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Does Intracerebral Hemorrhage Mimic Benign Dizziness Presentations? A Population Based Study

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Abstract

Objective—A principal reason to order a head computerized tomography (CT) scan for dizziness patients is to exclude stroke. Since CT imaging is substantially limited in assessing for any acute lesions other than hemorrhage, the most important stroke syndrome adequately evaluated by CT is intracerebral hemorrhage (ICH). We used a population-based stroke database to assess the frequency with which ICH might mimic a benign dizziness presentation.

Methods—The Brain Attack Surveillance in Corpus Christi (BASIC) project was used to identify cases of ICH from January 1, 2000, to December 26, 2007. The hospital records of ICH cases with a National Institutes of Health Stroke Scale (NIHSS) of < 2 were abstracted for more detailed information. Cases were classified as benign dizziness presentations when isolated dizziness and a normal general neurological examination were documented.

Results—Of 595 ICH cases, only 2.2% (13 of 595) had dizziness as the primary presenting symptom and an NIHSS < 2. No case mimicked a benign dizziness presentation. Only one case had isolated dizziness symptoms but this patient had dysmetria documented on the exam. All other cases had either focal or global neurological symptoms or exam abnormalities.

Conclusions—This study provides further support for the notion that ICH is highly unlikely to mimic a benign dizziness presentation. Coupled with the limitations of CT to show acute ischemia in the posterior fossa, these results suggest that screening for ICH may not be necessary in benign appearing dizziness presentations, though more research is needed.

Search terms

vertigo; intracerebral hemorrhage; CT

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INTRODUCTION

Head computerized tomography (CT) is commonly used to test for stroke syndromes in acute dizziness presentations.[1] Up to 30% of Emergency Department (ED) dizziness presentations receive a head CT,[1, 2] and head CT is frequently used even in patients diagnosed with a benign disorder, such as vestibular neuritis or benign paroxysmal positional vertigo.[3] Since head CT is insensitive for acute ischemia (sensitivity of 26%),[4, 5] the main value of head CT in acute dizziness is to assess for intracerebral hemorrhage (ICH). CT is a highly valuable test for ICH because it is accurate, readily available, fast, and relatively inexpensive compared to MRI. However, since ischemia is a substantially more common central cause of acute dizziness than hemorrhage,[1, 6] head CT may be a less valuable diagnostic test if the likelihood of ICH is extremely low.

Cases of ICH mimicking benign appearing dizziness (i.e., isolated dizziness and a normal general neurological examination) have been reported.[7, 8] However, these prior reports stem from case series or case-control designs and thus cannot be used to establish accurate estimates of the prevalence of ICH causing benign appearing dizziness in the routine ED care setting. The definitive way to establish the prevalence of ICH in benign appearing dizziness presentations is a prospective study with all cases undergoing head CT. However, such a study would be challenging and costly due to the need to prospectively recruit large numbers of patients and the potential for unnecessary radiation exposure.

In the current study, we reviewed ICH cases from a long-standing population-based stroke surveillance study to describe the clinical features of those cases with the least severe presentations and to assess for the frequency with which ICH might mimic a benign dizziness presentation. Our hypothesis was that very few, if any, ICH cases would present with isolated dizziness and a normal neurological exam. The findings will serve as an early step in informing future research that ultimately aims to support physicians in imaging decisions in patients with acute dizziness.

METHODS

The Brain Attack Surveillance in Corpus Christi (BASIC) project is a population-based stroke surveillance study conducted in Nueces County, Texas. The methods of the BASIC project have been published previously.[9, 10] Briefly, cases of potential stroke among patients ≥ 45 years of age were captured by active and passive surveillance of all hospitals in the county. Cases were ascertained actively by searching admission logs for a set of validated screening diagnostic terms and passively via hospital discharge records.[10, 11] Board certified neurologists blinded to ethnicity and age used source documentation to validate each stroke case based on published international criteria.[12] Corpus Christi makes up > 95% of the county's population and is an urban environment. The population of the county is approximately 300,000, and the location is on the Texas Gulf Coast. It is a non-immigrant community, with long-term residents and little influx or efflux of individuals.[13] Corpus Christi is about 200 miles from Houston and 150 miles from San Antonio, and the surrounding counties are sparsely populated, allowing for complete case capture of acute neurological disease. This study was approved by the University of Michigan Institutional Review Board (IRB) and by the IRBs of the Corpus Christi hospitals.

