

A Population-Based Retrospective Cohort Study of Geriatric Native Distal Femur Fractures in Alberta, Canada from 2012-2022: Distal Femoral Replacement is Non-inferior to Fixation

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INTRODUCTION:

Geriatric distal femur fractures are underrecognized fragility fractures that occur in a similar demographic as hip fractures with a 4:1 female to male ratio, and 1-year mortality of 10-50%. These fractures are associated with high morbidity and medical events such as pneumonia/respiratory insufficiency, deep vein thrombosis/pulmonary embolism, urinary tract infection, acute kidney injury, and myocardial infarction/congestive heart failure. Goals of treatment are early mobility and weight-bearing as prolonged immobility may be detrimental in this frail, older population. Treatment options include fixation with plate and screw constructs and/or intramedullary nails, and distal femoral replacement (DFR). Disadvantages of fixation include prolonged immobility, non-weight bearing to protected weight bearing, and the potential for nonunion (reported to be as high as 25%). Proponents of DFR suggest the benefits of early weight bearing, with the assumption that early weight bearing may have a positive outcome on mortality, similar to hip fractures. The primary objective of this study was to determine if there was a mortality difference in geriatric patients with native distal femur fractures managed with DFR versus fixation at 30-days, 90-days, 1-year, and 2-years. Secondary objectives included morbidity (medical adverse events, 1-year re-operation rate, and 1-year re-admission rate), and health services usage (length of stay).

METHODS:

Using provincial administrative health data, we compared treatment options for geriatric distal femur fractures for all eligible patients in Alberta, Canada from January 1, 2012 until December 31, 2022. Eligible patients were men age ≥ 60 , and women age ≥ 50 , with a native distal femur fracture as defined using International Classification of Disease 10 (ICD-10) codes. We combined this with ICD-10 procedure codes to define surgical management groups (DFR and fixation). Fixation included plate and screw constructs, and intramedullary nails.

Morbidity was measured by the Charlson Comorbidity Index (CCI), a widely used measure to classify comorbid conditions which may influence mortality risk. 1-year re-admission rate was defined as all cause re-admission rate including for transfers for further rehabilitation. Length of stay (LOS) was defined as length of stay in the acute care hospital, and episodic length of stay (eLOS) was defined as all contiguous Emergency Department visits and inpatient admissions prior to the surgical admission and all subsequent contiguous inpatient admissions to an institution of equal or lower level of care until a final discharge or re-admission to a facility of higher level of care. Categorical variables were compared between groups using Pearson Chi-square or Fisher's exact test. Continuous variables were compared with individual t-tests.

RESULTS:

A total of 757 patients with a mean age of 74.2 ± 12.2 years were included. 83.9% were female (635/757), and 16.1% of patients were men (122/757). 95.9% were treated with fixation (726/757), and 4.1% of patients were treated with DFR (31/757). There was no sex-related difference with respect to treatment modality; 87.1% of patients treated with DFR (27/31) were female, and 83.7% of patients treated with fixation (608/726) were female ($p=0.8$). The mean age was 3.2 years older in the DFR group (77.3 ± 10.7 vs 74.1 ± 12.3 , $p=0.07$). When comparing comorbidities as measured by CCI, patients treated with DFR had a significantly increased number of comorbidities compared to fixation (scores $>0 = 25.8\%$ vs 11.9% , $p=0.002$).

While there was no statistically significant difference in mortality between DFR and fixation, mortality appeared to increase more in the DFR group particularly at 2 years: 30-day mortality (6.5% vs 6.6%, $p=0.66$), 1 year mortality (19.4% vs 16.0%, $p=0.62$), 2-year mortality (35.5% vs 23.4%, $p=0.12$). However, after adjusting for age and comorbidity index, 2-year mortality between DFR and fixation did not appear significantly different (OR 0.79, 95%CI 0.34-1.84, $p=0.58$).

There was no significant difference between adverse medical events between DFR and fixation (Table 1), reoperation rates (9.7% DFR vs 9.2% fixation, $p=0.56$), nor in all cause re-admission rate between DFR and fixation (70.1% vs 69.5%, $p=0.20$) within 1 year. There was also no significant difference between DFR and fixation in terms of LOS (25.4 days [IQR 9.8-35.7] vs 19.6 days [IQR 5.8-18.8], $p = 0.33$) and eLOS (63.6 days [IQR 19.6-77.0], 53.0 days [IQR 9.6-81.9], $p = 0.31$).

DISCUSSION AND CONCLUSION:

Overall, geriatric native distal femur fractures have an approximately 16% 1-year mortality rate and affect females much more frequently than males. This is a frail population who had a 70% all cause re-admission rate within 1-year of surgery. DFR was performed in patients with significantly more comorbid disease as measured by CCI, and there was a trend to treat older patients with DFR. Mortality rate did not reach statistical significance between the two groups at any time point, and after adjusting for age and comorbidity index, the difference in 2-year mortality was not significant. Health care usage did not differ between groups with similar rates of re-operation and re-admission in 1-year, and length of stay in hospital.

The results of this study demonstrate that despite being used in an older population with significantly more comorbid diseases, DFR is a safe option for the treatment of distal femur fractures compared to fixation, with no significant difference in mortality, complications, health services usage.

While this is the largest cohort of patients comparing DFR and fixation in geriatric native distal femur fractures, only 4% of patients received DFR (31/757). Other limitations of our study include the inability to determine when patients began mobilizing and weight-bearing.

Table 1. Adverse medical events between DFR and fixation

	DFR	Fixation	p-value
UTI	3 (9.7%)	45 (6.2%)	p = 0.45
Pneumonia	2 (6.5%)	28 (3.8%)	p = 0.36
Aspiration	2 (6.5%)	17 (2.3%)	p = 0.19
Myocardial Infarction	1 (3.2%)	15 (2.1%)	p = 0.50
Cardiac Arrest	0	4 (0.5%)	p = 1
VTE/PE	1 (3.2%)	5 (0.7%)	p = 0.23
Decubitus Ulcer	0	5 (0.7%)	p = 1
Infection	1 (3.2%)	14 (1.9%)	p = 0.47
Stroke	0	2 (0.3%)	p = 1
Total	10	135	p = 0.19