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Nanoceria increases superoxide dismutase expression and vasodilation response to sodium nitroprusside in human saphenous vein

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Introduction: Cerium oxide nanoparticles (nanoceria) represent an important nanomaterial for medical use due to its potential antioxidant activity. Nanoceria has very attractive features such as high biocompatibility and large surface, which makes it an ideal therapeutic agent that can penetrate cell membranes and be used as a nanoceria. Despite its growing pharmaceutical relevance, nanoceria effects on cardiovascular system remain unexplored.

The main cause of saphenous vein bypass graft failure is the development of atherosclerosis. Oxidative stress accelerates endothelial dysfunction in atherosclerosis leading to vascular homeostasis alteration. Our hypothesis is that administration of nanoceria can decrease superoxide anion levels enhancing the nitric oxide bioavailability. Thus, the purpose of this work was to evaluate the effects of Nano ceria on vasodilatation response to sodium nitroprusside (SNP) and whether it reduces oxidative stress on human saphenous vein.

Material and methods: Twenty human saphenous veins were extracted following the usual surgical procedure for coronary bypass. Vein segments (3 mm long) were mounted for isometric recording of tension in organ baths chambers containing Krebs-Henseleit solution. Concentration-response curves to SNP (10-10-10-6M) were obtained in the absence and presence of nanoceria (10, 20 and 40 ug/ml) previously incubated for 30 minutes. Protein levels of soluble guanylil cyclase (sGC) and both isoforms of superoxide dismutase (SOD) were measured by western blot.

Results: Nanoceria 20 ug/ml shifted to the left the concentration-response curve to SNP, an endothelium-independent nitric oxide donor that triggers sGC activation. However, there were no changes in the protein levels of sGC after incubation with nanoceria, while there was an increase in the expression of both SOD isoforms. Therefore, the increased SNP-response could be related to the antioxidant activity of nanoceria.

Conclusions: Nanoceria exerts antioxidant properties by increasing the SOD 1 and SOD 2 protein expression. This effect decreases superoxide anion, thus enhancing the NO bioavailability and improving the vasodilator response to SNP in saphenous vein.

Biography

Cristina Rueda has finished her medical studies in 2007 at the University of Valencia. She completed his training in Cardiovascular Surgery in 2013 at the Hospital Clínico Universitario of Valencia where she worked as a Cardiovascular Surgeon until 2018. Since then, she has worked at the Hospital General Universitario de Valencia. She has published papers in national and international journals, and she has participated in clinical trials. Since 2008 she has collaborated with the Physiology Department of the University of Valencia in the vascular physiology research program.

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