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Review Article

An insight to kidney dialysis treatment

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ABSTRACT

The kidneys are a pair of crucial organs that perform multiple functions in maintaining the cleanliness and chemical balance of blood. The two most common causes of kidney damage are high blood pressure and diabetes. The national kidney foundation recommends three simple tests: a blood pressure check, a spot check for protein or albumin in the urine, and calculation of glomerular filtration rate (GFR) based on a serum creatinine measurement. Ridding the blood of waste and extra water is done through the procedure of dialysis. It is basically used in patients with renal failure to create an artificial substitute for the lost kidney function. End-stage renal disease (ESRD) is a condition other referred to as ESRD, referring to complete or almost complete, irreversible kidney failure. If treatment is not received, uremia can cause a coma, seizures, and death. Patients may require dialysis or a kidney transplant if both kidneys fail completely.

Keywords: End stage renal disease, Haemodialysis, Renal function, Treatment

INTRODUCTION

The kidneys are an important excretory organ in mammals and help the body eliminate excess waste products resulting from metabolism. The vast majority of species die a week or less after their complete loss of renal function. Depending upon the amount of functioning tissue remaining after partial loss of renal function, various abnormalities from normal occur. Nitrogenous wastes build up within the blood and are called azotemia. Although neither urea nor creatinine are very toxic in adequate amounts, blood levels of either are utilized as a signal for azotemia. Lethargy, loss of appetite, mucosal ulcers, vomiting, diarrhea, weight loss, anemia, and decreased urine output are just a few of the clinical signs that an animal affected with mild to severe azotemia may display. These signs are called renal failure, uremia, or uremic syndrome and represent the accumulation of abnormalities in a wide range of tissues resulting from subnormal renal functions. The kidneys carry out several functions which can be collectively said to comprise their role in life support. If the body's balance is negative, the kidneys retain water and virtually all other electrolytes,

which they excrete when the balance is positive. The kidneys actively accumulate nutrients like glucose and amino acids while processing the body fluids. As a result, urine contains almost negligible amounts of these molecules. Blood pH is tightly regulated within certain limits; it saves or destroys hydrogen ions. Urea, creatinine, and allantoin are the nitrogen end products that are excreted through urine, maintaining the levels small and steady in the blood. In addition to producing renin, prostaglandins, and erythropoietin, the kidneys perform a very important function: they hydroxylate vitamin D necessary for activation. The kidneys respond to many other hormones, such as adrenaline, parathyroid hormone, aldosterone, and thyroid hormones.¹

TEST OF RENAL FUNCTION

The kidneys are said to filter blood efficiently through a renal function test. A renal function test can give a sign of minor damage and a decline in renal function till it drops below 40%. The estimated GFR (eGFR), is a measurement of the percentage of renal function, which can be calculated typically by examining blood samples. A

disease that progresses may be indicated by a fall in kidney function. Serious medical conditions may be the result of a functioning level of less than 25%. Dialysis or a kidney transplant are often types of renal replacement therapy (RRT) that patients need when their kidney function falls to 10% to 15% to avoid death.

Two major calculations form part of the calculation of kidney function:

Partially filtered

This is a measure of the percentage of plasma that filters through the kidney. The formula:

$$FF = GFR / RPF.$$

FF=filtration fraction, GFR=glomerular filtration rate, RPF=Renal plasma flow. The average filtration fraction in humans is about 20%.

Renal clearance

It is the volume of plasma completely cleared from the blood within a given time. A formula that may be used in determining the renal clearance of a substance

$$(C_x): V/PX = (UX)CX,$$

Cx=substance X clearance (often measured in milliliters per minute); Ux= substance X concentration in urine, Px=substance X plasma concentration. urine flow rate=V. These measurements can, therefore be used in evaluating and monitoring the function of the kidneys in patients.²

KIDNEY FAILURE

Renal insufficiency-more commonly referred to as renal failure or kidney failure-is the decline of function concerning washing fluids, salts, and residues from the blood. Often referred to as a silent disease, symptoms cannot appear until the illness is well advanced. The GFR, which is the volume of fluid filtered into the Bowman capsule per unit of time, becomes one very important indicator for the diagnosing, assessing, and treating of kidney failure. As reported by the Brazilian society of nephrology, SBN, in its census conducted in 2018, the number of patients using chronic dialysis increased a 159.4% between 2002 and 2017.

