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Review

Pseudo-subarachnoid hemorrhage: A potential imaging pitfall associated with spontaneous intracranial hypotension

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ABSTRACT

Objective: (1) To determine the frequency of CT mimics of subarachnoid hemorrhage (SAH) in a large cohort of subjects with spontaneous intracranial hypotension (SIH). (2) To emphasize the distinctive radiologic features of SIH.
Patients and methods: CT scans of 95 subjects with SIH were retrieved and reviewed to search for findings of pseudo-SAH (CT mimics of SAH in the absence of blood).
Results: Pseudo-SAH radiologic findings (increased attenuation in the basilar cisterns, sylvian fissures, or along the tentorium) were detected on CT scans of 10 of the 95 SIH subjects. However, on MRI scans, these subjects exhibited the typical SIH abnormalities (diffuse pachymeningeal enhancement and brain sagging with obliteration of basilar cisterns).
Conclusions: In the emergency room, SIH should be considered in the differential diagnosis between SAH and pseudo-SAH. Although SIH and SAH can share some radiologic features, SIH has distinctive MRI and CT findings. Their recognition should obviate the need for more invasive procedures (e.g., cerebral angiography) to definitely rule out SAH and an aneurismal source of bleeding.

Contents

1. Introduction

Increased attenuation along the tentorium cerebelli and in the basal cisterns, sylvian fissure, and subarachnoid space on brain CT scan are characteristic findings of subarachnoid hemorrhage (SAH). Several radiographic mimics of SAH have been reported, including encephalopathy with brain swelling (hyponatremia, anoxic–ischemic and metabolic encephalopathy), pyogenic leptomeningitis, intrathecally administered contrast material, and leakage of high-dose intravenous contrast medium into the subarachnoid spaces [1–4]. Together, these CT mimics of SAH have been called pseudo-SAH [5,6]. The pseudo-SAH appearance can also be rarely seen in patients with spontaneous intracranial hypotension (SIH), an underrecognized condition characterized by orthostatic headache, low CSF pressure and distinct abnormalities on brain MRI (diffuse pachimeningeal enhancement, brain sagging and subdural fluid collections). These features emerge considerably less clearly on CT, which is usually the first imaging procedure performed in patients with SIH. We have observed 10 patients with pseudo-SAH on CT who were found to have SIH. We therefore reconsidered our experience with SIH to determine the frequency of this CT finding. We also reviewed the literature, investigating the pathophysiology behind its appearance, and discussed imaging findings useful for its recognition and distinction from true SAH.

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2. Patients and methods

We observed 153 consecutive patients with a diagnosis of SIH, according to the International Classification of Headache Disorder (2nd edition) 2004 criteria [7], who were referred to us for evaluation and treatment. Brain MRI (axial, coronal T1–T2 and FLAIR weighted sequences of 5 mm thickness and sagittal, axial and coronal T1 weighted gadolinium enhanced sequences of 5 mm thickness), was performed in all patients but two, who were respectively allergic to gadolinium or pace-maker carrier. Brain CT neuroimaging (axial nonenhanced CT scan sequences of 4 mm thickness), which were available for approximately two-third of the patients ($n = 95$) were retrieved and reviewed by one experienced neuroradiologist who was not blinded to the known MRI diagnosis of SIH. The attenuation value within the peri-mesencephalic cisterns and within deep gray matter of thalami was also calculated.

3. Results

Pseudo-SAH was present on CT in 10 patients (11%), of whom three were on anticoagulants with laboratory test results showing an INR between 2.0 and 2.5 (normal 0.8–1.3). Their mean age was 52 years (range 30–68). Clinical presentation was orthostatic headache in nine patients, and isolated change in hearing in the remainder. Symptoms associated with headache were ideational slowness (six patients), diplopia (one patient), change in hearing (two patients), dysphagia (two patients) and coma (one patient). Duration of symptoms before CT examination ranged from 3 days to 9 months.

Increased attenuation on brain CT involved the tentorium cerebelli as well as the basilar cisterns and sylvian fissures (Fig. 1). Corresponding brain MRI examinations revealed dense pachymeningeal enhancement along the tentorium cerebelli in nine patients, accounting for the increased attenuation seen on the CT scan (Fig. 2). However, no increased vascularity was observed in the basilar cisterns or the sylvian fissures. Brain sagging with obliteration of the basilar cisterns and sylvian fissures was found on MRI in nine patients (Fig. 2). Five patients with pseudo-SAH had symmetric (four patients) or asymmetric (one patient) chronic bilateral subdural hematomas (CBSH) associated with significant mass effect (Fig. 1). One patient had a CBSH with minimal mass effect and four patients had a CBSH without any associated mass effect (Fig. 1). On brain CT the attenuation value within the peri-mesencephalic cisterns ranged from 30 to 42 HU (average value of 39.1 HU) and within deep gray matter of thalami (to rule out cerebral edema as an etiological factor in pseudo-SAH) ranged from 32 to 35 HU (average value of 33.7 HU). On brain CT at the follow-up after recovery the attenuation values within deep gray matter of thalami had not changed value and were normal.