We searched the BASIC database from January 1, 2000, to December 26, 2007, for validated cases of ICH. ICH was defined as the non-traumatic onset of acute focal neurological symptoms associated with a focal collection of blood within the brain parenchyma on brain imaging or at autopsy and not due to hemorrhagic conversion of a cerebral infarction or tumor. Second presentations to the ED of the same ICH were

excluded. We then searched the ICH group for those having a National Institutes of Health Stroke Scale (NIHSS) of less than 2. In the BASIC project, an initial NIHSS was abstracted retrospectively using a previously validated approach by a trained abstractor using the first documented physician examination.[14] An NIHSS of < 2 was used in this study as a practical way to identify ICH visits with only the mildest neurologic deficits or no deficits at all.

The hospital charts of all the visits identified with NIHSS < 2 were reviewed by two of the authors (KAK and JB) to abstract detailed clinical information about the symptoms, examination, and imaging findings (based on radiology reports). The source documents for this review generally included the Emergency Department physician notes, Emergency Department nursing and triage records, admitting physician notes, and neurological consultant notes. The two investigators reviewed and coded all charts independently, with disagreements in coding adjudicated by consensus.

Symptoms and findings from the examinations were abstracted from the source documents. Dizziness symptoms were considered to be any of the following terms documented in the records: dizziness, vertigo, lightheadedness, or imbalance. The primary presenting symptom was determined to be the most intense symptom or the symptom consistently recorded first in physician notes. In cases of uncertainty about the primary presenting symptom, the following hierarchy was used: Focal symptoms were selected over non-focal symptoms and documentation from earlier in the visit was favored over documentation from later in the visit (e.g., initial Emergency Department documentation would be favored over later consultant documentation). A primary presenting symptom was assigned to each case, and categorized as either dizziness, headache, or other. Neurological examination components (including mental status, speech and language, visual, motor, sensory, and coordination) were classified as abnormal when there was at least one mention of an abnormality in any of the available records. The general neurologic exam was considered to be normal when no focal (i.e., language, motor, sensory, visual, or coordination) or global (i.e., confusion or altered level of consciousness) neurologic findings were recorded. A benign dizziness presentation was defined as isolated dizziness (dizziness without headache or other neurologic symptoms) with a normal general neurological exam.

Means and standard deviations were used to describe continuous data and frequencies and percents were used for categorical data. A kappa statistic was calculated to assess interrater agreement for the classification of the primary presenting symptom by study investigators. All analyses were performed using Stata, version 10.0 (StataCorp, College Station, TX).

RESULTS

Over the eight year surveillance period, 595 ICHs occurred. Of all the ICH presentations, 13.1% (78 of 595) had an NIHSS of < 2. After detailed chart review, four of these were excluded because the review found no ICH (two), ICH secondary to trauma (one), or a re-presentation for the same ICH event (one). Demographics and clinical characteristics of the remaining 74 cases are presented in Table 1. Interrater agreement for the classification of the primary presenting symptom was good – 77.0% overall agreement with a kappa statistic of 0.64.

Thirteen of the 591 ICH cases (2.2%) had dizziness as the primary presenting symptom and an NIHSS < 2. Details regarding the characteristics of these 13 patients are presented in Table 2. A neurological consultation was recorded in 87.8% (65 of 74) of the cases. No case of ICH mimicked a benign dizziness presentation (i.e., none had isolated dizziness and a normal general neurological examination). Only one patient had isolated dizziness symptoms (i.e., dizziness without a headache or other neurologic symptoms) but this patient

had dysmetria on exam (patient 1, Table 2). All other patients had a headache or other neurological symptoms (either focal or global symptoms). Two patients with dizziness as the primary presenting symptom had a normal neurological exam documented in the chart. One of these (patient 2, Table 2) had additional symptoms of left sided weakness, slurred speech, and confusion. The other patient (patient 3, Table 2) presented with persistent dizziness, nausea, and generalized weakness since an episode of loss of consciousness two days earlier which had led to a separate ED visit and a diagnosis of "heat exhaustion."

DISCUSSION

In this population-based stroke surveillance study, we did not identify any cases of ICH mimicking a benign dizziness presentation. Only one patient had isolated dizziness, but this patient did not have a normal exam. Two patients with dizziness as the primary presenting symptom did have a normal exam, but both of these patients had other features in their clinical histories to indicate central nervous system dysfunction. This study suggests that it would be very uncommon for ICH to mimic a benign dizziness presentation without other accompanying clues to suggest a central etiology.

