Usefulness of Erythrocyte Protoporphyrin Tests in Children with Elevated Blood Lead Levels

Written for the Lead Report
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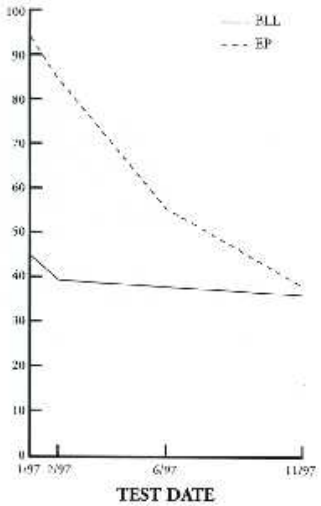
A Blood Lead Level (BLL) is the screening test of choice to detect increased lead burdens in children. However, blood lead levels are a poor indicator of the total body burden of lead. With chronic or prolonged lead exposure, the BLL represents only 1-2% of the lead in the body, only the tip of the iceberg. The majority of the lead is in the tissue and the bone.

This is where the Erythrocyte Protoporphyrin (EP) levels can provide additional information on body tissue levels. Protoporphyrin is the last precursor in hemoglobin synthesis in the body. Elevated leads of EP reflect impaired heme synthesis, one of the enzymes inhibited by lead. Iron deficiency and hemolytic anemia will also cause an elevated EP, so these must be ruled out.

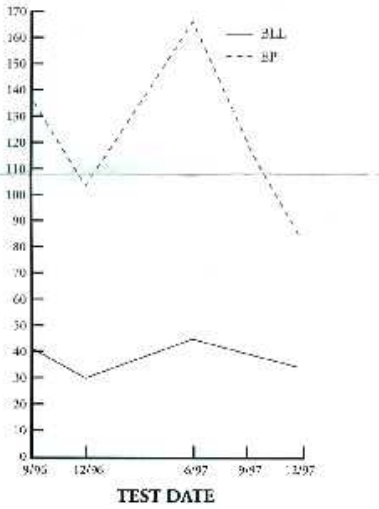
Although EP is not as sensitive as a screening tool for lead exposure, it helps measure the effects of lead on the body tissues. At the present time we do not have a better way to measure the total body burden of lead. For example, a child with a BLL of 33 and an EP of 200 has a much higher total body burden of lead than a child with a BLL of 33 and an EP of 80 or 40. The higher the EP, the more persistent the BLL elevations will be, provided we have ruled out iron deficiency.

The half-life of lead in the body is very long. Most of it is bound to the bone, but it is in a steady state of equilibrium with the blood lead. It can be very frustrating to monitor the slow decreases in BLL in a child previously exposed to lead. The EP levels more accurately reflect the progress in decreasing the lead burden in the body tissue. In this example, one three-year-old boy was monitored every 2 to 4 weeks for 6 months. His BLL remained high, but his EP showed the effects of chelation and removing lead hazards:



TEST DATE

Post-chelation is another time when following both the EP and BLL can be useful. We expect the BLL to decrease dramatically and then rebound in the month or two following chelation, as the bone lead reequilibriates with the blood lead. The blood lead often will return to around 70% of the prechelation level. It can be difficult to know if the child continues to be exposed to lead without also monitoring the EP. The EP should continue to decrease unless there is a new exposure. For example, this girl was reexposed to lead hazards between December 1996 and June 1997.



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In summary, Erythrocyte Protoporphyrin levels are a useful adjunct in monitoring children with BLL over 20 micrograms per deciliter. EP indicates the extent of the total body burden of lead and is useful post-chelation to follow progress in decreasing the total body lead burden and ensuring no new lead exposure.