

Supplementary article data

Gluteal muscle fatty atrophy is not associated with elevated blood metal ions or pseudotumors in patients with a unilateral metal-on-metal hip replacement

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MR protocol

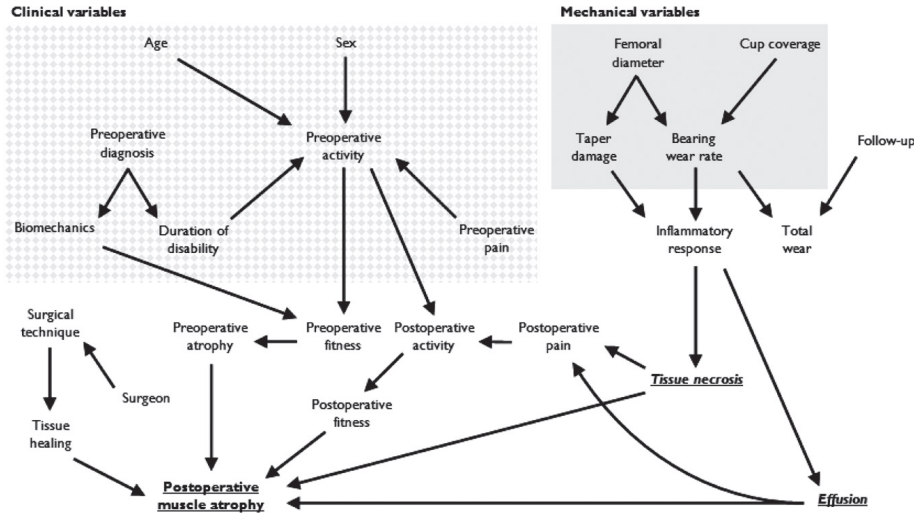
Device Pulse sequence name	TR (ms)	TE (ms)	TI (ms)	FOV (mm)	Matrix size	Slice thickness (mm)/gap (mm)
Siemens Magnetom Avanto 1.5T						
(Siemens Healthcare, Erlangen, Germany)						
Coronal T1 weighted Spin Echo	600	9		420	403x448	6.0/1.2
Coronal Turbo Inversion Recovery	3410	23	150	450	350x448	6.0/1.8
Transversal T1 weighted Spin Echo	440	9		420	302x448	6.5/1.2
Transversal Turbo Inversion Recovery	4871	24	150	420	392x512	6.0/1.8
Sagittal Turbo Inversion Recovery	3300	24	150	400	355x512	6.0/1.8
GE Signa HD 1.5T						
(General Electric, Healthcare, Wisconsin, USA)						
Coronal T1 weighted Fast Spin Echo	620	18		430	256x512	6.0/1.0
Coronal Fast Inversion Recovery	3200	41	150	430	224x512	6.0/1.0
Transversal T1 weighted Fast Spin Echo	610	19		440	224x512	6.0/1.5
Transversal Fast Inversion Recovery	4400	58	150	440	224x512	6.0/1.5
Sagittal Fast Inversion Recovery	6100	41	150	420	224x512	6.0/1.5

Causal pathways in directed acyclic graphs in the variable selection:

Exposure of interest = pseudotumor (= tissue necrosis + effusion)

Outcome = postoperative muscle atrophy

Suggested covariates = sex, age, follow-up, preoperative diagnosis, surgical technique, bearing wear rate



Notes:

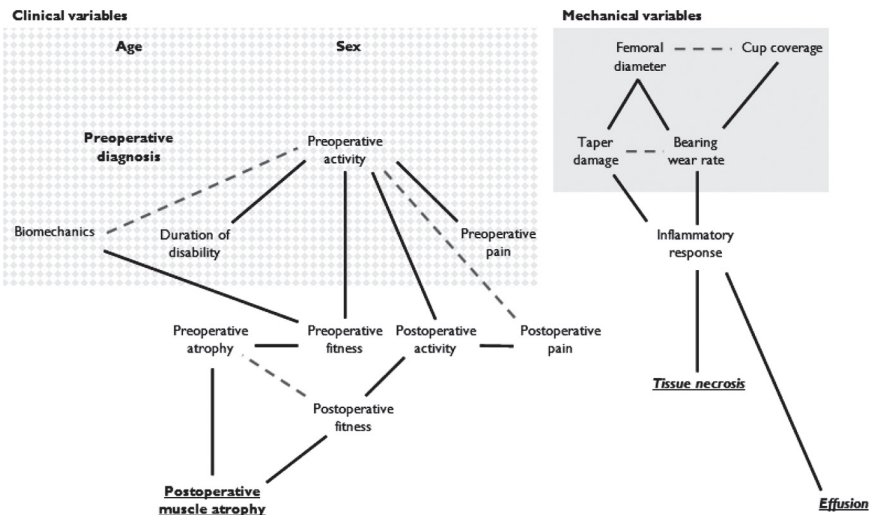
1. In optimal situation effusion/necrosis would be our main exposure of interest. Since we cannot measure or assess these two, pseudotumour classification is used as surrogate.
2. Follow-up is only associated to total wear without any pathway to postoperative muscle approach and is thus excluded.
3. Surgical technique is similar in all operations. No reason to expect any differences between surgeons. Different surgeons have operated different patients with different diagnoses and bias is thus introduced. Surgeon as variable is excluded.
4. WB metal ion levels are used as surrogate for bearing wear rate.
5. Preoperative atrophy would be ideal covariate. Since this is not assessed in our hospital it cannot be included.

