation due to any reason except recovery of kidney functions [7], unspecified dialysis termination and death [14], and all types of dialysis termination (by patient, family, physician or medical community [9]. Wetmore et al. (2017), defined the dialysis withdrawal as “patient elected discontinuation of dialysis” which is similar to our study. Their findings coincided with our present study findings: heart disease and hypertension increased the odds of dialysis withdrawal [18]. However, they did not explore mental health components (dementia, depression and bipolar disorder).

In the present study, dementia [p = 0.008] was found to be significantly associated with dialysis withdrawal. Irreversible neurologic impairment such as advanced irreversible dementia is one of the appropriate conditions for dialysis withdrawal [20]. Similarly, Kurella et al. (2006) [23] and Birmele et al. (2004) [9] found that dementia was associated with increased risk of death and dialysis withdrawal. However, the definition of dialysis withdrawal was not clear [23], and all types of dialysis termination, including a change in modality, death, and dialysis discontinuation was used as dialysis withdrawal [9] in these studies. Patients with comorbidities have a higher risk of mental health issues than patients without comorbidities [13,24]. Similarly, patients with mental conditions, such as depressive symptoms and dementia, have a higher incidence of comorbidities [25]. Because of this complex relationship, it is difficult to distinguish and understand the biologic plausibility between comorbid conditions and mental health issues in relation to dialysis withdrawal. This association between comorbid conditions and quality of life with dementia might be one reason for higher odds of dialysis withdrawal in patients with dementia, as was found in the present study.

The present study showed that age [AOR = 1.035; 95% CI = 1.012–1.058] was

significantly associated with dialysis withdrawal; an increase in age increases the odds of dialysis withdrawal. Authors have reported that older age is associated with a higher rate of dialysis withdrawal, which is similar to our findings [6,7,26]. Ellwood et al. (2013) found that increasing age was significantly

associated with dialysis withdrawal [HR (Hazard Ratio) = 1.81; 95% CI = 1.75–1.88] [7]. Like the present study, Wetmore et al. (2017) define dialysis withdrawal as “patient and family elected discontinuation of dialysis” and showed higher odds of withdrawal in dialysis patients with age > 75 years [OR=1.61; 95% CI = 1.54-1.68] [18]. Older age patients have multiple comorbidities that are difficult to control, such as diabetes and hypertension that further debilitate with dialysis, leading to drastic deteriorations in physical and mental health and resulting in dialysis withdrawal [7,9,27].

Finally, the duration of dialysis [AOR = 0.999; 95% CI = 0.999–1.00], was significantly associated with dialysis withdrawal. Duration of dialysis might influence dialysis withdrawal, as patients with ESRD have chronic diseases and gradually deteriorate patient health status over time, which might lead to complications that initiate a cascade of health issues. These health issues increase the burden of disease and might lead patients to discontinue dialysis treatment [22,19]. Wetmore et al. (2017) have shown higher odds of withdrawal in patients with a longer duration of dialysis [18]. However, the odds of withdrawal in term of the duration of dialysis in this study was close to one [AOR = 0.99; 95% CI = 0.999–1.00], and hence not clinically meaningful. This might be because most of the patients had a shorter duration of receiving dialysis treatment, as the analysis was restricted to the last 5 years, including incident dialysis patients. Patients who have started dialysis prior to the start date of the study thus might ben on dialysis for more than five years, were not included in the study. It is important to note, however, that the results were based on the data from a regional renal program in Ontario, and it may be different from what is experienced in other dialysis population. Our study also showed that the duration of dialysis was not a factor that impacted the odds for withdrawal. It could be possible that other factors such as comorbidities and the quality of life deteriorate significantly over the long period of dialysis, which might have led to the dialysis withdrawal. In summary, our study didn’t indicate any influence of duration of dialysis on risk of dialysis withdrawal for a patient, given the other variables held constant.

Limitations

The main weakness of the study is the retrospective study design, which depends entirely on the quality and completeness of patient records. The quality of the dataset for this study was also dependent on the data quality of physician notes and data entry of the electronic patient record systems. However, a careful review of randomly selected patient records provided a limited level of assessment of the accuracy between the extracted data with the source system of patient records. There was limited information about the severity of mental health diseases in our population. The only information we were able to obtain was the presence or absence of mental health disease at the baseline (start of dialysis) and their association with dialysis withdrawal. Further comments about whether their dementia was later progressed into an advanced stage or remain the same (no change from baseline), when and how it was diagnosed and treated was not possible, due to study design and data limitations.

