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Original Article

Causes of hospital readmissions within 7 days from the neurosurgical service of a quaternary referral hospital

Enyinna L. Nwachuku[1], Kevin P. Patel[2], Audrey L. Paul[3], Robert M. Friedlander[2], Peter C. Gerszten[2]

Departments of [1]Neurosurgery, [2]Neurological Surgery, [3]Wolff Center, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, United States.

E-mail: *Enyinna L. Nwachuku - nwachukuel@upmc.edu; Kevin P. Patel - patel.kevin@medstudent.pitt.edu; Audrey L. Paul - paulal@upmc.edu; Robert M. Friedlander - friedlanderr@upmc.edu; Peter C. Gerszten - gerspc@upmc.edu

***Corresponding author:**
Enyinna L. Nwachuku,
Department of Neurosurgery,
University of Pittsburgh
Medical Center, Pittsburgh,
Pennsylvania, United States.

nwachukuel@upmc.edu

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ABSTRACT

Background: Evaluation of readmission rates as a proxy metric of health-care quality in neurological surgery has grown to become a prevalent area of investigation in the last several years. Significant attention has been paid to 30-day readmission rates due to the financial incentive to health-care providers following the enforcement of the penalties created by the Affordable Care Act. However, relatively little attention has been paid to patients readmitted within 7 days of discharge to large quaternary neurological surgery services. This study was conducted to examine the causes and unique characteristics of 7-day readmission rates from a neurosurgical service at a large quaternary referral hospital.

Methods: A retrospective observational analysis of all 7-day readmissions to the neurosurgical surgery service of the University of Pittsburgh Medical Center, Presbyterian Hospital from August 2017 to June 2019, was performed. Patients were organized into seven categories based on their primary reason for readmission: scheduled surgeries, infection, pain, altered mental status or seizures, general postoperative complications, complications directly resulting from a neurosurgical intervention, and unrelated reasons. Demographic information, the time between initial discharge and subsequent readmission, and discharge disposition were also recorded.

Results: Of 5274 discharges, 258 patients (4.9%) were readmitted within 7 days (55.0% male; mean age 60 years of age). Two-thirds of patients readmitted initially underwent care for cranial pathologies (57% of 258 patients) as opposed to a third for spine pathologies (33% of 258 patients). Complications that directly arose from the neurosurgical intervention (e.g., shunt infection or misplacement, and hardware misplacement) represented 18.9% of total readmission, while general postoperative complications (e.g., urinary tract infection) accounted for 15.1% of total readmission, in which all together were slightly greater than a third of readmissions. Seizures or altered mental status led to less than a fifth of readmissions (17.0%), followed by readmissions from unrelated diagnosis or miscellaneous reasons (17.0%) and scheduled surgeries (13.1%). Taken together, surgical site infections (9.7%) and postoperative pain (9.3%) accounted for 9.7% and 9.3 % of readmissions, respectively.

Conclusion: Approximately 5% of patients discharged in a single year from our quaternary referral center were readmitted within 7-days. Approximately 90% of all 7-day readmissions were unplanned, with one-third resulting directly from perioperative complications. Further investigation to better understand this acutely vulnerable yet previously overlooked population may guide focused efforts to increase the quality of neurosurgical patient care.

Keywords: Complications, General neurosurgery, Hospital disposition, Readmission

INTRODUCTION

Several recent studies suggest that the average cost of general medical readmission was $2200,[10] which is dwarfed by published costs of neurosurgical readmissions, which can range between

$30,000 and $90,000.[1,4,5,10] Overall, expenditures associated with 30-day readmissions totaled to $41 billion in 2011,[1] which grew to $50.7 billion in 2013.[3,9] Following the passage of the Affordable Care Act and the establishment of the Hospital Readmissions Reduction Program (HRRP), financial penalties aimed at reducing costs associated with unplanned readmissions were developed and took effect in 2015. Capable of withholding as much as 3% of Medicare reimbursements, the HRRP withheld, on average, 0.71% of Medicare reimbursements, affecting 83% of hospitals evaluated [Figure 1].[3,6]

