ORIGINAL ARTICLE

Diagnostic Accuracy of Computed Tomography for Subarachnoid Haemorrhage in Patients Presenting With Thunderclap Headache (Lumbar Puncture as Gold Standard)

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ABSTRACT

Aim: To determine the diagnostic accuracy of CT (confirmed with lumber puncture analysis) for SAH in patients presenting in emergency department with thunderclap headache.
Study Design: Cross sectional study
Place and duration of study: 6 months, Radiology department, Nishtar hospital Multan
Methods: This was a cross sectional study which included 137 patients with thunder scalp headache. All the patients had CT brain without contrast for evaluation of subarachnoid hemorrhage and subsequently undergone CSF analysis (as gold standard).
Results: The sensitivity, specificity and diagnostic accuracy of CT scan was 85.58%, 88.46% and 86.13% respectively
Conclusion: CT scan Brain is a reliable test and should be done in every case of thunder scalp headache.
Keywords: Computerized Tomography; thunderscalp headache; Subarachnoid hemorrhage

INTRODUCTION

Thunderclap headache (TCH) is head pain that begins suddenly and is severe at onset[1]. It refers to an excruciating headache of instantaneous onset[8]. It's an uncommon type of headache, but recognition and diagnosis are important because of the possibility of a serious underlying brain disorder. Most importantly, subarachnoid hemorrhage should be excluded[6].

A subarachnoid hemorrhage is the foremost diagnosis to consider in any patient with a thunderclap headache[3]. Of patients with severe, abrupt-onset head-ache (thunderclap headache) and normal neurological examinations, about 20% have Subarachnoid hemorrhage (SAH)[2]. The initial diagnostic test in a patient with suspected SAH is CT scan of the brain without contrast[7]. Studies using third-generation scanners demonstrate sensitivities in the range of 90–98% within the first 24 h[2].

One preliminary report of 913 neurologically intact patients (75 with SAH) with severe, abrupt-onset headaches (thunderclap headache) found CT scan to be 92% sensitive and 100% specific[2]. In patients suspected of having a subarachnoid haemorrhage (SAH), a normal CT should be followed by lumbar puncture (LP) to detect xanthochromia[9].

It is very important to have an early diagnosis of subarachnoid haemorrhage because patients who have had an aneurysmal subarachnoid haemorrhage are at very high risk of rebleeding if the aneurysm is not treated[4]. Subarachnoid haemorrhage is missed in 20-50% of patients at first presentation[5.] Subarachnoid haemorrhage is diagnosed by demonstrating blood in the cerebrospinal fluid by means of a CT brain scan or lumbar puncture[5].

In most of the developing countries including Pakistan, literature about role of CT scan in early evaluation of patients with subarachnoid haemorrhage presenting with thunderclap headache is lacking. Therefore, this study to determine the diagnostic accuracy of CT scan brain for subarachnoid haemorrhage among the patients referred to teaching hospitals of Pakistan. This is going to help us in understanding the role of this modality for early diagnosis and therefore timely management of patients. This added in the data base which is helpful for treatment and management protocol.

MATERIAL AND METHOD

One hundred and forty six cases fulfilling inclusion criteria presenting in the Department of Radiology, Nishtar Hospital, Multan requested for CT evaluation of fulfilling the inclusion criteria registered for the study. An informed consent was taken from patients. General data including age (20-40 years) and sex(male/female) were collected. All the patients had CT brain without contrast for evaluation of subarachnoid hemorrhage and went subsequently under CSF analysis. CT protocol included CT brain

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without contrast with axial slices. The hard copies of CT scan were interpreted by a radiologist for assessment of subarachnoid hemorrhage.

Presence of subarachnoid hemorrhage was confirmed by cerebrospinal fluid analysis after lumbar puncture (as per operational definition). I performed lumber puncture under my supervisor having 4 years of post graduate experience. Correct finding by CT was labeled (as per operational definition). All the information was collected on a specially designed Performa (attached).The main outcome variable i.e., Diagnostic accuracy of CT scan for SAH (yes/no) was noted on the proforma. Confirmation of SAH by lumber puncture (yes/no) was noted.

The collected information entered in SPSS version 10.00 and arranged through it. The qualitative data like demographics (sex; male or female) ,thunderclap headache (yes/no) CT scan findings for SAH (yes/ no), lumber puncture analysis (positive/ negative for blood) will be presented as frequency distribution. Quantitative data in the study like age (in years) presented as means and standard deviations. The main outcome variable findings on CT in evaluation of subarachnoid hemorrhage (yes/ no) presented as diagnostic accuracy and calculated by taking sensitivity, specificity, positive predictive values, negative predictive values, true positive, true negative, false positive and false negative results. CSF analysis after lumbar puncture taken as a gold standard.