Final DAG and selected variables:

Exposure of interest = pseudotumour (= tissue necrosis + effusion)

Outcome = postoperative muscle atrophy

Included covariates = sex, age, preoperative diagnosis



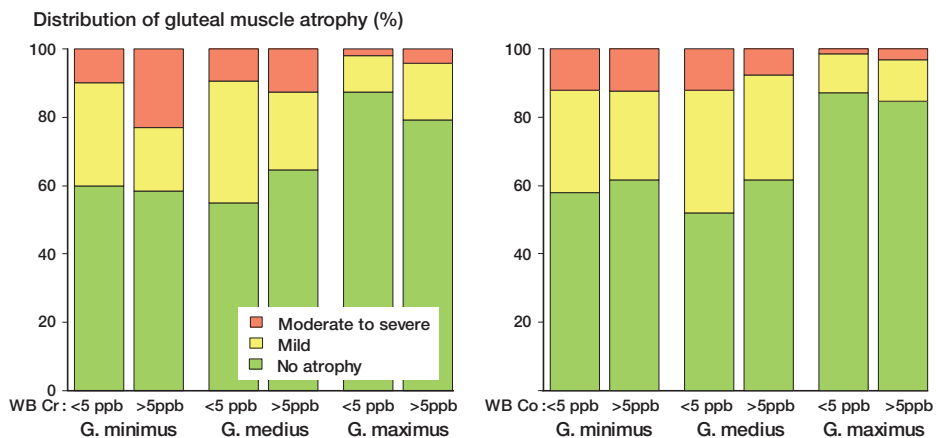


Figure 2. Bar plot showing distribution of gluteal muscle atrophy divided into WB Cr levels (left panel), and WB Co levels (right panel).

Table 3. Significancies of LR test with complete dataset, i.e. without missing values

		Regression model	LR test p-value
Gluteus minimus atrophy	Mild-to-severe	M ₁	0.01
	Moderate-to-severe	M ₂	0.3
	Severe	M ₃	0.8
Gluteus medius atrophy	Mild-to-severe	M ₄	0.04
	Moderate- to-severe	M ₅	0.07
Gluteus maximus atrophy	Mild-to-severe	M ₆	0.004

Table 4. 3 regression models with respective prevalence ratios (PRs) that had a significant LH ratio test indicating an adequate multivariate regression model

Variable		Model M ₁		Model M ₄		Model M ₆	
		PR	p-value	PR	p-value	PR	p-value
Sex	Female	1.0 (ref)		1.0 (ref)		1.0 (ref)	
	Male	1.02 (0.76–1.37)	0.9	1.14 (0.87–1.50)	0.2	2.32 (1.19–5.87)	0.03
Age	< 50 years	1.0 (ref)		1.0 (ref)		1.0 (ref)	
	≥ 50 years	1.41 (0.94–2.22)	0.1	1.25 (0.85–1.82)	0.3	1.35 (0.62–2.97)	0.5
Diagnosis	OA	1.0 (ref)		1.0 (ref)		1.0 (ref)	
	Other	1.83 (1.33–2.47)	< 0.001	1.56 (1.17–2.08)	0.002	2.69 (1.41–5.13)	0.002
PT category	No PT	1.0 (ref)		1.0 (ref)		1.0 (ref)	
	Cystic	1.21 (0.80–1.71)	0.2	1.26 (0.90–1.75)	0.4	2.11 (1.08–4.12)	0.03
	Mixed- or solid	1.11 (0.68–1.59)	0.4	1.13 (0.71–1.82)	1.0	1.41 (0.57–3.47)	0.2