The development of whole blood titanium levels after instrumented spinal fusion - is there a correlation between the number of fused segments and titanium levels?

Abstract:
Most modern spinal implants contain titanium and remain in the patient's body permanently. Local and systemic effects such as tissue necrosis, osteolysis and malignant cell transformation caused by implants have been described. Increasing tissue concentration and whole blood levels of ions are necessary before a disease caused by a contaminant develops. The aim of the present study was the measurement of whole blood titanium levels and the evaluation of a possible correlation between these changes and the number of fused segments. A prospective study was designed to determine changes in whole blood titanium levels after spinal fusion and to analyze the correlation to the number of pedicle screws, cross connectors and interbody devices implanted. Blood samples were taken preoperatively in group I (n = 15), on the first, second and 10th day postoperatively, as well as 3 and 12 months after surgery. Group II (n = 16) served as a control group of volunteers who did not have any metal implants in the body. Blood samples were taken once in this group. The number of screw-rod-connections and the length of the spinal fusion were determined using radiographic pictures. This study was checked and approved by the ethical committee of the University of Tuebingen. The mean age in group I was 47 ± 22 years (range 16 - 85 years). There were
three male (20%) and twelve female (80%) patients. The median number of fused segments was 5 (range 1 to 11 segments). No statistically significant increase in the titanium level was seen 12 months after surgery (mean difference: -7.2 µg/l, 95% CI: -26.9 to 12.5 µg/l, p = 0.446). By observing the individual titanium levels, 4 out of 15 patients demonstrated an increase in titanium levels 12 months after surgery. No statistically significant correlation between fused segments (r = -0.188, p = 0.503) length of instrumentation (r = -0.329, p = 0.231), number of interbody devices (r = -0.202, p = 0.291) and increase of titanium levels over the observation period was seen. Instrumented spinal fusion does not lead to a statistically significant increase in whole blood titanium levels. There seems to be no correlation between the number of pedicle screws, cross connectors and interbody devices implanted and the increase of serum titanium levels.