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Prevalence of Chronic Kidney Disease and Hemodialysis Related Problems for Patients in India

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Abstract - *A health condition as prevalent and common as Chronic Kidney Disease (CKD) would be expected to be known about by the general population, or at least for people to possess its basic information. However, a majority of the Indian population has limited information about CKD, its symptoms and risk factors. Evidently, there is a myriad of technological advancements and betterment in the standard of care that can be offered to future patients of renal diseases who are struggling with a possibly life-long and fatal disease. This research paper aims at narrowing the gap between the obvious problems that can be eradicated by simply being educated about the disease's early symptoms. Furthermore, it discusses approaches to enhance facilities for an improved patient care. It also presents observations from survey conducted for patients undergoing dialysis, staff of the facility, and doctors. Through this, it signifies the prevalent probable causes of CKD, defaults in diagnosis or current treatment, the lifestyle of patients and issues faced by them and their family members.*

Key words: hemodialysis, kidney, CKD, kidney disease, dialysis, nephrology

1. INTRODUCTION

The current standard of care in an overpopulated country such as India, the data, knowledge, and resources of CKD is outdated as compared to the development in biomedical sciences and instrumentation. Hence, it is important to conduct expansive findings in all precincts of renal diseases and fabricate solutions that are pre-eminently accessible and comprehensible by patients of all age groups and intellect. It is also essential for all these resources to be customised for a wider percentage of population of India in terms of cost, availability, and ease of usage. Patients undergoing dialysis in India face several different challenges which range from primitive diagnosis of the onset of kidney disease by healthcare providers to availability of dialysis machines for Hepatitis and HIV positive patients. The aim of this research is to survey CKD patients and identify major problems; and to study prospective solutions for overcoming these challenges.

Along with this, it makes an effort at spreading awareness regarding the disease and its diagnosis among patients and citizens of all categories of age, medical history, and levels of literacy, while making the prevalent causes of this fatal disease known to a wider amount of population, which also includes doctors and other health care providers. The study goes on to discuss how crucial it is to spread awareness and discusses cases of failure which have led to worsening of a patient's kidney disease for prolonged periods of time. For this purpose, first-hand data collected from dialysis centres in Mumbai, India, run by Apex Kidney Care, can prove to be extremely helpful.

2. OVERVIEW

Chronic kidney disease is defined as the onset of kidney damage or an estimated glomerular filtration rate (eGFR) < than 60 ml/min/1.73 mt^2, persisting for 3 months or more, irrespective of the cause. It is a state of progressive decay in kidney functionality which ultimately results in the need for renal replacement (dialysis or transplant). Kidney damage refers to pathologic abnormalities either suggested by imaging studies or renal biopsy, abnormalities in urinary sediment, or increased urinary albumin excretion rates [1]. Kidney diseases occur when the kidneys are damaged and hence unable to perform their functions. Damage may be caused by diabetes, High Blood Pressure (HTN), and various other chronic (long-term) conditions. Kidney disease can lead to other health problems, including anaemia, weak bones, nerve damage, and malnutrition [2].

CKD usually takes a long time to develop and is a progressive disease. In CKD, the kidneys continue to work, just not as well as they should. Wastes may build up so gradually that the body becomes used to having those wastes in the blood. Salts containing phosphorus and potassium could rise to unsafe levels, leading to heart and bone problems. Anaemia which is low red blood cell count can result from CKD because the kidneys stop making enough erythropoietin, a hormone that causes bone marrow to make red blood cells. After months or years, CKD may progress to permanent kidney failure, which requires a person to undergo kidney transplant or blood filtering treatment called dialysis regularly [3].

2.1 CKD Measurements

The measurement of accurate renal function is vital for the routine care of patients. Determining the renal function status can predict kidney disease progression and prevent toxic drug levels in the body. The glomerular filtration rate (GFR) indicates the flow rate of filtered fluid through the kidneys. Alternatively, the biochemical marker creatinine found in serum and urine is usually used to estimate GFR. Creatinine clearance (CrCl) is the volume of blood plasma cleared of creatinine per unit time. It is a fast and inexpensive method for the measurement of renal function. Both CrCl and GFR can be measured using the relative values of creatinine in blood and urine. Persistently, high

levels of serum creatinine and severely reduced GFR indicate chronic kidney disease. CKD occurs through multiple pathologic mechanisms of injury and affects various parts of the kidney [4].

2.2 Dialysis

There are two kinds of dialysis. In peritoneal dialysis, the inside lining of the belly acts as a natural filter. Wastes are taken out through a cleansing fluid called dialysate, which is washed in and out of the stomach in cycles. This process usually is done three, four or five times in a 24-hour period when the patient is awake during normal activities [5]. In hemodialysis, blood is pumped out of the body to an artificial kidney machine and returned to the body by tubes that connect the patient to the machine (as shown in fig. 1). Hemodialysis is a treatment to filter wastes and water from the blood, as kidneys did when they were healthy. Hemodialysis helps control blood pressure and balance necessary minerals in blood such as potassium, sodium, and calcium.

