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Research Article

Preventable factors contributing to increased rates of chronic kidney disease in rural India

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Background

Chronic kidney disease (CKD) is disproportionately more prevalent in rural and underserved areas globally, and the epidemiological factors contributing to this phenomenon are poorly understood. Here, we aim to identify several preventable factors contributing towards CKD in the city of Phalodi, a rural city located in the Indian state of Rajasthan.

Methods

The qualitative and quantitative data obtained in this study comes from interviews with doctors, nurses, hospital administrators, and patients at the dialysis clinic in Phalodi. This region was selected because of its known increased prevalence of CKD, and its long-standing relation with Discovering Dialysis.

Results

Several preventable factors were identified as contributors towards the increased prevalence of CKD: 1) Nimesulide abuse is fairly common in rural areas because it is affordable and effective, but it is highly nephrotoxic and hepatotoxic; 2) Kidney stones caused by the quantity and quality of rural water contribute towards both nimesulide abuse and CKD; 3) Lack of accessibility to healthcare for preventative measures and disease management exacerbate the severity of kidney disease; 4) Lack of transportation to dialysis centers limits the number of patients that can afford to receive dialysis treatment.

Conclusions

This study demonstrates that several factors can be targeted to reduce the prevalence of CKD in rural India. Namely, legislation should focus on reducing nimesulide use, providing access to clean and available water, and increasing transportation to medical centers that can provide preventative care.

The Global Burden of Disease Study conducted in 2015 ranked chronic kidney disease (CKD) as the 17th leading cause of death in all deaths globally.[1] In India, CKD is ranked 8th.[1] The etiology of such a multifaceted issue is difficult to fully understand since it arises at the intersection of many factors including access to medical care and dialysis, pathophysiology and genetics of kidney disease in at-risk populations, and environmental factors. To address this issue, I founded Discovering Dialysis, a 501(c)[2] registered nonprofit organization that strives to provide accessible dialysis care in underserved areas with the hope of eliminating health disparity caused mortality. In the summer of 2017, I had the opportunity to visit several clinics in the Indian state of Rajasthan to better understand the epidemiological factors contributing to this increase in CKD prevalence. After visiting these clinics in rural India and interacting with the physicians and medical staff who deal with this disease on a daily basis, it became apparent that several preventable factors are leading to a disproportionately increased prevalence of CKD in these areas.

METHODS

This research was conducted at a clinic in the city of Phalodi in Rajasthan, India. This specific clinic was chosen because of its long-standing relations with Discovering Dialysis, as the nonprofit organization helped purchase and establish a dialysis machine at the Phalodi clinic. Information regarding patient selection was obtained directly from interviews from medical professionals at the clinic and the patients themselves. All research was conducted ethically, and patient consent was verbally obtained before each patient was interviewed.

RESULTS

Nimesulide, a non-steroidal anti-inflammatory drug (NSAID) marketed as a cheap solution for fever and pain in India, was at the top of the list of preventable factors contributing to CKD. This drug was first launched in Italy in 1985, and since then has expanded to more than 50 countries worldwide. As this drug became more popular, more scientific data emerged about the benefits and risks of nimesulide, leading to the steady decline of nimesulide use in the countries in which it was previously approved. Several case studies have shown severe hepatotoxicity and nephrotoxicity associated with brief nimesulide use and therefore, it has never gained Food and Drug Administration (FDA) approval in the United States and has been banned from many European countries because of these serious adverse effects.[3] Specifically, these case studies found that brief nimesulide use resulted in elevated urinary Tamm-Horsfall glycoprotein and beta-*N*-acetyl glucosaminidase, with some patients achieving acute renal failure with several administrations of the medication.[2] In India, however, it is sold regularly in small stores and pharmacies at a price point lower than comparable NSAIDs, making the drug accessible to almost everyone. In addition, several medical professionals at the rural clinics have reported an environmentally-driven psychological dependence on cheap NSAIDs like nimesulide in adult populations. Since most of the rural population relies on walking as their major form of transportation and since most of the jobs in rural areas rely heavily on physical labor, nimesulide tablets are frequently taken to combat daily muscle aches and pains. As a result, nimesulide abuse has become commonplace and has contributed heavily towards the spike in CKD prevalence within this population.

