

Comparison of supplementary plate versus cerclage wire fixation methods to diaphyseal engaging stem revision for Vancouver B2 peri-prosthetic femoral fractures

Janna van den Kieboom MD¹, Venkatsaikhil Tirumala MSc¹, Paul Walker¹, Christian Klemt PhD¹, Ruben Oganessian MD¹, John Drago¹, Kaya Adelzadeh¹, Andriana Velmahos¹, Saimrunali Dadigala¹, Travis Dang¹, Alina Syros¹, Young-Min Kwon MD, PhD¹

¹Bioengineering Laboratory, Department of Orthopaedic Surgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA
ymkwon@mgh.harvard.edu

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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 United States with an expected volume of 635,000 by 2030, the incidence of peri-prosthetic femur fractures (PFF), currently approximately 4.1%, is likely to 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. Fractures presenting with a loose stem and sufficient bone stock are considered Vancouver B2. Treatment options for B2 fractures include several types open reduction internal fixation (ORIF) in addition to revision of the stem. Fracture fixation using cerclage wires could potentially reduce healthcare costs as plates are more expensive, often require removal, and are associated with complications such as impingement. To the best of our knowledge, no study to date has compared supplementary ORIF comparing a plate fixation with cerclage wire fixation. The aim of this study is to analyze the outcomes of plate versus cerclage wires as supplementary fixation options to revision with diaphyseal engaging stem for Vancouver B2 femur fractures.

METHODS: A retrospective review was performed on a cohort of 277 consecutive patients who underwent revision surgery due to Vancouver B2 peri-prosthetic femur fractures. All patients received a long diaphyseal engaging stem during revision THA. Patient demographics including data on primary THA, Vancouver fracture classification, type of procedure, and type of fixation were recorded alongside follow up time and clinical outcomes such as readmission and re-revision rates. All patients received a long diaphyseal engaging stem revision. Supplementary ORIF with a plate was compared with cerclage wires using Pearson Chi-Square Test. Continuous variables were compared using Student's t-test.

RESULTS: This study included 34 patients that were treated with a plate and 177 patients treated with cerclage wires, both in addition to long stem revision THA. There was no significant difference between both groups with respect to patient demographics and medical history (Table 1). There was also no significant difference between both cohorts with respect to length of hospital stay ($p=0.56$), 30, 60 and 90 day readmission rates ($p=0.27$; $p=0.56$; $p=0.40$), re-revision rates ($p=0.31$) as well as death rate ($p=0.37$) (Table 1).

DISCUSSION: Peri-prosthetic femur fractures is a serious complication after THA that is accompanied by high morbidity and mortality rates. This study demonstrates that the treatment of B2 peri-prosthetic fractures with either plate or cerclage wire supplementary fixation yields similar outcomes. As the findings of this study suggest that the choice of supplementary ORIF method for Vancouver B2 peri-prosthetic fractures is not a risk factor for inferior outcomes in revision THA, the use of cerclage wire fixation has the potential to reduce healthcare costs and improve patient outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: This study demonstrates that the treatment of B2 peri-prosthetic fractures with either plate or cerclage wire supplementary fixation yields similar outcomes in patients following total hip arthroplasty.

Table 1: Patient cohort characteristics and outcomes

Characteristic	Plate (N=34)	Cerclage wires (N=177)	p-value
Female/male	21/17	91/82	0.766
Right/left	20/14	88/89	0.331
Age (years)	75.4 ± 10.2	76.7 ± 11.9	0.531
BMI (kg/m ²)	29.2 ± 6.9	27.8 ± 6.6	0.337
Cardiovascular disease	25 (65.8%)	114 (65.9%)	0.990
Diabetes Mellitus	3 (7.8%)	18 (10.4%)	0.640
Renal disease	1 (2.6%)	16 (9.2%)	0.175
Malignancy	3 (7.9%)	13 (7.5%)	0.936
Depression	7 (18.4%)	16 (9.4%)	0.100
Smoking	1 (2.6%)	11 (6.8%)	0.369
Alcohol	13 (34.2%)	54 (31.2%)	0.719
Drugs	0 (0.0%)	6 (3.5%)	0.794
Mean Follow-up Time (months)	42.4 ± 52.3	28.8 ± 42.2	0.163
30 day readmission	5 (13.1%)	34 (19.6%)	0.350
60 day readmission	7 (18.4%)	38 (22.0%)	0.629
90 day readmission	7 (18.4%)	42 (24.3%)	0.439
Re-revision	6 (15.8%)	15 (8.7%)	0.184
Death rate	6 (15.8%)	16 (9.2%)	0.232
Length of Stay (days)	7.0 ± 4.0	7.5 ± 4.8	0.565