Acute renal failure was associated with a case fatality rate of close to 50%. For any public health intervention, it is indispensable to identify the disease at an early stage. In this paper, the purpose of this study was to enhance the treatment outcome for patients suffering from renal failure through the formulation of an approach for the early detection of the disease. Toward this end, various machine learning methods were implemented and the accuracy of each was measured.³

TYPES OF KIDNEY FAILURE

Acute kidney failure

Otherwise known as acute renal failure or acute kidney damage, is a type of medical condition characterized by a sudden onset and can sometimes occur in a matter of hours or days. Kidney failure is caused by numerous factors such as direct injury of the kidneys, infection, slowing blood flow into the kidneys, blockages such as kidney stones, and extremely high levels of blood pressure. Although most cases of AKF can be fully treated to achieve complete remission, timely medical intervention is essential given dangerous potential of condition: between 12% and 15% of cases may involve a lifelong requirement for dialysis. Three major types of AKFs can be distinguished-

Chronic kidney injury before renal failure

Prerenal failure is more than the damage caused to the nephron. It is mainly due to a decrease in blood flow to the kidneys. Some of the causes of prerenal failure are as follows: Blood loss or gastroenteritis or cardiovascular vasodilation by certain drugs, severe hypovolemic shock, change in the dynamics of hemodynamics or blood flow due to dehydration, decreased output of the heart, anaphylaxis, Addisonian crisis, salt-wasting syndrome, protein-losing enteropathy and in intrarenal redistribution, the kidneys are affected by poor blood flow, and this is generally brought about by vasoconstrictors, anesthesia, stress, or surgery.

Intrinsic acute renal injury

Direct damage to the nephrons is also known as intrinsic renal injury. Such injuries are often the combination of many problems and sometimes a result of another disease. As mentioned above, prerenal can be one cause of ATN. The following are also possible factors: Glomerulonephritis (such as acute post-streptococcal and others), microangiopathic conditions, which include disseminated intravascular coagulation [DIC], thrombotic thrombocytopenic purpura [TTP], and hemolytic uremic syndrome and vasculitis, which includes Wegener's granulomatosis, lupus, and polyarteritis nodosa.

Post-renal intrinsic renal injury

The post-renal injury refers to a problem in the urine flow that tends to damage the nephrons by creating back pressure on the kidney. There are several possible causes for this. Urinary tract posterior valves, urethral strictures, or urethral narrowing, clot-related bladder blockage (hemorrhagic cystitis) and formation of stones in ureters.⁴

Chronic kidney disease

A condition known otherwise as chronic renal disease or chronic renal failure; This is the gradual deterioration of the kidneys over time.

Contributors to the development of CKD are diabetes, hypertension, heart disease, and familial predispositions in some instances. As with the progression of chronic kidney disease, it could be chronic renal disease which requires management and treatment continuously to control related symptoms and slow down the course of the disease. There are three forms of chronic renal disease classified into: Chronic prerenal kidney failure: This is when the kidneys are deprived of blood supply for an extended period. This reduced blood supply over time may cause the kidneys to shrink and stop functioning. Chronic intrinsic kidney failure: This is a result of intrinsic kidney disease where the kidneys get damaged over a long period. Such kidney disease is directly caused to the kidneys through damage such as severe bleeding or oxygen deprivation. Chronic post-renal kidney failure: This is caused by prolonged urinary tract obstruction and inability to urinate. Kidney disease results from pressure building up in the urinary system.

Acute-on-chronic renal failure

This is the phrase used to describe the new onset of acute renal injury or acute renal failure in a background of chronic renal disease. Such an illness potentially poses fatal consequences and may be challenging to differentiate from chronic renal failure. It should be kept in mind that the majority of patients, who present with acute renal injury, already possess some level of chronic impairment of renal function.

