くも膜下出血の診断の困難性について

平成２０年７月７日

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昨今、医学の進歩とともに医療は予防および治療を越えて再生医療の時代を迎えております。その中で、日本の医療は世界保健機構（ＷＨＯ２０００）の評価で，世界一位の地位にあります。その結果国民の多くが、医療へ過剰な期待を抱くようになりました。このような医療への期待が大きいことは医療界にとって大変な励みになり良いことです。しかし、医学が進歩した今日においても、日常的な疾患において診断が困難な場合が少なくありません。国民の皆様に、その事実をあらためて御理解いただき、さらに診断と治療について単純に白黒では判定できない場合があることも、あわせて御理解いただきたいと思います。今回くも膜下出血の診断について日本脳神経外科学会において得られました結果を御報告いたします。以上の事実をもとに、より良い医療を目指してゆきたいと思います。どうぞ御理解と御協力をお願い致します。

資料1-1

宮城

クモ膜下出血 連続198例 (2007.1.1-2008.5.31)

	一般医家		脳神経外科医			
	CT (-)	CT (+)	CT (-)	CT (+)	合計	
軽度頭痛	8	10	0	29	47	23.8%
高度頭痛	2	17	0	38	57	28.8%
意識障害	0	0	0	94	94	47.5%
合計	10	27	0	141	198	
	5.1%	13.6%	0%	71.2%		

外来診断名：

風邪	3例
高血圧	2例
片頭痛	1例
めまい	1例
髄膜炎	1例
原因不明	1例
カルテ記載無し	1例

一般医家で初診時CTを施行されなかった10例の治療成績

	軽度頭痛(8例)	高度頭痛(2例)
GR	5	2
MD	1(術中脳梗塞)	0
D	2 (待機中破裂、DIC)	0

資料2-1

くも膜下出血　連続293例（1996-2005、某病院）

	一般医家（病院内科医含む）		脳神経外科医		
	CT(−)	CT(＋)	CT(−)	CT(＋)	
軽度頭痛	9	5	1	7	22 (7.5%)
高度頭痛	14	20	0	33	67 (22.9%)
意識障害	0	0	0	204	204 (69.6%)
	23 (7.8%)	25 (8.5%)	1 (0.3%)	244 (83.2%)	

軽度頭痛：肩こり程度の頭痛として患者が訴え、一般医家では、確定診断不可。
（通常CT検査なしで経過をみる。）
高度頭痛：従来の教科書的な頭痛で、患者は激烈な頭痛として訴え、くも膜下出血を疑わせる。
（CT検査を一般医家も勧める。）

外来診断名：風邪 ;4
血圧が高いだけ ;2
動眼神経麻痺を顔面神経麻痺と判断 ;1
「原因不明」 ;1
カルテ記載なし ;15

一般医家（病院内科医含む）で初診時CTを施行されなかった23例の治療成績

	軽度頭痛（9例）		高度頭痛（14例）	
GR	7		12	
MD	1		1	（術前にspasmによる右麻痺あり）
D	1	（入院時に収縮spasmあり、手術待機中の肺炎）	1	（術後偽膜性腸炎）

BRIEF REPORT

Initial Misdiagnosis and Outcome After Subarachnoid Hemorrhage

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Context Mortality and morbidity can be reduced if aneurysmal subarachnoid hemorrhage (SAH) is treated urgently.

Objective To determine the association of initial misdiagnosis and outcome after SAH.

Design, Setting, and Participants Inception cohort of 482 SAH patients admitted to a tertiary care urban hospital between August 1996 and August 2001.

Main Outcome Measures Misdiagnosis was defined as failure to correctly diagnose SAH at a patient's initial contact with a medical professional. Functional outcome was assessed at 3 and 12 months with the modified Rankin Scale; quality of life (QOL), with the Sickness Impact Profile.

Results Fifty-six patients (12%) were initially misdiagnosed, including 42 of 221 (19%) of those with normal mental status at first contact. Migraine or tension headache (36%) was the most common incorrect diagnosis, and failure to obtain a computed tomography (CT) scan was the most common diagnostic error (73%). Neurologic complications occurred in 22 patients (39%) before they were correctly diagnosed, including 12 patients (21%) who experienced rebleeding. Normal mental status, small SAH volume, and right-sided aneurysm location were independently associated with misdiagnosis. Among patients with normal mental status at first contact, misdiagnosis was associated with worse QOL at 3 months and an increased risk of death or severe disability at 12 months.

Conclusions In this study, misdiagnosis of SAH occurred in 12% of patients and was associated with a smaller hemorrhage and normal mental status. Among individuals who initially present in good condition, misdiagnosis is associated with increased mortality and morbidity. A low threshold for CT scanning of patients with mild symptoms that are suggestive of SAH may reduce the frequency of misdiagnosis.

