

### Brain Computed Tomography evaluation of patients with syncopal episode in the emergency department at King Hussein Medical Center

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**Objective:** The aim of our study is to determine the value of using brain computerized tomography as a routine investigation in patients presenting with syncope to the emergency department at King Hussein Medical Center Amman Jordan.

**Methods:** In the time period between March 2006 and April 2008, a total of 254 patients (134 males and 120 females) with a mean age  $\pm$  SD of  $62 \pm 27$  years (range: 32-73) presented with syncope to the emergency department. All of these patients underwent various investigations to verify the cause of syncope including brain CT scan. Patients were categorized into three groups according to CT scan findings and their neurological examination on presentation.

**Results:** Patients were classified into three groups based on their brain CT findings and their neurological examination on presentation.

The first group included 203 (79.9 %) patients, all of which had normal brain CT scan and normal neurological examination.

The second group included 10 (3.9%) patients all of which had abnormal brain CT scan findings and abnormal neurological examination. The abnormal neurological findings can be attributed to their syncopal episode and abnormal brain CT findings.

The third group included 41 (16.1%) patients who had abnormal brain CT findings and either normal or abnormal neurological examination which is not related and can't be attributed to the abnormal head CT findings and their syncopal episode.

**Conclusion:** The use of brain CT scan as a routine investigation in the evaluation of patients presented to the Emergency Department at King Hussein Medical Center with syncope is unjustifiable, unless these patients had abnormal neurological examination.

**Keywords:** Syncope, Brain CT scan, Emergency Department, Transient loss of consciousness.

Syncope is one of the most common causes of presentation to the emergency department<sup>1</sup>. It accounts for up to 3% of emergency department (ED) visits and between 1- 6% of all hospital admissions<sup>2</sup>. It is also an indicator of reduced survival rate among older adults<sup>3</sup>.

Syncope may be defined as sudden loss of consciousness, associated with a decrease in cerebral blood flow, from which the patient fully recovers without the need for resuscitation or pharmacological intervention<sup>4</sup>.

Causes of syncope are multiple and diverse, so the clinicians usually use a wide range of investigations to determine the cause of syncope, and patients are often subjected to many diagnostic tests and hospitalizations<sup>5</sup>. Clinical examination is an essential part of the work-up of patients with syncope, and physicians can establish a diagnosis of the cause of syncope, or may suggest a strategy of evaluation<sup>6</sup>.

Brain CT scan is one of these investigations that are frequently requested for patients with syncope in our hospital. However, current guidelines do not recommend obtaining a brain CT for patients presenting with syncope, unless there is a justifying indication in the history and physical examination<sup>7</sup>.

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Several studies have classified causes of syncope into three categories; cardiac, non-cardiac (including neurological causes), and unknown causes<sup>8</sup>. In cases where the cause of syncope is not clear even after a complete clinical examination and laboratory testing; neurological imaging are often performed<sup>9</sup>. However, multidisciplinary approach in the evaluation of patients with syncope in the emergency department is not only useful but it is necessary for management and diagnosis, as evident by the numerous causes of syncope that require the attention of emergency department physicians<sup>10</sup>.

### Methods

During the time period between March 2006 and April 2008 a total number 254 patients (134 males) were included in the study. We conducted our study to determine the value of head CT in evaluation and management of patients presenting with syncope. We are also trying to evaluate the value of neurological physical examination as a predictive factor for the brain CT.

Detailed history was taken and physical examination was performed. All patients underwent various investigations, which included baseline laboratory testes (complete blood cell count, electrolytes, serum urea nitrogen, creatinine, and glucose blood level), chest radiography, 12-lead electrocardiogram, Electroencephalography, carotid Doppler ultrasonography (if clinically indicated). Brain CT scan was performed using adult protocol of 5 mms slice thickness by GE Light Speed Plus machine (GE Healthcare, CT, USA).

All CT scans were reviewed by a radiology specialist and all patients examined by a neurologist. Results of the CT scans were recorded and analyzed.

