Relationship between blood and lead concentration and Zinc Protoporphyrin in workers exposed to inorganic lead in the north east of England

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ABSTRACT

Background: Lead is a known occupational health hazard. Blood lead (BL) and Zinc Protoporphyrin (ZPP) are the main markers used in the health surveillance. No particular advice is available on how to evaluate ZPP results.

Aim: To evaluate whether measuring ZPP contributes to the health surveillance for lead.

Methodology: BL, ZPP and Haemoglobin (Hb) results were extracted from the lead workers’ health records undertaken by the Newcastle Occupational Health and Hygiene Department between 1995 and 2007. Complete results formed a cross sectional group. Subjects with more than 1 set of data formed historic retrospective cohorts based on the interval between two blood samplings (1, 3 and 6 months). Receiver-operator curve was used to compute sensitivity and specificity of different levels of baseline variables for future BL≥50μg/dL and anaemia (Hb<13g/dL). Linear regression was used to formulate future BL and Hb based on the baseline variables. The University of Manchester Ethical Committee approved the study.

Results: In total 1315 sets of data from 460 lead workers were available. The mean BL and ZPP were 21.9 μg/dL and 23.5 μg/dL. Anaemia was more frequent in individuals with BL≥50μg/dL (OR = 6.8, CI 95% = 3.6 – 12.5). Correlation coefficient between BL and Log ZPP was the strongest in cross sectional group (r = 0.54, p = 0.000). Baseline BL, ZPP, ZPP / Hb and Log ZPP all had significant correlation with future BL. Baseline Hb had the strongest correlation with future Hb (r = 0.58, 0.43 and 0.50, p = 0.000). Baseline BL had the highest area under curve to predict future BL≥50μg/dL (0.93, 0.92 and 0.89).

Conclusion: Baseline BL and Hb are the best predictors of future BL and Hb in lead exposed workers. Measuring ZPP at every occasion is unnecessary. Further prospective studies are required to assess female workers and the impact of the industry and exposure.