Furthermore, this study was unable to explore the relationship between financial burden, beliefs, and cultural and personal views in relation to the decision to withdraw treatment by either family or individual.

However, the objective of the study was to identify factors at the start of dialysis between the two groups to identify the population at risk and early screening and intervention.

These limitations, though beyond the scope of the current study, are highly relevant for determining the factors that influence dialysis withdrawal. Being a single-center study, the generalizability of our study is also limited. However, consecutive sampling was performed to make the sample a better representation of a larger population. Due to the cross-sectional nature of our study, we are unable to comment on the causal association between identified factors with dialysis withdrawal.

Advancement of Knowledge and Application in Practice: Implications of the Study

Our findings were based on patient voluntarily refused dialysis treatment rather than patients who died or patients who likely faced imminent death and did not truly withdraw from the treatment, as withdrawal is commonly understood and reported in previous studies. The identified factors associated with voluntary withdrawal from the dialysis treatment will help understand what factors at the baseline (start of dialysis) that are associated with dialysis withdrawal. The findings will likely help clinicians and researchers develop a screening instrument by including the predictors identified in the study, such as cardiac disease, hypertension, and dementia, to identify patients with a higher risk of dialysis withdrawal at the time of enrolment. Some of these predictors are highly prevalent in the dialysis population. Intervention studies should develop models and instruments further include the severity of these predictors and how they affect withdrawal and assigning weights based on the severity of the disease. This instrument might also help clinical decision making and better engage patients in their care when the risk of dialysis withdrawal is discussed at the beginning of dialysis and throughout the entire treatment.

One of the most important findings was the identification of a mental health component for dialysis withdrawal, including dementia as one of the factors associated with dialysis withdrawal. KIDGO [20] mentioned irreversible neurologic impairment as one of the reasons for dialysis withdrawal. Renal Physicians Association has also provided many tools with acceptable psychometrics for assessment of mental health issues such as cognition, decision making capacity, depression, etc. in dialysis patients [28]. We measured mental health status (including dementia) at the start of dialysis. We assumed that dialysis patients with dementia were not at an advanced stage, as advanced irreversible neurologic impairment was one of the contraindications of dialysis initiation. The results showed dementia as a significant factor associated with dialysis withdrawal; highlighting that patients with dementia at the start of dialysis were more likely to withdrawal from the treatment than their peers without dementia. Due to the retrospective, cross-sectional nature of the study, we cannot infer whether the severity and stage of dementia progressed or remain the same for these patients and the use of mental health screening instruments and frequency of these assessments for these patients. In clinical practice, most dialysis programs screen patients for severe mental health issues prior to the enrollment of the dialysis program and potentially exclude patients with severe mental health conditions. This study identified a need for a modified mental health screening measure specific for dialysis patients, and the need for continuous monitoring of a patient's mental health.

Lack of social support and mental health services might be one of the main barriers to the continuity of dialysis. These two components are highly interrelated since the lack of social support has a negative influence on mental health outcomes. However, due to the limited sample size and availability of data, we did not explore these topics in depth. To identify the mediators that influence the relationship between predictors, such as social support, mental health, quality of life, and dialysis withdrawal, future researchers should conduct studies with larger sample sizes, and qualitative exploration of the process.

In clinical practice, most dialysis programs screen patients for severe mental health issues before the enrollment of the dialysis program and potentially exclude patients with severe mental health conditions. This study identified a need for a modified mental health screening measure specific for dialysis patients, and the need for continuous monitoring of a patient's mental health.

Conclusions

The study showed a low rate of dialysis withdrawal (9.41%) in a cohort (N = 723) of dialysis patients included in the study. Age, cardiac disease, hypertension, dementia, and duration of dialysis were associated with dialysis withdrawal. These findings might help in identifying a cohort of patients who are susceptible to dialysis withdrawal at the start of dialysis.

Declarations

Ethics approval and consent to participate:

The Tri-Hospital Research Ethics Board (THREB) and the University Human Research Ethics Committee approved the research project (THREB File # 2016-0619) along with the waiver of "the requirement to obtain patient informed consent".

Permissions to access NephroCare database

Grand River Hospital REB granted permission to perform the chart review. HAQ and ME went through NephroCare to review patient records. We didn't access NephroCare database directly to extract data.