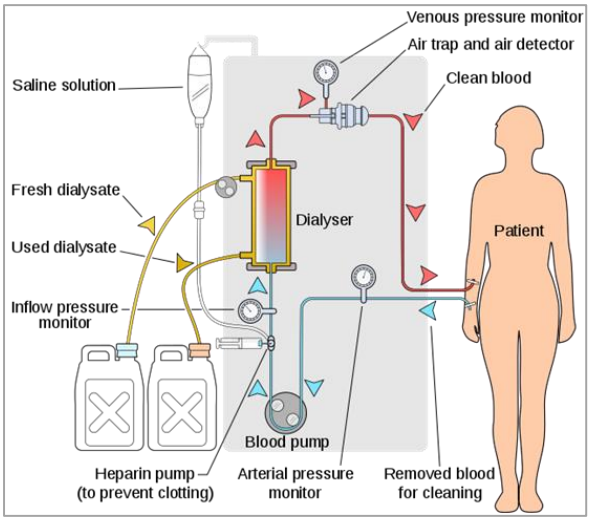

Fig - 1: Hemodialysis (Image source: [6])

During hemodialysis, the patient's blood goes through a filter, called a dialyzer which is outside their body. A dialyzer is acts like an "artificial kidney." The dialysis machine pumps blood through the filter and returns the blood to the body. During this, most dialysis machines check the patient's blood pressure along with controlling how quickly blood flows through the filter and fluid is removed from the body. Blood enters at one end of the dialyzer filter and is sent into many, very thin, hollow fibres. As blood passes through the hollow fibres, dialysis solution passes in the opposite direction on the outside of these fibres. Waste products from the blood move into the dialysis solution. Filtered blood remains in the hollow fibres and then returns to the patient's body [7].

2.3 Challenges in India and Current Statistics

A GFR (Glomerular filtration rate) between 130 and 90 is considered normal for most people. Due to lack of awareness and misinformation along with indiscernible symptoms, over 50% of patients in India with advanced CKD are first seen when the eGFR (Estimated glomerular filtration rate) is less than 15 ml/min per 1.73 m. The reported prevalence of CKD in different regions ranges from less than 1% to 13%, and recently, data from the International Society of Nephrology's Kidney Disease Data Centre Study reported a prevalence of 17%. The etiology of CKD varies to an extent throughout India. Parts of the states of Andhra Pradesh, Odisha, and Goa have reported increased levels of CKD of unknown etiology (CKDu), which is a chronic interstitial nephropathy with insidious onset and slow progression [8].

The exact burden of CKD in India is undefined with only limited data from the three population-based studies addressing this issue. In the prevention study done in Chennai, the prevalence at the community level is 8600 per million population (pmp) in the study group and 13900 pmp in the control group. The second study based in Delhi revealed a prevalence of CKD (serum creatinine more than 1.8 mg %) at 7852 pmp. The third study from Bhopal revealed an incidence of 151 pmp suffering from end stage renal disease (ESRD). On the baseline of healthcare, chronic kidney disease (CKD) in India has failed to be assessed accurately. The approximate prevalence of CKD is 800 pmp (per million population) and incidence of ESRD (End-stage renal failure) is 150-200 pmp. The most common cause of CKD has been found to be diabetic nephropathy [9].

In the absence of any available data, Mumbai Kidney Foundation (MKF) conducted a data collection survey with the help of industry, sources, personal discussion with nephrologists and telephonic confirmation of dialysis centres in the year 2009. The findings are as follows:

- As of January 2009, there are approximately 950 nephrologists (not all ISN members) all over India.
- There are 700 dialysis centres with a total of 4000 dialysis machines, mostly in the private sector and mainly concentrated in cities, especially metros.
- There are around 20,000 patients undergoing dialysis at these centres.
- There are around 170 government recognized transplant centres in India, performing around 3500 transplants annually. The patients on CAPD number less than 5000 [9].

Clearly, the choices and facilities for renal replacement therapy are predominantly focused on maintenance hemodialysis and are inadequate. The cost of each hemodialysis (HD) session in India varies from ₹150 in government hospitals, as low as ₹100 in some, and ₹2000 in some corporate hospitals. The monthly cost of hemodialysis in most private hospitals average ₹12,000 and the yearly cost of dialysis is ₹1,40,000, equivalent of $3000, which is in sharp contrast to an annual cost of $60,000 in the US and UK. So, the cost of treatment in India is the cheapest in the world and yet more than 90% of Indians are unable to afford it [9].