ESRD

It is a state with a GFR less than 5% of normal and thus represents nearly a complete loss of function. The tissues of the kidneys might present with signs of atrophy and fibrosis in ESRD. In this stage, dialysis or transplantation of kidneys from a living donor are typical interventions that would sustain life.⁵

NEED FOR DIALYSIS

ESRD is the abbreviation for ESRD; it describes total or almost-total, irreversible failure of the kidneys. In essence, if someone's kidneys entirely fail, excess water and waste products fill their body. We refer to this disease as uremia. The feet and/or hands may swell up. A person will feel weak and tired because healthy blood is essential for one's functioning. If left untreated, uremia can lead to a coma, seizures, and death. If both kidneys completely fail, then the patient might be required to undergo dialysis or a kidney transplant.⁶

KIDNEY TRANSPLANTATION

Living style as normally as possible is often restored as kidney transplantation is still the preferred treatment for end-stage renal failure, but there are inadequate transplantable organs, and up to 60% of dialysis patients are not well enough for surgery or postoperative care. The

main therapeutic aspect of transplantation, is immunosuppressive drugs are given to prevent rejection, except in those rare cases when donors of identical genetic stock are available. Because the immunosuppressive treatments cause a generalized depression of the immune system, their major disadvantage is also non-specificity. As a result, the patient becomes more susceptible to infection and cancer, which remain the leading causes of morbidity and death.⁷

DIALYSIS

Intermittent hemodialysis

Indications

Trends in renal replacement treatment indications have not changed much over the years despite the advances in dialysis technology.⁸ The Current treatment objective is nearly the same as providing supportive biological functions of the kidney, which encompasses its vital function that also includes the elimination of waste material, small solute removal from the blood, extra body volume removal, and finally maintaining proper blood pH. HD also helps in clearing some harmful intakes.⁹ It depends upon the patient for when to initiate dialysis; however, evidence has shown that waiting for an indication to commence dialysis rather than initiating early does not appear to have advantages related to CKD. The adult patients with CKD were randomly assigned to initiate dialysis at an eGFR of 5-7 mL/min/1.73 m² or 10-14 mL/min/1.73 m². This was part of the ideal trial. After randomization, dialysis was started by the delayed-start group roughly six months later than by the early-start group, but the researchers found no difference in death or adverse events between the two groups.¹⁰

Physiologic principles

HD is designed to partially replace the body's very efficient but normally functioning kidney. A dialyzer, consisting of more than 10,000 tiny, semipermeable membrane-filled hollow fibers, removes and treats the patient's blood. Small pores in these fibers allow chemicals to be exchanged between the blood and dialysis fluid chamber, bathing the fibers and allowing the necessary solute and fluid exchange to take place.¹¹

The dialyzer and the dialysate

Rotating pumps are used to pump the blood across the circuit. There are air detectors in the circuit that can clamp the circuit and thus stop the blood flow if they detect any air in the circuit. Sensors of dialysis access pressures are also attached to the circuit. Pumps are available for injecting heparin so that there is no clotting in the access. Currently, dialyzers are seldom prepared with the traditional, more immunogenic substituted cellulose filters. Instead, synthetic biocompatible materials such as polysulfone are used. To increase clearance in the

treatment, most of the dialyzers currently used are thought to have high flux-big pore size, and high-efficiency surface area.¹² Dialyzers come in different sizes and surface areas for interchange. Although the prescription takes into account the patient's body surface area and the duration of treatment, the size of the dialysis membrane chosen tends to vary minimally.¹³ Many purification techniques need to be used on the water when preparing dialysate, of which three are widely utilized: reverse osmosis, de-ionization, and charcoal filtration.¹⁴ If the water purification system fails, patients would be exposed to lead, copper, fluoride, aluminum, and chloramine, which could result in adverse effects either from long-term toxicity due to dementia and osteomalacia or acute hemolysis. Because dialysis membranes function as filters against microorganisms, the dialysate does not have to be sterile to be used for dialysis therapy. If endotoxins are present in the dialysis solution, pyrogenic responses may be experienced.¹⁵ Pre-dialysis concentrations of sodium, bicarbonate, potassium, and calcium are adjusted within the dialysis bath once the water satisfies the requirements for usage in a dialysis treatment. Although the concentrations in the dialysate fluid are adjusted to individual patient's needs, they normally approximate the normal serum values. For instance, for a patient suffering from hyperkalemia of 6 mEq/L, a potassium bath of 1 or 2 mEq/L is selected to achieve a normal post-dialysis serum potassium concentration. Electrolyte choice in dialysate is critical and should be initiated only for patients with notable electrolyte imbalances (for instance, severe hyponatremia or severe hyperkalemia) to avoid rapid correction.¹⁶

