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The primary aim of *World Journal of Diabetes (WJD, World J Diabetes)* is to provide scholars and readers from various fields of diabetes with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

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Selection of dialysis methods for end-stage kidney disease patients with diabetes

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Abstract

The increasing prevalence of diabetes has led to a growing population of end-stage kidney disease (ESKD) patients with diabetes. Currently, kidney transplantation is the best treatment option for ESKD patients; however, it is limited by the lack of donors. Therefore, dialysis has become the standard treatment for ESKD patients. However, the optimal dialysis method for diabetic ESKD patients remains controversial. ESKD patients with diabetes often present with complex conditions and numerous complications. Furthermore, these patients face a high risk of infection and technical failure, are more susceptible to malnutrition, have difficulty establishing vascular access, and experience more frequent blood sugar fluctuations than the general population. Therefore, this article reviews nine critical aspects: Survival rate, glucose metabolism disorder, infectious complications, cardiovascular events, residual renal function, quality of life, economic benefits, malnutrition, and volume load. This study aims to assist clinicians in selecting individualized treatment methods by comparing the advantages and disadvantages of hemodialysis and peritoneal dialysis, thereby improving patients' quality of life and survival rates.

Key Words: Diabetes; End-stage kidney disease; Hemodialysis; Peritoneal dialysis; Dialysis methods selection

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Core Tip: The prevalence of diabetes is leading to an increase in the number of End-stage kidney disease (ESKD) patients with diabetes. Dialysis is the most commonly accepted treatment for ESKD patients. However, the optimal dialysis method for diabetic ESKD patients remains controversial. Diabetic ESKD patients often present with complex conditions and numerous complications. This article reviews recent literature on renal replacement therapy to determine the most suitable dialysis method for diabetic ESKD patients. This review is the first to evaluate the benefits of different dialysis types for diabetic ESKD patients across nine aspects.

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INTRODUCTION

End-stage kidney disease (ESKD) is a global health concern with a significantly high mortality rate[1,2]. The prevalence of ESKD in the United States increased by 41.8% from 2000 to 2019. Among Asians, the prevalence increased by 149.5%, the largest rise among all racial and ethnic groups[3]. The number of ESKD patients with diabetes is increasing with the rise in the prevalence of diabetes[4]. Currently, the commonly used treatment for ESKD includes hemodialysis (HD) and peritoneal dialysis (PD)[5,6]. ESKD patients with diabetes undergoing dialysis have higher cardiovascular risks and mortality rates than non-diabetic ESKD patients[7]. Furthermore, ESKD patients with diabetes are at increased risk of complications, including blood sugar fluctuations and infections. Therefore, dialysis treatment for ESKD patients with diabetes is more complicated. Selecting appropriate treatment strategies for these patients is crucial. This study specifically highlights the evidence types considered, including randomized controlled trials, cohort studies, large-sample retrospective studies (sample size ≥ 500), and case-control studies. This review aims to systematically organize and compile available evidence for a comprehensive analysis. Including high-quality studies ensures reliable and trustworthy results. Selecting the dialysis method with the greatest clinical advantages for patients has been challenging. However, there are only a few articles that suggest the type of dialysis method suitable for ESKD patients with diabetes, and the evidence presented is inconsistent[8,9]. This article reviews recent literature on renal replacement therapy to determine the most suitable dialysis method for diabetic ESKD patients, focusing on nine key aspects: Survival rate, glucose metabolism disorders, infectious complications, cardiovascular events, residual renal function (RRF), quality of life, economic benefits, malnutrition, and volume load.

LITERATURE SEARCH AND EVIDENCE SELECTION METHODS

A comprehensive literature search was conducted using the PubMed database. Initially, titles and abstracts were reviewed to identify relevant studies, followed by a thorough full-text evaluation to ensure scientific rigor and relevance. Studies were selected based on nine key criteria: Survival rate, glucose metabolism disorders, infectious complications, cardiovascular events, RRF, quality of life, economic benefits, malnutrition, and volume load. This study discusses these criteria in detail and provides clinical evidence to support the analysis, offering guidance for clinical practice. Studies evaluating diabetic patients undergoing HD or PD for ESKD and providing data on key assessment criteria were included. Articles were excluded if full texts were unavailable or data were incomplete.

