



Emergency computed tomography in patients with first seizure



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ABSTRACT

Purpose: To determine the frequency of emergent imaging findings on head computed tomography (CT) in an adult population of first seizure (FS) patients presenting to an emergency department (ED); and to search for associations between clinical features and emergent imaging findings among these patients. **Methods:** For this retrospective registry-based study, adult FS patients presenting to Helsinki University Hospital ED in 2006 were identified based on ICD-10 diagnosis. Clinical parameters were extracted from patient records. A neuroradiologist blinded to clinical information reviewed the CT scans for emergent imaging findings prompting changes in acute treatment, predefined as intracranial haemorrhage, acute ischemia, central nervous system infection, mass effect, midline shift, obstructive hydrocephalus and/or brain oedema.

Results: 449 FS patients were identified, of which 416 (93%) had undergone emergency CT imaging. Of these, 49 (12%) had emergent imaging findings on non-contrast CT. Logistic regression suggested that headache (odds ratio (OR) 3.62, 95% confidence interval (CI) 1.30–10.12), focal motor sign in the ED (OR 3.23, 95% CI 1.58–6.62), history of malignancy (OR 3.05, 95% CI 1.17–7.92), and altered mental state in the ED (OR 2.27, 95% CI 1.15–4.49) were associated with emergent imaging findings on NCCT. Presence of at least one of these factors had 84% sensitivity for emergent imaging findings.

Conclusion: In FS patients, clinical information can be used to guide imaging decisions in the ED. However, if emergency imaging is not performed, urgent outpatient imaging and pre-imaging follow up should be secured.

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1. Introduction

Among patients presenting with first seizure (FS) to emergency department (ED), the challenge for the evaluating physician is to identify patients with acute symptomatic seizures. Formally, an acute symptomatic seizure is defined as a clinical seizure occurring at the time of a systemic insult or in close temporal association with a documented brain insult [1]. Pragmatically, acute symptomatic seizures are symptoms of a condition deserving immediate attention and treatment, such as stroke or central nervous system

infection. The lifetime incidence of acute symptomatic seizures is 3.6% [2], whereas the cumulative incidence of at least one unprovoked epileptic seizure before age 74 is 4.1% [3]. Thus, a substantial proportion of FS patients have an acute underlying insult. Yet, surprisingly few studies address FS from an ED perspective.

One of the questions encountered in the ED is whether all FS patients need emergency neuroimaging to rule out intracranial pathology or whether imaging can be deferred in selected cases based on clinical judgment. In the ED, computed tomography (CT) is often easily available and therefore preferred over magnetic resonance imaging (MRI). Previous studies suggest that emergency brain CT leads to an acute change in management in 1.8–17% of cases [4–6]. There is limited data to guide patient selection for emergency imaging, as only one study looked for correlations between clinical parameters and imaging findings prompting acute changes in management [4]. Current guidelines state that an emergency CT may be considered in adults with first seizure [7]. According to other guidelines, for patients who have fully recovered from their FS, early outpatient neuroimaging may be

Abbreviations: CECT, contrast-enhanced computed tomography; CI, confidence interval; CT, computed tomography; eCRF, electronic case report form; ED, emergency department; FS, first seizure; HUH, Helsinki University Hospital; MRI, magnetic resonance imaging; NCCT, non-contrast computed tomography; NPV, negative predictive value; OR, odds ratio; PPV, positive predictive value; SD, standard deviation; SDH, subdural haematoma.

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considered if there is no suspicion of an intracranial lesion based on a new focal neurological finding, history of acute head trauma, fever, malignancy, immunocompromised state, anticoagulation, focal seizure onset, and the patient is under 40 years of age [8].

The purpose of our study was to retrospectively determine the yield of non-contrast head CT (NCCT) in an adult population of patients presenting to ED with FS and to search for associations with clinical information and emergent imaging findings among these patients. Finally, we compared the yield of NCCT and contrast enhanced CT (CECT) to elucidate if use of contrast agent increases sensitivity for emergent imaging findings in FS patients.

2. Methods

2.1. Study design

This is a retrospective registry-based study comprising adult FS patients presenting at Helsinki University Hospital (HUH) ED over a one year period (Jan 1 2006–Dec 31 2006). HUH institutional research board permit was granted.

2.2. Study setting and population

HUH is a tertiary health care facility for patients over 16 years. A neurologist or a neurology resident is present in the ED at all times. During the study period, 16,153 patients were admitted to this ED. According to local guidelines until the end of year 2006, all patients from Helsinki City with their first convulsive seizure were evaluated in this ED, except elderly patients not independent in activities of daily living and patients with known acute head trauma, which were treated in separate geriatric or neurosurgical

units, respectively. Local ED practice guidelines recommended an emergency NCCT of the brain of all FS patients, and CECT was suggested.

