Sub-Arachnoid Hemorrhages in Minnesota:

Minnesota Stroke Registry

Technical Report

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Consultant's Report

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INTRODUCTION

Sub-arachnoid hemorrhages are a stroke sub-type characterized by bleeding within the sub-arachnoid space of the brain. They comprise between 5-10% of all strokes. The majority of sub-arachnoid hemorrhages (~80%) are due to rupture of berry/saccular aneurysms. Hence, these strokes are not mediated by vascular risk factors unlike most ischemic strokes and a large percentage of intra-parenchymal hemorrhages. Due to this, the incidence of sub-arachnoid hemorrhages has remained stable over the last few decades. The natural history of sub-arachnoid hemorrhage is grim and is particularly devastating compared to other stroke sub-types. About 10-12% of patients with sub-arachnoid hemorrhage die before reaching medical attention. The 30-day mortality is in the range of 40-50% with most of the deaths within the first week of the rupture. Survivors are frequently disabled due to neurological sequela of the hemorrhage. Sub-arachnoid hemorrhage affects a relatively younger group of otherwise healthy patients and hence social and economic costs of this illness are significant. [1-3]

The last decade has seen an increase in efforts to improve the quality of acute stroke care by hospitals and health systems. These efforts have been in response to nationwide movements including the JCAHO Stroke Center Certification, American Heart Association Get With the Guidelines (GWTG), and, the Paul Coverdell National Acute Stroke Registry (PCNASR). The quality of stroke care in these programs is measured by adherence to acute stroke care quality metrics. (http://www.cdc.gov/dhdsp/programs/pcnasr_metrics.htm). While these metrics are evidence-based and measurable, many of them, (e.g., anti-thrombotic therapy at discharge, early anti-thrombotic therapy) are applicable only to ischemic strokes. There are a total of 10 performance measures used by JCAHO, GWTG and PCNASR to measure stroke quality. Ischemic strokes are eligible for all 10 measures. Hemorrhagic strokes including intra-parenchymal and sub-arachnoid hemorrhages are eligible for 5 measures. Hemorrhagic strokes are frequently ignored in stroke QI efforts. In this report we examine demographics and quality of care of sub-arachnoid hemorrhage cases in the Minnesota Stroke Registry, part of the PCNASR, with the aim of increasing awareness of the need for targeted quality improvement for this stroke subtype. We also examined claims data from the Minnesota Hospital Association to understand patterns in sub-arachnoid hemorrhage management.

METHODS

Data

We used data available in the Minnesota Stroke Registry (MSR) from 2006-2014. Our study sample was restricted to cases admitted with a diagnosis of sub-arachnoid hemorrhage (SAH) and who had a discharge ICD-9 code of 430. We examined demographics and quality of care of the study sample in comparison to other stroke subtypes. Specifically we examined performance on appropriate care for ischemic vs. hemorrhagic strokes (includes SAH and intra-parenchymal hemorrhages) and also performance on each of the 5 quality metrics for ischemic strokes vs. SAH.

We also examined issues related to SAH using a second source of data from the Minnesota Hospital Association (MHA). This second data set was claims data submitted to the MHA by hospitals in Minnesota in the year 2014. Due to issues of patient and hospital confidentiality we did not link these 2 data sets though potentially a link is possible. We examined common procedures used in the treatment of SAH using the MHA claims data.

