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HOSPITAL EFFLUENT INDUCED CHROMOSOMAL ABERRATION IN RATS LIVER AND KIDNEY FROM NATIONAL ORTHOPAEDIC HOSPITAL AND UNIVERSITY OF NIGERIA TEACHING HOSPITAL ITUKU OZALLA

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ABSTRACT

The deteriorating conditions of environment by heavy metal pollution have led to the study of impact of improper hospital waste disposal of Enugu State Nigeria. Most pollutions result from uncontrolled discharge of untreated wastes and effluent from hospitals in the study area. These hospitals are sited at residential homes and the method of wastes disposal from them is open dumping which have adverse effect on the surrounding environment. Hospital effluent induced chromosomal aberration in rat liver and kidney from National Orthopaedic Hospital, Enugu and University of Nigeria Teaching Hospital Ituku/Ozalla was carried out to assess the level of heavy metal concentrations and impacts on the organs. The histological investigation of the rat kidney and liver organs was carried out using chromosomal aberration test. The primary aim is to ascertain the toxicological impact of hospital wastes disposal on living animal (rat) and investigate the degree of damage of rat kidney and liver using chromosomal aberration test. The results of the findings showed different mutagenicity effect on the tested rat organ. The kidney and liver of the rats were subjected to histopathological examination of the internal organs of the rat (kidney and liver) of the rats to reveal the extent of damage as compared to the control that was fed with only saline water. The plates showed degeneration, necrosis and tissue disruption, and histopathological effects in the rat kidney and liver organs. It showed that the rat has accumulated the selected heavy metals in their system. Based on the accumulation of these metals, there was mutation in the genetic mechanism of the rats both in the kidney and liver turning the cells to ring-like form. Based on the above findings, the study recommends: periodic monitoring of the disposed wastes in order to mitigate the harmful effects to both the hospital workers and inhabitants within the area. Improper disposal of hospital waste should be discouraged and offenders should be seriously punished. Hospital waste should be treated and incinerated instead of open dumping. There is also the need for use of colour codes for waste segregation, disposal and management and relocation of the dumps sites in the study areas to Shale terrain as shale does not allow percolation of pollutant.

KEYWORDS: *environment, metal pollution, mutagenic effects, metal pollutants*

BACKGROUND

Enugu State has numerous healthcare service delivery including National Orthopaedic Hospital and University of Nigeria Teaching Hospital in the area. These hospitals generate waste that poses health challenges to healthcare workers and the communities in general. The types of waste generated in these hospitals are special wastes, including sharps, chemicals, genotoxic, pasteurized, pressurized, pathogenic and infectious wastes. Owing to the fact that these wastes are carelessly disposed in the environment around the hospitals without pre-treatment, there is need to evaluate the toxicological impact of these wastes in rats organs as an evidence to portray the possible health impact on man and the environment, hence, this study.

The deteriorating conditions of environment by heavy metal pollution have led to the study of impact of improper hospital waste disposal of Enugu State Nigeria. Most pollutions result from uncontrolled discharge of untreated effluent from hospitals in the area. These hospitals are sited at residential homes and the method of wastes disposal from these hospitals is open dumping. According to Rashed (2001) and Vinikour *et al.* (1980), metal pollutants in environment are not degraded, rather they are deposited, and some of them are assimilated by the animals posing serious threats to human health when they are they come in contact with the food and water. Some heavy metals such as Zn, Cr, Cd, Co, Mg, and Fe are dangerous at high levels (Nadal *et al.*, 2004; Ochieng *et al.*, 2007; Kar *et al.*, 2008; Aktar *et al.*, 2010). The concentration of some of these metals may cause neurological impairment and central nervous system malfunctioning. The detection of toxic level of these pollutants in the rat organs observed in this vicinity in recent times necessitated this study and this has attracted the attention of various non-governmental organizations and researchers. Rat diagnoses are often used to detect and monitor these heavy metal contaminations in environment. This study is embarked upon to determine the levels of heavy metals in rats fed with effluent from National Orthopaedic Hospital and University of Nigeria Teaching Hospital Ituku Ozalla in Enugu State, Nigeria.

AIM AND OBJECTIVES

The aim of the study is to evaluate the effects of hospital waste induced in chromosomal aberration in rat liver and kidney from National Orthopaedic Hospital Enugu and University of Nigeria Teaching Hospital Ituku Ozalla. To achieve the aim the objectives includes: to ascertain the toxicological impact of hospital wastes disposal on living animal (rat) and investigate the degree of damage of rat kidney and liver using chromosomal aberration test.