Along with this, a major proportion of end stage renal disease patients in developing countries such as India are unable to receive an imperative kidney transplant. The increasing demand and need for renal replacement therapy are apparent throughout the country. The official statistics are that 97% of kidney transplants are working at the end

of a month; 93% are working at the end of a year; and 83% are working at the end of 3 years. 7% of people's transplant failed within a year and 17% of people have failed their transplants within 3 years. Nearly 3,000 people lose their kidney transplants in the first year and over 6,000 people lose their transplants within 3 years. At 10 years, 54% of transplant kidneys are still working. In fact, over 20% of kidney transplants every year are re-transplants [10]. Moreover, health-economic analysis of the consequences of untreated chronic kidney disease is a key factor [11]. The need for technological advancements in the field of artificial kidneys and cost-effective portable/home dialysis is evident across the country.

2.4 Diabetes and Hypertension

In a few cases, no specific symptoms were noticed for the patients before they were diagnosed with CKD. It was observed that a substantial percent of these had a definitive history of underlying hypertension (high blood pressure), diabetes or both, in most cases. In fact, 62% of the patients suffered from these underlying conditions which have proven to be a major causal factor of end-stage kidney failure in various studies. When blood pressure is high, there is a high amount of tension inside the blood vessels that may lead to damage. Diabetes mellitus, on the other hand, is seen in approximately 30% of the patients wherein type 2 is responsible in 97% of the cases as the cause of CKD in India [11].

Hence, even when there have been cases where almost no symptoms were depicted by patients of chronic kidney disease or kidney failure, evaluation of the risk factors and prevalent causes amongst the population may help curb the diseases in its initial stages, during which it is treatable through changes in diet and proper medication. Early detection, along with low blood sugar levels and controlled blood pressure are steps towards preventing kidney disease to slow down the process or avoiding its progression into acute renal failure. Screening of high-risk individuals for CKD could be one of the feasible solutions to curbing the number of people diagnosed with kidney disease in India.

2.5 Alternatives for Patients with CKD

Alongside the physical and fiscal effects, the process of developing renal diseases followed by the need for frequent dialysis was found to have caused the patients to have lower enthusiasm for everyday activities due to incredulous loss of time that was spent during the treatment each week. The preferred option for treating end stage kidney failure is kidney transplantation, which involves the surgical placement of a healthy kidney from a donor since, humans can live with one kidney; receiving a healthy kidney graft means a return to nearly normal kidney function for many kidney transplant recipients.

Availability of a donor kidney is another issue that was highlighted in various studies. Due to this, dialysis results in being the only expedient. Apart from this, risks in kidney transplant range from transplant rejection caused by immunological factors to reduction in life expectancy of kidney donors by 0.5–1 year in most donors and increased risks of contracting ESRD [12].

2.5 NSAIDs and Antihypertensives

Over-the-counter analgesics containing diclofenac and ibuprofen, and sometimes a combination of such ingredients have been linked to kidney disease. Heavy or long-term use of some of these medicines, such as ibuprofen, naproxen, and higher dose aspirin, can cause chronic kidney disease known as chronic interstitial nephritis [13].

Acute kidney injury comprises of abrupt reduction in GFR, leading to retention of urea, creatinine, and other nitrogen waste substances that are normally cleared by the kidneys. Long-term NSAID use can lead to CKD. In patients without renal diseases, especially young and without comorbidities, NSAIDs are not explicitly harmful. However, because of its dose-dependent effect, caution should be exercised in chronic use since it increases the risk of developing nephrotoxicity [14]. Table 1 shows the main effects of NSAIDs on kidney functionality.

Table 1 - Main effects of NSAID on kidney function. Source [14]

	Mechanisms	Risk factors	Prevention/Treatment
Water and electrolyte disorders -Sodium retention -Hyperkalemia -Hyponatremia -Metabolic acidosis -Lower response to diuretics (especially loop diuretics)	PGE2 and PG12-induced kidney vasodilatation inhibition; RAAS activation	NSAID use (most common nephrotoxic effects	Discontinue NSAID use
Acute kidney injury	Hemodynamic alterations/Kidney perfusion reduction	Liver diseases; Kidney diseases; Heart failure; Dehydration; advanced age	Avoid in high-risk patients (patients with comorbidities); Discontinue NSAID
Acute interstitial nephritis	Hypersensitivity reaction	Prolonged NSAID exposure; some specific NSAIDs (Phenoprofen, Naproxen, Ibuprofen)	Discontinue NSAID use

Chronic kidney disease	Hemodynamic alterations	Chronic use of NSAIDS	Avoid use in high-risk patients (those with comorbidities and advanced age); Discontinue NSAID use
Papillary necrosis	Direct toxicity	Phenacetine abuse; Aspirin and acetaminophen combination	Discontinue NSAID use and avoid chronic use of analgesics

*PGE2: prostaglandins; PGI2: prostacyclins; RAAS: Renin-angiotensin-aldosterone system; NSAIDs: Non-steroidal anti-inflammatory drugs.

