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Thirty-day readmission and mortality among Medicare beneficiaries discharged to skilled nursing facilities after vascular surgery

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ABSTRACT

Background: Readmission within 30 d of an acute hospital stay is frequent, costly, and increasingly subject to penalties. Early readmission is most common after vascular surgery; these patients are often discharged to skilled nursing facilities (SNFs), making postacute care an essential partner in reducing readmissions. We characterize 30-day readmissions among vascular surgery patients discharged to SNF to provide evidence for this understudied segment of readmission after specialty surgery.

Methods: We utilize the Centers for Medicare & Medicaid Services Chronic Conditions Warehouse, a longitudinal 5% national random sample of Medicare beneficiaries to study 30-day readmission or death after discharge to SNF following abdominal aortic aneurysm repair or lower extremity revascularization from 2005-2009. Descriptive statistics and logistic regression with Least Adaptive Shrinkage and Selection Operator were used for analysis.

Results: Two thousand one hundred ninety-seven patients underwent an abdominal aortic aneurysm procedure or lower extremity revascularization at 686 hospitals and discharged to 1714 SNFs. Eight hundred (36%) were readmitted or had died at 30 d. In adjusted analysis, predictors of readmission or death at 30 d included SNF for-profit status (OR [odds ratio] = 1.2; $P = 0.032$), number of hospitalizations in the previous year (OR = 1.06; $P = 0.011$), number of comorbidities (OR = 1.06; $P = 0.004$), emergent procedure (OR = 1.69; $P < 0.001$), renal complication (OR = 1.38; $P = 0.003$), respiratory complication (OR = 1.45; $P < 0.001$), thromboembolic complication (OR = 1.57; $P = 0.019$), and wound complication (OR = 0.70; $P = 0.017$).

Conclusions: Patients discharged to SNF following vascular surgery have exceptionally high rates of readmission or death at 30 d. Many factors predicting readmission or death potentially modify decision-making around discharge, making early detection, discharge planning, and matching patient needs to SNF capabilities essential to improving outcomes.

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Introduction

Readmission after vascular surgery is among the most common and the costliest on a per patient basis among surgical procedures.[1,2] Approximately 24% of patients undergoing a vascular procedure are readmitted within 30 d; in contrast, the overall surgical readmission rate is less than 16%.[2] This is unsurprising given that patients undergoing vascular procedures are commonly older adults with compromised blood flow who suffer a high morbidity burden and often require significant postoperative care.[3,4] Vascular procedures are becoming more common as the US population ages and percutaneous techniques are available to frail patients who were not previously candidates for open surgery. As such, projected demand for vascular procedures is increasing at the highest rate among medical specialties.[4]

Management of postoperative recovery, which includes the surgical wound, in the setting of preexisting poor blood flow and comorbidity in these patients is uniquely complex. Moreover, patients are frequently discharged to skilled nursing facilities (SNFs) with the goal of rehabilitation until they are ready to transition to a residential setting.[5,6] The postacute care setting is thus an essential partner in minimizing the incidence of adverse events in the postoperative period as hospitals decrease postoperative lengths of stay. As a result, SNFs are increasingly the targets of accountable care organization efforts to coordinate care and improve outcomes.[7-9] SNFs are ideal targets for improving outcomes, having been criticized as "the revolving door of rehospitalization" with nearly a quarter of Medicare-covered patients discharged to SNF returning to the hospital within 30 d.[10] This suggests that discharging hospitals may anticipate a level of patient care that is not available at SNF, and suboptimal care coordination frequently occurs between the hospital and SNF staff.

In a complex service delivery environment with competing demands, specialty surgical care providers caring for complex patients face a dearth of evidence informing (1) which patients are appropriate for discharge to SNFs and (2) what SNF characteristics predispose patients to readmission. To inform transitional care for this vulnerable and growing patient population, we examine (1) patients' clinical characteristics and (2) SNF organizational characteristics associated with 30-day readmission for vascular surgery patients to inform discharge planning and care coordination.

Methods

Data source

We analyzed data from the Centers for Medicare & Medicaid Services Chronic Conditions Data Warehouse (CCW), a 5% national random sample of Medicare beneficiaries who are followed over time after cohort entry.[11] We obtained CCW claims for all patients undergoing a vascular procedure for open or endovascular abdominal aortic aneurysm (AAA) repair or lower extremity revascularization with an associated qualifying diagnosis code for the years 2005-2009 using Current Procedure Terminology and International Classification of Diseases, Ninth Clinical Modification codes for the relevant procedures (full list in Appendix).

To evaluate SNF organizational characteristics, we linked the CCW data for qualifying inpatient stays with publicly available organization-level data from the Nursing Home Compare Provider and Deficiency File and the Nursing Home Compare Quality Measures File (located at https://data.medicare.gov/data/nursing-home-compare) using the provider number and year to match SNF data with CCW inpatient encounters.[12] We obtained a 58% same-year match for data for patients discharged to SNF and their corresponding SNF data; 39% of the remaining unmatched SNF discharges were matched to SNF data within 1 y, and the remaining 3% were matched to SNF data within 2 y of the discharge.

Inclusion criteria

We included those patients discharged to SNF after a qualifying hospitalization with complete enrollment in Medicare Part A and Part B for 365 continuous days prior to the qualifying procedure to characterize comorbidity, and at least 60 d after discharge to capture 30-day readmission and 60-day mortality. These criteria permit the inclusion of patients discharged to and readmitted from SNF as well as patients discharged to SNF, sent home, and subsequently readmitted. We excluded patients discharged against medical advice and those who died during the qualifying hospitalization. We also excluded patients with incomplete data owing to Medicare health maintenance organization enrollment or receipt of railroad benefits. If a patient had multiple qualifying hospitalizations during the study period, only the first hospitalization-readmission pair was included in analysis. We excluded those hospitals with very low vascular procedure volume based on criteria defined in Birkmeyer, *et al.* (2002) because they represent extreme outliers for whom suboptimal outcomes may be a consequence of the operative team's experience rather than postoperative care quality.[13,14]

Dependent variables

The primary outcome of interest is readmission to an acute care hospital or death within 30-days of a qualifying vascular procedure and following discharge to SNF; we also examined death within 60 d. Readmitting diagnosis, which helps to contextualize the outcome, is classified into disease groups based on multilevel disease categories using Clinical Classification Software from the Healthcare Cost and Utilization Project.[15]

Independent variables

Patient characteristics

Patient characteristics include age at discharge, sex, and race (white *versus* nonwhite). Any previous Medicaid eligibility and residence in a nursing home in the year prior to the procedure are also included in analysis.[16]

Clinical characteristics include the number of comorbidities defined by Charlson for the year prior to the intervention (range 0-17) and the use of a mobility device (first claim date for cane,