MATERIALS AND METHODS

Chromosomal aberration test: Biological risk assessment of sublethal concentration of lead and zinc on test animal: In order to investigate the capability of lead, chromium, copper, cadmium, magnesium, arsenic, nickel, and aluminum to induce mutagenic effects (chromosomal aberrations) in biological systems of animal as health effect assessment, rat were chosen and employed because of its karyotypic stability. This was undertaken after the establishment of the metals concentration in water and soil samples at sublethal concentrations. Four rat samples were collected from Animal Husbandry Department of University of Nigeria, Enugu. These were weighed with respect to length and documented before acclimatizing to laboratory condition for fifteen days before experiment. The rats were fed twice daily on the effluents from the hospitals and good conditions were maintained for the rats. Effluent water and wastes in the bioassay container was changed every alternate day after feeding. The physicochemical properties of holding water were determined using standard APHA, AWWA, Andrew *et al.* (1995). No mortality was recorded for the period of acclimatization. For the experiment, the rats were divided into five groups with five rats in each group. Group I served as the primary control and was maintained under normal conditions using saline water. The experimental Group II, III and IV were exposed to sublethal concentrations of the selected metals for 120hrs and 17 days. After 120h and 17 days, respectively, rat of all groups were injected with 0.5% colchicines four hours prior to dissection to arrest the metaphase stage.

Chromosomal preparation and analysis: Chromosome preparations were made following the procedure described by Obiakor *et al.* (2010) and Onwuemesi, (2012) using the liver and kidney, since kidney and liver represent the first target organ for contaminant. More than 100 well-spread metaphase plates were analysed for chromosomal aberrations at magnification of X400 oil immersion for all the groups, selecting 10-20 metaphases from each slide.

RESULTS

Improper disposal of hospital waste without pre-treatment has resulted to high level of toxic heavy metal pollution in the study area. The results of the chromosomal aberration test showed a significant alterations in the rat organs (liver and kidney). It shows inflammatory cells with mild to medium changes in the natural cells of the rats. This means improper disposal of hospital wastes without pre-treatment could cause health implications to human being and hence, there is need for serious monitoring of the method of waste disposal and management.

The kidney and liver of the rats were subjected to histopathological examination of the internal organs

of the rat (kidney and liver) of the rats to reveal the extent of damage as compared to the control that was fed with only saline water. From the result of the investigations, the following findings were made and shown in plates below.

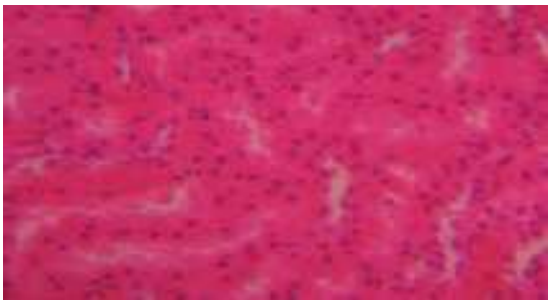

Plate 2(a) Liver of rat showing normal histological structure
congestion in the cells.

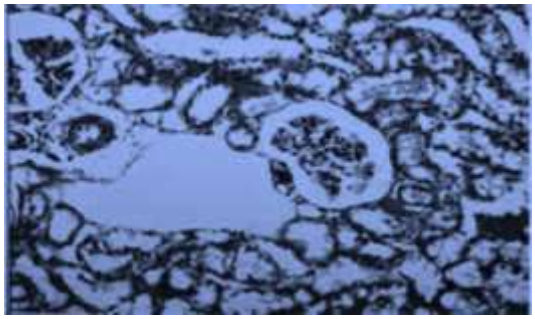

Plate 2(b): liver of rat A showing mild congestion in the cells structure of the tested rat.

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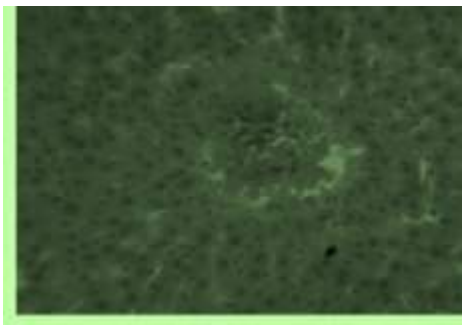

Plate 2(c): liver of Rat showing inflammatory cells with congestion changes in the rat liver organs