2.6 Genomics and Data Science for CKD

Based on the observations, a wide number of patients suffered from hereditary CKD or other conditions which commonly lead to kidney diseases. Hence, genetics are a key factor in determining individuals at risk of contracting CKD and in finding appropriate treatment for specific individuals based on their genetic history. Recent advancement in genomics and sequencing technology have led to a better understanding of involvement of genetics in CKD risk. Genetics could partly account for racial differences in treatment response for medications including anti-hypertensives and immunosuppressive medications due to its correlation with ancestry. However, there is still a substantial lag between generation of this information and its adoption in routine clinical care.

Incorporating genomics into routine clinical care of CKD patients holds great promise. With decreasing costs of high-throughput sequencing, new discoveries are likely, and testing could become a commonly available and cost-effective resource for routine clinical care. Just as we send a serum creatinine test, and providers and patients can rapidly grasp and discuss the implications of the result, we will be able to use APOL1 and other tests to predict risk, and even to develop treatments, or lead to cures for CKD. Pharmacogenomics is already a guiding therapy.

However, the future of practical application of genomics in prevention and treatment of renal diseases will depend on the degree of penetration into and adoption by healthcare practitioners, and the degree of genetic research and discovery in nephrology. It will also require genetics and genomics education beginning early in clinical training.. Clinicians, researchers, patients, and advocates should work together to develop new research questions and strategies, and the best ways to translate findings into probable actions. Team efforts involving geneticists, pharmacists, counsellors, health care providers, investigators and advocates will help engage patients and stakeholders, and utilize genomic information to improve patient care and outcomes, particularly for people of colour, who are disproportionately impacted by CKD and ESRD [15].

3. COVID-19 EVALUATION

A 2019 editorial in the National Medical Journal of India deduced that over 90 per cent of dialysis patients' families suffered catastrophic healthcare expenditure, even in a relatively prosperous states like Kerala, India. This is defined as expenditure which is more than 40 per cent of monthly non-food related expenses. Around 75 per cent of the citizens had to resort to distress financing, involving borrowing and selling possessions to continue their treatment [16].

Subsequently, the Lalbaugcha Raja dialysis centre in Lalbaug, India [17], run by Apex Kidney Care, was surveyed for COVID-19 related conditions of the facility and its effect on daily functioning, the healthcare providers and patients of CKD visiting for dialysis. Here, it was observed that the facility maintained strict protocols during the quarantine period of COVID-19. All the patients were taken inside in batches, between which all bedsheets and dressing were changed, and surrounding area was disinfected and sanitized. COVID tests were performed in the early months of quarantine on all existing patients visiting the centre regularly, amongst which 8 were found to be positive carriers of the virus and appropriate actions were taken to avoid the spread of disease. Along with this, all the staff members and doctors have been continuously tested. The centre has been open all-year-round and has ensured necessary and safe treatment for people who require regular dialysis. The number of patients visiting had reduced initially but it gradually went back to normal in the latter half of the year 2020. Currently, every newly admitted patient is required to present authorised COVID test results before the start of their treatment. No other change in procedure or protocols was observed.

4. METHODS AND MATERIAL

4.1 Dialysis facility information

The Apex Kidney Care dialysis centre at Sushrut Hospital & Research Centre [18] located in Chembur, India, provides one of the highest standard and high-tech dialysis treatments in India. The kidney care network was established in 2008 and runs a chain of world class dialysis centres in various hospitals and facilities all over India [19]. The average cost per regular dialysis session is ₹1600, which may vary for each patient. This facility has a separate accommodation for Hepatitis and HIV positive patients, which is not commonly available in most dialysis centres across India. On an average, dialysis is performed thrice a week for every patient, for the duration of three to four hours per session.

The dialysate consisting of glucose and nutrients like magnesium, potassium, calcium, and sodium, which leave the body through the urine due to dysfunctional kidneys, are supplied through a tube to the patient's body. The catheter is inserted either in a permanently placed catheter at the chest, or temporarily injected for every session into the patient's arm or neck. The water used in the cans as a medium to carry minerals into the body is compulsorily RO filtered. Other vitamins and hemoglobin adjustment are made by injecting them separately into the patient's body using a syringe. The blood pump is set to a constant blood flow rate between 350-500 mL/min (millilitres per minute)

with an expected clearance of 1.2Kt/V (K – dialyzer clearance of urea. t – dialysis time. V – volume of distribution of urea, approximately equal to patient's total body water [20].