The patients were categorized into three groups according to head CT scan findings, and their neurological examination. Correlation of these findings with the syncopal presentation was performed. These groups were; first group included patients with a normal neurological examination and normal head CT scan. The second group included patients with abnormal neurological

examination, and abnormal head CT scan. The neurological findings can be attributed to the abnormal head CT findings and syncopal presentation. The third group included patients with abnormal head CT scan and either normal neurological examination or abnormal neurological examination which is not related and can't be attributed to the abnormal head CT findings and syncopal episode. Neurological examination was considered normal if there was no focal neurological deficit recorded on the admission physical examination and neurological examination should attempt to identify signs suggestive of true syncope rather than seizure activity pointing towards a primary neurological seizure. CT scan was considered normal if there is no focal brain lesion or shift of midline structures. A positive HCT was defined, and included any intracranial hemorrhage (epidural, subdural, subarachnoid) or intraparenchymal or intracranial space occupying lesion with mass effect, brain abscess, tumor, granulomas.

All patients studied here did not have any evident reason for undergoing a HCT, other than the fact that they had a transient loss of consciousness, they had no history of neurological deficit (motor or sensory deficit), disarthria, incoordination or other neurological abnormality.

The patients were also categorized into three groups according to the cause of syncope. The first group includes patient with cardiac causes, the second group included patients with non cardiac identified causes (including neurological causes), and the third group included patients with no identifiable cause for syncope.

### Results

The diagnosis of syncope was identified in a total of 254 patients. After performing full physical examination and undergoing the necessary investigations, 67 (26.3%) patients were found to have cardiac causes. 147(57.8%) patients were found to have other non cardiac causes, and in 40 (15.7%) patients no identifiable organic cause was found (fig .1).

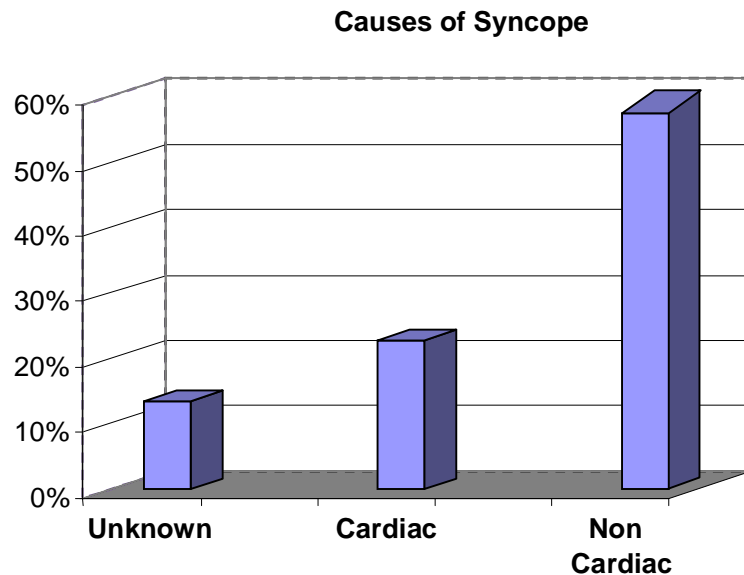


Fig 1: causes of syncope.

Non-cardiac causes of syncope included vasovagal, neurological, and metabolic causes in 68, 49, 30 patients respectively. Patients presented to the emergency department with syncopal episode underwent many investigations which included brain CT scan and electroencephalography which were frequently performed in 221 (87%) and 33 (13%) patients respectively. The frequency of other investigations performed including chest x-ray, electrocardiography (ECG), and basic blood chemistry analysis and carotid doppler ultrasound, were 246 (96.9%), 239 (94.1%), 239 (94.1%), 76 (29.9%) respectively (Table.1).

Table1. Investigation requested for patients with syncope at ED

Type of investigation	N.	%
Chest X-Ray	246	96.9
Electrocardiography	239	94.1
Head CT Scan	221	87.0
Basic blood analysis	239	94.1
Carotid Doppler ultrasound	76	29.9
Electroencephalography	33	13.0
Total Patients	254	100

Of all the patients who underwent head CT, 203 (79.9%) patients had a normal head CT as well as a normal neurological examination (fig.2).

A total of 10 (3.1%) patients had an abnormal head CT scan which is related to the syncope episode, and abnormal neurological examination; two patients had brain tumor, three patients had intraparenchymal hemorrhage, one patient had subarachnoid hemorrhage, and four patients had cerebral ischemia.

