Economic and Mortality Burden of Revisions After Proximal Femoral Fracture Fixation

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Highlights

- Average total payment after proximal femoral fracture (PFF) surgery was $31,839 at 30-day, $40,916 at 90-day, and $52,562 at 1-year of follow-up.
- Among patients who survived through 90-day post-index, 1-year mortality rate was 19.8% among patients who had a revision within 90 days post-index, and 14.9% of those who did not have a revision within 1 year.
- Revision following PFF surgery was associated with significant incremental total payment. Incremental total payment for patients undergoing revision was $17,219 at 30-day, $28,355 at 90-day and $33,324 at 1-year.

Introduction

Proximal femoral fractures (PFF) is a common injury in the elderly population. Intramedullary nailing (IMN) remains a commonly used treatment, especially in displaced fractures..

Despite advances in surgical techniques, complications are relatively common, leading to significant health and economic burdens.

Surgical procedural factors, such as tip-apex distance (TAD) have been empirically shown to be associated with post-operative complications.

Objectives

We examined short- and long-term total Medicare payment (a proxy for resource utilization) after PFF fixation and its association with surgical revisions, with risk adjustment for a comprehensive list of patient characteristics, as well as surgeon- and hospital-level characteristics. We also examined 1-year mortality rate post PFF fixation.

Data

Data were collected retrospectively using the 100% Fee-for-Service (FFS) Medicare Limited Data Set (LDS) Standard Analytic Files (SAF).

Methods

We included patients aged ≥65 years with an ICD-10-PCS or CPT code indicating initial encounters of PFF with IMN (index surgery) from Jan 1, 2016, to Dec 31, 2023. Continuous Medicare Part A/B enrollment was required from 6-months before index surgery through each follow-up window.

We measured total payment, including index PFF surgery and follow up care throughout the follow up windows.

Generalized Linear Models with log link and Gamma distribution were used to assess the relationship between surgical revisions and total payment, adjusted for patient demographics, clinical characteristics, fracture location and type, and provider characteristics. Surgeon annual volume of PFF surgery was categorized into quartiles: <5, 5-9, 10-18 and 19+. We then used recycled prediction to estimate the incremental total payment by whether the patient had surgical revisions.

Table 1. Predicted total payment with or without revision

Outcome	30-Day Total Payment[a]			90-Day Total Payment[a]			1-Year Total Payment[a]		
	N = 295,733			N = 265,215			N = 193,959		
Revision*	Predicted Total Payment	Marginal Difference	95% CI	Predicted Total Payment	Marginal Difference	95% CI	Predicted Total Payment	Marginal Difference	95% CI
No	$31,714	Ref	Ref	$40,746	Ref	Ref	$52,424	Ref	Ref
Yes	$48,932	$17,219	($16,423, 18,014)	$69,101	$28,355	($26,982, 29,728)	$85,748	$33,324	($30,751, $35,897)

[a]Analysis is limited to patients continuously enrolled in Medicare FFS through the follow-up time window.

*Revision is measured for the time window aligned with the total payment, i.e., revision is measured within 30 days for a 30-day total payment.

Results

We identified 523,658 patients who underwent PFF surgery between January 2016 and December 2023. Of these, 342,030 patients whose surgery used IMN.

The majority of patients were Caucasian (92.2%), 75+ years of age (78.8%), and females (71.0%). Most patients had fractures of the trochanteric location (85.3%), followed by head and neck (15.4%), subtrochanteric (9.4%) and basicervical (0.8%). Note that patients can have fractures at one or more of abovementioned locations. Most fractures were displaced and closed (85.0% and 94.9%, respectively).

The mean revision was 0.8% at 30-day post index surgery, increasing to 2.1% by 90-day and 5.9% at 1-year post-index. Patients who required revisions had higher predicted total payments at the 30-day, 90-day, and 1-year post-index periods (**Table 1**).

Among all patients who had an IMN index surgery for PFF, 28.24% of patients died within 1 year. Among patients who survived through 90-day post-index, 1-year mortality rate was 19.8% among patients who had a revision within 90 days post-index, and 14.9% of those who did not have a revision at 1 year.

Discussion

Revision following PFF surgery was associated with significant incremental total payment and elevated 1-year mortality. Specifically, surgical revision was associated with a 54% increase in total payments at 30-days post-index surgery, a 70% increase at 90-day, and a 64% increase at 1-year, respectively.

Lower surgeon volume was associated with a higher incidence of adverse outcomes after PFF surgery with IMN. Nearly 80K (23%) patients were treated by surgeons with an annual PFF volume < 5 and 250K (73%) with surgeons with an annual PFF volume < 19.

This presents an opportunity for emerging digital technologies, which have been shown to reduce variation in TAD and therefore lower opportunity for cut-out, to reduce the post-operative economic and mortality burden through reduced risk of surgical revision.