ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 12, Issue, 11, pp.14705-14708, November, 2020

DOI: https://doi.org/10.24941/ijcr.40132.11.2020

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

WATER POLLUTION: IS IT A RISK FACTOR FOR CKD?: AN OBSERVATIONAL STUDY.

[1*]Dr. Arti Muley and [2]Dr. Divya Lalwani

[1]Professor, Deptt., of Medicine, PIMSR, Parul Univrsity Piparia, Vadodara
[2]Resident, Deptt., of Medicine, SBKS MIRC, Piparia, Vadodara

ARTICLE INFO

Article History:
Received 10th August, 2020
Received in revised form
17th September, 2020
Accepted 30th October, 2020
Published online 30th November, 2020

Key Words:
CKD, Unknown Risk Factors,
Water Pollution.

ABSTRACT

Introduction: One of the triggering factors for CKDu has been observed to be associated with drinking water. In our hospital, we see many patients of CKD who appeared to be coming from a particular geographical area. Hence, we performed this study to identify the common geographical area and see if there have been reports of water pollution from that particular area. **Methodology:** This retrospective cohort study included all patients > 18 years old coming to OPD or admitted with CKD. A detailed information was collected regarding patients' residence and their water source and whether water pollution was reported from that common source. The data collected regarding the geographical areas was matched with the geographical areas in previous reports where water pollution had been reported. **Results:** Total 71 patients were included. 38 did not have any underlying cause of CKD. 25 (75.75%) came from Madhya Pradesh and 12 (36.36%) came from Gujarat. It was observed that the regions from which these patients came lied either in Narmada basin (Khargaon, Khandva, Badwani and Alirajpur) or around it (Dhaar, Ratlam, Ujjain, Mandsor, Vadodara and Godhra). Some previous studies reported that water in Narmada basin was polluted with agriculture and industrial wastes and also contained chromium, copper and iron metals beyond the permissible limits especially in the wet season. **Conclusion:** Water pollution due to agricultural and industrial waste may contribute to development of CKD even in absence of any other risk factors. A separate study is required for proving causation.

Citation: ***Dr. Arti Muley and Dr. Divya Lalwani*****. 2020.** "Water pollution: Is it a risk factor for CKD?: An observational study.", *International Journal of Current Research*, 12, (11), 14705-14708.

INTRODUCTION

Chronic kidney disease (CKD) is a global health problem with high morbidity and mortality (Levey, 2012) It affected 753 million people globally in 2016 (Bikbov, 2018) It multiplies risk of diabetes, hypertension and cardiovascular mortality manifolds (Couser *et al*., 2011; Sathya, 2012) 80% of cases come from low or middle income countries (Couser, 2011). African Americans, American Indians and South Asians are at high risk due to socioeconomic and environmental reasons (Appel *et al*., 2008). Water pollution has been reported to be important for causation of CKD of unknown etiology (CKDu) (World Health Organization, 2013), the most common pollutants suggested being excess fluoride and hardness (Ca^{2+}, Mg^{2+}), ions ($HCO3^-$, Cl^- , $SO4^{2-}$) (Dissanayake, 2017; Chandrajith *et al*., 2011; Wasana, 2016; Wickramarathna *et al*., 2017) and metals (arsenic, cadmium, aluminium) (Anon, 2016; Jayasumana *et al*., 2013) In India, the presence of silica has also been a cause of concern (Khandare *et al*., 2015). In our hospital, patients of CKD appear to be coming from a particular geographical area. Hence, we performed this study to identify the common geographical area and see if there have been reports of water pollution from that particular area.

METHODOLOGY

The study was a retrospective cohort study carried out for one year from January 2019 to December 2019. All Patients 18 years old and above coming to OPD or admitted with previous or new diagnosis of CKD based on National Kidney Foundation (NKF) guidelines *(*National Kidney Foundation, 2002*)* were included in the study. The records of these patients were procured from the records section of the hospital and data was collected.

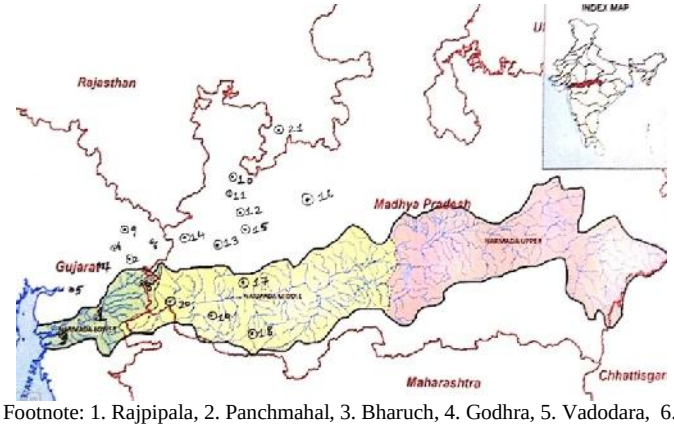
A detailed information was collected regarding the demographic data including the areas where the patients resided, whether those areas had a common water bed or source or not, and whether water pollution was reported from that common source. Information regarding industrial area present in the region and water pollutants reported in the region in previous studies was collected. The data collected regarding the geographical areas was matched with the geographical areas in previous reports where water pollution had been reported and with the areas in which industries were present.

