Outcomes of Revision Total Hip Arthroplasty for Vancouver A, B, and C periprosthetic femoral fractures

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INTRODUCTION: Total Hip arthroplasty (THA) is an effective and successful treatment for patients with severe hip damage. As over 380.000 hip replacements are performed annually in the Unites States with an expected volume of 635.000 by 2030, the incidence of peri-prosthetic femur fractures (PFF) will additionally rise. Peri-prosthetic femur fractures are stratified according to the Vancouver classification that identifies fracture location, state of implant fixation and quality of the surrounding bone. In the current body of literature, the outcomes for the different types of peri-prosthetic femur fractures are lacking. The aim of this study is to evaluate the outcomes for patients who sustained a peri-prosthetic femur fractures after THA.

METHODS: A retrospective review was performed on patients who sustained a peri-prosthetic hip fracture. Patient demographics including data on primary HA, Vancouver fracture classification and surgical treatment were retrieved from hospital records alongside follow up time and clinical outcomes such as readmission and re-revision rates. Patient demographics and outcomes for the Vancouver A and B subsets were compared using Pearson Chi-Square Test for dichotomous variables and Student's t-test for continuous variables. Additionally, a subgroup analysis of patients presenting with loosening of the femoral component (Vancouver B2 and B3) was performed.

RESULTS: A total of 303 consecutive patients were included, of which 50 A fractures, 248 B fractures (9 B1 fractures, 211 B2 fractures, 28 B3 fractures), and 5 C fractures (Table 1). The mean follow up was 36 months. Patients who sustained a Vancouver A fracture were significantly younger ($p<0.001$), had a significantly lower risk of readmission within 30 days ($p=0.009$) and 60 days ($p=0.028$), showed a significantly shorter length of stay (LOS) ($p<0.001$), and were seen to be at significantly higher risk for re-revision ($p=0.004$) compared to patients who sustained a Vancouver B fracture (Table 1). Subgroup analysis of Vancouver B2 and B3 showed no significant difference with regard to patient demographics and outcomes. Patients with Vancouver C fractures had significantly lower re-revision and 30, 60, and 90 day readmission rates ($p<0.001$).

DISCUSSION: The findings of this study suggest that although revision for Vancouver A fractures is associated with significantly better LOS and readmission rates, it has inferior outcomes regarding re-revision. This may be attributable to the quality of the bone stock as 18% of patients with Vancouver A fractures presented with wear and osteolysis in contrast to 7.2% of patients with a Vancouver B fracture. Vancouver C fractures, despite the small sample size, rarely show complication rates at a mean of 36 months follow up. This might be explained by the localization of the fracture below the stem of the hip prosthesis not involving the hip joint. This knowledge could potentially be helpful for clinicians in healthcare planning and patient expectations.

SIGNIFICANCE/CLINICAL RELEVANCE: The findings of this study demonstrate that Vancouver A fractures are associated with inferior re-revision rates when compared to Vancouver B and C fractures, with Vancouver C fractures demonstrating the smallest number of post-operative complications.

Table 1: Patient cohort characteristics and outcomes

Characteristic	Vancouver A, (N=50)	Vancouver B, (N=248)	p-value A-B	Vancouver B1, (N=9)	Vancouver B2, (N=211)	Vancouver B3, (N=28)	Vancouver C, (N=5)	p-value B2-B3
Female/male	31/19	133/115	0.278	4/5	112/99	17/11	4/1	0.446
Right/left	24/26	129/119	0.645	6/3	108/103	15/13	2/3	0.812
Age (years)	65.5 ± 12.1	68.6 ± 9.9	**<0.001**	67.5 ± 11.6	0.208	67.5 ± 11.6	80.4 ± 11.6	0.158
BMI (kg/m^2)	32.6 ± 7.6	33.3 ± 6.6	0.097	30.3 ± 4.6	0.423	29.2 ± 4.7	24.4 ± 6.4	0.801
Cardiovascular disease	28 (56.0%)	169 (68.1%)	0.098	7 (77.8%)	139 (65.9%)	23 (82.1%)	5 (100.0%)	0.084
Diabetes Mellitus	9 (18.0%)	22 (8.9%)	0.098	1 (11.1%)	21 (10.0%)	0 (0.0%)	0 (0.0%)	0.272
Renal disease	3 (6.0%)	19 (7.7%)	0.054	0 (0.0%)	17 (8.1%)	2 (7.1%)	0 (0.0%)	0.867
Malignancy	4 (8.0%)	19 (7.7%)	0.682	0 (0.0%)	16 (7.6%)	3 (10.7%)	1 (20.0%)	0.565
Depression	5 (10.0%)	24 (9.7%)	0.935	0 (0.0%)	23 (10.9%)	1 (3.6%)	0 (0.0%)	0.225
Smoking	4 (8.0%)	17 (6.9%)	0.773	1 (11.1%)	12 (5.7%)	4 (14.3%)	0 (0.0%)	0.087
Alcohol	16 (32.0%)	76 (30.6%)	0.850	2 (22.2%)	67 (31.8%)	7 (25%)	1 (20.0%)	0.468
Drugs	1 (2.0%)	6 (2.2%)	0.858	0 (0.0%)	6 (2.8%)	0 (0.0%)	0 (0.0%)	0.830
Follow-up Time	51.0 ± 46.3	32.3 ± 46.0	**0.030**	43.9 ± 46.0	31.2 ± 44.3	40.8 ± 63.8	45.6 ± 54.1	0.471
30 day readmission	2 (4.0%)	47 (19.0%)	**0.009**	5 (55.6%)	39 (18.5%)	3 (10.7%)	0 (0.0%)	0.310
60 day readmission	4 (8.0%)	53 (21.4%)	**0.028**	5 (55.6%)	45 (21.3%)	3 (10.7%)	0 (0.0%)	0.188
90 day readmission	8 (16.0%)	60 (24.2%)	0.208	5 (55.6%)	49 (23.2%)	6 (21.4%)	0 (0.0%)	0.832
Re-revision	13 (26.0%)	27 (10.9%)	**0.004**	2 (22.2%)	21 (10.0%)	4 (14.3%)	0 (0.0%)	0.496
Death rate	4 (8.0%)	26 (10.5%)	0.594	0 (0.0%)	22 (10.4%)	4 (14.3%)	1 (20.0%)	0.538
Length of Stay (days)	5.2 ± 3.5	7.4 ± 4.6	**<0.001**	5.0 ± 1.5	7.4 ± 4.7	8.2 ± 4.6	6.6 ± 2.4	0.419