Supplementary article data

Metal ion levels and lymphocyte counts: ASR hip resurfacing prosthesis vs. standard THA

2–year results from a randomized study

Jeannette Ø Penny[1, 2], Jens–Erik Varmarken[2], Ole Ovesen[1], Christian Nielsen[3], and Søren Overgaard[1]

[1]Department of Orthopaedic Surgery and Traumatology, Odense University Hospital, Institute of Clinical Research, University of Southern Denmark, Odense; [2]Department of Orthopaedics, Hospital South – Naestved, Region Zealand; [3]Department of Clinical Immunology, Odense University Hospital, Odense, Denmark.
Correspondence: jeannette.penny@yahoo.com
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Serum results

Materials and methods

Serum samples were sampled in 6/7 mL Plus serum tubes (368380) (both Becton Dickinson, NJ, USA) and centrifuged for 10 minutes at 1500 rpm, before pipetting of the serum, stored at minus 80 °C before analyzation for Co and Cr content on an ICP-SFMS Finnigan ELEMENT (Finnigan MAT, Bremen, Germany) in an independent ISO 17025/ISO 9001:2000 accredited lab (ALS Scandinavia's laboratories, Luleaa, Sweden).

Results

At two years the median serum Co and Cr reached 1.95 (0.86 to10.7) ppb and 1.7 (0.80 to 15.3) ppb respectively (Figure.3). The correlation between whole blood and serum of Co was r=0.87 and r=0.75 for Cr (p<0.001), and at all follow up times all metal ion levels were significantly higher in patients with a RHA compared to THA (p=0.001 or below). Both the serum Co and Cr ion concentrations continued to increase from the first to the second year (p=0.04 and p=0.004) (Figure 3). The regression analysis (Table 5), demonstrated a depressing effect of metal ion on all lymphocyte subgroups except for the NK cells which displayed a modest, and primarily non significant, stimulating effect. Statistical significance was predominantly seen for cobalt, but was not consistent at all times.

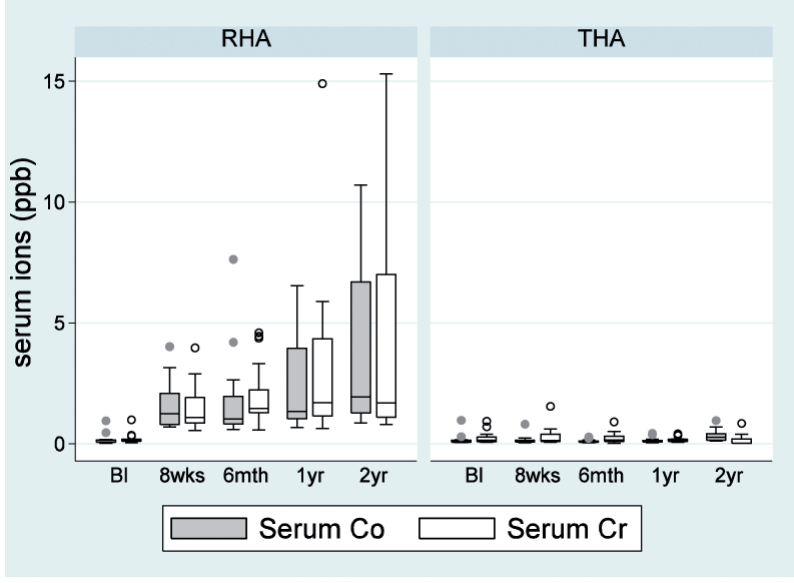

Figure 3. Box plot depicting median, lower and upper quartiles (box). Whiskers mark the adjacent values and dots mark the outliers.

Conclusion

As expected from other studies the highest median Co and Cr levels were observed in serum (Daniel et al. 2007, Walter et al. 2008), and like whole blood, high serum levels of metal ions, in particular cobalt, were also associated to a decline in the T lymphocyte counts.

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Table 5. Serum values. Regression analysis of RHA and THA combined between ion level and change in lymphocytes with regression coefficients expressed as $\times 10^9$ cells/L/ppb. Dependent variable: change in T–cell levels from baseline to the time given; independent variable: metal ion concentration at the time given. ANCOVA adjusted for baseline values of T–cell levels and for gender

		8 weeks		6 months		1 year		2 years	
		coeff.	95% CI	coeff.	95% CI	coeff.	95% CI	coeff.	95% CI
Total lymphocytes	Se Co	–0.03	(–0.22 to 0.16)	–0.24 [a]	(–0.46 to –0.03)	–0.01	(–0.12 to 0.11)	–0.06 [a]	(–0.12 to –0.01)
	Se Cr	–0.04	(–0.20 to 0.13)	–0.17	(–0.35 to 0.00)	–0.02	(–0.06 to 0.01)	–0.03 [a]	(–0.07 to –0.00)
CD3+	Se Co	–0.08	(–0.25 to 0.09)	–0.22 [a]	(–0.40 to –0.04)	–0.03	(–0.12 to 0.07)	–0.08 [c]	(–0.12 to –0.04)
	Se Cr	–0.07	(–0.26 to 0.11)	–0.14	(–0.32 to 0.04)	–0.03	(–0.07 to 0.01)	–0.04	(–0.08 to 0.00)
CD3+CD4+	Se Co	–0.00	(–0.11 to 0.10)	–0.14 [a]	(–0.27 to –0.02)	–0.01	(–0.08 to 0.06)	–0.05 [c]	(–0.08 to –0.03)
	Se Cr	–0.01	(–0.10 to 0.09)	–0.09	(–0.21 to 0.02)	–0.01 [a]	(–0.03 to –0.00)	–0.02 [a]	(–0.04 to –0.00)
CD3+CD8+	Se Co	–0.02	(–0.07 to 0.03)	–0.07 [a]	(–0.12 to –0.02)	–0.01	(–0.04 to 0.02)	–0.01 [a]	(–0.03 to –0.00)
	Se Cr	–0.02	(–0.05 to 0.02)	–0.06 [b]	(–0.09 to –0.02)	–0.00	(–0.01 to 0.01)	–0.01	(–0.02 to 0.00)
CD3–CD19+	Se Co	–0.00	(–0.03 to 0.02)	–0.03	(–0.07 to 0.01)	0.00	(–0.01 to 0.01)	–0.01	(–0.03 to 0.00)
	Se Cr	–0.01	(–0.03 to 0.02)	–0.02	(–0.05 to 0.01)	–0.00	(–0.01 to 0.00)	–0.01	(–0.02 to 0.00)
CD16+CD56	Se Co	0.00	(–0.03 to 0.04)	–0.02	(–0.04 to 0.01)	0.01	(–0.00 to 0.03)	0.01	(–0.00 to 0.02)
	Se Cr	0.00	(–0.02 to 0.03)	–0.01	(–0.03 to 0.00)	0.01 [a]	(0.00 to 0.01)	0.00	(–0.00 to 0.01)

[a] $p < 0.05$.
[b] $p < 0.01$.
[c] $p < 0.001$.