MSTS 2026 Abstract

Title: No Difference in Medical or Surgical Complications after Long and Short Intramedullary Nail Fixation for Pathologic Pertrochanteric Femur Fractures

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Significance & Hypothesis: While the prospective PERFORM trial aims to determine the optimal management of impending or completed pertrochanteric femur fractures, clinical equipoise currently persists**.** While intramedullary nail (IMN) fixation is widely accepted, the optimal construct length remains controversial. Long nails are traditionally favored to protect the entire femur from future metastatic progression, while short nails offer operative efficiency and reduced surgical morbidity. In this study, we hypothesize that the rate of subsequent distal disease requiring reoperation would not differ between short and long IMN constructs.

Innovation: This study challenges the current dogma of whole-bone protection by evaluating whether longer constructs confer a measurable clinical advantage over shorter, less invasive fixation strategies.

Approach: Adult patients treated for metastatic impending or completed pertrochanteric pathologic femur fractures with either a short or long IMN between January 1, 2011 and September 15, 2025 were retrospectively identified. Inclusion criteria included age ≥18 years, diagnosis of metastatic carcinoma, multiple myeloma, or lymphoma, and minimum follow-up of 6 months or cancer-related mortality within 6 months. The primary outcome was development of subsequent distal lesion requiring surgical intervention. A Shapiro-Wilk test was used to analyze the normality of continuous variables. Parametric data were analyzed using *t* tests, while nonparametric data were analyzed using Mann-Whitney *U* tests. Categorical variables were compared using Fisher exact tests. Institutional Review Board approval of this study was obtained.

Results: Of the 51 patients included, 24 patients were managed with short IMN (54.2% female) and 27 patients managed with long IMN (63.0% female). Mean follow-up did not differ between the groups (519 ± 510 days vs. 404 ± 477 days, p=0.409). There were no differences in baseline demographic data, including age at cancer diagnosis and history of neoadjuvant chemotherapy and radiotherapy (Table 1). Long IMN fixation was associated with significantly increased operative time (126 ± 57.7 vs. 85.7 ± 45.3 minutes, p=0.001). There were no significant differences between short and long IMN cohorts in subsequent distal lesions requiring surgery, postoperative complications, transfusion rates, or 6-month revision rates (Table 2). Only one patient in each group required revision; the patient in the short nail group underwent revision to a hip hemiarthroplasty and the patient in the long nail group underwent revision of the lag screw.

Discussion & Impact: Short and long IMN constructs demonstrate equivalent short-term clinical outcomes in pathologic pertrochanteric femur fractures. Notably, short nails did not result in increased distal disease progression or reoperation, while offering shorter operative times. These findings challenge the routine use of long constructs for prophylactic whole-bone protection and support a more tailored, morbidity-conscious approach to fixation. As survival improves in metastatic bone disease, longer-term follow-up and prospective data will be essential to refine surgical decision-making.

Table 1: Patient demographics, oncologic characteristics, and surgical variables. No significant differences were observed between patients treated with short versus long intramedullary nail constructs.

Variables	**Short Nail (n = 24)**	**Long Nail (n= 27)**	***p***
Age	67.0 (SD 10.3)	65.4 (SD 13.7)	0.622
Sex			0.625
Male	11 (45.8%)	10 (37.0%)	
Female	13 (54.2%)	17 (63.0%)	
Body Mass Index (BMI)	26.1 (6.47)	27.4 (5.42)	0.472
Race			0.784
White	3 (12.5%)	6 (22.2%)	
Black	13 (54.2%)	11 (40.7%)	
Other	6 (25.0%)	8 (29.6%)	
Declined	2 (8.33%)	2 (7.41%)	
Ethnicity			0.820
Not Hispanic	16 (66.7%)	19 (70.4%)	
Hispanic	6 (25.0%)	6 (22.2%)	
Declined	2 (8.33%)	2 (7.41%)	
CCI	8.46 (2.21)	8.62 (2.32)	0.805
ECOG	2.00 (1.06)	2.05 (1.00)	0.874
Age at Cancer Diagnosis	64.5 (11.0)	62.0 (11.6)	0.419
Years since Diagnosis	2.50 (3.74)	3.54 (7.99)	0.909
Primary Cancer			
Breast	8 (29.6%)	9 (31.0%)	
Colon	1 (3.70%)	1 (3.45%)	
Cholangiocarcinoma	0 (0.00%)	1 (3.45%)	
CLL	0 (0.00%)	1 (3.45%)	
Hepatocellular	0 (0.00%)	1 (3.45%)	
Lung	3 (11.1%)	6 (20.7%)	
Prostate	3 (11.1%)	2 (6.90%)	
Renal cell	1 (3.70%)	1 (3.45%)	

Thyroid	1 (3.70%)	1 (3.45%)	
Multiple Myeloma	9 (33.3%)	4 (13.8%)	
Unspecified carcinoma	0 (0.00%)	1 (3.45%)	
Neoadjuvant Chemotherapy	15 (62.5%)	12 (44.4%)	0.313
Neoadjuvant Radiation	8 (33.3%)	12 (44.4%)	0.600
Adjuvant Radiation	2 (8.33%)	3 (11.1%)	1.000
Fracture Type			0.061
Impending	17 (70.8%)	11 (40.7%)	
Complete	7 (29.2%)	16 (59.3%)	
Lesion Type			0.125
Metastasis	15 (62.5%)	23 (85.2%)	
Multiple Myeloma	9 (37.5%)	4 (14.8%)	
Fracture Location			0.722
Intertrochanteric	16 (66.7%)	16 (59.3%)	
Subtrochanteric	3 (12.5%)	6 (22.2%)	
Other	5 (20.8%)	5 (18.5%)	
Laterality			1.000
Left	14 (58.3%)	15 (55.6%)	
Right	10 (41.7%)	12 (44.4%)	
Follow up (days)	519 (510)	404 (477)	

CCI = Charlson Comorbidity Index, ECOG = Eastern Cooperative Oncology Group, CLL = Chronic lymphocytic leukemia

Table 2: Intraoperative and postoperative outcomes. Procedure duration was significantly longer for long intramedullary nail constructs, with no other significant differences observed between groups.

Variables	**Short Nail (n = 24)**	**Long Nail (n= 27)**	***p***
Subsequent lesion of the distal femur	0 (0%)	0 (0%)	1.000
Procedure Time (min)	85.7 (45.3)	126 (57.7)	0.001
Estimated Blood Loss (ml)	140 (62.5)	280 (319)	0.074
Intraoperative Complication	0 (0%)	0 (0%)	1.000
Intraoperative Transfusion	2 (7.41%)	6 (20.7%)	0.103
Admission LOS (days)	16.8 (22.1)	13.6 (11.7)	0.940
Postoperative LOS (days)	12.1 (15.5)	10.4 (10.4)	0.917
Postoperative Complication	13 (54.2%)	14 (51.9%)	1.000
Postoperative Transfusion	10 (43.5%)	12 (44.4%)	1.000
Disposition			0.597
Home	12 (50.0%)	9 (33.3%)	
Subacute rehab	10 (41.7%)	13 (48.1%)	
Acute rehab	1 (4.17%)	2 (7.41%)	
Death	1 (4.17%)	3 (11.1%)	
90-Day Readmission^	9 (39.1%)	10 (38.5%)	1.000
6-Month Revision^	1 (4.76%)	1 (3.85%)	1.000
6-Month Mortality^	7 (29.2%)	12 (44.4%)	0.403

^ Patients who died during admission excluded from analysis.
LOS = Length of stay