In addition, concerning is the fact that other surgical specialties have witnessed a decline in readmission rates over time, whereas reductions in readmissions for neurological surgery have plateaued and, in some cases, even increased.[10] Recent systematic reviews suggest that 30-day readmission rates for spinal pathologies vary between 4.2% and 7.4%[2] and are generally lower than rates for cranial pathologies, which vary between 14% and 24%.[5] These rates are lower than the rate of readmission for Medicare patients across the board (17.8%); however, the costs associated with neurosurgical readmissions are proportionally greater in comparison to all Medicare patients.

Beyond just their financial burden, evidence suggests that neurosurgical readmissions are associated with significant morbidities, reductions in quality of life, and increased mortality[10]. Understanding financial and labor costs associated with 30-day readmissions in neurological surgery have resulted in a significant increase in the surveillance of such readmissions. However, the controversy surrounding the use of these rates by HPPR to penalize hospitals has also invited scrutiny of 30-day readmission rates in neurological surgery as a health-care quality metric.[7,8,11]

To the best of our knowledge, the present observational study of 7-day readmissions in neurological surgery is the first of its kind. Three goals were identified at its outset: (1) to identify and better characterize a poorly understood population of patients being readmitted from a neurological surgery service, (2) to decrease the overall readmission rate of all discharged patients from our neurological service, and (3) to guide future efforts to identify the causal mechanisms underlying 7-day readmissions in neurological surgery.

MATERIALS AND METHODS

Analysis

A retrospective observational study of 7-day readmissions between August 2017 and June 2019 to the neurosurgical service of the University of Pittsburgh Medical Center, Presbyterian Hospital (UPMC-PUH), was conducted.

Database

All data were approved for use by the Total Quality and Patient Safety Council as a quality improvement initiative for the department of neurological surgery at UPMC. Eighteen different attending level providers cared for this patient cohort.

Demographic information

Demographic data were collected for all patients: age, sex, and interval number of days between initial discharge and subsequent readmission, along with the patients' discharge disposition were recorded.

Coding scheme

The primary reason for readmission was organized using a seven-category system: surgical site infection, pain, altered mental status/seizures, postoperative complication, and "unrelated." These categories were constructed anecdotally based on the clinical observation that comprehensively covers reasons for readmission at UPMC Presbyterian Hospital (PUH). Statistical analyses were organized and conducted through the Microsoft Excel spreadsheet. Figures and graphics were constructed with Tableau.

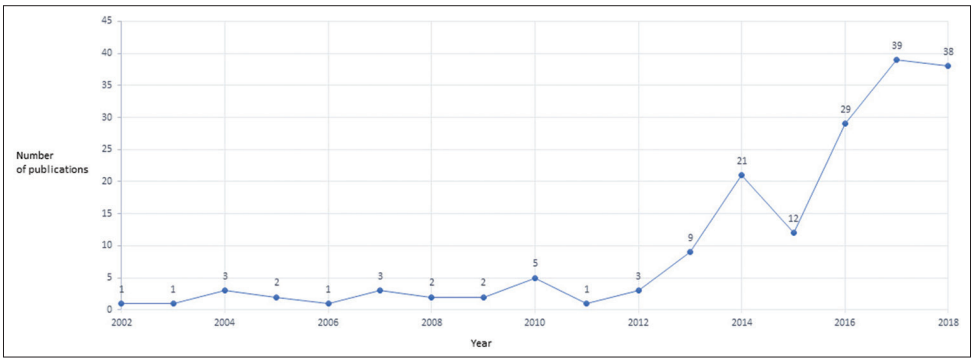

Figure 1: Outlines trend in neurosurgical publications on readmission as it correlates with the creation of the Hospital Readmissions Reduction Program through the Affordable Healthcare Act.

Data acquisition and anonymization

Batched data of all readmissions to the UPMC-PUH neurosurgery service between August 2017 and June 2019 were graciously provided by the were password protected and anonymized consistent with institutional standards and HIPAA guidelines.

