How Can We Combat Environmental Toxins?

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A growing foundation of scientific research has clearly established a link between environmental toxins and poor health and decreased well-being. Widespread exposure as well as diverse clinical impacts is now well documented. However, our current understanding of this harm and how best to address it is still in its early stages. We are only beginning to grasp the subtle and in some cases transgenerational effects of these toxins, with no real grasp of how the many toxins we are exposed to interact with one another, though we are certain that they do so. Here, we'll review some of the research literature documenting this link, as well as to briefly discuss strategies for both the avoidance and enhanced detoxification of environmental toxins.

Toxin Exposures/Clinical Importance

In many ways, the significant harm caused by environmental toxins is the "elephant in the room." At least 60,000 substances are registered with the U.S. EPA, some of which are known to be endocrine disruptors, neurotoxins, persistent and/or carcinogenic.(1,2) Approximately 6.5 billion pounds of chemicals are released into the environment each year, thus it should not be surprising that most of us have exposure to diverse types of compounds, including toxic metals, pesticides, insecticides, and PCBs.(3,4) At a level found in 70 percent of U.S. women over age 50, cadmi um for example, is known to increase the risk for myocardial infarction by 80 percent, as well osteoporosis by 40 percent, and may be responsible for over 20 percent of the osteoporosis among this age group.(5,6) Another toxic metal, arsenic, has been associated with a twoto four-fold increased risk for diabetes, at low levels of exposure often found in drinking water.(7,8) Although the reduction in blood lead levels over the past 30 years has been considered a major public health victory, millions of U.S. children are still exposed to levels considered safe by the Centers for Disease Control (CDC), but linked to neurodevelopmental damage and reductions in IQ.(9,10) Many pregnant women still have blood levels associated with a lower birth weight among their children.(11)

Unfortunately, the problem is not limited to toxic metals, and exposure to other harmful substances appears to be accelerating. For example, data from the NHANES for persistent organic pollutants (POPs, a designation which includes polychlorinated dibenzo-pdioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB), and several organochlorines used as pesticides) found a significant increase in risk for both cardiovascular disease (including hypertension) and diabetes. While the risk for cardiovascular disease was increased as much as five-fold with higher exposure, there was an astonishingly high 38-fold increase in risk for diabetes among those with the highest levels of just six POPs.(12-15) Organochlorine pesticides specifically were also found to increase the risk for diabetic neuropathy, in addition to the risk for neuropathy associated with diabetes itself.(16) POPs appear to directly impair insulin sensitivity, as well as to disrupt mitochondrial function, at low-dose levels commonly found in the diet.(17,18) Remarkably, in people with undetectable levels of POPs, the strong association between obesity and diabetes is not observed. In other words, when POPs concentrations are very low, type 2 diabetes is rare even among obese persons.

Environmental toxins also pose the greatest risk to those most vulnerable, such as children, and appear to have effects that may span generations. We are just beginning to discover the epigenetic modifications caused by many chemicals (i.e., changes that affect the expression of our genes without changing the sequence). A very recent paper published in Nature Reviews/Endocrinology details how even very low levels of exposure at developmentally critical times "may 'reprogram' the developing organism through irreversible changes in gene expression and predispose it for dysfunction much later in life."(19)

Strategies/Detoxification

The best strategy we have for preventing the damage done by environmental toxins is to reduce exposure, though given their ubiquitous nature this can be difficult to do. We can also support the detoxification of these compounds by supplying key nutrients such as N-acetylcysteine, alpha lipoic acid and other antioxidants, which have been shown to reduce cellular damage and increase glutathione levels (a major route of elimination for many chemicals).(20-23) An organic diet rich in plant-based foods limits the intake of toxins (which bioaccumulate up the food chain), and also provides antioxidants and other compounds important for detoxification. Cruciferous vegetables are particularly important, because they enhance the production of phase II detoxification enzymes, as well as inducing a number of cytoprotective genes.(24)

A switch to organic techniques - not just for commercial use, but also for residential use - is important as well. Pyrethroid pesticides, for example, are routinely applied residentially and found in at least 70 percent of individuals in the U.S., with particularly high levels in children.(25) Similarly, organophosphate pesticides are neurotoxins to which we also have widespread exposure, and to which newborns are particularly susceptible. (26) Genetic variation in the enzyme which metabolizes these pesticides (Paraoxonase 1, PON1) was recently shown to cause as much as a 164-fold increase in sensitivity to these toxins among newborns.(27-29) Polymorphisms in this gene have also been shown to increase the risk for amyotrophic lateral sclerosis (ALS), an effect influenced by exposure to organophosphate pesticides.(30)

These last examples also highlight why assessment of exposure, as well as assessment of detoxification capacity may also need to become more routine in medical practice. The considerable variations in detoxification capacity also influence the damage done by more recognizable toxins such as tobacco smoke, which is more likely to cause asthma in children with variants in the gene for glutathione production (GSTP1).(31) Some individuals may need a more thorough assessment to help identify the source of exposure, as well as interventions tailored to more specifically enhance their detoxification pathways. Other supportive therapies include sauna, fasting and hydrotherapy.

Conclusion

Environmental toxin exposure is common and at levels high enough to either cause or contribute to most diseases. Fortunately, we can do something about this first by decreasing exposure by eating organically grown foods and using personal care and household products that are low in toxins and by supporting our liver's ability to excrete and detoxify metals and chemicals with nutrients such as NAC, alpha lipoic acid and vitamin C and herbs like milk thistle and curcumin.