COMPARISON OF DIFFERENT TREATMENT METHODS FOR DIABETIC ESKD PATIENTS

Survival rate

The survival rate of dialysis patients is an important indicator for evaluating patient benefit. However, the impact of dialysis methods on the survival of diabetic ESKD patients remains debated.

The survival rates of diabetic ESKD patients undergoing HD and PD are similar: Several studies have indicated that PD and HD offer comparable survival rates for diabetic ESKD patients[10-14]. A propensity-matched score study in Guangdong Province, China, compared the mortality rates of PD and HD in 268 ESKD patients with type 2 diabetes (T2D). The study revealed that PD and HD had similar mortality rates, both in the first 2 years and beyond 2 years of starting dialysis treatment[10]. Additionally, a propensity-matching score study on 210 diabetic ESKD patients from 2012 to 2019 indicated similar survival rates for T2D-ESKD patients undergoing PD and HD[11]. Similar results were observed in a Norwegian study[13]. However, all the aforementioned studies were retrospective. A 2020 systematic review of 214 papers, including 17 cohort studies and 113578 patients, found no significant difference in mortality risk between PD and HD (HR: 1.06, 95%CI: 0.99-1.14). Subgroup meta-analysis showed that patients with diabetes had HR: 1.09 (95%CI: 0.98-1.21), while those without diabetes had HR: 0.99 (95%CI: 0.90-1.09)[14]. No randomized controlled trial (RCT) to support

this analysis requires further RCT verification.

Diabetic ESKD patients have a higher survival rate after PD than HD: Some studies have indicated that ESKD patients with diabetes have a higher survival rate with PD than with HD[15-17]. A 2010 retrospective study by Weinhandl *et al*[16] in the United States found that PD had a survival advantage over HD in the first year after starting dialysis, whereas HD had a survival advantage after one year. Furthermore, a 2016 Korean prospective cohort study on 902 diabetic patients indicated that according to the multivariate analysis, PD has a higher survival advantage than HD (HR: 0.59, 95%CI: 0.37-0.94, $P = 0.03$), and good blood sugar control is associated with better survival in PD patients[15]. Overall, these studies have indicated that the survival rate of diabetic patients undergoing dialysis is associated with dialysis method and time. With the continuous advancement of PD technology, the survival advantage of diabetic patients undergoing PD is gradually increasing. A 2018 single-center retrospective study in Shanghai, China, reported that the 3-year survival rate of PD patients was significantly higher than that of HD patients (log-rank = 5.582, $P = 0.018$)[17]. Therefore, it can be inferred that PD offers increased survival rates for diabetic ESKD patients compared to HD.

Diabetic ESKD patients have a lower survival rate after PD than HD: Studies suggest that diabetic ESKD patients have a reduced survival rate with PD compared to HD[18-21]. A 2012 Canadian registry study found that the mortality rate of PD among elderly diabetic women was higher than that of HD[18]. Furthermore, a 2015 retrospective cohort study in Taiwan indicated similar results for ESKD patients with diabetes and a history of stroke. However, in ESKD patients without diabetes and a history of stroke, HD and PD had similar overall survival rates[19]. A 2017 retrospective study by I-Kuan Wang *et al*[20] suggested that the survival rate of elderly diabetic ESKD patients undergoing PD was lower than that for HD. A systematic review conducted by Cecile Couchoud *et al*[9] also revealed an elevated risk of mortality in elderly and frail patients undergoing PD treatment. A 2017 South Korean study confirmed this conclusion[21]. However, all these studies are based on clinical databases, and variables missing in the database cannot be adjusted, which may interfere with the results. Furthermore, the differences in the results of these studies may be caused by differences in the populations included. Table 1 indicates specific information on PD and HD survival studies.

Despite the similar survival rates for PD and HD, PD is often recommended as the first dialysis method, particularly for patients with a long life expectancy, younger age, and better glycemic control. For elderly and frail patients, the choice of PD treatment should be cautious[9]. Treatment decisions must be tailored to the individual, considering both patient preferences and comorbidities.

Glucose metabolism disorder

Blood glucose fluctuations are an important characteristic of aberrant glucose metabolism. Poor blood sugar control promotes the progression of diabetic nephropathy[22]. On the other hand, tight glycemic control reduces the risk of cardiovascular disease (CVD) and improves outcomes in acute coronary syndromes[23].