Consent for publication:

Not applicable

Availability of data and materials:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing Interests:

The authors declare that they have no competing interests

Funding:

Not Applicable

Author's contribution:

HAQ made substantial contribution to the conception, study design, data collection, analysis, interpretation and writing of the manuscript. HC was included in conception, major contribution in writing and supervising data collection. PV provide technical subject expertise on CKD and dialysis processes, study design and interpretation of the study. AC provide contribution in data analysis and interpretation. ME provide contribution in data collection and writing. All authors read and approved the final manuscript.

Acknowledgments:

The authors express gratitude to Meng Zhu, for his assistance in data collection. We are grateful to Kim Hendrick, Tina Mah, Katherine Lavoie and to the staff at the Grand River Hospital, for their support of this research. We would like to thank the IT Team for enabling the access to the patient records for the chart review.

Abbreviations:

Not applicable

References

1. National Collaborating Centre for Chronic Conditions (Great Britain): Chronic kidney disease: national clinical guideline for early identification and management in adults in primary and secondary care. In: Royal College of Physicians; 2008.
2. Levey AS, Coresh J. Chronic kidney disease. Lancet. 2012;379(9811):165-180.
3. Ojo A. Addressing the global burden of chronic kidney disease through clinical and translational research. Trans Am Clin Climatol Assoc. 2014;125:226-229.
4. United States Renal Data System [USRDS]. "International Comparisons". Atlas of ESRD. Washington: USRDS Coordinating Center. https://www.usrds.org/2012/view/v2_12.aspx. Accessed April 09, 2019.
5. Seshasai RK, Mitra N, Chaknos CM, et al. Factors associated with discontinuation of home hemodialysis. Am J Kidney Dis. 2016;67(4):629-637.
6. Chan HW, Clayton PA, McDonald SP, Agar JW, Jose MD. Risk factors for dialysis withdrawal: an analysis of the Australia and New Zealand Dialysis and Transplant (ANZDATA) Registry, 1999-2008. Clin J Am Soc Nephrol. 2012;7(5):775-781.
7. Ellwood AD, Jassal S V, Suri RS, Clark WF, Na Y, Moist LM. Early dialysis initiation and rates and timing of withdrawal from dialysis in Canada. Clin J Am Soc Nephrol. 2013;8(2):265-270.

8. Mizuno M, Ito Y, Tanaka A, et al. Peritonitis is still an important factor for withdrawal from peritoneal dialysis therapy in the Tokai area of Japan. Clin Exp Nephrol. 2011;15(5):727.
9. Birmelé B, François M, Pengloan J, et al. Death after withdrawal from dialysis: the most common cause of death in a French dialysis population. Nephrol Dial Transplant. 2004;19(3):686-691.
10. Workeneh B, Guffey D, Minard CG, Mitch WE. Causes for Withdrawal in an Urban Peritoneal Dialysis Program. Int J Nephrol. 2015; 2015:652953.
11. Hazama T, Fukami K, Yamagishi S, et al. Dialysate vascular endothelial growth factor is an independent determinant of serum albumin levels and predicts future withdrawal from peritoneal dialysis in uremic patients. Ther Apher Dial. 2014;18(5):391-397.
12. Remón-Rodríguez C, Quirós-Ganga P, Portolés-Pérez J, et al. Grupo Cooperativo Registros Españoles de Diálisis Peritoneal: Results of the cooperative study of Spanish peritoneal dialysis registries: analysis of 12 years of follow-up. Nefrologia. 2014;34(1):18-33.
13. McDade-Montez EA, Christensen AJ, Cvengros JA, Lawton WJ. The role of depression symptoms in dialysis withdrawal. Heal Psychol. 2006;25(2):198.
14. Fissell RB, Bragg-Gresham JL, Lopes AA, et al. Factors associated with “do not resuscitate” orders and rates of withdrawal from hemodialysis in the international DOPPS. Kidney Int. 2005;68(3):1282-1288.
15. Foley RN, Collins AJ. End-stage renal disease in the United States: an update from the United States Renal Data System. J Am Soc Nephrol. 2007;18(10):2644-2648.
16. O’Connor NR, Kumar P. Conservative management of end-stage renal disease without dialysis: a systematic review. J Palliat Med. 2012;15(2):228-235.
17. Qazi HA, Chen H, Zhu M. Factors influencing dialysis withdrawal: a scoping review. BMC Nephrol. 2018;19(1):96.
18. Wetmore JB, Yan H, Hu Y, Gilbertson DT, Liu J. Factors Associated With Withdrawal From Maintenance Dialysis: A Case-Control Analysis. Am J Kidney Dis. 2018;71(6):831841.
19. Ikäheimo R, Kervinen M, Karhapää P, et al. Discontinuation of dialysis treatment: Experience of a single dialysis centre. Scand J Urol Nephrol. 2005;39(5):417-422.
20. Davison, SN, Levin, A, Moss AH, et al. Executive summary of the KDIGO Controversies Conference on Supportive Care in Chronic Kidney Disease: developing a roadmap to improving quality care. Kidney Int. 2015; 88(3):447-459
21. Murtagh F, Cohen LM, Germain MJ. Dialysis discontinuation: quo vadis? Adv Chronic Kidney Dis. 2007;14(4):379-401.
22. Neu S, Kjellstrand CM. Stopping long-term dialysis. N Engl J Med. 1986;314(1):14-20.
23. Kurella M, Mapes DL, Port FK, Chertow GM. Correlates and outcomes of dementia among dialysis patients: the Dialysis Outcomes and Practice Patterns Study. Nephrol Dial Transplant. 2006;21(9):2543-2548.