According to medical specialists in rural India, another mechanism contributing to nimesulide abuse is the high prevalence of kidney stones. The reason for this high prevalence is twofold: the quantity of water consumed, and the quality of rural water. To address the former, it has been shown that almost 54% of certain Indian subpopulations consume a suboptimal amount of water.[4] This fact is extremely important because it is well established that increased water consumption reduces the risk for kidney stone formation, and the decreased consumption of water in Indian subpopulations is directly increasing their risk for stones.[4] In addition, rural Indian populations lack sophisticated water filtration, and consumed water often has a high concentration of calcium ions which have historically been linked stone formation.[4] However, correlation between low-quality water, also known as "hard water", and kidney stone formation remains controversial. Regardless, kidney stones are common among Indians living in rural areas, and many individuals turn to nimesulide tablets to lessen the pain of kidney stones. Furthermore, kidney stones themselves have been shown to be a risk factor for CKD, and the high incidence of stones in rural populations likely contributes to the CKD epidemic in these areas.[5]

In February 2011, the Indian government banned the pediatric use of nimesulide because of its connection to liver failure and CKD. Yet, the availability of nimesulide tablets for adult use remained untouched. A quick market analysis of adult nimesulide sales in India puts the market at 2710 crore, which is equivalent to a little over $594 million US dollars at the time of the pediatric nimesulide ban.[6] Adult nimesulide sales represented roughly 0.032% of the entire GDP of the Indian subcontinent in 2011 and thus may have played a role in keeping adult nimesulide tablets on the market despite the strong scientific evidence against their use.

Accessibility is another important issue in rural India that perpetuates high rates of CKD. After spending time at a clinic in the town of Phalodi, located in the Jodhpur district of the Indian state of Rajasthan, it became clear that medical resources and access to dialysis in this area are very limited. Namely, there exists a single clinic that manages the renal health of the 49,914 residents of Phalodi as well as many of the rural satellite cities that lie on the outskirts. A study looking at the prevalence of CKD in the rural Indian city of Karnataka found that CKD was present in 6.3% of the population.[7] Assuming the same prevalence of CKD in the area surrounding Phalodi, we estimate that there are upwards of 3,000 individuals with CKD, many of whom will require access to dialysis care at some point in their life. However, these thousands of individuals will be fighting for access to one of six accessible dialysis machines at the Phalodi clinic.

At the time of my visit, the six dialysis machines were at full capacity and managing the health of 14 individuals with end-stage renal disease (ESRD). Much time was spent investigating how these 14 lucky people were chosen out of a pool of thousands, and by the end of the trip it became evident that transportation is the bottleneck that dictates dialysis care (Table 1). Many individuals living in these rural areas have extremely limited access to transportation services and are unable to travel to dialysis centers at the frequency required for regular dialysis care. Importantly, this disparity in transportation also makes it difficult for CKD patients to manage their disease, allowing a higher percentage of CKD patients to progress to ESRD. As a result, rural India sees a higher percentage of exacerbated CKD and ESRD, while these same regions have little access to medical resources and dialysis care.

CONCLUSION

In conclusion, although the etiology of CKD in rural India is eclectic in nature, several preventable factors that contribute greatly to disease prevalence exist. By targeting solutions aimed at mitigating the effects of these preventable factors, we can hopefully ameliorate the CKD epidemic in these rural areas. Namely, legislation should focus on reducing nimesulide use, providing access to clean and available water, and increasing transportation to medical centers that can provide preventative care.

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Table 1. Epidemiological data of dialysis patients at the Phalodi clinic

Patient Number	Age	Gender	Length of period on dialysis	Diagnosis	Distance from dialysis clinic	Mode of transport and time taken to dialysis clinic
1	34	F	6 Years 3 Months	CRF and Hypertension	15 Km.	Own Vehicle (45 Minutes)
2	48	M	1 year 3 Months	CRF and Hypertension	58 Km.	Public Transport (2.5 Hours)
3	40	M	3 Years 4 Months	CRF and Hypertension	20 Km.	Public Transport (2 Hours)
4	42	M	7 Months	CRF, Diabetes and Hypertension	70 Km.	Public Transport (2 Hours)
5	38	M	1 Year 1 Month	CRF and Hypertension	20 Km.	Public Transport (1 Hours)
6	32	F	6 Years 6 Months	CRF and Hypertension	2 Km.	Own Vehicle (20 Minutes.)
7	38	M	5 Years 9 Months	CRF and Hypertension	22 Km.	Public Transport (2 Hours)
8	75	M	8 Years 9 Months	CRF and Hypertension	38 Km.	Public Transport (2 Hours)
9	48	M	3 Years 4 Months	CRF and Hypertension	38 Km.	Public Transport (2 Hours)
10	28	M	3 Years 6 Months	CRF and Hypertension	54 Km.	Public Transport (3 Hours)
11	42	M	2 years 8 Months	CRF and Hypertension	31 Km.	Public Transport (1 Hour)
12	45	M	1 Year 3 Months	CRF and Hypertension	38 Km.	Own Transport (1 Hour)
13	40	F	2 Years	CRF, Diabetic and Hypertension	8 Km.	Rental Auto (30 Minutes.)
14	38	F	3 Years 6 Months	CRF and Hypertension	7 Km.	Rental Auto (30 Minutes.)

CRF – chronic renal failure

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COMPETING INTERESTS

The authors completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf (available upon request from the corresponding author), and declare no conflicts of interest.

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