Exploring challenges and considerations while providing hemodialysis to pediatric, elderly, and pregnant cases: A narrative review of globally published literature

Megha Nagaraj Nayak, Veena Natti Krishna *

Department of Renal Replacement Therapy & Dialysis Technology, Manipal College of Health Professions, Manipal Academy of Higher Education, Manipal, 576104, Karnataka, India

ABSTRACT

Background: Hemodialysis patients have unique physiological characteristics that necessitate specialized care during the treatment. As the prevalence of kidney disease continues to rise, the importance of addressing the unique needs of these patient populations in hemodialysis cannot be overstated. This paper aims to explore the distinct considerations and challenges involved in providing hemodialysis in pediatric, elderly, and pregnant cases.

Methods: The narrative search was conducted in the online database of Google Scholar, and Pub Med and the inclusion period for eligible studies spanned from 2012 to 2022. The final extraction of data focused specifically on the topic of “Challenges and considerations when providing hemodialysis to elderly patients, pregnant women, and children”. The gathered data was narratively summarized into themes derived by authors.

Results: Hemodialysis treatment poses distinct challenges for pediatric, elderly, and pregnant cases, requiring specialized attention. In the case of pediatric patients, ensuring proper vascular access was a major challenge, while elderly cases on hemodialysis had issues related to cardiovascular health and frailty. Pregnant women face the delicate balance of providing adequate dialysis to manage uremic symptoms while safeguarding the well-being of the mother and the developing foetus.

Conclusion: Tailoring treatment plans to account for unique physiological, psychosocial, and medical considerations is essential to achieve optimal outcomes when providing hemodialysis to pediatric, elderly, and pregnant cases. The literature review underscores the importance of evidence-based practice, ongoing research, and the collaboration of healthcare providers from various disciplines.

1. Introduction

Hemodialysis is a life-sustaining extracorporeal blood purification therapy that aims to achieve partial function for the normal kidneys in an artificial manner by using an artificial kidney and machine. It removes nitrogenous waste products and excess fluids from the blood when the kidneys are unable to perform these vital functions. While hemodialysis is a critical therapy for individuals with end-stage kidney disease (ESKD), the approach to delivering the treatment must be tailored to the unique needs and challenges presented by specific patient populations.

Pediatric patients with kidney failure constitute a distinct population that requires specialized care. Evidence from the US Renal Data System showed that glomerular disease, congenital kidney and urinary tract abnormalities, cystic and secondary glomerular disorders were the most common categories for pediatric patients with End Stage Kidney Disease (ESKD). Roughly three-quarters of all pediatric hemodialysis patients are from North America, Europe, or Japan. Only 60 % of children received one or more dialysis sessions, and only 35 % continued on dialysis for at least three months, according to a thorough narrative review of publications on the availability, effectiveness, and results of dialysis treatment for patients with ESKD. Children have distinct physiological and developmental differences from adults that necessitate a customized approach during hemodialysis treatment.
Establishing and maintaining Arterio-Venous Fistula (AVF) construction for vascular access is often challenging in pediatric cases due to their smaller blood vessels. Central venous Catheter-based access is an alternative, but it has many complications as compared to AVF. Managing fluid and electrolyte balance in pediatric patients is another challenge that is complicated by their dynamic growth and development. Additionally, complications like hypotension, muscle cramps, and Dialysis Disequilibrium Syndrome (DDS) during hemodialysis procedures are more common compared to adults. Thus, close and continuous monitoring by experienced dialysis staff is important during dialysis to avoid intradialytic complications in pediatric cases.

The elderly population represents a growing segment of patients who require hemodialysis, and they face unique challenges stemming from age-related physiological changes and comorbidities. Maintaining hemodynamic stability in hemodialysis patients is another challenge that requires a comprehensive and individualized approach, considering the their overall health, comorbidities, and the specific parameters. The world’s population is progressively ageing, and it is currently estimated that there are approximately 420 million individuals aged 65 years or over. Aging directly affects the prevalence of chronic diseases, including cancer, diabetes, cognitive impairments, and chronic kidney disease. According to the National Health and Nutrition Survey, the prevalence of Chronic Kidney Disease (CKD) was 46.8 % in older people as compared with 6.71 % in those between 40 and 59 years of age. Elderly individuals often have underlying cardiovascular conditions, such as hypertension and atherosclerosis. Hemodialysis can exacerbate these issues by causing hemodynamic instability. Close monitoring and careful fluid management are essential to mitigate these cardiovascular risks. Frailty and cognitive impairment are other challenges that are common in the elderly, affecting their ability to adhere to treatment regimens and communicate their needs. Polypharmacy is prevalent among elderly patients due to multiple co morbidities. Hemodialysis can affect drug clearance, requiring adjustments in medication dosages and schedules to prevent toxicity or therapeutic failure. Elderly patients may have unique nutritional requirements due to muscle wasting, malnutrition, or specific dietary restrictions. Dieticians should collaborate with the healthcare team to ensure that nutritional goals are met and that patients maintain optimal muscle mass.