24. Davison SN, Jhangri GS. The impact of chronic pain on depression, sleep, and the desire to withdraw from dialysis in hemodialysis patients. J Pain Symptom Manage. 2005;30(5):465-473.
25. Shirazian S, Grant CD, Aina O, Mattana J, Khorassani F, Ricardo AC. Depression in chronic kidney disease and end-stage renal disease: Similarities and differences in diagnosis, epidemiology, and management. Kidney Int reports. 2017;2(1):94-107.
26. Findlay MD, Donaldson K, Doyle A, et al. Factors influencing withdrawal from dialysis: a national registry study. Nephrol Dial Transplant. 2016;31(12):2041-2048.
27. Jassal S V, Watson D. Dialysis in late life: benefit or burden. Clin J Am Soc Nephrol. 2009;4(12):2008-2012.
28. Renal Physicians Association. *Shared Decision-Making in the Appropriate Initiation of and Withdrawal from Dialysis: Clinical Practice Guideline*. 2nd, Rockville: Renal Physicians Association, 2010.

Tables

Table 1. Characteristics of Dialysis Group (all patients in the study sample) and Dialysis Withdrawal Group

	All patients (N= 723)	Dialysis Withdrawal (N=68)
Age in years, n (%)		
≤ 40	52 (7.2)	3 (4.4)
41-60	179 (24.8)	9 (13.2)
61-80	391 (54.1)	34 (50)
>80	101 (14)	22 (32.4)
Gender n (%)		
Males	453 (62.6)	45 (66.2)
Females	270 (37.3)	23 (33.8)
Comorbidities n (%)		
Diabetes	461 (63.8)	41 (60.3)
Infarct	198 (27.4)	23 (33.8)
Heart Disease	413 (57.1)	48 (70.6)
Vascular accident	196 (27.1)	26 (38.2)
Malignancy	228 (31.5)	27 (39.7)
Lung disease	172 (23.8)	22 (32.4)
Hypertension	642 (88.8)	65 (95.6)
Mental health	232 (32.1)	25 (36.8)
Depression	213 (29.5)	19 (27.9)
Dementia	40 (5.5)	9 (13.2)
Bipolar disorder	18 (2.5)	2 (2.9)
Modality n (%)		
HD	592 (81.9)	59 (86.8)
PD	131 (18.1)	9 (13.2)
Duration of Dialysis in Years		

≤1	341 (47.2)	41 (60.3)
≤2	159 (22)	12 (22.1)
≤3	108 (14.9)	4 (5.9)
≤4	70 (9.7)	3 (4.4)
>4	45 (6.2)	5 (7.4)
Year of Dialysis Start		
2012	121 (16.7)	11 (16.1)
2013	139 (19.2)	17 (25)
2014	132 (18.2)	17 (25)
2015	128 (17.7)	9 (13.2)
2016	128 (17.7)	8 (11.8)
2017	75 (10.4)	6 (8.8)

Abbreviations: HD: hemodialysis; PD: peritoneal dialysis

Table 2. Primary Cause of Renal Disease in Dialysis Withdrawal Group (N=68)

Category	Summary Statistics n (%)
Diabetes	21 (30.9)
Renovascular	10 (14.7)
Others	16 (23.5)
Uncertain	14 (20.6)
Nephritis	7 (10.3)