RESULTS

Total 71 patients were included. Out of these, 24 (33.80 %) were females and 47 (66.19 %) were males. 33 (46.47%), 21(29.57 %) and 17 (23.94 %) belonged to ≤ 40 years, 41 – 60 years and > 60 years age group respectively. All 31 who were < 40 years in age and seven patients of age 41-45 years did not have any underlying cause of CKD. Out of the 33 patients 25 (75.75%) came from Madhya Pradesh, 12 (36.36%) came from Gujarat while only one came from Rajasthan. Out of the 25 patients of Madhya Pradesh, 7 (28%) came from Khargaon, 4 (16%) from Dhar and 3(12%) each came from Khandwa, Badwani and Ratlam. (Table 1) Out of the 12 patients from Gujarat, 6(50%) came from Vadodara, 2(16.66%) each came from Godhra, Rajpipla and Mahisagar. The regions from which these patients came was recorded and plotted on the geographical map. (Fig. 1) It was observed that most of these areas lied either in Narmada basin (Fig. 2) (Khargaon, Khandva, Badwani and Alirajpur) or around it (Dhaar, Ratlam, Ujjain, Mandsor, Vadodara and Godhra).

Table 1. Areas from where patients with no underlying cause of CKD came

S.no	Madhya Pradesh (25)	No. of patients (%)	Gujarat (12)	No. of patients (%)
1.	Khargon	7 (28%)	Vadodara	6 (50%)
2.	Dhaar	4 (16%)	Godhra	2 (16.66%)
3.	Badwani	3 (12%)	Mahisagar	2 (16.66%)
4.	Ratlam	3 (12%)	Rajpipla	2 (16.66%)
5.	Khandva	3 (12%)		
6.	Javra	2 (8.0%)		
7.	Alirajpur, Ujjain, Mandsor	1(.04%) each		



Footnote: 1. Rajpipala, 2. Panchmahal, 3. Bharuch, 4. Godhra, 5. Vadodara, 6. Dahod, 7. Halol, 8. Chota Udaipur, 9. Mahisagar, 10. Mandsaur, 11. Ratlam, 12. Ujjain, 13. Dhar, 14. Jahwa, 15. Indore, 16. Nagda, 17. Khargaon, 18. Khandwa, 19. Jhalawar; 20. Badwani, 21. Alirajpur; 1-9: Gujarat, 10-20: Madhya Pradesh; 21: Rajasthan

Fig.1 Areas where patients belonged

Our search for studies regarding water pollution in this region yielded one study which reported that water at Sandia, Hoshangabad, Mandleshwar and Garudeshwar stations in Narmada basin contained chromium, copper and iron metals beyond the permissible limit. The contents of metal ions were higher during February and June month (Jakir Hussain, 2014). Another study reported that water quality of Narmada was not suitable for consumption in monsoon season (Nidhi Gupta, 2017).

Fig. 2 Narmada basin

In a study in 2014, the water quality analysis indicated that the river water in the Pipariya area was polluted and can serve as a bad habitat for many aquatic animals including endangered species with Narmada River (Mukesh Katakwar, 2014). The authors suggested the major source of pollution to the Narmada river being the anthropogenic municipal solid waste and sewage from nearby towns/habitations, agricultural runoff and native soil erosion. They suggested that quality of the Narmada River was degraded due to the municipal and industrial discharges from the catchment.

DISCUSSION

CKD has now become a global health problem in both developing[18] and non-developing countries.[19] Diabetic glomerulosclerosis and hypertensive nephrosclerosis are supposed to be the major pathological entities as it is usually related with diabetes, old age and hypertension (Levey, 2012). CKDu has been reported to be common in agroindustrial sectors. While some report that the main etiology is pesticides used in agricultural activities (For example, sugarcane culture), (Jayasumana, 2017) others (Valcke, 2017) showed a role of nephrotoxic agrochemicals as the cause. Some heavy metals like cadmium, mercury, lead, chromium and platinum have also been suggested to be related to the increased risk of CKDu (Barbier *et al*., 2005; Johri, 2010; Jha, 2013) Additionally, in some countries dehydration and chronic heat stress is considered a key contributory etiologic factor (Soderland, 2010).

