

# Global Longitudinal Strain is compromised in patients with elevated blood cobalt levels secondary to metal-on-metal hip implants

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## Introduction

Metal-on-metal (MoM) hip arthroplasties are known to release metal ions including cobalt into the blood stream. Elevated blood cobalt at levels over 250µg/l have been shown to be a risk factor for developing systemic complications including neurological, endocrine and cardiovascular symptoms. Published case reports document cardiomyopathy, a need for cardiac transplantation and, in some cases, death in patients with severely elevated blood cobalt. Clinical studies have found conflicting evidence of cobalt-induced cardiomyopathy in patients with MoM hips. The extent of cardiovascular injury in patients with elevated blood cobalt levels above 250µg/l has not previously been examined and is the focus of the current study.

## Methods

Sixteen patients with documented blood cobalt ion levels above 250µg/l were identified from a regional arthroplasty database. They were matched with eight patients awaiting hip arthroplasty with no history of cobalt implants. All patients underwent electrocardiogram and echocardiogram assessment for signs of cardiomyopathy including left ventricular (LV) dysfunction and cardiac remodelling. Global longitudinal strain (GLS), E/e' ratio (an index for evaluating LV filling pressure), ejection fraction, LV wall thickness, LV end diastolic dimension, LV end systolic dimension and fractional shortening were all assessed.

## Results

The patients with MoM hip arthroplasties had a mean time from initial arthroplasty of 15 years and had a mean blood cobalt level of 450µg/l compared to 0.25µg/l in the control group. Echocardiographic analysis showed no difference in either LV end systolic dimension (2.9cm v 3cm, (MoM v control) p=0.592) or LV end diastolic

dimension (4.7cm v 5cm, (MoM v control)  $p=0.2594$ ). Neither was there any difference between ejection fraction (61.5% v 63.7%, (MoM v control)  $p=0.41$ ) or fractional shortening (38.9% v 40.1%, (MoM v control)  $p=0.8133$ ). Ventricular wall thickness (1.2cm v 1cm,  $p=0.0591$ ) and E/e' ratio (8 v 7.8,  $p=0.44164$ ) were also comparable across MoM and control groups and there was no difference in rates of left ventricular or atrial hypertrophy. Interestingly, GLS was significantly reduced in patients with MoM hip arthroplasties compared to those without (-15.2% v -18%, (MoM v control)  $p=0.0125$ ).

## Conclusion

This study has demonstrated reduced cardiac function in the presence of normal ejection fraction as assessed by GLS in patients with elevated cobalt above 250µg/l. As GLS is a more sensitive measure of systolic function than ejection fraction, routine echocardiogram assessment including GLS should be performed in all patients with MoM hip arthroplasties and elevated blood cobalt above 250µg/l. Further work is recommended to assess if these cardiac changes are present in patients with elevated blood cobalt levels below 250µg/l.

## References

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