RESULTS

There are currently 56 participating hospitals in the MSR. There were a total of 2,175 cases of sub-arachnoid hemorrhage as defined by our inclusion criteria between the years of 2006-2014. Of these, 61% are female. This is consistent with the reported female preponderance from other epidemiological studies of SAH. In comparison, the gender distribution in other stroke subtypes is evenly split, (intracerebral hemorrhage, 48% female N=5,178; ischemic strokes, 49% female, N=27,202). The mean age of SAH patients is 57.9 years (SD 15). As expected SAH patients were younger in comparison to other stroke subtypes (Figure 1). Reflecting the Minnesota demographics, 78.1% of the SAH patients in our sample are white, 4.9% are black, 2.5% are Asian and 9.4% are of unknown race. The main outcome data in the MSR is the discharge disposition. Of the 2,175 SAH patients in our sample, 424 (19.5%) were missing a discharge disposition. Home discharge occurred in 1008 (46%) patients and acute rehabilitation discharge occurred in 123 (6%) patients both suggesting a good outcome. A total of 335 patients (15%) either died or were discharged to hospice care. A total of 154 patients (7%) were discharged to long-term/nursing home care and another 120 (6%) were transferred to other acute care facilities. The latter may be doubly represented in the registry since these cases were transfers to other hospitals and there is the possibility of a duplicate entry for the patient from the receiving hospital. The lack of PHI in the MSR makes this non-verifiable in our dataset. Of interest, a small percentage of patients (7 patients, 0.3%) left against medical advice and likely represent cases of peri-

mesencephalic hemorrhage which have very good prognosis and are different from SAH due to aneurysmal rupture. The MSR collects data on severity of SAH using 3 measures. These data were unusable due to overwhelming proportions of missing data: Glasgow coma score (39% missing), Fisher scale (98% missing), Hunt & Hess score (98%) missing.

A comparison of hospital performance on appropriate care measures for ischemic vs. hemorrhagic strokes showed that the failure rate was higher for hemorrhagic strokes, especially when compared to ischemic stroke, discharge care measures, (Table 1). The failure rates between appropriate care for inpatient ischemic stroke and hemorrhagic stroke were more similar. Review of the individual components of the appropriate care measures suggests that the failures are largely driven by the dysphagia screening measure which is part of inpatient care. A comparison of performance for ischemic stroke and SAH for each measure in the hemorrhagic stroke appropriate care set supports this (Table 2). Though we show data from 2014 in Table 2, this trend for dysphagia screening is similar across other years.

The MHA claims data for the year 2014 was analyzed in conjunction with the MSR data though the 2 data sources were not linked. There were a total of 428 cases with a principal diagnosis of SAH in the MHA claims for the year 2014. Outcomes were similar to that reported in the MSR: 15% (65/428) of SAH patients expired in the hospital and 44% (188/428) patients were discharged home. The mean length of stay for SAH patients was 11.3 days (SD=9.5). The MHA claims had information on procedures used to treat the aneurysm: 38 patients (8.9%) underwent aneurysm clipping (ICD-9 CM code 3951) as a principal procedure and 135 patients (31.5%) underwent endovascular interventions, (ICD-9 CM codes 3972, 3975, 3976), as a principal procedure. On considering all procedures including the principal procedures, aneurysm clipping was done in 38 patients (8.9%) and, endovascular interventions in 157 patients (36.7%) patients. A total of 3 patients underwent both clipping and endovascular procedures.

DISCUSSION

Sub-arachnoid hemorrhages are an important stroke subtype with high morbidity and mortality. Data from Minnesota suggests that the in-hospital mortality (15%) is lower than that reported in literature. This may be due to pre-hospital mortality with patients not reaching a healthcare facility in time though this cannot be inferred with certainty. Between 40-50% of patients appear to have had a good outcome with discharge home or to acute rehabilitation. The MHA data reflects changing practices due to the advent of endovascular procedures for treatment of aneurysms. The rate of endovascular

procedures for treatment of aneurysms was four times higher than the rate of traditional surgical clipping.

We note that the SAH cases had a higher failure rate for appropriate care compared to ischemic stroke discharge care. The SAH appropriate care failure rates were more comparable to the ischemic stroke inpatient care. The appropriate care measures for SAH contain elements of both the inpatient as well discharge care bundles for ischemic stroke. On examining individual care elements, it is clear that the failure rate for appropriate care in SAH is driven by the dysphagia screening measure.[4] This represents an opportunity for targeted interventions to improve this measure.

CONCLUSIONS

There are opportunities to improve the quality of appropriate care for sub-arachnoid hemorrhages in Minnesota.

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Table1. Comparison of Appropriate Indicators for Ischemic Stroke vs. Hemorrhagic Stroke in all Minnesota Stroke Registry Hospitals.

