Association of new cardiovascular disorder with cobalturia from orthopedic implants. A prospective blinded study of 229 subjects with cobalt-chromium joint components.

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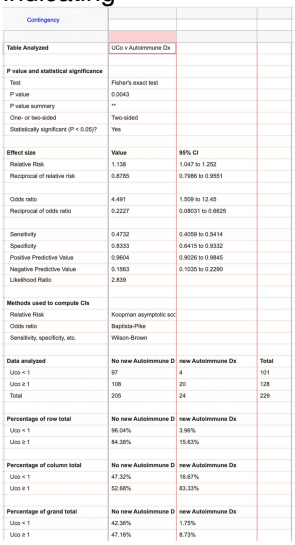
INTRODUCTION:
Cobalt is a mitochondrial toxin, cobaltism most commonly presents with neurologic, constitutional, or neurologic pathology. Case reports and series of Orthopedic-Implant-Cobaltism (OIC) generally report severe cardiovascular manifestations though it is likely that OIC is a spectrum toxidrome with lesser manifestations being commonly experienced by patients with cobalt-chromium orthopedic implants.
Median urine-cobalt in pre-operative arthroplasty patients and in the general United-States adult population is 0.3 ppb. A urine-cobalt of ≥ 1 ppb is an outlier value in pre-operative arthroplasty patients.
METHODS:
229 consecutive patients with cobalt-chromium joint component(s) presented to one orthopedic surgeon over four-years. A Cobaltism-Symptom-Inventory (CSI) was done as was an interval medical history since the cobalt-chromium containing arthroplasty was performed.
The interval medical history included any new or worsened cardiovascular disorder including heart failure, arrhythmia, aneurism, and hypertension.
After the encounter a urine-cobalt determination was made. Subjects with a urine-cobalt ≥ 1 ppb were considered to be cobalturic.
RESULTS: The association of cobalturia with elevation of the CSI score in this study cohort is previously reported. 36 (28%) of the 128 cobalturic patients reported new or worsened cardiovascular conditions since implantation of a cobalt-chromium orthopedic-implant. Comparatively, 8 (8%) of the 101 not-cobalturic subjects reported a new or worsened cardiovascular condition. This is a significant finding (Fischer's two-tailed p <0.0001). The odds ratio for a new or worsened cardiovascular condition in the cobalturic subjects is 4.5.
DISCUSSION AND CONCLUSION: Cobalturia (urine-cobalt ≥ 1 ppb) in patients with cobalt-chromium orthopedic-implants significantly associates with new or worsened cardiovascular pathology. This is consistent with analysis of the The National Health and Nutrition Examination Survey (NHANES) database that found the upper quartile of blood-cobalt of United States adults had a higher prevalence of cardiovascular pathology. It is also consistent with echocardiographic studies of populations with similar degrees of cobalt exposure from orthopedic-implants or industry indicating subclinical cardiomyopathy.



Contingency			
Table Analyzed	UCo v Autoimmune Dx		
P value and statistical significance			
Test	Fisher's exact test		
P value	0.0043		
P value summary	**		
One- or two-sided	Two-sided		
Statistically significant (P < 0.05)?	Yes		
Effect size	**Value**	**95% CI**	
Relative Risk	1.138	1.047 to 1.252	
Reciprocal of relative risk	0.8785	0.7986 to 0.9551	
Odds ratio	4.491	1.509 to 12.45	
Reciprocal of odds ratio	0.2227	0.08031 to 0.6625	
Sensitivity	0.4732	0.4059 to 0.5414	
Specificity	0.8333	0.6415 to 0.9332	
Positive Predictive Value	0.9604	0.9026 to 0.9845	
Negative Predictive Value	0.1563	0.1035 to 0.2290	
Likelihood Ratio	2.839		
Methods used to compute CIs			
Relative Risk	Koopman asymptotic sco		
Odds ratio	Baptista-Pike		
Sensitivity, specificity, etc.	Wilson-Brown		
Data analyzed	**No new Autoimmune D**	**new Autoimmune Dx**	**Total**
Uco < 1	97	4	101
Uco ≥ 1	108	20	128
Total	205	24	229
Percentage of row total	**No new Autoimmune D**	**new Autoimmune Dx**	
Uco < 1	96.04%	3.96%	
Uco ≥ 1	84.38%	15.63%	
Percentage of column total	**No new Autoimmune D**	**new Autoimmune Dx**	
Uco < 1	47.32%	16.67%	
Uco ≥ 1	52.68%	83.33%	
Percentage of grand total	**No new Autoimmune D**	**new Autoimmune Dx**	
Uco < 1	42.36%	1.75%	
Uco ≥ 1	47.16%	8.73%	