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SUBARACHNOID HEMORRHAGE (SAH) affects nearly 30 000 individuals annually in North America and results in serious impairment or death in 40% to 60% of cases.[1] Outcome is highly dependent on early diagnosis and aggressive intervention.[1,2] Immediate aneurysm repair is particularly crucial because rebleeding occurs in 26% to 73% of patients within days or weeks after the initial rupture if the aneurysm is untreated.[1,2]

The reported frequency of misdiagnosis of SAH ranges from 12% to 51%.[3-11] Correct diagnosis can be confounded because a key symptom of SAH, headache, is among the most common symptoms reported to emergency physicians.[12] Accordingly, misdiagnosed SAH represents one of the largest sources of emergency department litigation claims and malpractice settlement payments in the United States.[13] We sought to identify the frequency, risk factors, and impact on outcome of initial misdiagnosis in patients hospitalized with SAH.

METHODS

All patients who were diagnosed with SAH and were admitted to the Neurological Intensive Care Unit at Columbia-Presbyterian Medical Center in New York between August 1996 and August 2001 were invited to enroll in the Columbia University SAH Outcomes Project. The study was approved by the hospital's institutional review board, and written informed consent was obtained from the patient or a surrogate. SAH was diagnosed according to computed tomography (CT) or by xanthochromia of cerebrospinal fluid (CSF). Patients with spontaneous aneurysmal and nonaneurysmal SAH were included. Individuals with SAH caused by trauma, arteriovenous malformations, or other secondary causes were excluded, as were patients younger than 18 years and those admitted more than 14 days after their most recent hemorrhage.

Demographic data, medical and social history, and clinical features at admission were obtained through patient and surrogate interviews and medical record review by a study neurointensivist. Details about symptoms at the onset of hemorrhage, admission Hunt-Hess grade, and CT and angiographic findings were recorded, as described previously.[14-17] Sentinel headaches were defined as discrete episodes of severe headache that preceded the headache that initially led the patient to seek medical attention. Aneurysms were designated right-sided if located on the right middle cerebral artery (MCA) or internal carotid artery (ICA) and left-sided if located on the left MCA or ICA.

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Original Contributions

ANEURYSMAL SUBARACHNOID HEMORRHAGE: UPDATE FOR EMERGENCY PHYSICIANS

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☐ **Abstract—Aneurysmal subarachnoid hemorrhage (SAH) is a serious cause of stroke that affects 30,000 patients in North America annually. Due to a wide spectrum of presentations, misdiagnosis of SAH has been reported to occur in a significant proportion of cases. Headache, the most common chief complaint, may be an isolated finding; the neurological examination may be normal and neck stiffness absent. Emergency physicians must decide which patients to evaluate beyond history and physical examination. This evaluation—computed tomography (CT) scanning and lumbar puncture (LP)—is straightforward, but each test has important limitations. CT sensitivity falls with time from onset of symptoms and is lower in mildly affected patients. Traumatic LP must be distinguished from true SAH. Cerebrospinal fluid analysis centers on measuring xanthochromia. Debate exists about the best method to measure it—visual inspection or spectrophotometry. An LP-first strategy is also discussed. If SAH is diagnosed, the priority shifts to specialist consultation and cerebrovascular imaging to define the offending vascular lesion. The sensitivity of CT and magnetic resonance angiography are approaching that of conventional catheter angiography. Emergency physicians must also address various management issues to treat or prevent early complications. Endovascular therapy is being increasingly used, and disposition to neurovascular centers that offer the full range of treatments leads to better patient outcomes. Emergency physicians must be expert in the diagnosis and initial stabilization of patients with SAH. Treatment in a hospital with both neurosurgical and endovascular capability is becoming the norm. © 2008 Elsevier Inc.**

Keywords—subarachnoid hemorrhage; diagnosis; lumbar puncture; cerebral angiography; xanthochromia; stroke

INTRODUCTION

Headaches, an exceedingly common complaint, are mostly caused by migraine, tension-type, and other primary headache disorders. Two percent of all Emergency Department (ED) patients have a chief complaint of headache, and of those, 2% have a serious life-, limb-, brain-, or vision-threatening condition diagnosed in the ED (Table 1) (1). One such disorder is subarachnoid hemorrhage (SAH). Although trauma is the leading cause of SAH, ruptured intracranial aneurysms account for 80% of non-traumatic cases (2,3). Of the remaining 20%, half are caused by non-aneurysmal venous "perimesencephalic" hemorrhages. The other 10% are caused by arteriovenous malformations, other vascular lesions, tumors, and other less common disorders (2–5).