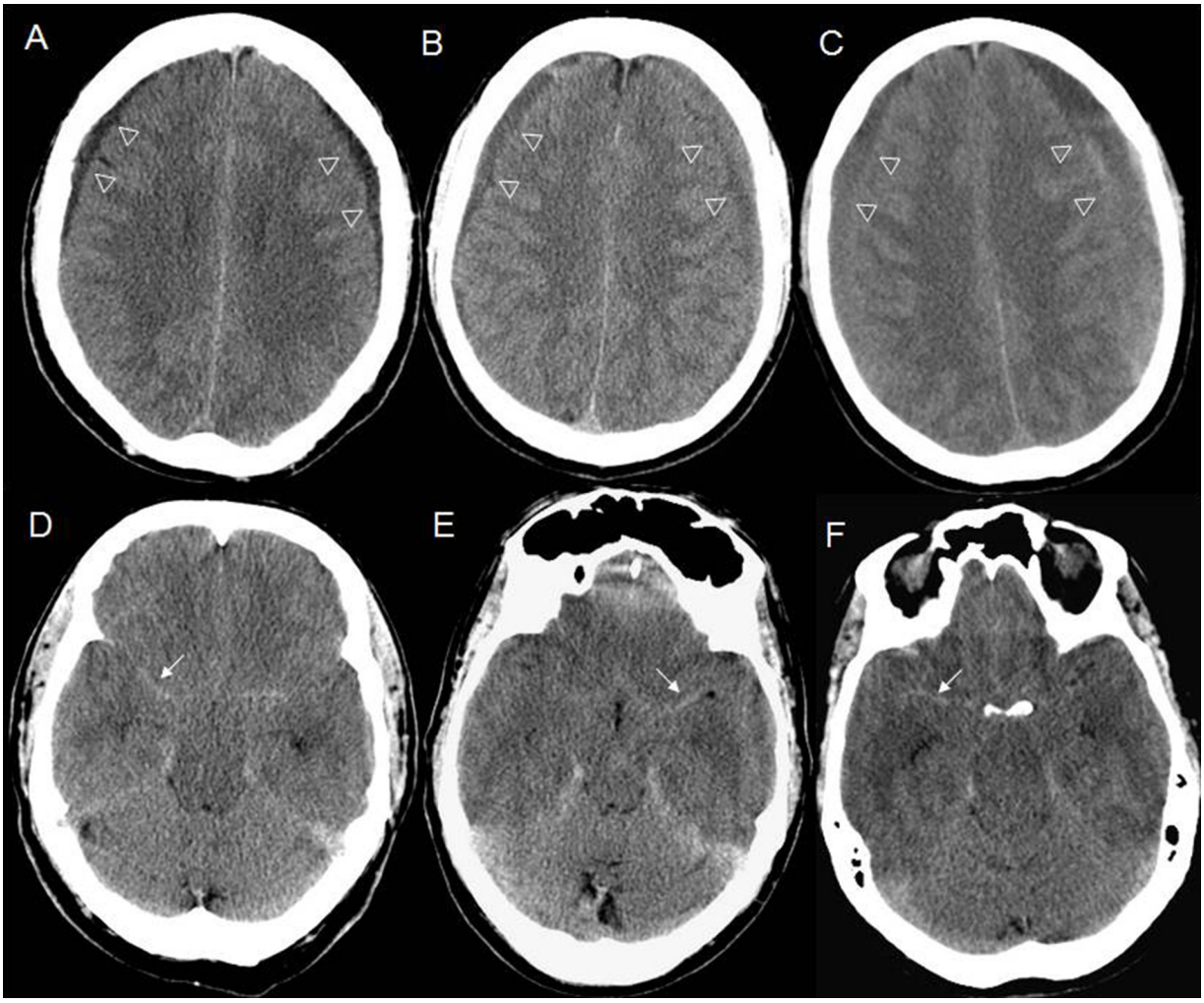

Fig. 1. Nonenhanced CT scans pt. 1 (A and C), pt. 5 (B and E), pt. 6 (C and F). Subdural hematomas (SH) (A–C arrowheads) without mass effect (A and D), SH with minimal mass effect (B and E), SH with significant mass effect (C and F). Notice increased attenuation in the basilar cisterns/sylvian fissures (i.e., pseudo-subarachnoid hemorrhage) (D–F white arrows) and tentorium (D–F).