There are many reasons that head CT is not an adequate test to evaluate for relevant central causes in acute dizziness presentations. First, the sensitivity of CT for acute ischemic stroke – the most common central cause of acute dizziness[1, 6] – is very low (<30%).[4] Second, central nervous system anatomy is poorly visualized within the posterior fossa yet the posterior fossa is the most likely lesion location in acute dizziness presentations.[15, 16] Lastly, although CT is a very accurate test for ICH,[4] the likelihood of ICH appears to be so low in relevant dizziness presentations that the frequent use of head CT in benign appearing dizziness cases may be more likely to result in harm (e.g., false negative diagnosis of ischemic causes, inefficiencies in care, and unnecessary radiation exposure) than benefit.

When considering the current findings together with prior findings about central causes of acute dizziness, it is clear that more research is needed to support frontline physicians in imaging decisions for acute dizziness presentations. The utilization rates of head CT in acute dizziness presentations increased by 169% from 1995 to 2004,[1] and emergency medicine physicians recently ranked the identification of serious or central causes of dizziness as the #1 topic for clinical decision support in adults.[17] If this call for support is not answered, then head CT may soon be considered a routine test in acute dizziness presentations, if it is not already. The steps to achieving meaningful decision support include the development and subsequent validation of clinical decision rules, followed by appropriate effort to implement such information into routine clinical care.[18, 19]

CT is faster, less expensive, and more widely available than MRI; all of these reasons likely contribute to the current clinical practice pattern of preferentially choosing CT over MRI for acute dizziness. But it might be that CT is so problematic in benign appearing dizziness presentations that CT should only rarely be considered a suitable option. Because of this, there is an urgent need to clearly define the clinical characteristics of the suspected very small proportion of dizziness patients that are likely to benefit from MRI. An alternative strategy would be to search for ways that MRI could be more practical in routine care with efforts to make it faster, less expensive, and more available.

Limitations

This study was limited as it was based on medical record review which accounts only for what is documented. It remains possible that clinical information (i.e., symptom or examination information) was obtained by treating physicians but was not documented. Nevertheless, prior research has demonstrated acceptable concordance between

documentation in the medical record and actual performance as assessed by direct observation or videotapes.[20, 21] It was not possible to determine the timing of documentation relative to the completion of imaging studies and thus physician documentation could have been biased by the knowledge of imaging results. The current results do not apply to other non-stroke central neurological disorders, such as tumor, subarachnoid hemorrhage, or subdural hematoma. Because the starting population was ICH cases, we could not compare presentation features of ICH dizziness cases to control dizziness cases. It is possible that ICH cases were missed if a head CT was not ordered or if the patient did not present for an evaluation. The NIHSS score was retrospectively calculated from the chart. Although this method has been validated and shown to be well correlated with prospectively obtained NIHSS,[14] the BASIC study has a relatively high proportion of mild stroke cases as assessed by NIHSS suggesting there may be an overall underestimation of stroke severity.[22] Importantly, this limitation would not have influenced our ability to identify ICH cases meeting our criteria for benign dizziness. We did not perform a detailed assessment of the types of dizziness symptoms (e.g., vertigo, lightheadedness, imbalance) because patients' accounts of these various types of symptoms can be unreliable and inconsistent,[23] and documented symptom types are often not adequate discriminators of underlying etiologies.[6, 24]

Conclusions

The typical presentation of a benign dizziness disorder – isolated dizziness and a normal general neurologic examination – appears to be a very rare presentation of ICH. Thus, screening patients with isolated dizziness and a normal general neurological examination with CT may not be warranted, although more research is needed. Given that the definitive study design – a prospective study with all cases undergoing head CT – may not be feasible, further observational research of this type may play an important role in this topic.

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References

1. Kerber KA, Meurer WJ, West BT, et al. Dizziness presentations in U.S. emergency departments, 1995–2004. Acad Emerg Med. 2008; 15:744–50. [PubMed: 18638027]
2. Cheung CS, Mak PS, Manley KV, et al. Predictors of important neurological causes of dizziness among patients presenting to the emergency department. Emerg Med J. 27:517–21. [PubMed: 20584952]
3. Newman-Toker DE, Camargo CA Jr, et al. Disconnect between charted vestibular diagnoses and emergency department management decisions: a cross-sectional analysis from a nationally representative sample. Acad Emerg Med. 2009; 16:970–7. [PubMed: 19799573]
4. Chalela JA, Kidwell CS, Nentwich LM, et al. Magnetic resonance imaging and computed tomography in emergency assessment of patients with suspected acute stroke: a prospective comparison. Lancet. 2007; 369:293–8. [PubMed: 17258669]
5. Wasay M, Dubey N, Bakshi R. Dizziness and yield of emergency head CT scan: is it cost effective? Emerg Med J. 2005; 22:312. [PubMed: 15788853]
6. Kerber KA, Brown DL, Lisabeth LD, et al. Stroke among patients with dizziness, vertigo, and imbalance in the emergency department: a population-based study. Stroke. 2006; 37:2484–7. [PubMed: 16946161]
7. Cnyrim CD, Newman-Toker D, Karch C, et al. Bedside differentiation of vestibular neuritis from central "vestibular pseudoneuritis". J Neurol Neurosurg Psychiatry. 2008; 79:458–60. [PubMed: 18344397]