All dialysis machines at the facility provide readings of the patient's body parameters such as temperature (in degree Celsius), blood pressure (in mmHg), heart rate (bpm), along with arrangements to control and maintain temperature of the blood going into the patient's body (usually 36.5℃). The machines provided by this facility also included a functionality for continuous blood pressure readings during the procedure. Additionally, heparin is injected through an IV to avoid blood clotting which is a usual procedure in hemodialysis treatments. The biomedical waste from the process, which constitutes of excess water and small waste products, is collected, and sent to a drainage system where it is treated before disposal. [16].

On an average, the age group of people undergoing dialysis at this facility ranges from 60-90 years. Even so, there are younger patients who regularly require dialysis; patients as young as 11 years of age have visited the centre for regular treatment, some of which were in the very early stages of kidney disease and were ridden of need for regular dialysis after a specific period of treatment.

4.2 Observations

Table 2 - Observations taken from individual patients or an accompanying relative (marked with an asterisk).

Obs no.	1	2	3*	4	5	6	7*	8*	9*	10	11	12	13
Age	74 (M)	72 (M)	83 (F)	49 (F)	54 (M)	70 (F)	72 (F)	80 (F)	40 (M)	53 (M)	65 (M)	50 (M)	40 (M)
Duration of CKD	7 months	5 years	7 months	2 years	4 years	7 years	10 years	10 years	2 years	19 years	11 years	10 years	1 month
Period of dialysis	6 months	8 months	7 months	7 months	4 years	7 years	10 years	1 year	2 months	15 years	11 years	10 years	2 months
Frequency of dialysis	Alter-nate days	Alter-nate days	Alter-nate days	Alternate days	Alter-nate days	Alternate days	Alternate days	Alter-nate days	Not specified	Not specified	Not specified	Alter-nate days	Alter-nate days
Preexisting diseases	None	HTN and diabetes	None	None	None	HTN and diabetes	Heredi-tary diabetes, HTN	HTN, diabetes, heart strokes	AIDS, CVD, TB, HTN, diabetes	Hepatitis B-ve	Hepatitis C+ve, HTN	Heredi-tary HTN, kidney stone	CVD, angio-plasty
Initial symptoms	Swollen feet, foamy urine	Diagnosis after heart attack	Foamy urine	Extreme vomiting, fatigue	LOA, fever, cold	Swelling in leg, restless-ness	Dyspnea, swelling, irregular urine	Multiple tests	Dyspnea, CVD	Dyspnea, multiple tests	Irregular urine, swelling, dyspnea, dizziness	Freq-uent urina-tion	Dyspn-ea, swell-ing
Diagnosis	Doctor consult-ation	High creatine detected	Doctor consult-ation	High creatine detected	Doctor consult-ation	Doctor consul-tation	Angio-graphy	Heredi-tary CKD, high creatine	Multiple tests, angio-graphy	Multiple tests	Doctor consulta-tion	Doctor consult-ation	Doctor consult-ation
Effect on daily routine	Fatigue	None reported	Extreme sleep	Limita-tion on water intake	None report-ed	Limitation on water intake	Limita-tion on water intake	Brittle bones	Blood in urine, swollen oesoph-agus & stomach	Urine stopped for 9 years	None reported	Loss of positive -ty	None report-ed
Accompany -ing relative	Wife	Wife	Son's co-worker	Husband	None	Husband	Daughter -in-law	Daugh-ter	Wife	None	None	None	Brother
Food and water intake	Reduced water intake	Normal	Normal	Reduced water intake	Norm-al	Reduced water intake	Increae in intake	Normal	Unable to swallow food	Normal	Unable to eat during dialysis	Normal	Normal
Probable cause	None specified	Underly-ing diseases	None specified	Frequent painkiller intake	None speci-fied	Underlying medical conditions	Underly-ing diseases	Frequent painkill-er intake	Genetic HTN, diabetes, opioids	Inaccurate diagnosis	Inaccur-ate intake of BP pills	Freq-uent analge-sics intake	BP pills after heart surgery
History of kidney transplant	None	None	None	Ongoing search	None	None	None	None	None	Failed	None	None	None
Problems	Stents, boredom treat-ment	None reported	Painful needles	Pungent smell, un-available transplan t kidney	None report-ed	Prescribed medication for swelling proven ineffective	None reported	Unable to walk	Scarce AIDS dialysis, delayed diagnosis	Unavailabl e hepatitis machine, delayed diagnosis	HTN if eaten during dialysis	None report-ed	None report-ed
Cost analysis	Costly treat-ment	Costly medica-tion/ injection	No issues observ-ed	Costly medicatio n & injections	No issue observ-ed	No issues observed	No issues observed	No issues observ-ed	Expen-sive HIV dialysis (Rs 3100)	No issues observed	No issues observed	No issues observ-ed	No issues observ-ed

Data and disease history of various subjects currently undergoing hemodialysis at the centre was collected, which was retrieved from the patients, their relatives, and the health care providers at the facility. These subjects were asked about the initial symptoms of the patients, duration of disease, frequency of dialysis and their everyday routine along with their current food and drinking habits, genetic and medical history, and challenges or issues faced by the patients and their family during the process. This data was provided by either the patients undergoing dialysis or an accompanying relative, which is marked with an asterisk. These observations were collected from April 2018 to July 2019. All observations mentioned in the table are direct results from an in-person survey conducted and are unmediated opinions of the patients or their close relatives. No separate assumptions have been made.

