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## DIAGNOSTIC YIELD IN COMPUTED TOMOGRAPHY OF THE BRAIN IN CLINICAL ABSENCE OF NEUROLOGICAL DEFICIT PATIENTS

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### ABSTRACT

**Objective:** 1. to assess diagnostic yield in computed tomography of the brain in variable complaints and clinical absence of neurological deficit patients.  
2. to determine correlation between age, sex, underlying disease and the abnormal computed tomographic finding.

**Materials and methods:** During July 2005-September 2006, 115 patients with variable complaints but clinical absence neurological deficit were examined by general medicine, neurologist and neurosurgeon (53 women, 62 men, mean age 53.03, range 11-95 years) at the general medicine department. The clinical records were reviewed for clinical information.

Three observers assessed the plain and contrast study of the computed tomography of the brain for abnormal findings. The outcomes described as negative finding, minor positive findings (abnormal finding without changed of treatment) and major positive findings (abnormal finding with changed of treatment).

**Results:** The positive study (major and minor positive) in the computed tomography of the brain in clinically no neurodeficit patients is 59.1%. There was 35.7% with major positive, or distinctive abnormal findings with altering of the management.

The ages and underlying diseases have strong correlation with abnormal CT findings but there is no correlation with sex.

**Conclusion:** Diagnostic yield in hospital-based patients with variable complaints but without clinically neurological deficit was about 60% but enough for decision of treatments, the yield remained only 35.7%. In advanced ages and underlying disease patients had the evidence base for more opportunity in having abnormal computed tomography but no difference between sex. The strictly following guideline for each complaint will help in increasing the yield.

**Key words:** diagnostic yield, clinical absence neurological deficit.

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## INTRODUCTION

The computed tomography scan (CT scan) of the brain is one of the most worldwide and useful diagnostic equipment using for diagnosis including pre and post treatment evaluation in many human diseases. Because of the hazard of the exposure to radiation the exposed radiation, the risk for contrast study reaction and high cost, there are many attempts for developing absolute indications, avoiding unnecessary CT scan of the brain.

The overviewed indications for CT scan of the brain are

1. Intracranial
  - Acute stroke: for rule out hemorrhage
  - Transient ischemic attack
  - Acute subarachnoid hemorrhage especially headache with focal neurological sign, nausea/vomiting or Glasgow coma score below 14
  - Acute head injury in or Glasgow coma score below 9
  - Space occupying lesion as tumor
  - Suspected hydrocephalus
  - Chronic headache with epilepsy, changes of personality.
  - Intracranial infection: to rule out raised intracranial pressure prior to lumbar puncture.
  - Detection or evaluation of calcification as oligodendroglioma.
  - Others as mental status change, acute neurological deficit
2. Extracranial
  - Middle or inner ear symptoms including vertigo.
  - Sinus diseases.
  - Congenital anomalies
  - Orbital lesions, including eye trauma.
  - Fracture of the temporal bone, skull and face.
  - Evaluation of the skull base including primary or secondary bone lesion.

- Craniomaxillofacial surgery.

Every neurological deficit patients with variable complaints have absolute indication for imaging study as CT scan or MRI. In clinical absence of the neurological deficits patient, only some complaints such as trauma have true indication. There is a doubt for other complaints for diagnostic yield. Hirano et al presented that yields of CT scan of the brain in absence of neurological deficit is low (6% for true positive and 8.5 % with leading to treatment change) and concluded better criteria defined to guide decision about which patients need CT scans.<sup>1</sup> There are few evidence-base studies for diagnostic yield of the computed tomography of the brain in the clinical absence of neurological deficit.

There are possible factors as advanced ages, preexisting disease or even sex may relate to abnormal CT findings as brain atrophy or small vessels diseases.

This study aims to assess diagnostic yield in computed tomography of the brain in patients with variable complaints but without clinical neurological deficit and to determine the correlation of age, sex and underlying diseases to the abnormal computed tomographic finding.

## MATERIALS AND METHODS

A retrospective study of all patients identified on the general medicine department at Prachuab kirikhun hospital who presented with multiple complaints but clinically absence of neurological deficit and who underwent computed tomography scan of the brain during the 14-months period from July 2005 to September 2006, were undertaken.