Dialysis dose adequacy

The dialysis prescription should include adequate removal of uremic solutes. The conventional manner in which this is assessed is through the kinetics of urea, a "marker" solute. In patients on dialysis, it is measured by Kt/V and the closely related urea reduction ratio (URR).^{17,20} Kt/V is an intangible parameter measured from three components: (1) K, which is urea clearance in mL/min during the treatment; (2) t is the time of the treatment in min; and (3) V, which is the volume of distribution for urea in mL, approximating total body water. The fractional removal of blood urea during a single dialysis session often comes out as URR (URR=1 [postdialysis BUN/predialysis BUN]). The preferred parameter to measure the adequacy of dialysis is Kt/V. Even though numerous parameters vary and influence Kt/V, of which the most important are dialysate flow rate, blood flow rate, and membrane size, the treatment time is the most easily manipulated factor to produce adequate dialysis therapy. The threshold value for Kt/V was established in the HEMO trial.¹⁸ This clinical trial randomly allocated patients to one of two groups: one of a single treatment Kt/V of 1.65, with a greater clearance group, a single treatment Kt/V of 1.2. Hospitalization and overall patient mortality rates did not differ at a mean follow-up of 2.8 years. The existing KDIGO guidelines provide a hint that one session should have an adjunctive Kt/V higher than 1.2 and a URR of more than 65%. Still,

each patient's residual renal function, uremic symptoms, nutritional indicators, and general functional state must be taken into account when deciding whether to provide enough clearance or not.^{17,19}

CONTINUOUS RRT

Peritoneal dialysis

Among the modalities of CRRT, PD stands alone because it can be administered on an outpatient basis in patients with ESRD. Beyond the period when CAV therapy was first discovered in the 1980s, PD remains the only option to manage unstable inpatients who have suffered from acute kidney injury and require some form of CRRT.^{21,22} Continuous venovenous (CVV) therapy is now utilized to treat almost every hemodynamically unstable inpatient in the United States, even when there is a renewed emphasis on the use of urgent-start PD in hospitalized patients. When hospitalized ESRD patients are already receiving this modality, PD is often continued; however, when these patients are very ill and in the ICU, thought should be given to the use of CVV.^{24,23} PD has the following advantages compared to in-center HD: Dialysis is done daily-the patient has more control over their therapy, it is bloodless, Volume shifts are less than thrice weekly HD and may be tolerated better in the setting of severe cardiovascular disease, as well as it is not a blood transfusion.

Meanwhile, a well-focused, motivated patient is needed for effective PD. Pre-existing abdominal surgery or untreated hernias would prevent PD, and some patients are less well suited to this technique because of the biological nature of the peritoneal membrane. The PD catheters are internally coiled within the pelvis after being tunneled from an entry point either below the belt line or in the presternal area. It is, therefore, recommended to delay two to four weeks for the insertion site leaks.²⁵ The same thing goes for the administration of dialysate; in this case, it should be delayed from two to four weeks. In effect, PD exchanges the solute and fluid by using the peritoneum or the parietal part as a biological filter. The three-pore model describes solute exchange as: large pores (100-200 Å) are in charge of movement, small pores (40-60 Å) transport easily dialyzable compounds such as salt and urea, and ultrasmall pores (aquaporin-1) mediate water flux along osmotic gradients. Responsible for inducing macromolecules such as b-2 microglobulin to translocate.²⁶ Each patient has a unique peritoneal biology that defines how long dialysate needs to stay in the peritoneum to ensure effective and successful dialysis. Patients can be categorized as low, low average, high average, or high transporters by a peritoneal equilibration test, or PET. Most patients have APD, where the machine exchanges 1.5-3 L of dialysate every 4-6 hours while the patient is asleep. Changing the delivery route of PD can also be adapted to the patient's needs. Osmosis of water along osmotic gradients formed by the concentration of dextrose in the dialysate leads to ultrafiltration. Patients