2.3. Study protocol

2.3.1. Patient identification

Records of patients with ED discharge diagnosis codes (ICD-10) possibly associated with seizures were read by two neurologists (K. K., F.S.). Screening diagnoses included seizure, status epilepticus, stroke, cerebral tumour, hyponatremia, intoxication, eclampsia and CNS infections (see Online Resource 1 for complete list of diagnoses screened).

2.3.2. Patient population

From the screened patients, we included those evaluated for first-ever witnessed convulsive seizure. The definition “convulsive” seizure was chosen, as the eyewitness of a first ever seizure may often be unable to give a seizure description detailed enough for precise seizure classification. We excluded patients with non-convulsive seizures for two reasons: firstly, when a patient presents with cognitive or speech related symptoms without motor manifestations, the risk of misdiagnosis increases. Further, in these cases, the decisions on imaging can be guided by considerations on differential diagnosis (eg. acute stroke, encephalitis). We did not exclude patients who were later considered not to have had an epileptic, but rather, e.g., a psychogenic non-epileptic seizure. Exclusion criteria included history of seizures diagnosed by a medical doctor, pre-hospital intubation, and imaging at a district hospital with subsequent referral to tertiary care.

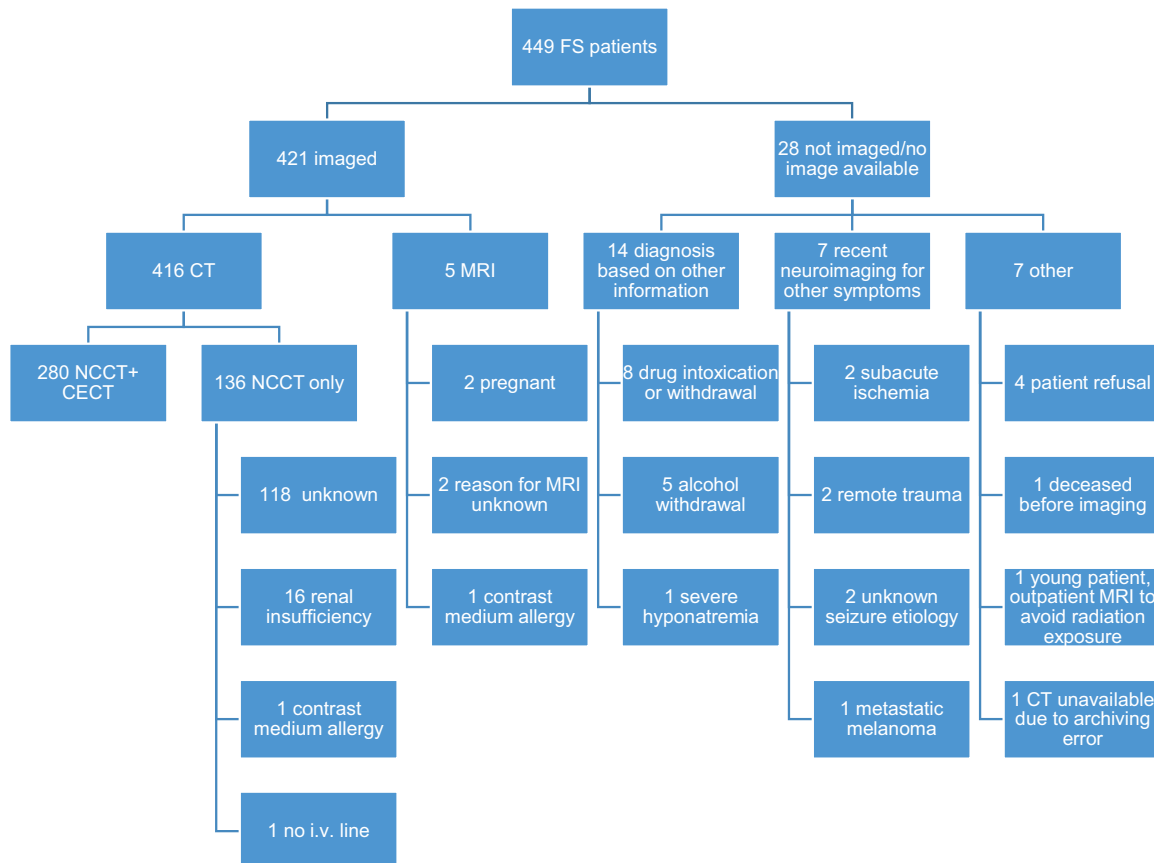


Fig. 1. Flow of patients in the study. All 5 patients imaged only by MRI had normal results. CECT = contrast enhanced computed tomography. FS = first seizure. MRI = magnetic resonance imaging. NCCT = non contrast computed tomography.

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