The medical records were reviewed for clinical information and the clinical absence of the neurological deficit were proven by general medicine clinicians, neurologists or neurosurgeons. The lists of

the complaints for each patient were collected. Exclusion criteria are patients with history of head injury, known malignancy and previous intracranial surgery.

All patients received one or more investigations with CT scan of the brain. The CT scan was performed by axial 5 mm at the posterior fossa and 10 mm slice thickness of the rest using GE CT SYTEC 2000. The contrast study was given if it indicated.

Results were analyzed using SPSS version 11.5. Confidence intervals of 95% and p-value of <0.05 were considered statistically significant. The Spearman's rank correlation coefficients at p<0.005 was used to determine the association between age, sex, underlying disease and abnormal CT findings. Logistic regression determines the relation between each clinical presentation and abnormal CT finding.

**RESULTS**

115 patients who have multiple complaints and clinical absence of neurological deficit were included. The age ranged from 11 years to 95 years and the mean age was 53.03+/-21.86 years. There are 53.9% male (n = 62) and 46.1% female (n =53).

Each patient presented with one obvious complaint listed below;

**Table 1** Number of patients with varying age as shown in table 1 .

Age range (years)	No. of patient
Under 30	20
31-40	20
41-50	14
51-60	11
61-70	15
OVER 71	35

<i>Complaints</i>	<i>Number of patients</i>
<i>Chronic headache</i>	30 (26.1%)
<i>Convulsion</i>	27 (23.5%)
<i>Alteration of conscious</i>	19 (16.5%)
<i>Vertigo</i>	18 (15.7%)
<i>Numbness</i>	6 (5.2%)
<i>Fever</i>	5 (4.3%)
<i>Syncope</i>	5 (4.3%)
<i>Fatigue</i>	3 (2.6%)
<i>Other</i>	2 (1.7%)

All the CT scans of the brain with clinical absence of neurological deficit patients were reviewed. There are three patterns of interpretation as

1. negative finding means normal finding.
2. minor positive finding means abnormal finding without change of the treatment.
3. major positive finding means abnormal finding lead to change of the treatment.

Overall diagnostic yields for variable complaints with clinical absence of neurological deficit is about 59.1% (n = 68). The minor positive findings is about 23.4% (n = 27) and the major positive findings is about 35.7% (n=41), about 40.9% (n=47) is negative findings.

There are strong correlation between abnormal CT findings and ages, underlying diseases but there is no correlation with sex, using Spearman's rank correlation coefficients at p<0.005 and logistic regression.

<i>Topic</i>	<i>p- value</i>
<i>Age</i>	0.009
<i>Sex</i>	0.441
<i>Underlying diseases</i>	0.022

There is no correlation between abnormal findings and each complaint such as alteration of conscious, vertigo, headache, syncope or etc, by using Spearman's rank correlation coefficients at p<0.005 and logistic regression.

**Table 2** Diagnostic yields classified to each complaint as shown in table 2

Complaints	CT findings		
	Negative	Minor positive	Major positive
Chronic headache	15 (50%)	2 (6.7%)	13 (43.3%)
Convulsion	11 (40.7%)	9 (33.3%)	7 (25.9%)
Alteration of conscious	5 (26.3%)	5 (26.3%)	9 (47.4%)
Vertigo	7 (40.7%)	6 (33.3%)	7 (25.9%)
Numbness	2 (33.3%)	1 (16.7%)	3 (50%)
Fever	3 (60%)	0	2 (40%)
Syncope	7 (80%)	0	1 (20%)
Fatigue	0	3 (100%)	0
Other	0	1 (50%)	1 (50%)

<i>Complaints</i>	<i>correlation significance</i>
<i>Chronic headache</i>	<i>-0.57</i>
<i>Convulsion</i>	<i>-0.58</i>
<i>Alteration of conscious</i>	<i>0.109</i>
<i>Vertigo</i>	<i>-0.03</i>
<i>Weakness</i>	<i>0.13</i>
<i>Numbness</i>	<i>0.058</i>
<i>Fever</i>	<i>0.011</i>
<i>Syncope</i>	<i>-0.136</i>
<i>Other</i>	<i>0.135</i>

about 35.7%. The different in the results may be due to more strictly following guideline in each complaint than the previous study. In convulsion, nearly all of the positive findings are firstly generalized seizure, complicated seizure<sup>2</sup> and having underlying disease as AIDS which prone to opportunistic infection and need to imaging. Some of the negative studies are alcoholic withdrawal syndrome. If there were better strictly guideline to be followed with exclusion of the alcoholic withdrawal syndrome patients, the diagnostic yield would be higher.