One in 100 headache patients presenting to EDs have SAH (6–8). Of patients with severe, abrupt-onset head-

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Table 1. Life, Limb, Vision, or Brain-threatening Causes of Headache

Subarachnoid hemorrhage
Meningitis and encephalitis
Cervico-cranial artery dissections
Temporal arteritis
Acute narrow angle closure glaucoma
Hypertensive emergencies
Carbon monoxide poisoning
Idiopathic intracranial hypertension (pseudotumor cerebri)
Spontaneous intracranial hypotention
Cerebral venous and dural sinus thrombosis
Acute strokes: hemorrhagic or ischemic
Pituitary apoplexy
Mass lesions
Tumor
Abscess (including parameningeal infections)
Intracranial hematomas (parenchymal, subdural, epidural)
Colloid cyst of 3rd ventricle

ache and normal neurological examinations, about 10% have SAH (9–12). The initial bleed may be fatal, may result in significant neurological dysfunction, or may produce relatively minor symptoms. Because early treatment is associated with improved outcomes, timely diagnosis is critical (13). Despite a straightforward diagnostic algorithm, misdiagnosis remains common. Mildly affected patients who are most commonly misdiagnosed also have the best outcomes if correctly identified and treated (2). Misdiagnosis of SAH is an important cause of medico-legal actions against physicians (14,15).

This review updates emergency physicians on diagnostic and management issues of SAH that have emerged over the last several years.

Incidence of Aneurysms and Effects of Rupture

Intracranial aneurysms are common and are located on the large arteries of the circle of Willis and its branches. Autopsy series uncover them in 0.4–3.6% of individuals, whereas cerebral angiography documents incidental aneurysms in 3.7–6.0% of patients. Therefore, roughly 2% of all individuals harbor aneurysms (16). Approximately 80–85% of these lesions are in the anterior cerebral circulation, and the rest are in the posterior circulation (Figure 1); cerebral aneurysms are multiple in 25% of cases (17).

The reasons for aneurysmal rupture are incompletely understood. Although local hemodynamic forces may initiate aneurysmal formation, the tensile stress in the aneurysm wall may be more important in rupture. Larger aneurysm size and aspect ratio (dome size/neck size) are independently correlated with risk of rupture (18–20). Surface irregularities or multiple lobes on the aneurysm confer additive risk (21).

When an aneurysm does rupture, the intracranial pressure (ICP) rises precipitously. Cerebral perfusion may transiently cease, resulting in unconsciousness, or death, if the ICP is sufficiently high to cause irreversible structural damage or halt cerebral perfusion. The mortality rates on the