Eligibility

All patients aged 18 or older who were readmitted between August 2017 and June 2019 to the UPMC-PUH Neurological Surgery service within 7-days of their initial discharge were included in our dataset.

RESULTS

Between July 2017 and June 2019, 5274 patient discharges were performed. During this time, 258 patients (4.9%) were readmitted within 7 days (55.0% men; mean age 60 years) [Table 1]. General postoperative complications and direct surgical complications accounted for a little over a third of readmissions (15.1 and 18.9%, respectively), altered mental status/seizure resulted in 17.0% of readmissions, unrelated readmissions (18.0%), and scheduled surgeries (13%). Surgical site infections and postoperative pain-related readmissions accounted for nearly a fifth of readmissions (9.7% and 9.3%, respectively, Table 2).

Two-hundred thirty patients out of 258 who were readmitted either underwent cranial (57%) or spinal (32.5%) surgery with miscellaneous procedures accounting for the remaining 11% [Table 1]. Patients readmitted for general postoperative complications were largely represented by individuals who underwent a cranial operation [23/39 patients, Table 3]. In addition, patients readmitted within 7 days for complications that directly arose from the neurosurgical intervention were from the cranial operation cohort in a significant amount of the cases [33/47, Table 3]. A large portion of readmissions due to seizure or altered mental status (34/43, 79% cranial) occurred in patients with cranial pathologies; similarly, more than half of miscellaneous readmissions (27/47, 57% cranial) occurred in patients who exhibited cranial pathologies. Conversely, patients who underwent spinal surgical intervention were readmitted more often for postoperative pain (17/24, 71% spinal) and surgical site infections (14/25, 56 % spinal). Finally, patients readmitted for elective or scheduled surgical procedures were cranial patients (14/33, 42% spinal).

Approximately 66% of patients discharged following inpatient hospitalizations on the neurological surgery service were discharged to home [Figure 2]. All patients ultimately readmitted for postoperative pain or scheduled surgeries had been initially discharged home. However, <½ of patients readmitted for treatment of infections had been initially discharged home. This cohort was more likely to have been discharged to an inpatient rehabilitation facility or a skilled nursing facility. Nearly a third of patients readmitted for complications from the direct neurosurgical intervention were originally discharged to an inpatient rehabilitation facility; the remaining were discharged home.

DISCUSSION

The aim of this retrospective study was to better understand the reasons that patients were readmitted to the neurological surgery service of a large quaternary referral hospital within 7 days of readmission. The 7-day all-cause readmission rate was nearly 5%. Many interesting points of discussion

Table 1: Demographic characteristics of readmitted patients (*n*=258).

Characteristic	Value, (%)
Male	144, (55.0)
Female	115, (45.0)
Average time to readmission, days	3.78
Average age, years	60.36
Median age, years	64
Cranial index procedure type	146, (56.59)
Spinal index procedure type	84, (32.56)
Neither index procedure type	28, (10.85)

Table 2: Reason for readmission (*n*=258).

Reasons	#, (%)
AMS/Seizures	43, (16.67)
General postoperative comp	39, (15.12)
Miscellaneous	47, (18.22)
Postoperative pain	24, (9.30)
Scheduled surgery	33, (12.80)
Surgical postoperative comp	47, (18.22)
Surgical site infection	25, (9.69)

Table 3: Readmission reason by index procedure type (*n*=258).

Readmission reason category	Cranial #	Spinal #	Neither #
Scheduled surgery	14	7	12
Surgical site infection	9	14	2
Postoperative pain	6	17	1
AMS/seizures	34	4	5
General postoperative complication	23	12	4
Direct neurosurgical postoperative complication	33	13	1
Miscellaneous	27	17	3

