Toxic effects of heavy metals on the placenta

Koumousidis A., Turpin S., Roberts N.

Department of obstetrics and gynecology, Conquest hospital,

East Sussex Healthcare NHS Trust, United Kingdom

Introduction: During pregnancy, feto-placental unit replaces the function of the not-fully-formed organs of the fetus and protects against infections, toxins, and chemical substances. Examination of the placenta provides information for the endometrium and contributes in investigations of perinatal deaths, intrauterine growth retardation and malformations. Heavy metals are considered one of the most important groups of environmental pollutants, which may well in small quantities be essential nutrients protecting health, but in greater quantities they can become toxic and dangerous. The major heavy metals are: antimony, aluminum, silver, arsenic, vanadium, barium, bismuth, tungsten, gallium, zirconium, thallium, indium, iridium, cadmium, tin, lanthanum, platinum, manganese, lead, nickel, niobium, palladium, rhodium, ruthenium, scandium, strontium, tantalum, mercury, yttrium, copper, hafnium, gold, chrome.

Methods and results: Several articles were reviewed regarding the impact of heavy metals on the placenta and, further, on the fetus and the future childhood.

Results: Toxic mechanisms of heavy metals include enzyme interaction (activation/ inhibition), disruption of organelles' structure and function and carcinogenic interactions with the fetal DNA. Cadmium and mercury are affecting the fetal kidney, methylmercury and lead compounds are neurotoxic. Infants and fetuses exposed to lead can develop behavioural and learning disabilities. Exposure to copper has toxic effects on fertility. Mercury can damage the fetal nervous system causing learning difficulties and can also negatively affect the reproductive system (infertility, miscarriage, preterm birth). Association of cadmium exposure in pregnancy with low-birth-weight newborn and preterm birth is reported.

Discussion: The placenta is impermeable to chemicals of 1000 Dalton molecular weight or more. Many heavy metals, known for their toxicity to the human body, have smaller molecular weight and readily cross the placenta. Common toxic mechanisms include enzyme inhibition/activation, structural or functional disruption of intracellular organelles and carcinogenesis. According to toxicodynamics, lead can alter the associated with calcium cellular processes in syncytiotrophoblasts and appears to be associated with reduced oxidation activity on cytochrome. Target organs for metal toxicity are the kidneys (cadmium and mercury), the nervous system (methylmercury), the endocrine and reproductive system (cadmium), and the respiratory system (ie. fibrosis (aluminum) or carcinogenesis (arsenic, chrome, nickel).

Conclusion: An overview of the current knowledge of the toxic effect of metals during pregnancy is very important, as it can explain and more important, prevent any negative obstetric outcomes.