The prevalence of CKD in the general population has increased in recent years, and now it has been calculated that 3–4 % of women of childbearing age are affected by CKD. Pregnant women with ESKD present a complex clinical scenario that demands careful management to safeguard both the mother and the foetus. The choice of dialysis modality during pregnancy is a critical decision. Hemodialysis is preferred over peritoneal dialysis due to its better clearance of waste products, although the frequency and duration of sessions may need adjustment. Regular foetal monitoring, including ultrasound scans and foetal heart rate assessments, is essential to detect any foetal complications early. Close collaboration between nephrologists and obstetricians is necessary for optimal care.

Patients undergoing hemodialysis have distinct physiological traits that call for particular attention during treatment. It is crucial to address the specific demands of various patient populations during hemodialysis because the prevalence of kidney disease is still on the rise. The purpose of this review is to examine the unique issues and difficulties associated with hemodialysis care for three special patient populations: pediatric patients, elderly people, and pregnant women. This work will contribute to the development, improvement of policies and procedures for the safe and efficient administration of hemodialysis to these patients’ subgroups.

2. Approach and methodology

2.1. Methodology

This narrative review aimed to assess the existing body of evidence concerning considerations and challenges involved in providing hemodialysis treatment to pediatric patients, elderly individuals, and pregnant women, following the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). A comprehensive narrative search was performed to identify published literatures across the globe related to challenges and considerations when providing hemodialysis to elderly patients, pregnant women, and children. Any study which was published in a peer reviewed journal related to the “Challenges and considerations when providing hemodialysis to elderly patients, pregnant women and children” was included in this review. Articles were excluded if they did not discuss about challenges and considerations, published in predatory journals and in languages other than English.

2.2. Criteria for eligibility

The narrative search was conducted in online database of Google Scholar and Pub Med. The inclusion period for eligible studies spanned from 2012 to 2022. The search strategy employed by the authors involved the utilization of controlled vocabularies specific to each database, as well as relevant free text terms. Details of the search strategy is presented Table 1. Two authors (MNN and VNK) independently assessed the titles, abstracts, and full texts of potentially relevant articles. In case of disagreements between the two authors, a discussion was conducted to reach a consensus. Additionally, we examined the reference lists of retrieved articles for any additional studies suitable for inclusion. The final extraction of data focused specifically on the topic of “Challenges and considerations when providing hemodialysis to pediatric, elderly, and pregnant cases”.

2.4. Data extraction

Data extraction from the selected studies was conducted independently by MNN and VNK, who recorded the information in a Microsoft Excel sheet. The extracted data were subsequently cross-checked by the authors to ensure accuracy. The collected information for each eligible study was used to narrate the review paper.

2.5. Summary

A total of 14,800 articles were found through online database search. After removing duplicates 1180 articles were processed for title and abstract screening based on inclusion and exclusion criteria. After careful examination, 1118 articles that didn’t fit our requirements for selection were eliminated. We next read all 62 of the remaining publications in their entirety, 47 of which were eliminated because their features and study objectives did not align with this review. Ultimately, we discovered fifteen full-text publications that satisfied every requirement for this narrative evaluation. The summary of physiological and psychological considerations among special cases on hemodialysis is presented in Table 2.