In a Srilankan study, elevated concentration of hardness, fluoride, salinity and alkaline nature of water with higher concentrations of Ca, Mg, Fe, and DOC levels (dissolved organic carbon) were reported to be the main issues reported in water in the areas from where cases of CKDu were coming. They also reported poor water quality in these areas in wet season (Titus Cooray, 2019). In a study published in India, the odds of finding agricultural and industrial workers in patients with CKD were significantly greater than that in controls (Muley, 2019) may be because of presence of environmental or industrial toxins such as residual pesticides, fluoride, aluminum, cadmium, and cyanobacteria in drinking water. Thus, to reduce the burden of CKD, the risk factors associated with CKD locally should be identified, and then, policies should be aimed to make people aware of the risk factors. We performed this study to see if water pollution can be a

contributory factor for the CKD seen in young patients (with no history of diabetes or hypertension or any other cause for CKD) coming to our hospital. We observed that the regions from where these patients were coming lied in or around the Narmada basin. We also found that there have been reports of presence of heavy metals in water and water pollution due to sewage and agroindustrial waste in this region in the past. It has been shown that the risk of CKD generated by pesticides can be even higher due to the presence of heavy metals like cadmium and lead due to synergistic toxicity of pesticides and heavy metals (Jha, 2013) Hence, we inferred that water pollution might be a contributory factor in development of CKDu in young patients coming to our hospital.

It might be argued that the region from where these patients are coming is actually the surrounding region of the hospital and that a major chunk of our patients come from this region hence it might be just an illusion that our CKD patients are coming from these areas. However, we found that the proportion of CKD in these patients was much higher than that in patients coming from other areas. In higher proportion or not, the fact still remains that young people without any underlying cause are developing CKD and those with diabetes also developed CKD at a quite young age. Hence, although this study does not prove causation, it still gives a good reason to study the water in this area (keeping CKD especially in mind) for contaminants which may lead to CKD.

Conclusion

Although a separate study is required for proving causation, this study highlights the fact that water pollution due to agricultural and industrial waste may contribute to development of CKD even in absence of any other risk factors and this should be kept in mind while making policies for management of water resources being used for domestic purposes.

Acknowledgement: None.

Conflicts of Interest: None.

Funding: None.

REFERENCES

Anon. International Expert Consultation on CDKu- 2016. Paper 6: Interventions and resaerch priorities on water and heavy metals in relation to CKDu in Sri Lanka. Colombo, Sri Lanka: 2016.

Appel LJ, Wright JT, Greene T, Kusek JW, Lewis JB, Wang X, Lipkowitz MS, Norris KC, Bakris GL, Rahman M, Contreras G. Long-term effects of renin-angiotensin system–blocking therapy and a low blood pressure goal on progression of hypertensive chronic kidney disease in african americans. Archives of Internal Medicine. 2008 Apr 28;168(8):832-9.

Barbier O, Jacquillet G, Tauc M, Cougnon M, Poujeol P. Effect of heavy metals on, and handling by, the kidney. Nephron Physiology. 2005;99(4):p105-10.

Bikbov B, Perico N, Remuzzi G. on behalf of the GBD Genitourinary Diseases Expert Group. Disparities in Chronic Kidney Disease Prevalence among Males and Females in 195 Countries: Analysis of the Global Burden of Disease 2016 Study. Nephron. 2018;139(4):313-8.

Chandrajith, R.; Dissanayake, C.B.; Ariyarathna, T.; Herath, H.M.J.M.K.; Padmasiri, J.P. Dose-dependent Na and Ca in fluoride-rich drinking water—Another major cause of chronic renal failure in tropical arid regions. Sci. Total Environ. **2011**, 409, 671–675. (CrossRef) (PubMed)

Couser WG, Remuzzi G, Mendis S, Tonelli M. The contribution of chronic kidney disease to the global burden of major noncommunicable diseases. Kidney international. 2011 Dec 2;80(12):1258-70.

Dissanayake, C.B.; Chandrajith, R. Groundwater fluoride as a geochemical marker in the etiology of chronic kidney disease of unknown origin in Sri Lanka. Ceylon J. Sci. **2017**, 46, 3–12. (CrossRef)

Jakir Hussain (1)*, Ikbal Husain (2), Mohammed Arif (3). Occurrence of trace and toxic metals in river Narmada. EQA – Environmental quality.14 (2014) 31-41.