Table 3. Final Logistic Regression Model

Parameter	p	AOR	95% CI AOR
Intercept	<.0001		
Duration of dialysis in months	0.0092	0.999	0.999 - 1.00
Modality HD vs PD (Ref)	0.4388	1.348	0.633 – 2.870
Age in years	0.0024	1.035	1.012 – 1.058
Diabetes Yes vs No (Ref)	0.1359	0.660	0.382 – 1.140
Cardiac Disease Yes vs No (Ref)	0.0166	1.921	1.126 – 3.278
Hypertension Yes vs No (Ref)	0.0196	5.711	1.322 – 24.676
Dementia Yes vs No (Ref)	0.0087	3.042	1.325 – 6.983

Note. *p>0.05 as significant, 95% CI AOR; 95% Confidence Interval for Adjusted Odds Ratio Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; HD, hemodialysis; PD, peritoneal dialysis

Figures

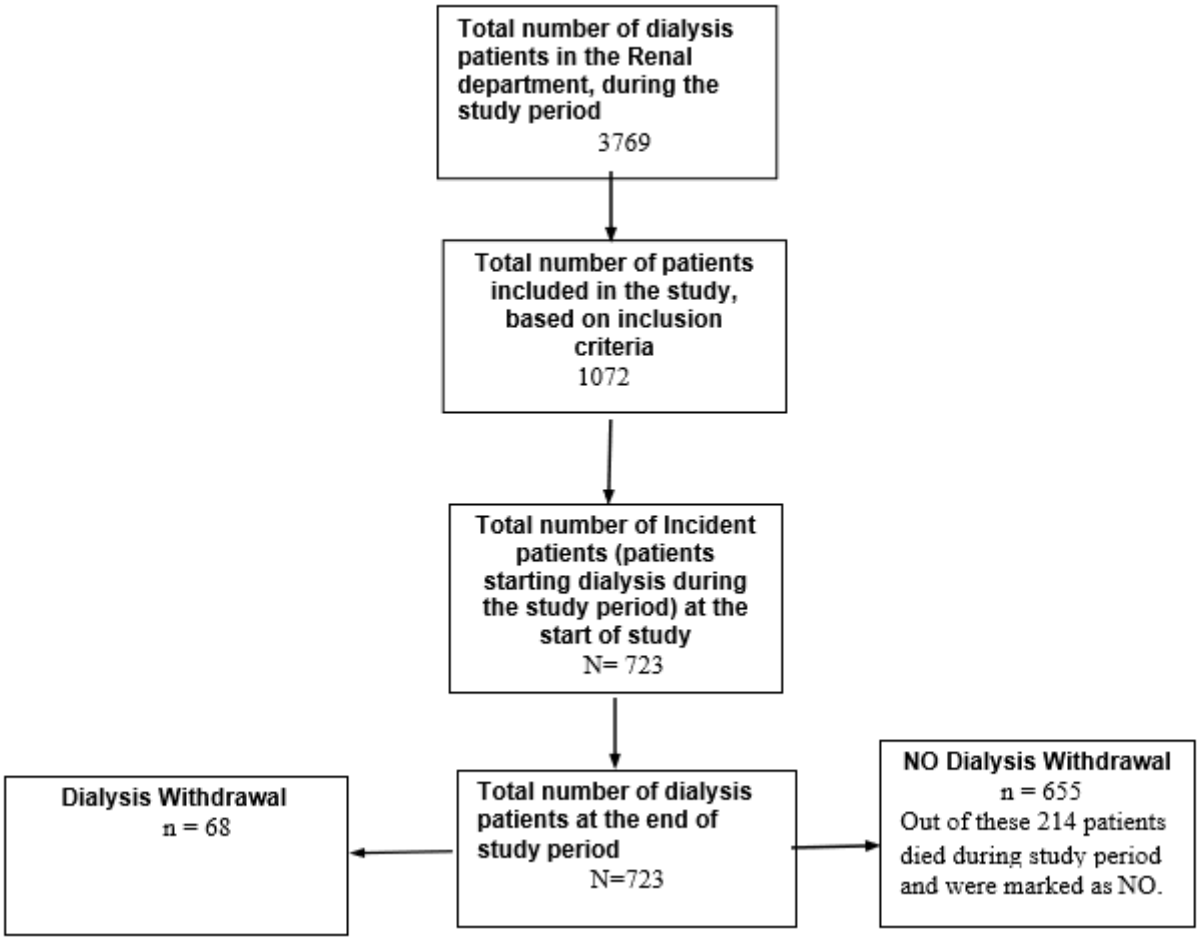

Figure 1

Flowchart process of selection of study sample till the end of study period. All patients included in the study have their outcome measured as Withdrawal (Yes/No) at the end of the study period. No patient was excluded from the analysis. Patients who died during the study were marked as NO Withdrawal. No patient was followed up beyond the study duration.