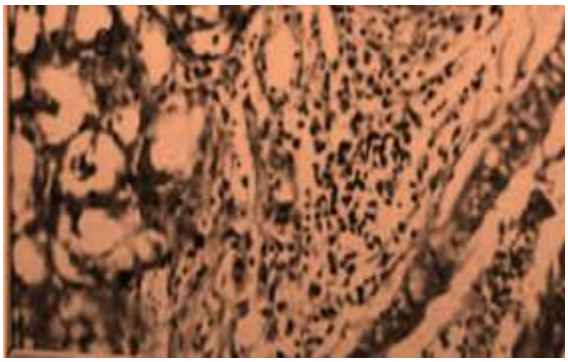

Plate 2(d): liver of Rat showing inflammatory cells infiltration with congestion and degenerative cells organs

Plates 2a showed normal histological structure of the rat liver organ which serves as the control while plates 2b, 2c and 2d showed different mutagenicity effect of hospital waste on the tested rat liver which were analyzed for the presence of heavy metals. From the plates, it was observed that serious gene mutation took place when the rats were fed with effluent and waste from the study area. The above findings were in line with several findings of some scholars like Onwuemesi, *et al*, (2013), Obiakor, (2011) and Oje, (2008).

The plates showed degeneration, necrosis and tissue disruption, and histopathological effects in the rat kidney and liver organs. It showed that the rat has accumulated the selected heavy metals in their system. Based on the accumulation of these metals, there was mutation in the genetic mechanism of the rats both in the kidney and liver turning the cells to ring-like form. The implication of such changes/alteration is that when human come in contact with such rat either by infesting/invading the food, man become liable and prone to the infection.

The above findings was in agreement with findings of Zahra, Amin and Reza, (2010) who showed that the concentrations of nickel (Ni) and vanadium (V) in liver of rats were higher in *P. erumei* than E. *orientalis* in both sampling regions. According to him, histopathology of the liver from their study shows some cellular alterations including degeneration, necrosis and tissue disruption, and histopathological effects were severe in *P. erumei* than *E. orientalis*. Results showed that Bandar Abbass region was more polluted than Bandar Lengeh and because Ni and V were oil pollution indicators and two flat fishes were benthic, they can receive considerable amount of oil pollution through their biological activities like feeding. Also, higher amounts of heavy metal concentrations and major histopathological effects in *E. orientalis* showed

strong relationship between benthic habitat of the fish and amounts of received pollutants from water and sediments since *E. orientalis* is more related to the bottom than *P. erumei*.

In a similar findings, Ma and Ma (2002) reported a similar result when rats were exposed to diesel exhaust. He observed marked lymphocytes aggregation, oedematous changes in alveolar septa and bronchioles. Also, thickening of alveolar walls and small blood vessels were observed. The long-term exposure period induce the development of lung tumours.

Moreover, Ajayi, *et al.,* (2011) found out that histopathological examination of internal organs (heart, lung, kidney and liver) of rats at busy roads revealed histopathological damage as compared to the control. The results of their findings indicated that vehicular exhaust fumes may have adverse physiological effects on the rats and hence humans living in close proximity to busy roads will be predisposed to automobile pollution.

A similar result was obtained by Abudule *et al.,* (2006) with higher concentration of Pd and Co in busy road compared to non-busy roads. Idrees (2009) observed a similar result of high concentration of Zn and Pd in busy roads. Vidhya (2007) obtained high concentration of Pd in busy road. A study by Ogunsola *et al.* (1994) from Nigeria has shown that traffic wardens have a higher blood lead levels than controls and they also have reduced spirometric measurements than controls. Sofoluwe (1968), working in Lagos, Nigeria visited the homes of 98 children suffering from bronchiolitis and pneumonia and found that these patients had been exposed to high concentrations of carbon monoxide, nitrogen dioxide, sulphur dioxide and benzene. Heavy metal concentrations were observed in the control rats. A similar result was obtained by Babalola *et al.* (2005). The distribution of heavy metals in the organs from the liver and kidney is probable that some quantity of this metal was present in the food (effluent and waste) given to the animals.

CONCLUSION

In conclusion, the studied hospitals are mildly polluted with toxic heavy metals; chromosomal aberration test showed high level of alteration in the kidney and liver organs of the tested rats, hence, there is need for periodic monitoring of the disposed wastes in order to mitigate the harmful effects to both the hospital workers and inhabitants within the area. Improper disposal of hospital waste should be discouraged and offenders should be seriously punished. Hospital waste should be treated and incinerated instead of open dumping. There is also the need for use of colour codes for waste segregation, disposal and management and relocation of the dumps sites in the study areas to Shale terrain as shale does not allow percolation of pollutant.

