

(6) GEOGRAPHICAL

6.1 A STUDY OF GEOGRAPHICAL DISTRIBUTION OF CHRONIC KIDNEY DISEASE OF UNKNOWN ORIGIN IN SRI LANKA USING GIS & GPS MAPPING

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Introduction:

In early nineties investigators in Sri Lanka have noticed an alarmingly high incidence of an apparently new form of chronic kidney disease of unknown aetiology (CKDu) in some parts of Sri Lanka. A steady increase has been observed within last twenty years. Histopathological studies have revealed a tubulo interstitial nephritis at early stage of the disease which is suggestive of a toxic aetiology. Researchers who investigated the disease proposed number of risk factors including high level of fluoride in ground water , leaching of heavy metals such as cadmium from agrochemicals into water sources, exposure to inorganic pesticides and usage of aluminium containers for cooking. However, the lack of sufficient epidemiological studies made the identification of the aetiological agent difficult. Aim of the present study is to investigate the geographical distribution of CKD-U using modern GPS and GIS mapping.

Method & material : Information of 11630 patients were collected and used for GIS mapping using AR 9.2 software and GPS mapping.

Results

GIS mapping indicated five high prevalent areas in the region namely Medawachchiya (identified 20 yrs ago), Padaviya (identified 18 yrs ago), Girandurukotte (identified 12 yrs ago), Medirigiriya (identified 8 yrs ago) and Nikawewa (identified 5yrs ago). Low prevalence of the disease was noted in communities who consume water from natural springs for drinking. In all five areas the distribution is related to stagnant irrigated water. Most of the affected villages are located below the level of the reservoirs and canals. GPS mapping showed most of the cases are located below the level of some reservoirs and some are related to the irrigation canals.

Conclusions

All the high prevalent areas are clustered around reservoirs of the irrigation system. The epidemiological data on geographical distribution infers that while older foci of CKD-U are persisting, there is an emergence of new foci of CKD-U with the time. The presence of the affected villages located below the level of the reservoirs and canals indicated the possibility of irrigated water draining to the shallow wells of the households which is the source of drinking water. A similar pattern of distribution of endemic nephropathy was described in Balkan region along the Danubi river in low altitude areas where water stagnates.

Extended Abstract

Introduction:

In early nineties investigators in Sri Lanka have noticed an alarmingly high incidence of a new form of chronic kidney disease of unknown aetiology (CKDu) in North Central Region of the Sri Lanka. This kidney disease was not related to any of the known causes such as diabetes mellitus, hypertension & infection. However, histopathology of affected kidneys showed tubulo interstitial nephritis which is suggestive of a toxic aetiology. Researchers who investigated the disease proposed number of risk factors including high level of fluoride in ground water, heavy metals such as cadmium leached out from agrochemicals into water sources, exposure to inorganic pesticides, usage of aluminium containers for cooking and ochratoxin etc. Although many studies on the aetiology of the disease were carried out by different research groups, a comprehensive epidemiological study has yet been reported. As such, identification of the aetiology has become a difficult task. In this study, we attempted using GIS and GPS technologies to study the geographical distribution of chronic kidney disease of unknown origin which is an important non communicable health problem in Sri Lanka.

Aim:

The present study was carried out to with the aim of studying demographic characteristics of the patients, geographical distribution of the disease, location of households of the CKD-U patients in relation to reservoirs, irrigation canals and the topography of the affected area that would help identifying potential aetiological factor/s which could be associated with the disease.

Method & material:

Information was collected with reference to basic demographic data (age & sex) and respective addresses of 11323 chronic kidney disease patients who attended to community renal clinics that were especially established to follow up CKD-U patients. Geographical Information System (GIS) mapping was used to study the geographical distribution of the disease using ARC 9.2 software. Based on the findings of the GIS mapping, two locations were selected for further studies to identify the location of households of the CKD-U patients in relation to reservoirs, irrigation canals and the topography of the two selected areas. Homes of these patients were visited to record the GPS coordinates, collect demographic data and to reconfirm the diagnosis using documentary evidence. The sample was restricted to 863 during home visits. (796 and 67 patients from Padaviya and Nikawewa respectively).

Results :

The demographic information showed that the male : female ratio of the disease is 2.4 :1. CKD-U is more prevalent in the age groups between 40-60 with a mean age of 54.7 yrs. Out of the total, 90% of the patients were farmers. In 92% of patients the source of drinking water was shallow wells. CKD-U was present even among patients who consumed boiled water exclusively for lifelong drinking. Clustering of the disease was observed in 30% of the families.

mapping shows that most of the affected villages are below the reservoir or canals. Area with the lowest altitude is affected by the disease.

Discussion :

It has been observed that all five regions affected with the CKD-U encompass a well developed irrigation system comprising of reservoirs. Water from these reservoirs is mainly used for agricultural purposes. However, the people who live in these areas consume water from shallow wells and water levels of these shallow wells are proportionate to the water levels of the canals indicating that the ground water table is recharged from irrigation canals & reservoirs. It has been observed that the prevalence of the disease is comparatively low in the villages where natural spring water is available for consumption.

Observations of the study reveals that the exposure to the aetiological agent remains unchanged and new disease foci are reported to be emerging. Disease preponderance in males may be due to their frequent exposure to the aetiological agent than females or due to another unknown contributory factor that operates in males which increases the risk of the disease.

Conclusion:

The characteristic geographical distribution of the disease related to stagnant irrigated water indicates the possibility of an environmental factor related to water in the pathogenesis of the disease. The use of water from the shallow wells for drinking by the affected population indicates the possibility that the aetiological agent is water soluble. Presence of the disease in patients who consume boiled water for life long drinking indicates the possibility of heat stable nature of the aetiological agent. Unraveling the etiology of CKD-U will also allow appropriate preventive measures to be taken in the afflicted areas, such as by treatment of the drinking and cooking water or changing the main water supply.

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