4.3 Symptoms

Usually, the onset of kidney disease can have no symptoms, but people may experience fatigue, high blood pressure, loss of appetite, malaise, or water-electrolyte imbalance [21]. A variety of similarities in primitive symptoms were noted from the survey done on individuals undergoing regular dialysis. Most of these, that is 62%, either experienced swelling in their body or some changes in urination or both, which are typically known symptoms of kidney related problems. A number of these patients, which is about 54% of the total number, experienced a dyspnoea (loss of breath) or restlessness/nausea which are amongst the unacquainted, yet common symptoms of CKD. Congestive heart failure, unrecognized chronic lung disease, pulmonary hypertension, lung fibrosis, air micro-embolism, dialyzer bio-incompatibility, anaemia, sodium, and fluid overload are potentially the frequent causes of breathing disorders amongst the patients [22]. These symptoms are not well documented and are usually overlooked which suggests a dire necessity of research on the relationship of CKD with pulmonary functions.

5. DISCUSSION

As mentioned in the problem statement, the key aim of this research is to observe the current challenges faced by individuals undergoing dialysis in India and provide feasible solutions and scope of improvement. However, the challenges were observed to be less significant during the actual treatment for patients undergoing dialysis on a larger scale. They were instead more serious due to every other citizen possessing inadequate knowledge of renal disease, its problems, symptoms and how treatments for other illnesses can adversely affect or cause kidney disease, and in serious cases, can lead to on-the-spot kidney failures. Relatively, fewer than 1 in 10 patients in USA are even aware of carrying the diagnosis of early chronic kidney disease and a similar number of physicians continue to fail to make the diagnosis when CKD is present [23]. There were also several cases of aggravated condition of kidney disease due to delay in receiving prompt medical attention. Overall, the doctors and caregivers need to focus more on educating people about renal diseases, which includes its symptoms, modes of prevention, the remedies, and most of all, the liable causes that have been highlighted from the trends of past experiences of CKD patients.

The technology for dialysis and the standard of care, as observed in the mentioned dialysis facility unit was found to be up to date and satisfactory, and the patients undergoing dialysis experienced considerable comfort during the 3-4-hour long procedure. There was no discomfort or negligence regarding the instruments or the hospitality and stay, the hygiene or even with the staff or caregivers in the observed facility. It was also observed that there was no pain or issues experienced by patients regarding the instrumentation used for blood exchange which includes fixated stents, apart from the nominal initial pain during needle insertion.

On an average, each patient spent 12 hours a week at the hospital, an approximate of 4 hours/day. This adversely affected their everyday lifestyle, jobs, family life, sport activities and subsequently affected their overall positivity as well as psychological and social domains of functioning and well-being. It is important to emphasize on the fact that there is close to no cure for CKD. Hemodialysis is solely a treatment for sustenance. Few studies have examined HRQoL (Health-related quality of life) patterns in various stages of CKD which indicates that more knowledge is needed about this. The objective of this study was to evaluate HRQoL in patients with different stages of CKD up to initiation of dialysis treatment and to explore possible correlating and influencing factors. It was assumed that HRQoL would decline progressively with flawed renal function but also that co-morbidity, age, gender, inflammation, anaemia, hypertension and altered nutritional markers would impact negatively on HRQoL [24]. This sobering number highlights the requirement for robust screening programs for those at risk for CKD.

Patients face several challenges in regards with access to healthcare facilities and resources, which range from family members having to miss several hours a week while accompanying the patients, to fewer modes of entertainment during the procedure. This loss of time can be made up for through portable or at-home dialysis machines which is a convenient alternative for traditional methods to help reduce the amount of time spent travelling to the centres and during treatment. The current issue with this is the scarcity of available machines and high cost involved in their setup and operation. Research in this field is necessary to make cost-effective alternatives available in India which, in turn, would assist CKD patients in living a comparatively normal life.