usually set the dextrose concentration by color; yellow for 1.5%, green for 2.5%, and red for 4.25%. In addition to this, patients commonly communicate their ultrafiltration goal, which is usually based on their weight. Ultrafiltration can be maintained larger and longer by using 4.25% dextrose, yet prolonged use induces breakdown and sclerosis of the peritoneal membrane. Icodextrin is less frequently used as a substitute for dextrose-based dialysate because it falsely elevates blood glucose in some glucometers.^{28,27} This elevation would persist for two weeks after stopping PD based on icodextrin. Crucially, sufficient solute and fluid clearance mainly rely on residual renal function, that is the production of urine more than 100 mL daily in PD patients and is associated with a lower death rate.^{30,29} When antagonists of the renin-angiotensin-aldosterone pathway are frequently provided they may sometimes delay the onset of loss of residual renal function. Where possible, avoid the use of potentially nephrotoxic drugs such as NSAIDs and iodinated intravenous contrast.^{32,31} PD has several associated complications. The high dextrose concentration of the dialysate (2.5% exchange=2500 mg/dL dextrose) may lead to hyperglycemia, which can worsen or even induce diabetes mellitus. Catheter transient dysfunction is most commonly due to intraluminal fibrin or constipation in the

patient. Abdominal hernias occur at a rate of 0.04-0.08 hernias/patient/year and are more likely in patients consuming bigger dwell volumes or doing ambulatory PD while standing.^{34, 33} Bowel blockage from an internal hernia may occur in patients in whom the PD catheter may have been internally sutured; this requires a high index of suspicion and occasionally laparoscopic assessment for diagnosis. Side effects include peritonitis and exit site infections. PD peritonitis rates should be less than 0.39 per patient-year when undertaken with the best possible approach.³⁵ Investigate for peritonitis as early as possible if you have cloudy effluent and/or abdominal pain. Most cases of peritonitis and exit site infections can be taken out.³⁶ Hydrothorax can occur in 1-2% of people due to dialysate transudation through pleuroperitoneal communications. Under these conditions, the pleural fluid glucose concentration should be effectively similar to that in the dialysate, and technetium-99m scintigraphy may help establish the diagnosis. And of course, patients must not bathe in untreated fresh water or immerse the catheter in a bathtub. Swimming in salt water or a chlorinated pool may be done, but such swimming must be rendered safe by clearance by the PD program, inserted with the catheter, initially. Among the conditions for which a PD catheter is likely to necessitate removal is fungal peritonitis.³⁷

Table 1: Peritoneal modalities.³⁷

Abbreviation	Modality	Description	Comments
Automated PD			
NIPD	Nocturnal intermittent PD	The machine makes automated swaps for eight to ten hours while the patient sleeps.	Minimizes disruption to patient's schedule while awake. Best for "high transporters," but may not achieve adequate clearance of unmeasured "middle molecules."
CCPD	Continuous cycling PD	This leaves a "last fill" in the peritoneal cavity after nocturnal cycling. The patient may or may not manually drain the effluent before cycling the next night.	The convenience of nocturnal exchanges with the addition of at least 1 longer daytime exchange to augment middle molecule clearance. Fewer nocturnal exchanges with longer daytime dwells are better suited to slower transporters.
Manual			
CAPD	Continuous AMBI Continuous ambulatory PD	The patient carries out several manual exchanges throughout his day.	Provides the best clearance for low transporters but requires significant time commitment from patients

CONTINUOUS VENOVENOUS THERAPY

As long as correctly assessed and the patient is critically ill and needs renal replacement therapy, CVV therapies are preferred because these offer slower blood flow and dialysate flow rates for slower solute clearance and reduction in hemodynamic instability. To ensure proper solute delivery, dialysate flow rates have to be up to 20 times slower than recommended for intermittent HD in

continuous venovenous hemodialysis (CVVHD). CVVHD therapy would need a duration of around 24 hours to achieve the modest solute clearance obtained in 3-4 hours in the case of intermittent HD. Patient groups who are best suited for CVV treatments include those with unstable hemodynamics, intracranial pressure, severe hypo- or hypernatremia, acute failure of the liver, and poisonings with dialyzable drugs that have a large volume of distribution. For the administration of CVV medicines, a