2.5.1. Challenges and considerations for children on hemodialysis

2.5.1.1. Vascular access. Given the low survival rate of kidney allografts, children with ESKD are likely to experience multiple prolonged hemodialysis sessions throughout the course of their lifespan. Thus, when planning for any vascular access in pediatric hemodialysis patients, a thoughtful, long-term approach is required. Young children’s forearm vessels are too tiny to be utilized for it, hence it is preferable to use the veins in the upper arm. Children’s growth poses an ongoing challenge as the AVF must accommodate physiological changes,
necessitating regular monitoring and potential interventions to address size discrepancies. Close monitoring and early detection of any issues become paramount in the care of pediatric patients undergoing this vascular procedure.23

2.5.1.2. Cardiovascular disease. Thirty percent of all deaths in children receiving dialysis are due to cardiovascular disease, which is the most common cause of mortality. Chronic fluid overload and Chronic Kidney Disease-Mineral Bone Disorder (CKD-MBD) are significant risk factors that can result in vascular calcification, increasing artery stiffness, left ventricular failure, and unexpected mortality.16,18 Hemodynamic instability during dialysis sessions, characterized by rapid fluid shifts and fluctuations in electrolyte levels, poses a risk for cardiovascular stress. Also, exposure to extracorporeal circulation during hemodialysis can trigger inflammatory responses, potentially impacting vascular function and cardiac health.17 Hypertension is prevalent in patients with chronic kidney disease and increases in children on dialysis. Physicians should be considerate regarding the cardiovascular health of the child while planning hemodialysis.15,18

2.5.1.3. Disruption to daily life. Children receiving hemodialysis face a significant disruption to their daily routines. Hemodialysis sessions can be lengthy, often several hours multiple times a week, making it challenging for them to attend school regularly, participate in extracurricular activities, or maintain social connection with peers.19 This disruption can lead to feelings of isolation and a sense of missing out on normal childhood experiences. Additionally, managing their health condition in a school setting may require special accommodations and support, which can be burdensome.15,16,17

2.5.1.4. Psychosocial outcomes. Hemodialysis can be physically demanding for children. The process can cause fatigue, low blood pressure and nausea. Moreover, the constant medical interventions and the sight of blood during dialysis sessions can be emotionally distressing for young patients, causing anxiety and fear.18 Adherence to food limitations may also give rise to emotions of deprivation and anger. A child’s mental and emotional health may suffer when they have hemodialysis.16 Social interactions might also be impacted because they could feel different from their classmates and find it difficult to communicate their condition to others, which could result in bullying or stigma.16-18

2.5.2. Challenges and considerations of elderly patients on hemodialysis

2.5.2.1. Negative perceptions and preconceived biases held by healthcare professionals. The negative perceptions and preconceived biases held by healthcare professionals regarding older adults receiving hemodialysis represent a significant obstacle in providing equitable and high-quality care to elderly patients.19 In the healthcare industry, ageism is a widespread problem that can affect older persons, especially those receiving hemodialysis. It has been evidenced that healthcare providers may undertreat or provide lower-quality care for elderly patients if they believe they are less likely to benefit from vigorous therapy.20 Additionally, there is a misconception that older people receiving hemodialysis have a lower quality of life, which makes it simple for medical practitioners to downplay the significance of providing them with care or treatment alternatives.21 The world’s population is getting older; by 2050, nearly 1.5 billion people will be 65 years of age or older, and in the years to come, the frequency of end-stage kidney disease in the elderly will continue to be high. This problem costs healthcare systems a lot of money because older patients often have many comorbidities. A customized therapeutic approach is frequently necessary for people with severe comorbidities, short life expectancy, or poor treatment compliance, even though the present guidelines may be helpful for older people with fewer comorbidities and no major disability. In these patients, doctors should treat comorbidity-related symptoms and common geriatric syndromes like cognitive impairment, depression, incontinence, falls, and polypharmacy in an effort to improve quality of life rather than aggressively pursuing different therapeutic targets. The decision to begin dialysis should be based on the patient’s beliefs and preferences as well as medical considerations.22,23

2.5.2.2. Dependability on caregivers. Caregiving for older adults on hemodialysis often involves assisting with daily activities, such as transportation to the dialysis center, medication management, and providing emotional support. These tasks can be physically exhausting. Caregivers frequently report a sense of isolation as they devote a substantial amount of time to caregiving, leaving less time for their own social lives and self-care.22 This affects the patients with negativity that they are not able to self-care and are dependent on someone else. They often go unnoticed and underappreciated, leading to feelings of invisibility and frustration.23