Glucose metabolism in diabetic ESKD patients receiving PD: Patients who undergo PD treatment are exposed to glucose dialysate for a long time, and the total glucose absorbed is 100-300 g/d, accounting for 20% of the total body energy[24]. Therefore, diabetic PD patients absorb large amounts of glucose and are prone to glucose metabolism disorders. Takatori *et al*[25] conducted a randomized controlled study and found that icodextrin helps control blood sugar and fluid levels in patients, thereby improving technical survival. In diabetic patients, icodextrin can reduce glucose intake; however, there are also risks of allergies and toxic accumulation of maltose. Therefore, new PD solutions suitable for diabetic patients require continuous research.

Glucose metabolism in diabetic ESKD patients receiving HD: A retrospective study in Nanjing, China, included 46 ESKD patients undergoing HD and found that these patients had greater blood sugar fluctuations than non-diabetic patients[26]. Furthermore, a study from China's People's Liberation Army General Hospital indicated that elderly diabetic ESKD patients receiving HD had higher blood sugar fluctuations on dialysis days than on non-dialysis days and experienced more frequent hypoglycemia[27]. Diabetic HD patients are primarily at risk for HD-related hypoglycemia. Using glucose-containing dialysate in these patients can reduce blood sugar fluctuations; however, HD-related hypoglycemia may still occur[28-30].

Comparison of blood glucose fluctuations between diabetic ESKD patients undergoing HD and PD: A retrospective study in Nanjing, China, compared glucose metabolism in 64 ESKD patients with T2D undergoing PD and HD. The study revealed that blood glucose fluctuations in diabetic patients undergoing HD were greater than in those undergoing PD. PD requires a larger dose of insulin than HD for the same blood glucose level[31], likely because PD patients consume excessive glucose from peritoneal dialysate and require more insulin. Furthermore, patients receiving HD develop insulin resistance and hyperglycemia because of insulin accumulation before dialysis and are prone to increased insulin sensitivity and prolonged exogenous insulin half-life after dialysis. Moreover, HD is associated with hypoglycemia, causing significant blood sugar fluctuation in patients. For patients with poor blood glucose control, PD is recommended as the initial dialysis method. Applying icodextrin PD solution can stabilize blood glucose, but attention must be paid to insulin dosage. Few articles address the impact of HD or PD on glucose metabolism in diabetic ESKD patients, and further confirmation requires RCTs or prospective studies.

Infectious complications

Diabetic patients have reduced immunity and are prone to infection[32]. Furthermore, infections are an important cause of increased mortality in diabetic dialysis patients.

Table 1 Summary of peritoneal dialysis and hemodialysis survival-related research information

| Year of publication | Ref. | Literature source | Area | Research methods | Sample size | Follow-up time | Conclusion |
|---------------------|---------------------------------|--|---------------|----------------------------|-------------|-------------------------|---|
| 2007 | Couchoud <i>et al</i> [9] | <i>Nephrology Dialysis Transplantation</i> | France | Register for research | 3512 | 2002-2005 | Within 2 years, patients undergoing PD and HD had similar death outcomes |
| 2010 | Weinhand <i>et al</i> [16] | <i>J Am Soc Nephrol</i> | United States | Propensity matching study | 12674 | 2003-2008 | The overall intention-to-treat risk of mortality after dialysis initiation was 8% lower in the PD group than in matched HD patients |
| 2012 | Yeates <i>et al</i> [18] | <i>Nephrology Dialysis Transplantation</i> | Canada | Register for research | 46839 | 1991-2007 | Among patients with diabetes, the mortality rate of PD patients is higher than that of HD patients |
| 2015 | Waldum-Grevbo <i>et al</i> [13] | <i>BMC Nephrology</i> | Norway | Propensity matching study | 1364 | 2005-2012 | Five-year all-cause or cardiovascular mortality in PD as an initial dialysis modality is similar to HD |
| 2015 | Wang <i>et al</i> [19] | <i>International Urology and Nephrology</i> | Taiwan, China | Retrospective cohort study | 1950 | 2000-2010 | Among ESKD patients with a history of stroke, mortality in patients with diabetic PD is higher than that in patients with diabetic HD |
| 2016 | Lee <i>et al</i> [15] | <i>Medicine</i> | Korea | Prospective cohort study | 902 | 2008. 8-2013. 12 | Among diabetic dialysis patients, the overall survival rate of PD patients is significantly higher than that of HD patients |
| 2017 | Kim <i>et al</i> [21] | <i>The Korean Journal of Internal Medicine</i> | Korea | Register for research | 32280 | 2005. 1. 1-2008. 12. 31 | PD mortality rate is higher than HD in diabetic ESKD patients |
| 2018 | Wang <i>et al</i> [20] | <i>European Journal of Internal Medicine</i> | Taiwan, China | Retrospective cohort study | 53103 | 2005. 1. 1-2011. 12. 31 | Icodextrin mitigates the survival disadvantage of PD relative to HD in patients with diabetes |
| 2021 | Liu <i>et al</i> [10] | <i>International Urology and Nephrology</i> | China | Propensity matching study | 268 | 2012. 1-2017. 12 | In patients with type 2 diabetes, mortality rates are similar between PD and HD |
| 2023 | Xu <i>et al</i> [11] | <i>Ther Apher Dial</i> | China | Retrospective cohort study | 281 | 2012. 1-2019. 12 | Survival rates are similar in patients with diabetes and end-stage kidney disease treated with HD and PD |