central venous catheter is required. Although a small study demonstrates a suitable application of AVF/AVG for CVV delivery, there is the potential for major access issues.³⁹ The CVV machine can be left on patients on ECMO thereby obviating the need for another vascular access. There are several types of CVV treatment. Dissolution of solutes between blood and dialysate across the semipermeable filter results in clearance in CVVHD. On the other hand, CVVH allows the clearance of solutes without the need for dialysate, but instead, replacement fluid is infused at physiologically balanced rates to maintain fluid balance, ultrafiltering significant quantities of plasma (500-5000 mL/h). Convection, also referred to as "solvent drag," transports molecules across the filter to remove the block. Hemodiafiltration can be obtained by combining the two methods (CVVHDF). No differential effect of the treatment is indicated among the various modes.⁴⁰ In all modalities, electrolytes such as sodium, potassium, and calcium in the dialysate/replacement fluid can be manipulated depending on the needs of the patient. Catheter and filter clotting are major side effects of CVV therapy due to low blood flow through the catheter and filter. Intravenous heparin is often used for reducing coagulation. Since systemic heparin therapy is inappropriate for most critically ill patients, likely alternative therapies will be needed. Other interventions include the use of blood flows of at least 300 mL/min, regular replacement of filters and catheters, and anticoagulation with citrate. The procedure called "regional citrate anticoagulation" involves injection of intravenous calcium postfilter, chelating, and inactivating the citrate prefilter. This technique reduces the risk of hemorrhage and systemic anticoagulation but increases the risk of citrate toxicity and hypo- or hypercalcemia, which

require careful monitoring.⁴¹ The need for specialized solutions, complicated protocols, and unfamiliarity among the nurses and nephrologists in most centers limit the use of regional citrate anticoagulation.⁴² It is managed by CVVU or SCUF, so mainly results in volume removal without important convective clearing due to the lack of using dialysate and with lower hourly UF rates than with CVVH. Isolated UF caused equal weight loss and more creatinine than diuretics when used to treat decompensated congestive heart failure in a randomized controlled trial.⁴³ Thus, isolated UF is inappropriate as initial therapy but useful in managing volume overload that has failed maximal medicinal therapy (especially SCUF in individuals hemodynamically unsuitable for intermittent therapy). Probably the most compelling reason is that an ICU nurse generally follows CVV therapies, and thus a smaller dialysis nursing staff can care for more patients with RRT at the same time than might be feasible otherwise. Nurse-patient ratios may be restricted as a result, and the critical care nursing personnel need to be appropriately prepared. A dialysis nurse may also be asked to conduct a 6–8-hour dialysis session at flow rates that fall between those of CVVHD and intermittent HD. This is known as slow low-efficiency hemodialysis, or SLED. Often called prolonged intermittent renal replacement therapy (PIRRT), this is one of a new cadre of disciplines under the umbrella of renal replacement therapy with a wide range of uses.⁴⁴ These techniques reduce the number of intensive nursing care resources needed but limit the amount of daily dialysis interventions that can be offered. The majority of the patients become hypophosphatemic; supplementation or reduction of dialysis dosage is often needed. There is also thrombocytopenia, likely due to platelet-filter interactions.⁴⁵

Table 2: Continuous venovenous modalities.³⁸

Abbreviation	Modality	Blood flow (ml/min)	Dialysate rate (ml/h)	Ultra/hemofiltration rate (ml/h)	Dialysis staff	Nursing staff
CVVHD	Continuous venovenous hemodialysis	200-300	1000-5000	Variable	+	+++
CVVH	Continuous venovenous hemofiltration	200-300	NA	1000-5000	+	+++
CVVHDF	Continuous venovenous hemodiafiltration	200-300	1000-5000	1000-5000	+	+++
SCUF	Slow continuous ultrafiltration	200-300	NA	Variable	+	+++
SLED	Slow low-efficiency hemodialysis	200-300	1000-2000	Variable	++++	+

CONCLUSION

Kidney disorders are highly prevalent and have emerged as one of the major public health issues today. They have high levels of co-morbidity and mortality, with very high levels of need for palliative care. The most common form

of RRT is maintenance dialysis therapy. The need for this service continues to escalate worldwide. More than a million individuals are kept alive by dialysis worldwide. AKI in the UK is 200 ppm, and by 2010, more than 6 lakh patients in the USA were receiving RRT (Dialysis). It is estimated that around 1 lakh people in India suffer from

ESRD every year. The two major risk factors for the incidence and prevalence of hemodialysis are diabetes mellitus and hypertension. Although hemodialysis is a better form of RRT, there are some disadvantages to the procedure. This information will be useful in providing the health care system with to plan for kidney disease prevention and to plan for the administration of RRT. It was determined that educating patients receiving hemodialysis concerning the disease, the medication, diet, and lifestyle changes can dramatically decrease their risk factors as well as promote compliance with the prescribed dosage.

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