For many of these patients, a major issue is a lack of regular planning and a sense of control over their lives. These patients have irregularities in their lives due to changes in their dialysis schedule; they feel as though they are always on call and have lost control over their lives; this, together with their lack of planning, has resulted in a decrease in their energy levels, a lower equality of life, and a shorter life expectancy.8,16

2.5.2.3. Geriatric challenges. Multifactor constellations of signs, symptoms, and events involving several organ systems that increase the risk of morbidity and death are known as geriatric syndromes. Frailty, falls, and functional disability are a few examples. Elderly people with

Table 1
Words that were used in combination for narrative search.

|-------------------------------|-----|----------------------------|-----|-----------------------------------------------------|-------------------------|-----------------|----------------------------------------|-------------|

Table 2
Summary of physiological and psychological considerations among special cases on hemodialysis.

<table>
<thead>
<tr>
<th>Treatment Adjustments</th>
<th>Paediatric</th>
<th>Elderly</th>
<th>Pregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Fluid and electrolyte imbalances can occur</td>
<td>- Smaller vascular access may be challenging.</td>
<td>- Vascular access issues due to aging vessels</td>
<td>- Consideration of foetal well-being during dialysis</td>
</tr>
<tr>
<td>- Age-appropriate communication is crucial.</td>
<td>- Emotional and psychological aspects of aging</td>
<td>- Consideration of cognitive function and dementia</td>
<td>- Emotional support for the pregnant patient and family</td>
</tr>
<tr>
<td>- Dialysate composition adjustments</td>
<td>- Impact on family dynamics and lifestyle</td>
<td>- Adjustments for comorbidities and medications</td>
<td>- Integration of dialysis into pregnancy care plan</td>
</tr>
<tr>
<td>- Close monitoring of fluid removal</td>
<td>- Consideration of growth and development</td>
<td>- Close monitoring of fluid removal</td>
<td>- Dialysis frequency and duration adjustments</td>
</tr>
<tr>
<td>- Close monitoring of fluid removal</td>
<td></td>
<td></td>
<td>- Monitoring for oedema and weight gain</td>
</tr>
</tbody>
</table>
advanced CKD and ESKD may experience worsening of these problems due to the presence of uremia and cognitive impairment. A phenotype linked to a higher chance of incapacity and hospitalization is called frailty. Reduced capacity to carry out instrumental or daily life activities is known as functional impairment. Research from Canada indicates that inpatient rehabilitation helped functionally impaired hemodialysis patients become more independent and perform better. It’s unknown if cognitive decline and renal failure are related. Dialysis had little impact on cognition, according to a single-centre trial of hemodialysis patients.  

2.5.2.4. Mental health disturbances. A typical ESKD patient takes approximately twelve different medications on a regular basis. High pill burden increases the risk of side effects and drug interactions and decreases compliance. Thus, Polypharmacy places frail elderly patients at high risk for medication related problems that have significant adverse impacts on morbidity, mortality, and healthcare costs. Some patients are frightened of conditions in the dialysis ward and picture events ahead. Fearing death, dialysis equipment and the future were among the stressful and frightening issues for patients. Cognitive impairment and depression are the most common mental disturbances in elderly ESKD patients and represent a risk factor for further functional decline by increasing the burden of comorbidities. Depression, unlike cognitive impairment can improve with appropriate treatment. However, the diagnosis of depression is often difficult in the elderly because of significant heterogeneity in underlying causes and clinical presentation. Evidence also suggests that lack of information regarding the diseases and its treatment also leads to fear and stress for the elderly undergoing hemodialysis.  

2.5.5. Obscure future  
Many elderly people undergoing hemodialysis are not sure about their future. Because of their incapacity, increased mortality, and co-morbidity of their diseases, the elderly receiving hemodialysis thought their future was uncertain. Patients’ descriptions of their treatment regimens and their ignorance of recuperation or other related topics point to an uncertain future. Patients undergoing dialysis often hope for a better future, but uncertainty and uncertainty impede their progress. According to the results of a qualitative study, “Participants did not know whether they were getting better or not.” Sufficient knowledge about the illness and the appropriate course of therapy can transform a patient’s outlook on life from one of negativity to optimism and clear any doubt over the future. This requires greater interaction between patients and the medical team to increase the patient’s awareness. Also, the patient’s awareness about the importance of treatment adherence reduces uncertainty.  