	Positive result on CT scan	**Negative result on CT scan**
+ve on lumber puncture	True Positive	False Negative
-ve on lumber puncture	False Positive	True Negative

Sensitivity: True Positive / True Positive + False Negative
Specificity: True Negative/True negative + False Positive
Positive Predictive Value: True Positive /True Positive+ False Positive
Negative Predictive Value: True Negative/True Negative+ False Negative

RESULTS

There were total one hundred and thirty seven patients included in this study. In the study, the mean age of the patients was 45.93±9.757 years [range 20 – 60]. There were 12(8.75%) patients of age range of 20–30 years, 20(14.59%) patients of age range of 31–40 years, 55(40.14%) patients of age range of 41–50 years and 50(36.49%) patients of age range of 51 – 60 years. (Table 1)There were 96(70.07%) male patients and 41 (29.92%) female patients in the study. The female to male ratio was 1: 2.34 (Table 2). Out of 137 patients included in the study, the CT scan was found to be positive for SAH in 98 patients. Of these, 95 were proved to be positive on Lumbar puncture so were labeled as true positive, while rest of the three patients were labeled as false positive. CT scan was negative in total 39 patients. Out of these 16 were positive on lumbar puncture (false negative) and 23 were also seen negative on Lumbar puncture (true negative) (Table 3). The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of CT Scan for diagnosis of Subarachnoid Hemorrhage was 85.58%, 88.46%, 96.93%, 58.97% and 86.13% respectively (Table 4).

Table 1:

Age in years	**n**	**%age**
20 – 30	12	8.75
31 – 40	20	13.69
41 – 50	55	40.14
51 – 60	50	36.49
Mean ± SD	49.48 ± 12.10	
Range	20 – 60	

Table 2: Distribution of patients by sex (n=137)

Gender	**Frequency**	**%age**
Male	96	70.07
Female	41	29.92

Table 3: Comparison of CT scan versus Lumbar puncture finding (n=137)

CT scan	**Lumbar puncture findings (Gold Standard)**		**Total**
	Positive	**Negative**	
Positive	95 (TP)	3(FP)	98
Negative	16 (FN)	23 (TN)	39
Total	111	26	137

Key: TP= True positive, FP= False positive
FN= False negative TN= True negative

DISCUSSION

Headache was the chief complaint of approximately 2,844,000 people presenting to US emergency departments (EDs) in 2002 and is considered the most common presenting neurologic complaint[10]. Among headache patients, approximately 1% to 4% have subarachnoid hemorrhage[11,12]. If only patients with “the worst headache of their life” are considered, the percentage with subarachnoid hemorrhage is 12%[3]. Approximately 80% of subarachnoid hemorrhages are due to ruptured intracerebral aneurysms[13]. The incidence of subarachnoid hemorrhage as a result of ruptured aneurysms is estimated to be 6 to 8 per 100,000 in the United States each year, or 27,000 to 30,000 annually[11,14,15].

Many clinicians use noncontrast computed tomography (CT) imaging to evaluate patients they consider at risk for subarachnoid hemorrhage and reserve lumbar puncture for those with negative CT

study results. Numerous publications have documented the utility of noncontrast cranial CT in demonstrating subarachnoid blood. It is a feature of the natural history of subarachnoid hemorrhage that blood diffuses away from the site of a transient bleed, which precludes detection by CT scan in some cases.

The study we conducted in our unit showed that the mean age was 45.93±9.752 years with age range of 20 – 60years with predominance male gender in ratio of 1: 2.23 showing that it is more common in age group of 40 – 60 years. While in another study the mean age was 45.1years[16]. In our study the results was found to be that the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy was 85.58%, 88.46%, 96.93%, 58.97% and 86.13%, respectively.

The study by Perry showing that the sensitivity of computed tomography overall was 92.9% (95% confidence interval 89.0% to 95.5%), the specificity was 100% (99.9% to 100%), the negative predictive value was 99.4% (99.1% to 99.6%), and the positive predictive value was 100% (98.3% to 100%).

CT scanning was found to have a sensitivity of 100% from day 1 to day 5. With declining patient numbers on the later days it is not possible to define an exact “cutoff point.” However, it seems safe to leave out lumbar puncture from day 1 to day 3 if the CT scan is negative

A recent study published by Boesiger and Shiber[19] supports these findings, also quoting the sensitivity of fifth-generation CT scanners evaluating for SAH as 100%. This study is quite small, however, resulting in a wide 95% CI ranging from 61 to 100%. Some older studies report less convincing results quoting the sensitivity of CT scanners from 95% to 97%. Most of these are also quite small and have not stratified patients according to time from onset of symptoms until CT scanning. It is well known that the sensitivity of CT scanners decreases with time from onset of symptoms. Also, some of these studies depended on older third-generation scanners[17,18,20-23].

CONCLUSION

CT sacn is a reliable investigation among patients with blunt thunderscalp headache. Its use is recommended in all patients of thunderscalp headache as a part of routine investigation.

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