8. Kattah JC, Talkad AV, Wang DZ, et al. HINTS to diagnose stroke in the acute vestibular syndrome: three-step bedside oculomotor examination more sensitive than early MRI diffusion-weighted imaging. Stroke. 2009; 40:3504–10. [PubMed: 19762709]
9. Morgenstern LB, Smith MA, Lisabeth LD, et al. Excess stroke in Mexican Americans compared with non-Hispanic Whites: the Brain Attack Surveillance in Corpus Christi Project. Am J Epidemiol. 2004; 160:376–83. [PubMed: 15286023]
10. Smith MA, Risser JM, Moye LA, et al. Designing multi-ethnic stroke studies: the Brain Attack Surveillance in Corpus Christi (BASIC) project. Ethn Dis. 2004; 14:520–6. [PubMed: 15724771]
11. Piriyawat P, Smajsova M, Smith MA, et al. Comparison of active and passive surveillance for cerebrovascular disease: The Brain Attack Surveillance in Corpus Christi (BASIC) Project. Am J Epidemiol. 2002; 156:1062–9. [PubMed: 12446264]
12. Gillum RF, Fortmann SP, Prineas RJ, et al. International diagnostic criteria for acute myocardial infarction and acute stroke. Am Heart J. 1984; 108:150–8. [PubMed: 6731265]
13. Morgenstern LB, Steffen-Batey L, Smith MA, et al. Barriers to acute stroke therapy and stroke prevention in Mexican Americans. Stroke. 2001; 32:1360–4. [PubMed: 11387499]
14. Williams LS, Yilmaz EY, Lopez-Yunez AM. Retrospective assessment of initial stroke severity with the NIH Stroke Scale. Stroke. 2000; 31:858–62. [PubMed: 10753988]
15. Kent DL, Haynor DR, Longstreth WT Jr, et al. The clinical efficacy of magnetic resonance imaging in neuroimaging. Ann Intern Med. 1994; 120:856–71. [PubMed: 7818632]
16. Teasdale GM, Hadley DM, Lawrence A, et al. Comparison of magnetic resonance imaging and computed tomography in suspected lesions in the posterior cranial fossa. BMJ. 1989; 299:349–55. [PubMed: 2506965]
17. Eagles D, Stiell IG, Clement CM, et al. International survey of emergency physicians' priorities for clinical decision rules. Acad Emerg Med. 2008; 15:177–82. [PubMed: 18275448]
18. McGinn TG, Guyatt GH, Wyer PC, et al. Users' guides to the medical literature: XXII: how to use articles about clinical decision rules. Evidence-Based Medicine Working Group. JAMA. 2000; 284:79–84. [PubMed: 10872017]
19. Gaddis GM, Greenwald P, Huckson S. Toward improved implementation of evidence-based clinical algorithms: clinical practice guidelines, clinical decision rules, and clinical pathways. Acad Emerg Med. 2007; 14:1015–22. [PubMed: 17967964]
20. Stange KC, Zyzanski SJ, Smith TF, et al. How valid are medical records and patient questionnaires for physician profiling and health services research? A comparison with direct observation of patients visits. Med Care. 1998; 36:851–67. [PubMed: 9630127]
21. McDermott MF, Lenhardt RO, Catrambone CD, et al. Adequacy of medical chart review to characterize emergency care for asthma: findings from the Illinois Emergency Department Asthma Collaborative. Acad Emerg Med. 2006; 13:345–8. [PubMed: 16495418]
22. Majersik JJ, Smith MA, Zahuranec DB, et al. Population-based analysis of the impact of expanding the time window for acute stroke treatment. Stroke. 2007; 38:3213–7. [PubMed: 17962593]
23. Newman-Toker DE, Cannon LM, Stofferahn ME, et al. Imprecision in patient reports of dizziness symptom quality: a cross-sectional study conducted in an acute care setting. Mayo Clin Proc. 2007; 82:1329–40. [PubMed: 17976352]
24. Newman-Toker DE, Dy FJ, Stanton VA, et al. How often is dizziness from primary cardiovascular disease true vertigo? A systematic review. J Gen Intern Med. 2008; 23:2087–94. [PubMed: 18843523]

Table 1

Demographics and other characteristics of patients with intracerebral hemorrhage and National Institutes of Health Stroke Scale < 2 (n= 74).