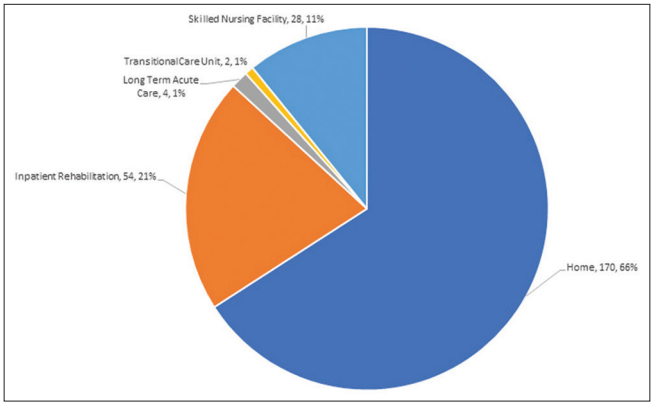

Figure 2: Original disposition of patients after their index procedure. Outlined is the total number of patients sent to the respective destinations and percentages out of the total readmission population of 258.

were revealed from this investigation. It was noted that 57% of readmissions within 7-days resulted from patients who underwent a cranial procedure; the remaining cohorts represented spinal (32%) and miscellaneous interventions (11%). Classically, a significant amount of outpatient resources, both from orthopedic and neurosurgical spine services, have been made possible for outpatient postoperative spine care, that is, home care, wound care nurses, and same-day mid-level providers' clinics. These types of initiatives have helped to lower spine surgery-related readmissions. However, there are relatively fewer resources available to cranial patients. Furthermore, not many rehabilitation facilities skilled nursing homes or outpatient nurses feel equipped to temporize even the smallest of cranial complications; therefore, these patients are readmitted more often for a higher level of support provided in the inpatient setting.

General postoperative complications and direct surgical complications accounted for a little over a third of readmissions (15.1 and 18.9%, respectively). General postoperative complications included readmission for diagnoses such as but not limited to urinary tract infections, pneumonia, pulmonary embolism, and/or deep venous thromboses. Diagnosis of CSF leaks, hardware misplacement, or shunt failures was considered to direct results of neurosurgical care. Unlike other studies of readmissions in neurological surgery,[7,8,11] it was not within the bounds of the present study to characterize these diagnoses as "avoidable" or "unavoidable." The authors found that the establishment of this sort of dichotomy introduced unnecessary subjectivity into a retrospective analysis chiefly designed to better understand an acutely vulnerable patient population. It stands to reason that a neurological surgery service has the greatest capacity to reduce the rates of readmissions from care modalities that they directly control. Therefore, these results may initiate initiatives which develop better-standardized discharge protocols in order to recognize and ultimately rectify perioperative errors before discharge so that neurosurgical patients, specifically those with cranial pathologies, can be spared readmissions.

Somewhat surprising, 7-day readmissions related to postoperative pain (9.3%) and infection (9.7%) proved to have the lowest incidence among readmitted patients. However, subgroup analyses showed that a patient who underwent spine surgery was a significant proportion in each of the categories. As previous data in the literature have soon, this result is likely from a subset of patients who are narcotic dependent and have significant comorbid conditions which predispose them to surgical site infection, that is, obesity and diabetes mellitus. Furthermore, readmissions for planned elective surgeries and those which are unrelated to neurosurgical care (e.g., patient displeased with rehabilitation or skilled nursing facility) accounted for 13% and 18%, respectively. This information provides an opportunity for more insightful means for institutions to scrutinize such readmission into a separate category that does not get lumped into the cohort, for which hospitals may be penalized.

There are several limitations to this study. These results are a reflection of our hospital's unique neurosurgical service line that may not compare directly to other hospitals, patient populations, and geographic locations. Our future goals are to increase the sample size and generalizability by collaborating with other large neurosurgical institutions for a multi-center database to increase the investigational rigor of the study.

CONCLUSION

The 7-day readmission rate for the UPMC-PUH neurosurgery service was 5%. Fifty-seven percent of all readmitted patients underwent a cranial intervention in comparison to 32% who had spine procedures. The majority of readmissions were related to direct perioperative complications. Therefore, focal efforts to decrease specific postoperative complications should translate into a reduction in 7- and subsequently 30-day unplanned readmissions.

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Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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