Mechanism of Chinese Silver Staining Diagnosis and Its Application as Rapid Test for Chronic Renal Failure

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"Chinese Silver Staining Diagnosis" is a traditional Chinese Medicine procedure. Despite its popularity and long history in southern China, its mechanism remains unclear. In this research, a novel mechanism explaining the diagnosis was proposed and verified. Its potential use as diagnosis for Chronic Renal Failure (CRF) was clinically tested as well. After various experiments, we postulated that the thiol group in cysteine attacks the silver ion in silver oxide. Afterwards, the carboxyl group or amine group can chelate to the silver ion again, forming two different Cys-Ag complexes of different colors: yellow and blue. The mechanism was verified by reacting cysteamine (a cysteine analog in the absence of carboxylic acid group) with silver, in which only blue color was observed. This indicated that the blue complex formed is solely due to the presence of amino and thiol groups. The contribution of carboxyl group to the yellow complex was verified similarly using 3-mercaptopropionic acid. Upon 72 hrs heating, the Cys-Ag yellow product gradually turns blue. Yet, the reaction was drastically shorten to 10 minutes in the presence of 1.00 x 10^-5 M phosphate ion, suggesting it being a powerful catalyst of the reaction. CRF patients generally show hyperphosphataemia. Thus, a preliminary test for CRF was invented based on the proposed mechanism. Applied on 38 CRF patients, the test demonstrates 97.3% specificity and 94.6% sensitivity. Although the accuracy of our test is lower than the current test, our proposed test is non-invasive, more economical and much faster. We hope our investigation can enhance our understanding on Chinese medicine, and utilize the ancient wisdom into modern medical field.

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