Jayasumana C, Paranagama PA, Amarasinghe MD, Wijewardane KMRC, Dahanayake KS, Fonseka SI. Possible link of chronic arsenic toxicity with chronic kidney disease of unknown etiology in Sri Lanka. Journal of Natural Sciences Research. 2013; 3:64–73.

Jayasumana,C.,Orantes,C.,Herrera,R.,Almaguer,M.,Lopez,L., Carlos-Silva,L., Ordunez,P.,Siribaddana,S.,Gunatilake,S.,DeBroe,M.E.,2017.Chronic interstitial nephritis in agricultural communities: a worldwide epidemic with social, occupational and environmental determinants.Nephrol.Dial.Transplant.32,234–24

Jha V. Garcia, Garcia G, Iseki K, *et al*. Chronic kidney disease. 2013.

Johri N, Jacquillet G, Unwin R. Heavy metal poisoning: the effects of cadmium on the kidney. Biometals. 2010 Oct 1;23(5):783-92.

Khandare AL, Reddy YS, Balakrishna N, Rao GS, Gangadhar T, Arlappa N. Role of drinking water with high Silica and Strontium in Chronic Kidney Disease: An Exploratory Community-based Study in an Indian Village. Indian Journal of Community Health. 2015; 27(1):95–102.

Levey AS, Coresh J. Chronic kidney disease. The lancet. 2012 Jan 14;379(9811):165-80.

Mukesh Katakwar. Water quality and pollution status of Narmada river s Anjan Tributary in Madhya Pradesh, India. Int. J. of Curr Res.Aca.Rev.2014;2(11)93-98.

Muley A, Mamtani S, Mistry M, Kantharia H, Chandrakar VR. To identify newer probable risk factors of chronic kidney disease in the indian population: A case–control study. Current Medical Issues. 2019 Jul 1;17(3):55

National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: Evaluation, classification, and stratification. Am J Kidney Dis 2002;39:S1-266

Nidhi Gupta, Pankaj Pandey & Jakir Hussain (2017) Effect of physicochemical and biological parameters on the quality of river water of Narmada, Madhya Pradesh, India, Water. Science, 31:1, 11-23, DOI: 10.1016/j.wsj.2017.03.002

Ploth DW, Mbwambo JK, Fonner VA, Horowitz B, Zager P, Schrader R, Fredrick F, Laggis C, Sweat MD. Prevalence of CKD, diabetes, and hypertension in rural Tanzania. Kidney international reports. 2018 Jul 1;3(4):905-15.

Sathya GR. Prevalence of Risk factors for chronic kidney disease in a coastal area of Tamil Nadu, South India. IOSR Journal of Dental and Medical Sciences 2012;2:29-33.

Shams S, Khan HA, Ayaz M, Afridi SG. Efficacy of Atorvastatin on Proteinuria in Chronic Kidney Disease Patients of District Mardan, Pakistan. J. Appl. Environ. Biol. Sci.. 2018;8(3):81-7.

Soderland P, Lovekar S, Weiner DE, Brooks DR, Kaufman JS. Chronic kidney disease associated with environmental toxins and exposures. Advances in chronic kidney disease. 2010 May 1;17(3):254-64.

Titus Cooray, Yuansong Wei, Hui Zhong, Libing Zheng, Sujithra K. Weragoda and Rohan Weerasooriya. Assessment of Groundwater Quality in CKDu Affected Areas of Sri Lanka: Implications for Drinking Water Treatment. Int. J. Environ. Res. Public Health 2019, 16, 1698; doi:10.3390/ijerph16101698

Valcke M, Levasseur ME, da Silva AS, Wesseling C. Pesticide exposures and chronic kidney disease of unknown etiology: an epidemiologic review. Environmental Health. 2017 Dec;16(1):49.

Wasana, H.M.S.; Aluthpatabendi, D.; Kularatne, W.M.T.D.; Wijekoon, P.; Weerasooriya, R.; Bandara, J. Drinking water quality and chronic kidney disease of unknown etiology (CKDu): Synergic e_ects of fluoride, cadmium and hardness of water. Environ. Geochem. Health **2016**, 38, 157–168. (CrossRef) (PubMed)

Wickramarathna, S.; Balasooriya, S.; Diyabalanage, S. Tracing environmental aetiological factors of chronic kidney diseases in the dry zone of Sri Lanka—A hydrogeochemical and isotope approach. J. Trace Elem. Med. Biol. **2017**, 44, 298–306. (CrossRef)

World Health Organization (WHO). Chronic Kidney Disease of Unknown Origin (CKDu): National Research Programme for Chronic Kidney Disease of Unknown Origin (CKDu) in Sri Lanka; World Health Organization (WHO): Geneva, Switzerland, 2013.

****