Alternatively, there are very few studies that demonstrate the long-term effects of medications such as NSAIDs and antihypertensives on the development of chronic kidney disease. However, it has been shown that continuous use of these medications over extended periods of time may increase the risk of developing CKD [14]. With

respect to these adverse effects, advancements need to be made in developing non-opioids and other alternative drugs. Paracetamols and analgesics which have also been proven to be safer and effective should be prescribed, such as Tylenol, which is a widely available alternative to NSAIDs that targets pain, rather than the inflammation.

Parallelly, people suffering from either hypertension, diabetes, cardiovascular disease or all the above are at increased risks of a renal failure. This is because the medications for these illnesses may have toxic effects on kidneys. One of the patients mentioned in the observations who had no history of diabetes and hypertension and had started taking prescribed medication post angioplasty for cardiovascular disease. He was diagnosed with CKD when symptoms were noticed within a year of surgery. The patient had consumed hypertension medication for a period of two months after surgery which may have resulted in CKD. In such cases, it is crucial to consider the implications of other medications on kidneys and alternative medicines need to be developed to reduce the risk of these pills causing renal diseases. Drugs such as diuretics, angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) can cause direct damage to the kidneys and are termed as "nephrotoxic medications". Therefore, the indication of this class of drugs should be well evaluated, always verifying the risk-benefit, besides taking into consideration the patient in question and the potential effects caused by its use. Moreover, medical prescription for every drug or medication must be strictly made a requirement across all the urban, as well as rural pharmacies and retailers of India. The people, more specifically from the age group of 25 and above must be made aware of the ill effects of incautious consumption of over-the-counter medicines.

For the financial evaluation and fiscal effects of kidney diseases and its related treatments, the Lalbaugcha Raja dialysis care unit [17] that was surveyed, proved to be an ideal solution for several families that live under poverty line and cannot afford the necessary treatment. This three-storied facility is equipped with 27 machines per bed with a usual 85-100 patients visiting daily. The average cost per session here varies from Rs. 100 to none (in accordance with the Rajiv Gandhi Jeevandayee Aarogya Yojana scheme) depending on the family's financial status. The facility is equally sterile, and all the features including the treatment and procedure, are similar to those observed at Apex Kidney Care, Chembur excluding differences in the number of times a dialyzer is reused after being disinfected. Research in this facility indicated that due to extremely low-cost of dialysis in this particular facility, patients were not drastically affected by the pandemic outbreak and have resumed their regular weekly visits to the centre. In inference, NGOs and other organisations such as the Lalbaugcha Raja committee are a panacea to several families in distress, with low incomes, especially in trying times such as a global pandemic. Hence, more charitable trusts taking an initiative to assist patients of kidney disease is as close as the patients would get to leading a relatively less taxing life.

Moreover, although a major part of a developing nation like India may seem to be lacking behind on technological progress in terms of mobile phone usage, India has surpassed the United States in number of smartphone users in 2018 by having the second most smartphone users, which is about 346 million [25]. This shows how the rapid increase in smartphone users can be leveraged into providing better education regarding lesser-known diseases like CKD using solutions such as applications for tracking symptoms, access to information about appropriate healthcare professionals, supplementary dietary and lifestyle changes, etc. Smartphone users that use social media can be kept well-informed through various online platforms to drive the education process. Hence, even with under par literacy rate, digital media can be utilised to reduce the burden and improvise the state of awareness regarding kidney diseases amongst the general population of India.

6. RESULTS

The images below provide graphical representation of selective parameters and readings from Table 2. Chart 1 demonstrates the duration of CKD with respect to patient age.

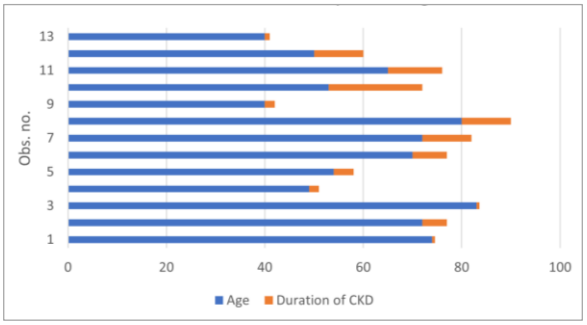

Chart 1 - Duration of CKD w.r.t patients' age

It can be noted that on an average, the candidates contracted kidney disease between the ages 40-80. For most of these patients, CKD makes up for almost 1/7th of their lifetime. Chart 2 reinstates the readings of the study regarding relation between hypertension and diabetes with the onset of CKD, since about 54% of the total surveyed patients had a history of these diseases prior to being diagnosed with CKD. In chart 3, the effects of unregulated use of prescribed drugs are evident through the 50% of CKD patients having a history of unregulated or harmful NSAID intake.