REFERENCES

1. *Abulude, F.O., Akinjagunla, Y.S. & Omoniyi, A. (2006). An Investigation into the Effect of Vehicle Exhaust Fumes on the Level of Some Heavy Metals in Cows Blood. Research Journal of Biological Sciences. 1(1-4):9-11.*
2. *Ajayi, O. A., Idowu, A. B., Eromosele, C. O., Dedeke, G. A. & Ademolu, K. O. (2011). Distribution and Effect of some Heavy Metals in Selected Organs and Tissues of Albino Rats Exposed to Vehicular Exhaust Fumes Proceedings of the Environmental Management Conference, Federal University of Agriculture, Abeokuta, Nigeria: 519-526.*
3. *Aktar, M.W., M. Paramasivam, M. Ganguly, S. Purkait and D. Sengupta, 2010. Assessment and occurrence of various heavy metals in surface water of Ganga River around Kolkata: A study for toxicity and ecological impact. Environ. Monitor. Assess., 160(1-4): 207-213.*
4. *Alink, G.M, J.T. Quik, E.J. Penders, A. Spenkelink, S.G. Rotteveel, J.L. Maasc and W. Hoogenboezemb, 2007. Genotoxic effects in the eastern mudminnow (Umbra pygmaea L.) after exposure to rhine water, as assessed by use of the SCE and comet assays: A comparison between 1978 and 2005.*
5. *Babalola, O.O., Ojo, L.O. & Aderemi, M.O. (2005). Lead levels in some biological samples of automechanics in Abeokuta, Nigeria. Indian J. Biochem. Biophys. 42: 401-403.*
6. *Idrees, F. A. (2009). Assessment of Trace Metal Distribution and Contamination in Surface Soils of Amman, Jordan. Jordan Journal of Chemistry. 4(1): 77-7.*
7. *Ma, J.Y & Ma, J.K. (2002).The dual effect of the particulate and organic components of diesel exhaust particles on the alteration of pulmonary immune/ inflammatory responses and metabolic enzymes. J . Environ Sci Health c Environ Carcinog Ecotoxicol Rev.20:17.*
8. *Obiakor, M. O., Okonkwo, J.C., Ezeonyejiaku, C.D & Ezenwelu, C.O (2010). Genotoxicology: Single and Joint Action of Copper and Zinc on Synodontis clarias and Tilapia nilotica. Journal of Applied Science and Environmental Management. Vol. 14 No. 3 pp59-64.*
9. *Ogunsola, O.J., Oluwole, A.F. & Asubiojo, O.I. (1994). Environmental impact of vehicular traffic in Nigeria; health aspects. Sci. Total Environ. 147:111-6.*
10. *Oje, (2008). Pollution statuses of lead and zinc in the lead-mining environment of Ishiagu, Town. Unpublished M.Sc. thesis, department of Biochemistry, University of Nigeria Nsukka, pp 36-39.*
11. *Onwuemesi, (2012). Environmental and Health Implications of Lead and Zinc Mining on Groundwater Resources of Ishiagu, Ebonyi State, Nigeria. M.Sc Thesis submitted to the Department of Environmental*

Management Department, Nnamdi Azikiwe University, Awka. 52-56.

12. *Onwuemesi, F.E. Onuba, L.N. Chiaghanam, O.I. Anudu, G.K. &Akanwa, A.O.(2013). Heavy Metal Accumulation in Fish of Ivo River, Ishiagu Nigeria. Research Journal of Environmental and Earth Sciences 5(4): 189-192.*
13. *Rashed, M.N., 2001. Monitoring of environmental heavy metals in fish from Nasser Lake. Environ. Int., 27: 27-33.*
14. *Sofoluwe, G.O. (1968). Smoke pollution in dwellings of infants with bronchopneumonia. Arch. Environ. Hlth. 16:670-672.*
15. *Vidhya, L., Dhandapani, M., Sekar, M. &Mahimairaja, S. (2007). Lead pollution in soil, water and plants due to automobile emission in urban environments in Coimbatore. Madras Agric. J., 94 (1-6): 89-96.*
16. *Vinikour, W.S., R.M. Goldstern and R.V. Anderson, 1980. Bioaconcentration pattern of zinc, copper, cadmium and lead in selected fish species from the Fox River Illonois. Bull. Environ. Contain Toxicol., 24: 727-734.*
17. *Zohreh Kheradpisheh, (2011). Medical waste production at obstetrics and gynecology Hospital in south of Iran. Journal of Public Health and Epidemiology Vol. 3(3):99-110.*