

Managing of Cobalt and Chromium Ions by Patients with Metal-on-Metal Hip Prosthesis

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Abstract : Recently the European Community, in line with the international scientific community such as with the Consensus Statement, has determined to stop the use of metal-on-metal big head stemmed hip prosthesis. Among the factors accounted as responsible for the high failure rates of these hip implants are the release and accumulation of metal ions. Many studies have correlated the presence of these ions, besides other factors, with the induction of oxidative stress response. In our study on 12 subjects, we observed the patient specific capability to eliminate metal ions after revision surgery. While for cobalt all the patients were able to completely excrete cobalt ions within 5-7 months after metal-on-metal bearing removal, for chromium ions it didn't happen. If on the one hand the toxicokinetic differences between the two types of ions are confirmed by toxicological and occupational studies, on the other hand, this peculiar way of exposition represents a novel and important point of view. Thus, two different approaches were performed to better understand the subject specific capability to transport metal ions (albumin study) and to manage the response to them (heme-oxygenase-1 study): - a mutational screening of ALBUMIN gene was conducted in 30 MoM prosthetic patients resulting in the absence of nucleotidic changes compared with the ALB reference sequence. To this study was also added the analysis of expression of modified albumin protein; - a gene and protein expression study on 44 patients of heme-oxygenase-1, that is one of the most important antioxidant enzyme induced by metallic ions, was performed. This study resulted in no statistically significant differences in the expression of the gene and protein heme-oxygenase-1 between prosthetic and non-prosthetic patients, as well as between patients with high and low ions levels. Our results show that the protein studied (albumin and heme-oxygenase-1) seem to be not involved in determining chromium and cobalt ions level. On the other hand, chromium and cobalt elimination rates are different, but similar in all patients analyzed, suggesting that this process could be not patient-related. We support the importance of researching more about ions transport within the organism once released by hip prosthesis, about the chemical species involved, the districts where they are contained and the mechanisms of elimination, not excluding the existence of a subjective susceptibility to these metals ions.

Keywords : chromium, cobalt, hip prosthesis, individual susceptibility

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