Characteristic	N, %, unless specified
Age, mean ± standard deviation	71.1 ± 12.4
Female	40 (54.1%)
Race-ethnicity	
Mexican American	42 (56.8%)
Non-Hispanic White	29 (39.2%)
Other	3 (4.1%)
Systolic blood pressure, mean ± standard deviation, mmHg	170 ± 33
Diastolic blood pressure, mean ± standard deviation, mmHg	88 ± 16
Symptoms	
Headache	37 (50.0%)
Dizziness	34 (46.0%)
Confusion or altered consciousness	26 (35.1%)
Focal motor	23 (31.1%)
Nausea	21 (28.4%)
Speech change	19 (25.7%)
Vomiting	14 (18.9%)
Generalized weakness	9 (12.2%)
Vision change	8 (10.8%)
Focal sensory	5 (6.8%)
Loss of consciousness	4 (5.4%)
Primary Presenting Symptom	
Other	40 (54.1%)
Headache	21 (28.4%)
Dizziness	13 (17.6%)
Dizziness Symptom Types	
Imbalance, any	22 (29.7%)
Lightheadedness, any	8 (10.8%)
Vertigo, any	6 (8.1%)
Not otherwise specified	6 (8.1%)

Table 2

Characteristics of the thirteen intracerebral hemorrhage patients who presented with dizziness as the primary presenting symptom and a National Institutes of Health Stroke Scale < 2.

	Isolated Dizziness	Presenting symptoms	Presenting Blood Pressure	General Neurologic Exam findings	Hemorrhage Location & Size	Other relevant clinical information
Patient 1 79 y/o F	Yes	Dizziness, vertigo, nausea, vomiting, imbalance, generalized weakness	199/81	Dysmetria on FNF, rotary nystagmus	Cerebellum, 1.1 cm	
Patient 2 60 y/o M	No	Imbalance, confusion, disorientation, left sided weakness, slurred speech	177/105	Normal	Right thalamus, 2.0 cm	
Patient 3 66 y/o M	No	Dizziness, loss of consciousness episode, generalized weakness, nausea	156/71	Normal	Left internal capsule, 0.9 cm	Acute on chronic renal failure; recent diagnosis of heat exhaustion
Patient 4 60 y/o F	No	Dizziness, imbalance, headache, nausea, heavy feeling in left arm	213/89	Dysmetria	Cerebellum, 2.5cm	On warfarin
Patient 5 58 y/o M	No	Dizziness, Nausea, vomiting, weakness left side, headache	165/95	Left hemiparesis	Right basal ganglia, 1.1 cm	
Patient 6 80 y/o F	No	Imbalance, dysarthria, right sided weakness	174/78	Dysmetria	Right corona radiata, 1.5 cm [a]	
Patient 7 76 y/o M	No	Imbalance, headache, nausea, vomiting, generalized weakness	169/82	Reduced level of alertness, dysmetria, right hemiparesis	Cerebellum, 3 cm	
Patient 8 81 y/o M	No	Dizziness, imbalance, lightheaded, speech change, found down	120/86	Dysarthria, “bilateral nystagmus”	Cerebellum, large	Died
Patient 9 69 y/o M	No	Imbalance, nausea, vomiting, headache, dysarthria, lightheaded	169/97	Dysarthria, dysmetria	Cerebellum, 1.6 cm	
Patient 10 74 y/o, M	No	Vertigo, imbalance, right sided weakness	180/95	Right hemiparesis, imbalance, dysmetria	Cerebellum, 1.0 cm	
Patient 11 87 y/o M	No	Imbalance, dysarthria, nausea, vomiting	190/98	Dysarthria, imbalance, dysmetria	Cerebellum, 2 cm	
Patient 12 70 y/o M	No	Dizziness, vertigo, confusion, headache, imbalance	151/77	Dysarthria, reduced level of consciousness	Left posterior parietal-occipital, 5 cm	

	Isolated Dizziness	Presenting symptoms	Presenting Blood Pressure	General Neurologic Exam findings	Hemorrhage Location & Size	Other relevant clinical information
Patient 13 92 y/o F	No	Dizziness, vertigo, lightheaded, confusion, generalized weakness	180/80	Right hemiparesis, right numbness, dysarthria, confusion	Left basal ganglia, 2 cm, intraventricular extension	

[a]Radiology report stated R corona radiata intracerebral hemorrhage, but several notes indicated CT revealed L corona radiate intracerebral hemorrhage.

ICH = intracerebral hemorrhage; FNF = finger-nose-finger test