Year	Ischemic Stroke Inpatient Care	Ischemic Stroke Discharge Care	Hemorrhagic Stroke
	Fail %	Fail %	Fail %
2010	38	10	39
2011	31	7	34
2012	27	8	31
2013	24	6	30
2014	15	6	20
2015	16	6	18

Table2. Performance on each measure in the hemorrhagic stroke appropriate care measure set for sub-arachnoid hemorrhage vs. ischemic stroke for the year 2014.

Measure	Ischemic Stroke Pass %	Sub-arachnoid Hemorrhage %
Venous Thromboembolism	97	98
Dysphagia Screening	87	68
Stroke Education	95	92
Smoking Cessation	80*	90
Assessed for Rehabilitation	99	94

*This is an anomalous performance for the year 2014. Performance for this measure for ischemic stroke for years 2010-2013 were in the 97-99% range.

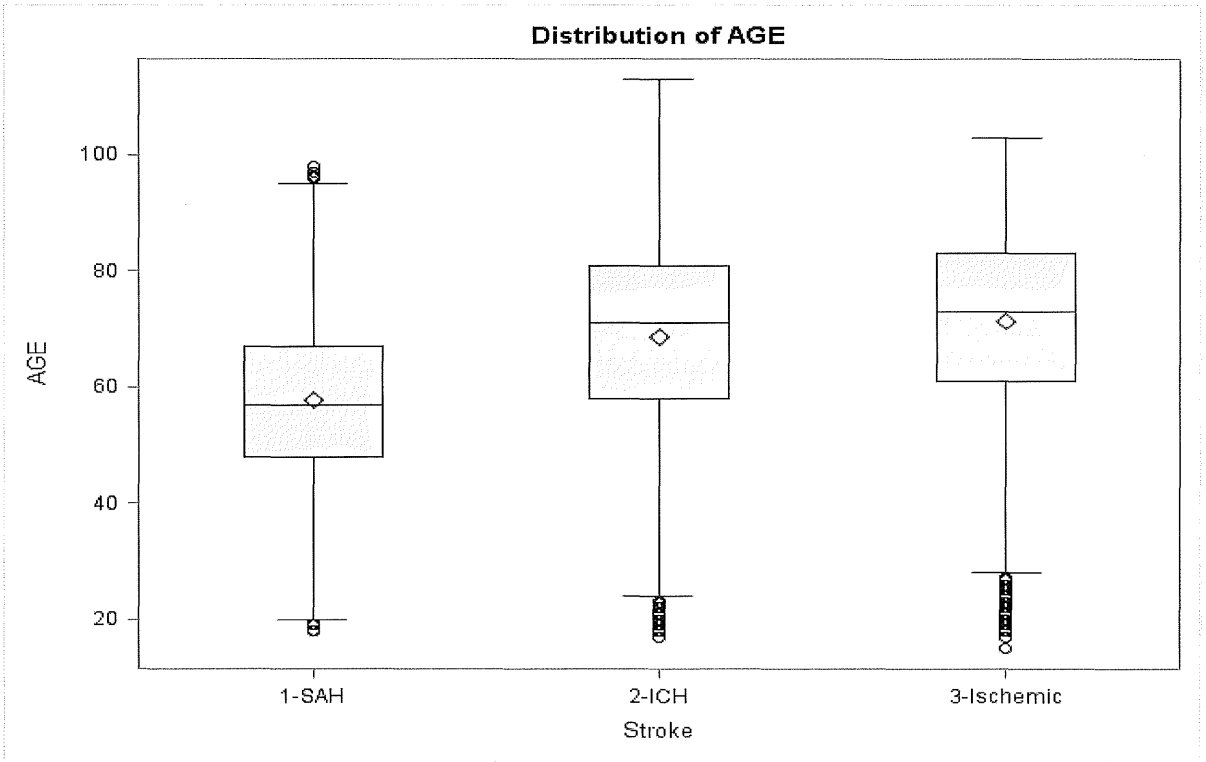

Figure1. Age Distribution of Stroke Subtypes in the Minnesota Stroke Registry.