

Risk and Benefit of Nanotechnology in Human and Health

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Abstract

Nanotechnology, nanomedicine and nanotoxicology are complementary disciplines aimed at the betterment of human life. Key concepts of nanotoxicology are addressed, including significance of dose, dose rate, and biokinetics, which are exemplified by specific findings of toxicity, Biokinetics or Pharmacokinetics, identification of potential hazards, and biopersistence in cells and subcellular structures to perform meaningful risk assessments of Nano Particles. Reducing size have different toxicological effect intrinsically. so safety evaluation of nanotechnology in surgical implants pose minimum risk but reaction surround tissues yet to be reported. Same thing Nano particle and nanostructure to be assessed. Regulatory point of view a risk management is already to be made in medical technology application. So competent authority and manufacturer must be aware to asses toxicological risk assessment.

KEYWORDS- Nano toxicology, Nano particles, risk management medical technology, nanotechnology, pharmacovigilance. Biokinetics, dose, exposure, hazard, inhalation, risk.

INRODUCTION-

The European Science Foundation (ESF) had defined nanomedicine as the science and technology of diagnosing, treating and preventing disease and traumatic injury, of relieving pain, and of preserving human health using molecular tools and molecular knowledge of the human body. ESF identified five main areas: (i) analytical tools, (ii) nanoimaging, (iii) nanomaterials and nanodevices, (iv) novel therapeutics and drug delivery systems and (v) clinical, regulatory and toxicological issues. General characteristics of Nano Particles Operating by Bio kinetic by Nano environment and Nano Medicine like -

Ratio: number / surface area per volume, Agglomeration in air, liquids, Deposition in respiratory tract, Protein / lipid adsorption in vitro, Translocation to secondary target organs, Clearance, Mucociliary, Alv. Macrophages, Epithelial cells, Lymphatic circulation, Blood circulation, Sensory neurons (uptake + transport), Protein / lipid adsorption in vivo, Cell entry / uptake, Mitochondria, Nucleus, Direct effects (caveat: chemistry and dose!), At secondary target organs, At portal of entry (resp. tract), Inflammation, Oxidative stress, Activation of signalling pathways, Primary genotoxicity, Carcinogenicity,

AND Physico-chemical of Nano Particles properties of relevance for adverse effect because of following points -

Size (airborne, hydrodynamic), Size distribution, Shape, Agglomeration / aggregation, Surface properties, Area (porosity), Charge, Reactivity, Chemistry (coatings, contaminants), Defects, Solubility (lipid, aqueous, in vivo), Crystallinity, Properties can change, with method of production, preparation process, storage, when introduced into, physiol, media, organism,

Some Doctor worried about Nan drugs cross Blood Brain Barrier easily could damage human body and crossing placental and testicular border is not clear. Nanotechnology can make us smart and trans human in evolutionary path. And create two races one rich and second poor by making fast healing and Nano surgery with high cost .Now running electronic economy will change in Nano economy with nonscientist and Nano politicians ,Nano physicians .

The use of nano medical application in diagnosis and imaging ,diseases, prosthesis and new drug delivery systems for harmful drugs are beneficial. But side by side Nano toxicology and adversity should be reported to regulatory authority for monitoring devices and drug early assessment and prevention for complications.

RISK MANAGEMENT-

Calls for more toxicological information that will help to protect workers' risk assessment paradigm, consisting of Hazard Identification, Hazard Characterization, Expo- sure Assessment and Risk Characterization for Whome are working with Nano factories & Nano Products. Nano toxicology should started immediately in medical products and medical devices for assessing risk by Nano particles in humans as well as animal experiments and in Hazards characterization as Epidemiological studies for workers ,consumers, exposed population, in vivo studies for route of administration , acute, chronic in different species with in vitro studies in human/animal, different cell types Models lung, skin, systemic etc. Other studies may direct to biomaterials cellular growth, cell behaviors and influenced by nano chemical . it should be made man- datory to prevent exposure by appropriate precaution- ary measures/regulations and by practicing best industrial hygiene to avoid future horror Nanotechnology, nanomedicine and nanotoxicology have bright future with multiple applications in many areas Nanotoxicity provides for the necessary safety assessment of nano-enabled products.

Methods-

First find out exposure and uses for various route of exposure via dermal , parental, inhalation, ingestion, implantation, dermal. Recently Nano crystalline silver is as antibacterial may influence inflammatory response and cellular toxicity.

So biomaterials and implants have reactionary process differently than large molecules and tissue necrosis and healings should be assessed. In addition its inherent toxicity ,dosage uptake pharmacokinetics and pharmaco dynamics so physicochemical

composition in Nano particle may have different effect over different biological compounds like endotoxines.

Seconds environmental exposure from free Nano particles and Nano tubes risk is related to occupational exposure for general population.

The over all adverse effect of nano sized air particles resultant effect in induction of oxidative stress in cells. Can damage cardiovascular, central nervous system and immune system.

Discussion-

It was observed that Nano particles damage the epithelial tissues of lungs and effect over immunity on Ig E in animal model system of oral burning allergy and induced toxicity in endothelial cells by induction of pro inflammatory cytokine IL8 . carbon tube exposure cause oxidative stress and cellular toxicity for dermal tissues.

Mechanism of unwanted effects ADR by NANO DRUGS-

These all are Hypothesis-

Induction of oxidative stress by lipid per oxidation

Induction of cellular DNA damage

Increase induction of oxidative stress

Interaction with cells and tissues

Effects on immune system

Reduced function of macrophages and reduced phagocytosis of particles mobility and cytoskeleton dysfunction

Induction of pro inflammatory cytokines and mediators

Adverse effects on vascular homeostasis and osteoblasts

Nano particles are very reactive and endogenous proteins and cells can interact.

Conclusion-

WE here only discuss about only Nano drugs not all nanotech worlds as they also effect to human by inhalation. Observation with several chemicals show that nano chemicals are more toxic than large particles. So further ethics and assessments should be done before making it popular it can cause silent damage to death of Human

References-

- Afaq F. Anodo P, Matin R, Rahman Q. Cytotoxicity, pro-oxidant effects and antioxidant depletion in rat lung alveolar macrophages exposed to ultrafine titanium dioxide. J Appl Toxicol 18, 307-312, 1998.

- Freitas, Jr., Robert A. “Nanotechnology, nanomedicine and nanosurgery. ‘Lecture at Stanford University. September 12, 2006.
- <http://www.nanomedicine.com/Papers/Int1JSurgdec05.pdf>
- Alt V, Bechert T, Steinrucke P, Wagener M, Seidel P, Dingeldein E, Domann E, Schnettler R. An in vitro assessment of the antibacterial properties and cytotoxicity of nanoparticulate bone cement. *Biomaterials* 25, 4383-4391, 2004.
- Brook RD, Franklin B, Cascio W, Hong Y, Howard G, Lipsett M, Luepker R, Mittleman M, Samet J, Smith SC, Tager I. Air pollution and vascular disease. A statement for healthcare professionals from the expert panel on population and prevention science of the American Heart Association. *Circulation* 109, 2655-2671, 2004.
- *Journal of Internal Medicine* safety assessment for nanotechnology and nanomedicine concepts of nanotoxicology G. Oberdorste 1365-2796.2009.