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ICD9 Codes Cannot Reliably Identify Hemorrhagic Transformation of Ischemic Stroke

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INTRODUCTION

A major objective of inpatient stroke care is the prevention of medical and neurologic complications. Though rare, hemorrhagic transformation (HT) of an ischemic stroke (IS) can cause neurologic deterioration and is associated with an increased risk of death.[1] If HT can be reliably identified in administrative data, it could become a component of hospital quality benchmarks. Prior studies have used administrative data to define hemorrhagic transformation of ischemic stroke; however, the accuracy of ICD9 coding for this condition is unknown.[2,3,4] Coding algorithms used in prior studies have varied but all have required a discharge diagnosis of IS, defined by ICD9 code or Clinical Classification Software code, and a discharge ICD9 for intracranial hemorrhage. We aimed to determine the accuracy of ICD9 coding for HT after IS using the Greater Cincinnati/Northern Kentucky Stroke Study (GCNKSS).

METHODS

The purpose of the GCNKSS is to ascertain all strokes among a 5 county region that includes Cincinnati. Study personnel identified potential cases from January 1st, 2005 through December 31st, 2005 by screening emergency department encounters and inpatient admissions at 17 acute care hospitals for discharge ICD9 codes for stroke (430–436). Data are collected for all cases of IS, intracerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH). Potential cases were excluded if they had a discharge/autopsy diagnosis

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CONFLICT(S) OF INTEREST/DISCLOSURES
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or neuroimaging with stroke but no clinical history consistent with stroke or if they had a clinical diagnosis of stroke and died within 24 hours of symptom onset without focal neurologic deficit or confirmatory neuroimaging/autopsy. Detailed methods of the GCNKSS have been published previously.[5]

For all potential cases, a research nurse abstracted history, physical examination, and diagnostic testing data, including neuroimaging. Study physicians reviewed the abstracted data and determined whether a stroke occurred, type of stroke, stroke mechanism, and whether HT was present. HT was characterized as asymptomatic or symptomatic (any neurologic deterioration).

For each HT case, hospital discharge ICD9 codes were examined. Our primary expectation was that HT cases would have both an ICD9 code for ischemic stroke (433.x1, 434.x1, 436) and for ICH (431). We looked separately at cases which were treated with rt-PA and evaluated the combination of ICD9 codes for IS with any ICD9 code for intracranial hemorrhage (430, 431, 432).

RESULTS

The GCNKSS identified 2,159 cases of ischemic stroke through hospital discharge screening, of which 102 had HT (symptomatic or asymptomatic). Among HT cases, 26 (25%) had an ICH code (431), and only 3 (3%) had codes for both IS (433.x1, 434.x1, 436) and ICH. HT was symptomatic in 38 patients, of whom 12 (32%) had a code for ICH, but none had both IS and ICH codes. Among the 102 cases of HT, 15 were treated with recombinant tissue plasminogen activator (rt-PA). There were 3 (20%) with an ICH code but only 1 (7%) had both IS and ICH codes. From the 38 cases of symptomatic HT, 9 were treated with rt-PA. One of these patients had an ICH code; this patient did not have an IS code.

A broader definition for hemorrhagic transformation, which used all of the intracranial hemorrhage ICD9 codes (430, 431, 432), identified 34 (33%) of the HT cases, although only 8 (8%) also had an IS code. The broader definition identified 17 (45%) of the symptomatic HT cases, although only 3 (8%) also had an IS code. Full results are presented in Table 1.

DISCUSSION

Hemorrhagic transformation after ischemic stroke is an appealing quality metric. HT can cause neurologic deterioration and death.[1] High rates of HT are associated with rt-PA protocol deviations, and HT rates can be lowered by quality improvement initiatives.[6, 7] In order to identify HT in administrative datasets ICD9 codes for both IS and ICH must be present. Although ICD9 codes from administrative databases have been used to identify HT after ischemic stroke in prior studies, the accuracy of these codes was not verified. Our results demonstrate that ICD9 codes cannot accurately identify HT after ischemic stroke. Three-fourths of patients with HT of an ischemic stroke did not receive an ICH ICD9 code at hospital discharge, and few of the HT cases received ICD9 codes for both IS and ICH. Current ICD9 guidelines do not address coding HT after IS. Improved identification of HT will likely require the creation of a dedicated code, or modifier code, as well as physician and coder education.

This study has several limitations. HT was rare, and the number of symptomatic cases was small. ICD9 codes performed so poorly, it is unlikely that adding cases would change the conclusion. In this study we do not know the order of ICD9 codes and are unable to differentiate between principal and secondary diagnosis codes. Some prior studies of HT have required IS to be the principal discharge diagnosis and ICH to be a secondary

diagnosis. This added constraint would likely make ICD9 coding less accurate for identifying HT. ICD9 coding may vary across institutions. All of the data in the present study come from hospitals affiliated with the GCNKSS. Because this study includes cases from 17 different hospitals, the results still have substantial generalizability. We are unable to assess the accuracy of ICD10 coding. As there is no specific code for HT in ICD10, it is also likely to be unreliable.

SUMMARY/CONCLUSIONS

ICD9 codes cannot accurately identify HT in ischemic stroke patients. HT cannot be reliably identified in administrative datasets.

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Table 1

Accuracy of ICD9 Coding for Hemorrhagic Transformation of Ischemic Stroke

ICD9 Codes	Any HT (n=102)	Symptomatic HTM (n=38)
Ischemic stroke code only (433.x1, 434.x1, or 436)	68 (67%)	21 (55%)
430 (SAH), no ischemic code	2 (2%)	2 (5%)
430 (SAH), with ischemic code	5 (5%)	3 (8%)
431 (ICH), no ischemic code	23 (23%)	12 (32%)
431 (ICH), with ischemic code	3 (3%)	0 (0%)
432 (intracerebral hemorrhage, NOS), no ischemic code	1 (1%)	0 (0%)
432 (intracerebral hemorrhage, NOS), with ischemic code	0 (0%)	0 (0%)

HT=hemorrhagic transformation, SAH=subarachnoid hemorrhage, ICH=intracerebral hemorrhage, NOS=not otherwise specified