Copper Chelation as a Possible Atherosclerosis Treatment: Finding the Optimal Therapy

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About 600,000 people die of heart disease in the United States every year. Atherosclerosis (the deposition of fatty plaques in the arteries) is the underlying cause of heart disease, and copper is known to be associated with its development. Copper chelation involves adding compounds called chelators to the blood to form complexes with copper and prevent it from reacting, thus reducing its effective concentration. Since copper chelation effectively removes copper from the bloodstream, it has potential as a new therapy for atherosclerosis. Five chelators (ethylenediaminetetraacetic acid (EDTA), cyclohexanediaminetetraacetic acid (CDTA), diethylenetriaminepentaacetic acid (DTPA), tetrathiomolybdate, and penicillamine) were tested for their effectiveness in chelating two forms of copper: (1) unbound copper ions in a solution with other metal ions and (2) copper ions bound to bovine serum albumin (BSA) in a solution with other metal ions. Effective copper concentration was measured after chelation occurred using two assays: diethyldithiocarbamate/DDC (used to test both forms of copper) and bicinchoninic acid/BCA (used to test copper bound to BSA only). While the DDC assay produced varied results, it was clear from the BCA assay that EDTA was the most effective in copper chelation. Statistical analyses were conducted, and it was confirmed that EDTA was the most effective in specifically chelating copper in a solution with other metal ions, followed by DTPA, tetrathiomolybdate, penicillamine, and lastly CDTA.