ESKD: End-stage kidney disease; HD: Hemodialysis; PD: Peritoneal dialysis.

Infection status of diabetic ESKD patients receiving PD: The main complications of PD infection include peritonitis, catheter outlet, and subcutaneous tunnel infection. Of these, peritonitis is the most common complication in patients undergoing PD. Furthermore, diabetes is an independent risk factor for death in peritonitis patients[33,34], which might be because diabetic patients are prone to multiple infections due to accelerated peritoneal fibrosis and persistent high blood sugar[32,35]. Some studies have found that diabetes does not increase the incidence of peritonitis ($P < 0.01$)[36]. However, the impact of diabetes on the incidence of catheter-related infections remains controversial, requiring further research[37,38]. Lee *et al*[39] conducted a retrospective study and indicated that diabetic ESKD patients who underwent stepped-up PD had shorter hospital stays and lower incidence of peritonitis than full-dose PD, which might be linked with fewer exchanges and less glucose exposure in the incremental PD group[40,41]. There are few studies on the application of incremental PD in diabetic patients, and more prospective studies are needed for confirmation.

Infection status of diabetic ESKD patients receiving HD: A study from Singapore on HD patients between January 1, 2010, and December 31, 2012, revealed that the incidence of catheter-related bloodstream infection and exit site infection was 0.75/1000 and 0.50/1000 catheter days, respectively[42]. Furthermore, the infection rate associated with HD performed with tunnel catheter is 17.6 times higher than that performed with arteriovenous fistula. The most common pathogenic bacteria is *Staphylococcus aureus*[43,44]. The 2022 USRDS data indicated that home HD patients have relatively stable hospitalization rates for sepsis[45]. Overall, the risk of death from catheter-related infections is increased in HD.

Comparison of infection complications between diabetic ESKD patients undergoing HD and PD: In addition to the risk of vascular access infection, patients undergoing HD are more susceptible to infection than those undergoing PD. A Danish study on 9997 ESKD patients revealed that HD has a higher incidence of bacteremia than PD. Diabetes is a risk factor for ESKD bacteremia[46]. However, some studies have found no significant difference in infection-related mortality between HD and PD (HR: 1.341, 95%CI: 0.453-3.969)[47]. Additionally, PD and HD patients had similar overall infection rates but different types of infection and risk over time. HD patients have a particularly high risk of bacteremia in the first 90 days, whereas the PD cohort shows no significant difference in peritonitis risk over time[48].

Patients with ESKD and comorbid diabetes may benefit from PD due to its advantages in preventing and managing infectious complications. Implementing an incremental PD approach could lower the incidence of infections and hospitalizations. Individualizing the selection of dialysis modality based on the patient's clinical circumstances is crucial to optimize treatment safety and efficacy. Current studies in this field are limited and warrant high-quality clinical research.

