Bio-reducible Copper (II)-Oxide Nanoparticles for Effective Treatment of Acute Kidney Injury

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Currently, acute kidney injury (AKI) has limited therapeutic strategies because there are no drugs in the clinic. Furthermore, high mortality with a prevalence rate of AKI makes a substantial unmet need in the development of drugs that can prevent and alleviate AKI.[1] Recently, advancements in antioxidant nanodrugs have emerged to address the limitations of current AKI treatments.[2] Antioxidant nanodrugs with controlling size, shape, and surface properties have been utilized for treating AKI due to scavenging reactive oxygen and nitrogen species (RONS) burst at the AKI site, alleviating AKI progression.[3] Herein, we developed bio-reducible copper (II)-oxide nanoparticles (CuHNPs) with good reactive oxygen species (ROS) scavenging ability and biocompatibility through simple and efficient one-step preparation. CuHNPs showed 130-150 nm of stable spherical shape in an aqueous condition. However, the nanoparticle structure was rapidly dissociated when CuHNPs were exposed to hydrogen peroxide or glutathione. CuHNPs simultaneously showed catalase-, superoxide dismutase-, and glutathione peroxidase-mimicking enzyme properties *in vitro*, showing potential antioxidant activity. Furthermore, CuHNPs significantly reduced hydrogen peroxide in the human proximal tubular cell line, resulting in a cytoprotecting effect against ROS-mediated damage. Moreover, CuHNPs showed significantly enhanced therapeutic effects in an AKI mouse model without any noticeable toxicity. Based on these results, we expected that CuHNPs could provide an attractive strategy to treat ROS-related diseases, including AKI.

References

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