2.5.4. Challenges and considerations of pregnant women on hemodialysis  
2.5.4.1. Nutritional challenges. Pregnant Women who undergo hemodialysis face a unique set of nutritional challenges and considerations due to the demands of the sustaining medical procedure. Nutritional assessment and implementation of a nutritional plan should be performed early after the diagnosis of pregnancy because the first few months are crucial for foetal development. Determining the dietary requirements for water, electrolytes, and macronutrients is the first step. There is a dearth of information on pregnant patients with chronic kidney disease (CKD), and most of the indications used in CKD nutrition treatment and pregnancy nutrition guidelines follow the same as that of healthy women. To make sure that the food plan satisfies the nutritional needs of both the mother and the foetus, consultation with a qualified dietitian and a specialist in maternal-foetal medicine is essential. Pregnant women with renal illnesses still have difficulties, mostly related to the need to balance the demands of the pregnancy with those resulting from renal impairment. Due to the complexity of this condition, as well as the vulnerability of CKD patients and their unique needs a multimodal approach is required. This approach should include social support, adequate nutrition and dialysis prescriptions, and medication management with the goal of improving maternal and foetal health outcomes.  

Maintaining an adequate protein intake is essential for women on hemodialysis. Protein is lost during dialysis, and a low protein diet can cause malnutrition overall and muscular weakness. Women who are pregnant and taking hemodialysis should exercise caution while consuming excessive amounts of fluids since this may result in hypertension, fluid overload, and issues connected to the heart. It’s critical to keep an eye on fluid intake to prevent these problems. Keeping phosphorus levels under control is another major concern for hemodialysis patients. Heart problems and abnormal bones might result from the kidneys’ inability to eliminate too much phosphorous from the blood. Potassium levels can fluctuate in individuals undergoing hemodialysis which can lead to dangerous heart arrhythmias. Women need to be vigilant about their potassium intake and avoid high-potassium foods like bananas, oranges, and potatoes. Maintaining adequate calcium and vitamin D levels is essential for bone health. Emotional and social factors can also influence the nutritional challenges on hemodialysis. Dietary restrictions and the need for strict adherence to a prescribed diet can lead to feelings of frustration, isolation, and stress.  

2.5.4.2. Emotional and psychological struggles. The stress of managing a chronic illness, undergoing hemodialysis multiple times a week, and coping with dietary restrictions can lead to feelings of depression and anxiety. Women who undergo hemodialysis may feel bereft and frustrated by the changes to their lifestyle. Hemodialysis demands might also lead to social distancing. Pregnant women may find it challenging to engage in social activities, go out for meals with friends, or travel without careful planning. This isolation can lead to feelings of loneliness and sadness. Managing the chronic illness and treatment can also strain relationships with family members and partners. Financial challenges can also exacerbate emotional distress among these patients.

Evidence from qualitative studies suggests that women undergoing hemodialysis should be considered with specificities of their life history that allow them to enhance their integral health. More attention should be given to women at the time of diagnosis of pregnancy and initiation of hemodialysis. The assistance and attention provided by the health teams to women with CKD should be improved, and women of reproductive age require more attention and follow-up. These results highlight the importance of the healthcare team addressing the subject of reproductive health with women undergoing hemodialysis because they report their anguish about the possibility of not being able to get pregnant or wanting to know if they will be able to have more children.  

Hypertension is also a common complication in pregnant women with kidney failure. Blood pressure must be tightly controlled to prevent adverse outcomes like preeclampsia and premature birth. Medications used for hypertension control should be chosen with foetal safety in mind. Anaemia is another common complication which may intensify during pregnancy due to increased blood volume and growing demands of the developing foetus. However, achieving this balance is intricate, requiring careful adjustment of erythropoiesis-stimulating agents and iron supplementation.  

3. Limitations of this study  
While the narrative review offers valuable insights, it is essential to acknowledge certain limitations inherent in this review. At first, the heterogeneity of the studies makes it challenging to draw definitive
conclusions and generalize findings to a broader population. Secondly, the review relies on published literature, which may be subject to publication bias. Negative or inconclusive findings may not be as readily available in the literature, potentially leading to an overemphasis on positive or significant results. Finally, while the review highlights the importance of interdisciplinary collaboration in providing hemodialysis to these patient groups, it does not delve deeply into the specific challenges and strategies for effective teamwork among healthcare providers. Additionally, some of the studies might have over presented the challenges and strategies for effective teamwork among healthcare providers.