Cardiovascular events

The ESKD complicated by renal anemia is characterized by increased cardiac output, elevated extracellular fluid increasing cardiac preload, and secondary hyperparathyroidism, which can also result in left ventricular dysfunction, metabolic acidosis, and electrolyte disorders (such as hyperemia and potassium imbalance), can cause abnormalities in cardiac conduction and contractility[49]. All these factors keep the heart in a high-load state, causing ventricular dilation, hypertrophy, decreased myocardial contractility, and heart failure[50]. It has already been reported that CVD is the leading cause of death in diabetic patients on dialysis[51].

Morbidity and mortality of cardiovascular events in patients with ESKD: The literature suggests that ESKD patients have a higher cardiovascular morbidity rate. Korean National Health Insurance Service data from 2004 to 2007 have indicated the incidence rate of cardiovascular events in patients undergoing PD (37.3/1000 person-years) and HD (33.1/1000 person-years)[52]. A 2022 study from Singapore included 5,309 patients (4449 HD and 860 PD) and found that nearly one-third of the patients died from cardiovascular events[53]. In ESKD patients, regardless of PD or HD, more than half of the deaths from known causes are related to CVD (including stroke, acute myocardial infarction, arteriosclerotic heart disease, congestive heart failure (CHF), cardiovascular accident, and cardiac arrest)[45]. Furthermore, CVD is also a leading cause of death in diabetic ESKD patients[51].

Comparison of cardiovascular events between diabetic ESKD patients undergoing HD and PD: Non-diabetic patients receiving PD generally have more stable hemodynamics and a lower incidence of cardiovascular events than those undergoing HD[54,55]. In contrast, diabetic patients undergoing PD have a higher mortality rate from cardiovascular events than those on HD[47]. A Taiwan research group conducted a retrospective study using the propensity matching score method on 6516 patients in the HD and PD groups. The study found no significant difference in the overall risk of new major ischemic cardiac events in patients undergoing HD and PD. Moreover, patients undergoing HD have an increased risk of new-onset CHF than PD during the first year of treatment[54]. This might be because extracorporeal blood filtration during HD alters the hemodynamics, which increases the risk of cardiovascular complications. Diabetic patients have vascular calcification and are more susceptible to bleeding risks[55]. A prospective cohort study on 1347 (258 PD and 1089 HD) patients revealed that CVD-related mortality in diabetic patients receiving PD was significantly higher than those receiving HD (HD *vs* PD: HR: 0.37)[47], consistent with the research of Hu *et al*[56]. Studies indicate that HD is more effective in mitigating cardiovascular complications and reducing mortality rates in individuals with ESKD and comorbid diabetes. For patients with high-risk factors for cardiovascular events, HD may be the optimal dialysis modality for those with ESKD and diabetes.

RRF

Generally, RRF is measured by 24-hour urea and creatinine clearance; however, serum cystatin C can also be used to predict RRF[57]. Maintaining RRF is important and difficult for ESKD patients. Whether using PD or HD, RRF is closely related to patient survival[58,59]. PD has been observed to have a better protective effect on RRF than HD. Furthermore, with the improvements in the PD model and peritoneal dialysate, the protective effect of PD on RRF has become more prominent[57,60]. A retrospective study by Lee *et al*[39] found that incremental PD better protects the RRF of diabetic ESKD patients, allowing more free time for activities. This may be due to a lower glucose load and ultrafiltration, which reduces RRF loss[61]. Moreover, Htay *et al*[62] also indicated that using biocompatible PD fluid and less glucose exposure can better preserve the patient's RRF. The biocompatible PD fluid can reduce exposure to glucose degradation products, thereby reducing renal tubular epithelial cell apoptosis[63]. Diabetes is a risk factor for increased RRF loss. Compared to patients undergoing PD, those receiving HD experience more rapid RRF loss, possibly due to hemodynamic instability [64-67]. Current research indicates that PD has clear advantages in maintaining RRF in diabetic patients. This is mainly due to its hemodynamic stability and the use of biocompatible dialysate, which helps slow the loss of RRF. Therefore, PD is more suitable for these patients.

Quality of life

People with ESKD often experience anxiety, depression, and reduced quality of life[68,69]. The impact of dialysis treatment on lifestyle, disease burden, and quality of life is very important to patients and their families. The HD and PD methods have different effects on patient's quality of life, kidney disease burden, and depression in different countries [69].

