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Area under the receiver–operating characteristics as a model for evaluating and predicting biomarkers of early renal tubular damage in subjects occupationally exposed to lead

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The incidence of kidney failure is on the increase, unfortunately, traditional renal function markers are equivocal especially at the early stage until end-stage renal disease when kidney transplant becomes inevitable. Hence, the need for an early and more sensitive marker of renal damage indicating the presence of covert renal damage in occupational lead toxicity is imperative. This work is proposing diagnostic methods that could predict the development of Chronic Renal Failure (CRF) especially in occupational lead-exposed subjects combining results of conventional and new biomarkers of kidney damage using a mathematical model based on Area under the Receiver Operating Characteristics (AUROC). Traditional Renal Function markers (TRF) (plasma creatinine, urea and uric acid) were determined in one hundred each of Lead-Exposed Subjects (LES) and non-exposed, non-nephrotic adults (control) along with sixty Chronic Renal Failure patients (CRF) (all age-matched) using standard spectrophotometric methods. Blood lead level (Pb) was determined in all participants using Atomic Absorption Spectrophotometry (AAS) while levels of novel urinary renal enzymes - Glutathione-S-transferase (GST) and N-acetyl- β -D-glucosaminidase (NAG)- activities were also evaluated using ELISA techniques. Pb was used as True Positive Indices (TPI) and TRF along with NAG and GST were used as False Negative Indices (FNI). Ratios of mean, Creatinine : GST (A) (0.01, 0.02 and 0.09), Creatinine:NAG (B) (0.03, 0.08 and 0.6), Uric acid : GST (C) (0.05, 0.08 and 0.08), Uric acid : NAG (D) (0.29, 0.3 and 0.55), Urea : GST (E) (0.17, 0.55 and 0.93), Lead : GST (F) (0.42, 0.59 and 0.88), Lead : NAG (G) (2.56, 2.28 and 6.09), Lead : Creatinine (H) (80.62, 30.37 and 10..22), Lead : Urea (I) (2.46, 1.07 and 0.95) and Lead : Uric acid (J) (8.66, 7.61 and 11.12) for LES, control and CRF groups respectively were computed and used to plot an ROC curve using the FNI values as the abscissa and the TPI values as the ordinate while their AUC were calculated. The AUC values for Lead : Creatinine, Lead Urea and Lead : Uric acid were 1.00, 0.917 and 0.833 respectively. We suggest that application of this model after proper standardization may be useful in early identification of covert kidney damage especially in occupationally vulnerable group.

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