2016-05-26

Lead Toxicity and Flint, Michigan

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**Recommended Citation**

Bishop, Adam; Davis, Marvel; and Flatt, Patricia, "Lead Toxicity and Flint, Michigan" (2016). *Academic Excellence Showcase Proceedings*. 42.  
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Lead Toxicity and Flint, Michigan

Adam Bishop, Marvel Davis, Patricia Flatt

Abstract

In light of the recent events in Flint, Michigan this poster will review lead poisoning and its long term effects. We will be covering the multitude of sources of lead poisoning, the mechanisms by which lead does its damage, detection methods, treatment options, and limitations therein. The issues in Flint have highlighted the flaws in current acceptable detection procedures as well as brought to light the dangers of lead. Public concerns about clean drinking water have brought these issues to the forefront.

Methods and Mechanisms

Lead has the capability of passing the blood-brain barrier, causing damage. Intracellularly, lead replaces calcium as a second messenger binding more readily than calcium, altering the protein’s conformation. Intracellular concentrations of Ca²⁺ increase in two ways: opening the calcium channels in the cell membrane or release of stored calcium. Lead has a high binding affinity even at low levels, often higher than calcium itself.

Testing and Acceptable Limits

Acceptable Limits
- Water: 15 µg/dl of lead
- Blood: 5 µg/dl of lead
- Soil: 400 ppm of lead

Testing
- Venous blood (VLL) testing is the recommended diagnostic tool to identify potential lead levels.
- Hair analysis can be used to detect lead in paint or soil.
- X-ray Fluorimeters can be used to detect lead in soil.

Symptoms and Toxicity

Symptoms
- Children: Developmental delay, Learning difficulties
- Adults: High blood pressure, Abdominal pain, Constipation, Jaundice

Toxicity
- The time signs and symptoms appear are typically already at toxic levels.
- Children: 1.5 µg/dl, - greater peripheral resistance response to stress
- Adults: >10 µg/dl

Cities Affected

Sebring, Ohio (2016)
Traverse City, Michigan (2016)
Newark, New Jersey (2016)
East Orange, New Jersey (2016)
Columbia, South Carolina (2015)
Tar Creek, Missouri (1983)

Treatment Options

Oral chelation therapies are used to lower blood lead levels, however they are not effective in removing lead from the bones, where lead can be stored. The effectiveness of chelation therapies to help those exposed to lead over long periods of time have been debated, and at the moment the only real effective treatment is to avoid exposure to lead altogether.

Conclusions

In conclusion, we found that there are many hidden sources of lead in and around the house which can contribute to lead toxicity. We also found that there is limited testing available for lead toxicity and the acceptable limits in water are at a rate which is not safe for children. Symptoms of lead toxicity are already beginning to appear. Surprisingly, toxic levels of lead found in the blood of children are all over the United States dating back into the 1990s, with 20 more cities with higher risks than Flint in 2003 which is too late for Flint.

Lead passes through the blood brain barrier via the calcium channel causing a multitude of symptoms to occur due to its higher affinity of binding to the substrate than calcium. Since studies have shown that even low levels of lead cause a degree of toxicity, often before symptoms occur, it is often the only lead that toxicity has occurred.

The crisis in Flint, Michigan should be a teaching moment for all of us. City officials had knowingly modified the procedures for testing lead levels in water so as to artificially lower the levels they reported to the EPA. This is a shocking trend that is being seen across the country in cities that are strapped for cash. If lead testing procedures are continually allowed to be modified, we will continue to see high lead levels across our country. The best course of action would be for legislation to be passed creating a standardized procedure for lead testing that cannot be modified by individual cities.