Quality of life of diabetic ESKD patients undergoing PD: The PD treatment makes it easier for patients to work and socialize more often because they can stay at home. The application of automated PD (APD) brings more convenience to patients' lives. Sun *et al*[70] found that the patients undergoing APD had a higher quality of life than those receiving traditional PD, primarily because APD patients continued the treatment at night, allowing them to work and live normally during the day. The quality-of-life benefits of APD are widely recognized.

Quality of life of diabetic ESKD patients undergoing HD: Diabetic ESKD patients undergoing HD often suffer from protein-energy malnutrition and muscle atrophy, reducing their quality of life[71]. Furthermore, Dembowska *et al*[72] identified that HD patients have an elevated risk of developing oral mycosis, osteoporosis, rheumatoid arthritis, coronary

heart disease, *etc.*, which seriously affects their quality of life. Moreover, elderly HD patients are at higher risk of developing depression[73].

Comparison of quality of life between diabetic ESKD patients undergoing HD and PD: Studies have generally found that patients undergoing PD have a better quality of life than those undergoing HD. For instance, Mathew *et al*[74] showed that compared with HD, patients with PD had better work lives due to their flexible treatment time[75,76]. Moreover, there are fewer restrictions on diet and activities, which significantly reduces patient anxiety, allowing a better standard of life[77,78], consistent with multiple studies[79-81]. However, some research indicates that HD has advantages in physical function and sleep quality[82,83]. Additionally, the literature also reports that for elderly patients, the quality of life is similar for both PD and HD[84,85]. Current research generally indicates that patients undergoing PD have a better quality of life than those undergoing HD. However, investigations on the quality of life of diabetic patients are limited and require more evidence. PD is often preferred for diabetic ESKD patients due to its adaptability and convenience, allowing treatment at home while maintaining normal daily activities. The use of APD can further improve overall quality of life. For elderly patients, the effects of PD and HD are comparable. Therefore, PD is generally considered the more advisable treatment option.

Economic benefits

The ESKD imposes a huge burden on the country in terms of public health expenditure and medical costs[86]. PD is generally considered to have better economic benefits than HD. A retrospective study on 100 patients in the United States found that the hospitalization rate and total cost of treatment for patients undergoing PD were significantly lower than that of HD[87]. A study in Taiwan and China also confirmed that the total cost of PD treatment is lower than that of HD, and the opportunity cost savings are more obvious, especially for patients with fixed jobs[88]. Furthermore, Shukri *et al* [89] also reached a similar conclusion. Moreover, in a study in Hong Kong, China, the lifetime treatment cost of PD and HD was US\$ 76915 (7.13 quality-adjusted life years) and US\$ 142389 (6.58 QALYs), respectively. Therefore, PD is more cost-effective than HD, supporting the existing PD priority policy[90]. Overall, PD can reduce patients' economic burden, meet basic needs, and achieve better socio-economic benefits for both developed and developing countries[91].

Malnutrition

Malnutrition is a major complication in ESKD patients due to low nutritional intake, increased catabolism, and elevated protein loss caused by dialysis. Malnutrition significantly affects dialysis patients' quality of life and increases mortality [92]. Malnutrition is assessed using indicators such as serum albumin, subjective global assessment score, elderly nutritional risk index, and protein energy consumption[93,94]. Lowrie *et al*[95] reported that low albumin levels are closely related to death and that malnutrition is a significant factor in patient mortality, consistent with findings by Wu *et al*[96].

Nutritional status of diabetic ESKD patients undergoing PD: PD treatment can result in excessive protein loss through the peritoneum, reduced appetite from continuous glucose absorption, and a feeling of abdominal fullness due to excessive PD fluid, all contributing to malnutrition. A study by Prasad *et al*[97] found that most PD patients had protein and energy intakes lower than NKF-K/DOQI recommendations, with many already malnourished at the beginning of PD. Additionally, PD patients with comorbidities have lower nutritional intake[98]. Therefore, these patients face significant challenges related to malnutrition.