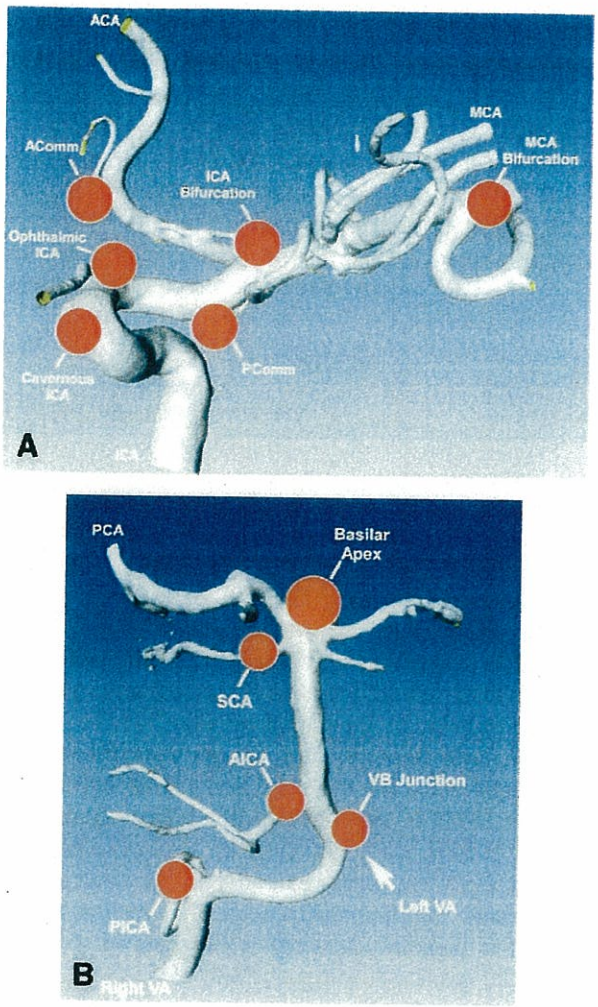

Figure 1. Cerebrovascular anatomy—Circle of Willis (shaded volume rendering images of 3-D rotational angiograms). The cerebrovascular circulation is conventionally divided into the (A) anterior circulation (internal carotid artery and its branches) and the (B) posterior circulation (the vertebral arteries and its branches). The two systems are linked up by the posterior communicating arteries, which connect the internal carotid artery and the posterior cerebral artery. The 3rd cranial nerve sits adjacent to the posterior communicating artery, which is the reason that aneurysms in this location are often associated with 3rd cranial nerve palsy. The red dots on the figure represent areas where aneurysms commonly form, typically at arterial bifurcations. ICA = internal carotid artery, PComm = posterior communicating artery, MCA = middle cerebral artery; AComm = anterior communicating artery, ACA = anterior cerebral artery; VA = vertebral artery, PICA and AICA = posterior (and anterior) inferior cerebellar artery, SCS = superior cerebellar artery; PCA = posterior cerebral artery.

CME Available

Missed Diagnosis of Subarachnoid Hemorrhage in the Emergency Department

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Background and Purpose—Subarachnoid hemorrhage (SAH) can be devastating, yet its initial presentation may be limited to common symptoms and subtle signs, potentially leading to misdiagnosis. Little is known about population rates of misdiagnosis of SAH, or hospital factors that may contribute to it. We estimated the population-based rate of missed SAH among emergency department (ED) patients and examined its relationship with hospital characteristics.

Methods—We studied persons admitted with a nontraumatic SAH to all Ontario hospitals over 3 years (April 2002 to March 2005). SAH was defined as missed if the patient had an ED visit related to the SAH (based on a prespecified definition) in the 14 days before admission. We examined the association between hospital teaching status and missed SAH and explored whether annual ED volume of SAH or CT availability explained this association.

Results—Of 1507 patients diagnosed with SAH, 5.4% (95% CI, 4.3 to 6.6) had a missed diagnosis. The risk was significantly higher among patients triaged as low acuity (odds ratio 2.65; 95% CI, 1.46 to 4.80), as well as in nonteaching hospitals (adjusted odds ratio 2.12; 95% CI, 1.02, 4.44). Neither ED SAH volume nor on-site CT availability explained the effect of teaching status.

Conclusions—About 1 in 20 SAH patients are missed during an ED visit. Lower acuity patients are at higher risk of misdiagnosis, suggesting the need for heightened suspicion among patients with minimal clinical findings. The risk is also greater in nonteaching hospitals, but this is not explained by the annual volume of SAHs seen in the ED or access to CT. **(*Stroke*. 2007;38:1216-1221.)**

Key Words: diagnosis ■ health services research ■ subarachnoid hemorrhage

Subarachnoid hemorrhage (SAH) is a serious condition that frequently leads to neurological impairment and death.[1–3] The diagnosis can be challenging because headache is the predominant symptom and often the only manifestation of the condition,[4] yet it is also a common benign complaint.[5,6] Delays in diagnosis and treatment of SAH are associated with a higher risk of rebleeding and related mortality.[7–9]

The rate of missed or delayed diagnosis has been reported to vary from 12% to 51%.[8–16] This wide range of misdiagnosis rates reflects a variety of study methods and definitions. In addition, important risk factors for misdiagnosis, such as patient acuity, physician experience and access to diagnostic resources vary between different clinical settings.

Hospital factors such as patient volume, teaching status and access to diagnostic resources have been found to be associated with misdiagnosis in emergency department (ED) patients with acute myocardial infarction,[17] yet little is known about how system factors might contribute to the risk of missed SAH. We sought to ascertain population-based rates of missed SAH among patients presenting to an ED, and certain hospital system factors associated with it. Specifically, we examined whether hospital teaching status, which reflects a number of system-related differences in health care, such as access to specific diagnostic technology and specialists, was associated with missed SAH and, if so, whether this relationship could be explained by the annual volume of SAHs seen in the ED and CT availability.

Methods

The study setting was Ontario, Canada's largest province with a population of 12.5 million. We included all Ontario residents aged 18 years and older with a valid health insurance number who were admitted to any hospital through an ED from April 1, 2002, to March 31, 2005, with a most responsible diagnosis (responsible for the majority of the hospital length of stay) of nontraumatic SAH (International Classification of Disease [ICD]-10-CA codes I60.0 to I60.9). Patient records were identified from the Discharge Abstract Database (DAD) and the National Ambulatory Care Reporting System (NACRS), administrative health databases containing all hospital admissions and ED visits in Ontario, respectively. We selected the earliest SAH admission in the study period and excluded patients admitted for an SAH or cerebral aneurysm in the previous

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