

Table i. Univariable and multivariable Fine and Gray¹ competing-risk (mortality) regression analysis to identify predictors of re-revision surgery following revision surgery performed for adverse reactions to metal debris (ARMD) in the imputed dataset

Covariate	Univariable subhazard ratio (95% CI)	p-value	Multivariable subhazard ratio (95% CI)	p-value
Gender				
Female vs male	1.13 (0.84 to 1.52)	0.411	†	
Age at revision (per year)				
	0.99 (0.98 to 1.01)	0.232	†	
BMI (per kg/m²)				
	1.04 (1.01 to 1.07)	0.008	1.05 (1.02 to 1.08)	0.003
Bilateral revisions for ARMD				
Primary hip arthroplasty				
THA	1.51 (1.09 to 2.10)	0.013		
HR	1.00	Ref	†	
Time from primary to revision (per yr)				
	0.89 (0.82 to 0.97)	0.006	0.91 (0.84 to 0.99)	0.038
ASA grade at revision				
1	1.00	Ref	†	
2	0.98 (0.69 to 1.41)	0.926		
3 or above	0.89 (0.49 to 1.61)	0.691		
VTE – chemical				
None	1.00	Ref	†	
LMWH (+/-other)	0.69 (0.44 to 1.06)	0.093		
Aspirin only	0.83 (0.34 to 2.02)	0.679		
Other	0.76 (0.48 to 1.19)	0.230		
VTE – mechanical				
Any vs none	0.88 (0.43 to 1.78)	0.715	†	
Number of ARMD hip revision procedures performed by each centre (per 10 cases)				
	1.02 (0.99 to 1.04)	0.074	1.03 (1.00 to 1.06)	0.011
Revision surgeon grade				
Consultant vs other	0.87 (0.45 to 1.70)	0.684	†	
Surgical approach				
Posterior vs other	0.90 (0.63 to 1.29)	0.559	†	
Revision indications				
ARMD only	1.00	Ref	†	
2 to 6 indications	0.81 (0.59 to 1.09)	0.160		
Revision details				
Acetabular component (+/- head +/- liner +/- taper adapter)	1.00	Ref	1.00	Ref
All components revised	0.77 (0.56 to 1.06)	0.105	*	0.338
Femoral component (+/- head +/- liner +/- taper adapter)	0.88 (0.36 to 2.16)	0.776	*	0.712
Modular components only [§]	1.61 (1.07 to 2.44)	0.023	2.04 (1.33 to 3.13)	0.001
Revision femoral head size				
< 36 mm	1.00	Ref	†	
36 mm	1.10 (0.81 to 1.50)	0.530		
> 36 mm	1.07 (0.56 to 2.03)	0.835		
Revision bearing surface				
CoP	1.00	Ref	1.00	Ref
CoC	1.51 (1.08 to 2.12)	0.015	1.57 (1.10 to 2.24)	0.013
MoP	1.42 (0.97 to 2.07)	0.069	1.45 (0.97 to 2.17)	0.068
CoM, MoM or MoC	‡	‡	‡	‡
Acetabular component fixation				
Cementless	1.00	Ref	†	
Cemented	0.89 (0.54 to 1.47)	0.656		
Femoral component fixation				
Cementless	1.00	Ref	†	
Cemented	0.76 (0.44 to 1.30)	0.316		
Bone graft (femoral)				
	0.91 (0.37 to 2.20)	0.827	†	
Bone graft (acetabular)				
	1.51 (1.10 to 2.07)	0.011	1.85 (1.33 to 2.58)	< 0.001

*specific subgroup did not meet inclusion criteria for final multivariable model (p > 0.200)

†covariate was not eligible for inclusion in the final multivariable model

‡unable to calculate value as no hips in this subgroup underwent re-revision surgery

§involves revision of the femoral head and liner, with or without the use of a taper adapter

Statistically significant differences (p < 0.05) have been highlighted in bold text

CI, confidence interval; BMI, body mass index; THA, total hip arthroplasty; HR, hip resurfacing; ASA, American Society of Anesthesiologists; VTE, venous thromboembolism; LMWH, low molecular weight heparin; CoP, ceramic-on-polyethylene; CoC, ceramic-on-ceramic; MoP, metal-on-polyethylene; CoM, ceramic-on-metal; MoM, metal-on-metal; MoC, metal-on-ceramic; Ref, reference group

Shorter time from primary to revision surgery, and centres performing higher volumes of ARMD revision surgery were both statistically significant predictors of re-revision surgery in the multivariable model based on the imputed dataset, but not in the complete dataset excluding body mass index (Table III). Although the effect sizes for these two covariates were almost identical between the two models,

the difference in statistical significance is related to the imputed dataset having greater statistical power given that 50 complete datasets were imputed.

References

1. **Fine JP, Gray RJ.** A proportional hazards model for the subdistribution of a competing risk. *J Am Statist Assoc* 1999;94:496–509.