The third group of patients included 41(16.1%) patients who had abnormal head CT scan findings, which were not related to their syncopal episode, and had either normal or abnormal neurological examination. These CT scan abnormalities included (periventricular white matter changes due to small vessel ischemia seen in 14 patients, 12 patients had cerebral atrophy, five patients had chronic left middle cerebral artery infarction, pineal gland cyst found in two patients, and small temporal arachnoid cyst (one patient). Seven patients presented with chronic lacunar infarct. No patients were found with normal neurological examination and abnormal CT scan examination.

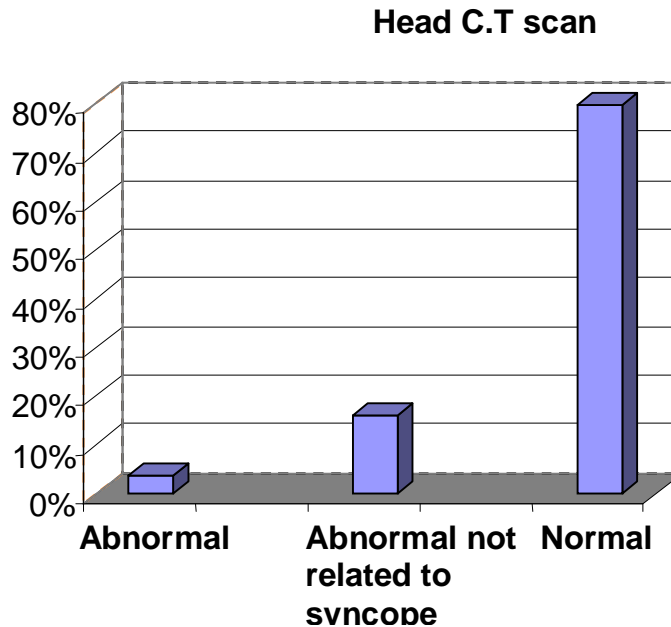


Fig 2: Results of Head CT scan

### Discussion

Syncope is a common clinical problem in general population<sup>11, 12</sup>. Investigations are often obtained to determine the etiology of syncope when the clinical examination does not provide an underlying cause, because inadequate approach in management and evaluation of patients with syncope may lead to incorrect diagnosis and treatment. There is often concern about missing conditions that may present with transient loss of consciousness without associated physical findings on initial examination, such as stroke, tumors, or sub-arachnoid hemorrhage. When the attending physician made a certain diagnosis, the patient was treated accordingly and no further diagnostic testing was required. Patients with highly likely diagnoses received further work-up aimed at the suspected cause<sup>13</sup>.

Our study was designed to optimize the work-up of syncope, minimize the use of unnecessary head CT examinations in patients with syncope who had normal neurological examination, avoiding useless tests that can cause over-utilization of medical resources. Unfortunately brain CT

scan is one of the most frequent investigations that are often requested and most likely overused in our ED for evaluation patients with syncope. Similar studies in literature confirmed that the use of abundant additional testing should be avoided in most patients with syncope and good clinical evaluation is of paramount importance for optimal in-emergency management, diagnostic choices, and therapeutic decisions<sup>14</sup>. Reviewing literature of 13 articles published on this subject classified diagnostic modalities used in syncope patients into three groups: helpful, not helpful, or of unclear value, and head CT scan was determined to be not helpful unless the cause of syncope was neurological seizures<sup>15, 16</sup>. The American College of Emergency Physicians issues Guidelines for treatment of syncope and determined what diagnostic testing data should be performed for patients with syncope, one of these recommendations was: echocardiography, cranial CT scanning, and other laboratory testing and advanced investigative testing should not be performed routinely in the

absence of specific findings in the history or physical examination<sup>17</sup>.

The results of our study also confirmed that brain imaging is unlikely to be abnormal in patients who had no neurological deficit or any evidence of certain or suspected neurological disease. Only 10% of the patients who underwent head CT examination were found to have abnormal head CT scan findings which are related or can be attributed to their abnormal neurological examination findings and syncopal episodes. Physicians should consider that only the absence or the presence of neurological symptoms can be the justifiable indication whether to perform brain CT or not, to rule out stroke, acute hydrocephalus, and structural causes that might be the cause for seizures and syncope (like tumors), so there is no need for patients presenting with syncope to undergo brain CT scan routinely, unless indicated.

### Conclusions

The evaluation of patients with syncope in the emergency department is often a challenging task. Physicians must determine the possible etiology and most probable causes of syncope, and determine the patients who need additional diagnostic tests to avoid routine use of unnecessary investigations that can increase overall healthcare cost.

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