Nutritional status of diabetic ESKD patients undergoing HD: Malnutrition in diabetic HD patients is associated with infection, elevated blood sugar, increased muscle breakdown, gastroparesis, diarrhea, and inadequate dialysis. Silva *et al* [99] indicated that diabetic patients undergoing HD are at increased risk of malnutrition, which might be linked with insufficient nutritional intake, consistent with many studies[100,101]. Furthermore, HD treatment causes chronic inflammation, low nutrient intake, and increased catabolism, which decreases muscle and fat mass[102,103]. This may also be affected by factors such as anorexia[104], energy metabolism disorder, metabolic acidosis, *etc.* Therefore, regular nutritional monitoring of patients is essential.

Comparison of nutritional status between diabetic ESKD patients undergoing HD and PD: Many researchers currently believe that PD poses a higher risk of malnutrition than HD. Xu *et al*[105], in their retrospective study, revealed that the PD group had lower total protein and albumin levels than the HD group, possibly due to protein loss with the dialysate. A multicenter study of 487 patients found that those under 65 years old undergoing PD were more likely to be malnourished than those undergoing HD, while in those over 75 years old, HD increased the risk of malnourishment compared to PD[106]. Improving the nutritional status of ESKD patients is crucial for better patient prognosis. Studies suggest that PD poses a higher risk of malnutrition, particularly in younger patients. In contrast, HD may increase the risk of malnutrition in older patients. Individualized dialysis regimens should be tailored to the unique nutritional needs of each patient.

Fluid overload

Fluid overload is related to excessive fluid intake by the body and is a common complication in dialysis patients with ESKD. Furthermore, it is an independent risk factor for CVD and death in ESKD patients[107]. The patients' body volume load is primarily assessed *via* multifrequency electrical impedance analysis (BIA). Moreover, it has been inferred that PD is more prone to fluid overload than HD. According to a Chinese single-center cross-sectional study on 307 continuous ambulatory peritoneal dialysis patients, the incidence of fluid overload was 66.8[108]. Zoccali *et al*[109] also suggested

Table 2 Comparative summary of studies on peritoneal dialysis and hemodialysis in end-stage kidney disease patients with diabetes

| Project | Randomized controlled study | Array research | |
|-----------------------------|-----------------------------|-----------------|---------------|
| | | Forward-looking | Retrospective |
| Survival rate | × | √ | √ |
| Glucose metabolism disorder | × | × | √ |
| Infectious complications | × | × | × |
| Cardiovascular events | × | √ | √ |
| Residual renal function | × | × | √ |
| Quality of life | × | √ | √ |
| Economic benefits | × | × | √ |
| Malnutrition | × | × | √ |
| Fluid overload | × | × | × |

that over 50% of HD patients experience fluid overload. ESKD patients undergoing PD are more likely to experience fluid overload than those on HD, and it is not easy to detect, possibly due to increased dialysate intakes[110]. Eldehni *et al*[8] have also discovered that individuals with diabetes face an increased risk of fluid overload during PD treatment. This could be linked to the absorption of glucose, loss of protein, and malnutrition. Fluid overload is a common complication of PD and HD, requiring strict water and salt intake restrictions. HD may be a more favorable choice for diabetic ESKD patients to better control volume overload and reduce related complications. Strict management of fluid and salt intake is critical for patients undergoing both HD and PD.

CONCLUSION

In summary, diabetic ESKD patients face complex conditions and numerous complications. HD and PD each have advantages and disadvantages, making the selection of the first-choice dialysis method challenging. Dialysis methods should be selected based on the patient’s condition, family economic status, peritoneal status, vascular access conditions, and regional medical insurance policies to achieve better survival rates and quality of life. A just and ethical approach to decision-making prioritizes patient autonomy and shared decision-making, ensuring each patient’s individual needs are carefully considered. Furthermore, the survival rates of diabetic ESKD patients under different dialysis methods remain debated. Table 2 summarizes studies comparing diabetic ESKD patients undergoing PD and HD. There is currently a lack of prospective clinical research on glucose metabolism, infectious complications, RRF, malnutrition, and fluid overload. Therefore, further research on these factors is warranted. Future research should implement a weighted scoring system, allocating weights to critical aspects of dialysis options for diabetic patients based on clinical evidence and their impacts. Dialysis methods will then be evaluated and scored based on empirical data, with the highest-scoring method being prioritized for recommendation. This approach aims to facilitate personalized treatment plans, enhancing patients’ quality of life and survival rates.

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FOOTNOTES

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