Inter-hospital Transfer of Neurosurgical Patients to a High Volume Tertiary Care Center: Comprehensive Analysis and Opportunities for Process Improvement

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Introduction

Neurosurgical care is a common reason for inter-hospital transfer (1,2) and the putative indication is the need for urgent or emergent evaluation and intervention. Many hospitals lack full-time neurosurgical coverage (2) and the transfer of patients to regional centers is expected to increase with further centralization of medical care (3,4). A comprehensive analysis of the transfer records from a large tertiary care medical center was conducted to identify trends and opportunities to improve the transfer process.

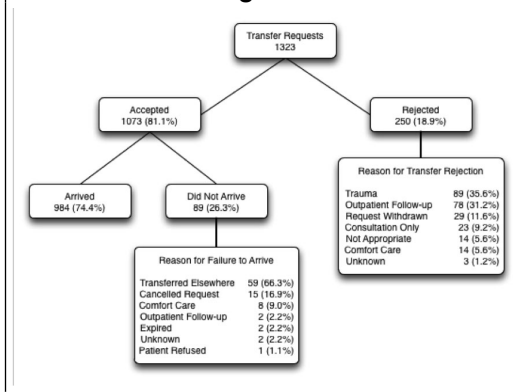
Methods

All consecutive, prospectively documented requests for ipatient transfer to the adult neurosurgical service of the Emory University Hospitals were identified from a centralized transfer center database for a one-year, study period. All transfer requests were analyzed independent of patient acceptance or arrival. Details of each transfer request, including the logistic and clinical information, were extracted from the transfer database. Clinical data for admitted patients was collected from the electronic medical record. Daytime was *a priori* defined as 07:00 to 17:59 consistent with shift schedules at our hospitals and comparable to prior studies (5,6).

Results

A total of 1323 transfer requests for neurosurgical care were received, 81.1% of these requests were accepted, and a total of 984 patients (74.4% of requests) arrived at our institutions (Fig 1).

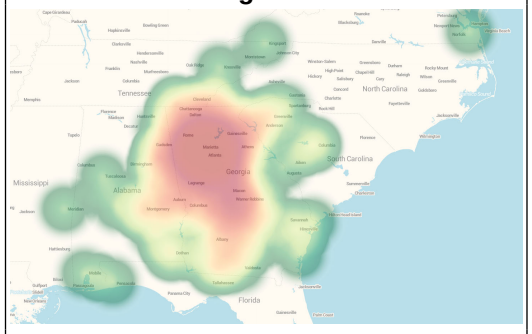
Figure 1



Distribution of Patient Transfer Requests

Patients arrived from 133 unique facilities throughout a catchment area of 66,287 square miles defined by hospitals transferring at least two patients in the study period (Fig 2). The majority of patients were transferred by ambulance with 11.4% arriving by helicopter.

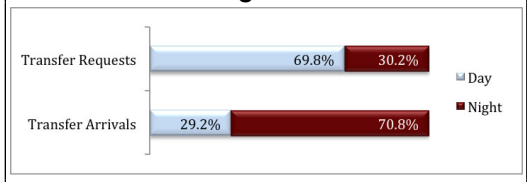
Figure 2



Heatmap of the Density of Transfers by Referring Hospital

Most transfer requests were received during the day, however, the majority of patients (70.8%) arrived at night (Fig 3) when there is limited staff, consulting physician, and operating room availability.

Figure 3



Day and Night Distribution of Transfer Request and Patient Arrivals

Further, while the median travel time was 36 minutes, the median interval between request and arrival was 4 hours 2 minutes. The most frequent diagnoses were intracranial hemorrhage (31.8%), subarachnoid hemorrhage (31.2%) and intracranial tumor (15.2%). The overall diagnostic error rate was 10.3%. Following admission, only 42.5% of patients underwent neurosurgical intervention. Most patients (73.5%) were admitted to the ICU, however 16.6% and 28.5% of these patients were transitioned to a lower level of care and 9.1% and 17.4% were discharged within 24 and 48 hours respectively.

Conclusions

Inter-hospital transfer is complicated and requires a coordinated effort between administrators, physicians, and staff to make complex decisions that govern this important and costly process. The potential impact of transfer delays is underscored by studies demonstrating that patients arriving at night experienced higher mortality and longer time to intervention(6,7). The efficiency of and indications for transfer will garner scrutiny as patients are increasingly managed at multi-disciplinary, regionalized care centers.

Our data suggest multiple areas for improvement in this process as rapid and safe transfer has been shown to reduce morbidity and mortality.

Learning Objectives

Participants should be able to: 1) Describe the factors influencing inter-hospital patient transfer for neurosurgical care. 2) Understand the triage, timing, and disposition of transfer patients and how these factors affect patient care. 3) Identify strategies for improving the efficiency and appropriateness of transfer of neurosurgical patients.

References

1. Babu MA, Nahed B V, Demoya MA, Curry WT: Is Trauma Transfer Influenced by Factors Other Than Medical Need? An Examination of Insurance Status and Transfer in Patients With Mild Head Injury. Neurosurgery 69:659–67; discussion 667, 2011
2. Byrne RW, Bagan BT, Slavin K V, Curry D, Roski TR, Origitano TC: Neurosurgical Emergency Transfers to Academic Centers in Cook County: A Prospective Multicenter Study. Neurosurgery 62:709–716, 2008
3. Cutler DM, Scott Morton F: Hospitals, market share, and consolidation. JAMA 310:1964–70, 2013
4. Greaney TL: Accountable Care Organizations — The Fork in the Road — NEJM. N Engl J Med 364:2011
5. Wunsch H, Mapstone J, Brady T, Hanks R, Rowan K: Hospital mortality associated with day and time of admission to intensive care units. Intensive Care Med 30:895–901, 2004
6. Laupland KB, Misset B, Souweine B, Tabah A, Azoulay E, Goldgran-Toledano D, et al.: Mortality associated with timing of admission to and discharge from ICU: a retrospective cohort study. BMC Heal Serv Res 11:321, 2011
7. Magid DJ, Wang Y, Herrin J, McNamara RL, Bradley EH, Curtis JP, et al.: Relationship between time of day, day of week, timeliness of reperfusion, and in-hospital mortality for patients with acute ST-segment elevation myocardial infarction. JAMA 294:803–12, 2005