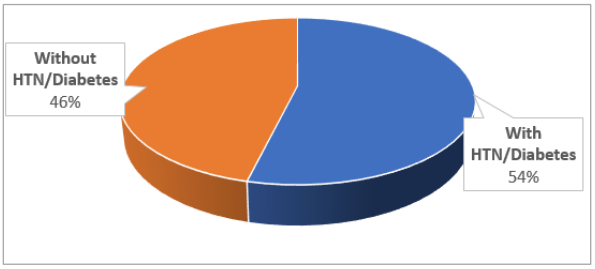

Chart 2 - Patients with a history of HTN and/or diabetes

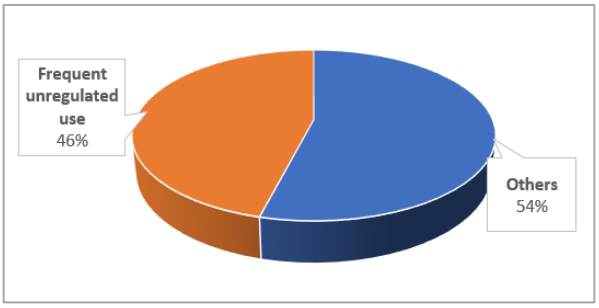

Chart 3 - Patients with history of unregulated consumption of prescription drugs.

Some common observations were made regarding the treatment, machines, and patient care:

- Machines that include accommodation for continuous monitoring and measurement of BP during dialysis are a necessity for better time management and ease of providing unerring treatment by healthcare providers.
- All machines equipped with temperature control of outgoing purified blood proved to be extremely effective in terms of lesser number of patients feeling cold during treatment.
- All the patients in the specified age range were noted to have minimal means of entertainment to pass time during the 3-4 hours of treatment, especially in cases of no one to accompany them during dialysis.
- Direct observations were made about diagnosing the onset of renal problems by the patients themselves, and occasionally, due to the mass variety of symptoms, there was a delay in providing the patients with appropriate treatment in early stages of kidney disease.
- Unsupervised intake of prescription drugs taken in excessive amounts is one of the notable causes of CKD and ESRD amongst the Indian population.
- Patients with a history of hypertension, diabetes or cardiovascular diseases are at increased risks of contracting CKD and must be tested, in accordance, for the onset of symptoms.

7. CONCLUSION

The surveys conducted at both facilities provide first-hand findings and a view into the lives of kidney disease patients. Considering the amount of time spent during actual treatment of dialysis, patient number 12, who is 50 years old has been undergoing dialysis for 10 years. This adds up to 6240 hours which is equivalent to 260 days in total. This shows how important it is to understand this diseases and work on its betterment. Just as the population is well versed with illnesses such as fever or cold and know about all its symptoms to be able to ask for required attention from the respective medical professionals, everyone needs to gain basic knowledge regarding CKD. This can be done by bringing about extensive technological changes.

Overall, kidney diseases can be extremely detrimental; they can cause long-lasting effects on patients' physicality and there is no known cure for chronic kidney disease. Apart from this, it may even lead to severe cases of deterioration on mental stability of patients as well as their family members. For this reason, it is crucial to make everyone aware of these ill effects alongside the commonly known struggle of going through weekly dialysis, the effect it can have on patients' daily lives and the gravity of debacle that its onset can bring to anyone suffering from all levels of minor to chronic kidney diseases.

The probability of contracting kidney related issues can, in some cases, be avoided from a young age. Even so, it might not always be possible to avoid CKD. For this, continuous research in the field of kidney diseases is extremely crucial. The population also needs to be educated regarding its common symptoms, frequent and hereditary causes, and methods of prevention, which will help the patients acquire early diagnosis and appropriate medical treatment which is the only known way to completely eradicate renal related problems and prevent acute kidney failure.

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APPENDIX

Glossary of terms

HRQol	Health Related Quality of Life *focuses on the impact health status has on quality of life.*
CKD	Chronic Kidney Diseases *is a longstanding disease of the kidneys leading to renal failure.*
ESRD	End-Stage Renal Disease *is a medical condition in which a person's kidneys cease functioning on a permanent basis.*
NSAIDs	Non-steroidal anti-inflammatory drugs *are medicines that are widely used to relieve pain, reduce inflammation, and bring down a high temperature.*
pmp	Per Million Population
Creatinine	*A waste product produced by muscles from the breakdown of a compound called creatine and is removed from the body by the kidneys.*
CrCl	Creatinine Clearance *is the amount of blood cleaned of creatinine by your kidneys.*

eGFR	Estimated glomerular filtration rate *is a number based on your blood test for creatinine and represents the best routinely available measurement of kidney function.*
CAPD	Continuous Ambulatory Peritoneal Dialysis *a form of peritoneal dialysis done manually.*
HTN	High Blood Pressure *or hypertension*
Dyspnea	*Medical term for shortness of breath*
CVD	Cardiovascular diseases
LOA	Loss of Appetite

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