## DISCUSSION

Due to the risk of radiation exposure, contrast induced reactions and expenses, the CT scan of the brain must be performed only in the necessary cases. In the clinical absence of neurological deficit patients, excepted in trauma, there were few studies of finding diagnostic yield for CT scan of the brain. Hirano et al presented that diagnostic yields of CT scan of the brain in absence of neurological deficit is low (6% for true positive and 8.5 % with leading to treatment change).<sup>1</sup> In this study, the diagnostic yields of CT scan of the brain was about 59.1% and major positive findings with leading to alter management

Another reason of low diagnostic yield may be due to the difficulties in finding out of the accuracy of clinical assessment especially in older patients. For example, in chronic headache and alteration of conscious, the evidence-based red flags for headache are paralysis, papilledema and reduced conscious level.<sup>3</sup> In most positive studies in both chronic headache and alteration of conscious the patient have an advanced ages and pre-existing diseases prone to evaluation actually conscious level such as alcoholism, cirrhosis with impending hepatic encephalopathy. It may be resulting in underestimate exactly conscious level to normal level in clinical records.

There are strong correlation between advanced age, pre-existing disease and abnormal CT finding. If patient have more advanced age or pre-existing disease, he will have chances to be detected the abnormal CT both major and minor positive findings.

Takeda et al presented atrophy of the brain started to occur in the 40s in men and the 50s in women. Both CSF space volume and BAI; brain atrophy index (% CSF space volume / cranial cavity volume) increased exponentially with age after the 30s in both sexes.<sup>4</sup> It means even in the normal CT scan of the brain, older patients will show abnormal finding as brain atrophy which interpreting as minor abnormal finding.

Gur RC et al presented gender differences in age effect of brain atrophy by men who are susceptible to ageing effect than women.<sup>5</sup> Takeda et al also supported that BAI will doubled in 19.4 years in men and 17.4 years in women.<sup>6</sup> Even more in the same mean range of age in both sexes, in this study, there is no correlation with sexes and the abnormal CT finding. The inadequate sample size may possibly be the answer.

M wasey et al presented diagnostic yield in vertigo with clinical neurological deficit to be low and not cost effective to be done in emergency cases of dizziness.<sup>7</sup> In this study, there were high diagnostic yields because nearly entire of the patients with positive study have old ages with risks of factors as DM, HT. The major positive study is cerebral infarction.

In fever, the diagnostic yield is about 40 %. It may be related to the positive patients who are immunocompromised as AIDs and prone to have opportunistic infection with demonstrable neurological symptoms. But on the other hand, the major positive study in our study is cerebellar AVM which clinically presented with fever and less severe headache. There is no definite positive cerebellar sign. But due to too small sample size, this cannot be concluded for this indication.

**BAI** = Brain Atrophy Index

In the literature reviews there were evidence varying from 10-78.6 % positive diagnostic yield in syncope<sup>8</sup> which is about 20 % of positive findings in this study. The only one with positive study has pre-existing diseases as DM, HT. This should be suggested to the clinician for requesting CT scan of the brain in syncope patients especially in no pre-existing disease after performing the other investigations.

The rest of the complaints as numbness, fatigue or others cannot be evaluated due to too small sample size. There are no relation between each complaints and abnormal finding from CT scan of the brain, may be also due to too small sample size. In further study, it should delineate diagnostic yield of the CT scan of the brain for each complaints with absence of neurological deficit in greater sample size.

## CONCLUSION

The overall diagnostic yields in the computed tomography of the brain in variable complaints and clinical absence of neurological deficit patients are not low when strictly following the guideline. In advanced ages and pre-existing disease, patients prone to have abnormal CT findings even there is no absolute indication. But different sexes have no correlation in opportunity for detecting abnormal CT finding.

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