COMPUTED TOMOGRAPHIC SCANS OF BRAINS IN ACCIDENTAL AND EMERGENCY PATIENTS AT SAPPASITTHIPRASONG HOSPITAL; A RETROSPECTIVE STUDY OF THE INDICATIONS AND FINDINGS.

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ABSTRACT

The requisition for computed tomographic (CT) scan of brain had been increasing continually each year at Sappasitthiprasong Hospital. In 2006, 80% of them were sent from Accident-Emergency Division, most of them were in a condition of Glasgow Coma Scale (GCS) score, of 15. (table 1) The retrospective studied were performed by reviewing the medical records and the CT brain scans of both the traumatic and the non-traumatic groups. (table 2) The demographic data, GCS score and clinical symptoms or indications were collected to observe the prevalence of negative and positive CT findings in order to determine the indications that are favorable correlated with positive CT findings in acute traumatic head injuries with GCS 15. There were totally 454 patients, included with an average of 43.08 ± 13.30 years, male 69.16%. The numbers of positive findings were more than that of the negative ones in the non-traumatic cases and traumatic cases with GCS less than 14. Where as in the 243 traumatic cases, only 84 had positive CT brain scan findings, of which 14 cases or 10.7% were the cases with GCS score of 15. In this group the indications that significantly constituted positive CT findings were headache, sign of basal skull fracture, skull crown fracture, nausea, vomiting, drowsiness and amnesia, respectively. This study agreed with particular indications that could limit the use of CT scan without underestimating the lesions at particular setting.

Keywords: computed tomography, Glasgow coma scale (GCS), indications and findings.

BACKGROUND AND RATIONALE

Sappasitthiprasong Hospital was a central hospital in Northeast of Thailand that had faced the crisis of increasing numbers of computed tomographic (CT) scans each year. In 2006, there were 12,126 patients underwent CT scans, of which 10,370 were CT scan brains (85.52%). Of all the CT scan brains, 80% were requested by the physicians in charge at Division of Accidents and Emergency. The decisions to perform CT scans partly depended on individuals, clinical signs and symptoms, and Glasgow coma scale (GCS) scores of patients at those moments. In patients with acute traumatic head injuries, CT scan brains were reasonably highly recommended for those with GCS score of less than 14, which referred to the moderate and severe head injuries. In cases with GCS 14-15 or mild head injuries, the every-case- CT scanning was being in controversial concerning the appropriate indications.[1]

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Many settings and institutes had designed some guidelines of CT scan brain indications in patients with mild head injuries based upon the researches and consensus such as Canadian CT head rules, NICE (the National Institute of Clinical Excellence) guidelines and NCWFNS guidelines (The Neurotraumatology Committee of the World Federation of Neurosurgical Societies).[2,3,4] The details were varied since the patients of interest were different from setting to setting, which determined the characteristics and severity of accidents,[5] the risk factors, and the restriction of resources, such as CT scan machines, human resources i.e. physicians, radiologists, radio-technologists, nurses, etc. The improper guideline could result in either the underestimation of diseases or unnecessary over utilization of the apparatus. Because CT scan brain was an expensive tool that needed high maintenance cost yearly, the risk of radiation to patients and personnels (once CT scan brain radiation dose equivalent to 100 times of chest radiography),[6] the particular indications that related with the positive findings would reduce the requirements of CT scan brain in some cases without the pitfalls to patients and treatments.

This retrospective study observed the prevalence of negative and positive CT findings in patients referred from Division of Accidents and Emergency at Sappasitthiprasong Hospital, Ubon Ratchatani in order to determine the indications that favorably correlated with positive CT findings in acute traumatic head injuries with GCS 15.

MATERIALS AND METHOD

The CT scan brains were performed by Toshiba Asteion Super 4, multi-four slices. The requisition papers of the patients aged 4 years old and more from Division of Accidents and Emergency, Sappasitthiprasong Hospital, Ubon Ratchatani underwent CT scan of brain at Department of Radiology, Sappasitthiprasong Hospital from August to October 2006 were obtained. These papers had to contain the GCS score of the patients or they would be excluded. For data collection, the radiologists reviewed the CT scan of brain images of these patients through the workstation monitors and reported the CT scan findings. The results were positive if there were abnormalities of any intracranial lesions including hematoma, tumor, infarction, infection, atrophy, or calcification. By reviewing the patients' medical records, demographic data and the clinical symptoms and indication for CT scan brain were carried out. The frequency of positive CT scans was determined for each group and then entered in two-by-two table. Chi square test was used to calculate with 95 percent confidence intervals.

RESULTS

All eligible patients underwent CT scan brains during August to October 2006 were 454, ranging from 4 to 95 years old (mean age, 43.08 ± 23.30 years), male percentage of 69.16. They were separated into two groups of 243 traumatic patients (mean age, 31.65 ± 17.53 years; male, 77.05%; alcoholic intoxication, 39.09%) and 211 non- traumatic patients (mean age, 56.23 ± 22.17 years; male, 60%). In traumatic group, there was no significant difference in mean ages of the patients with negative CT findings and with positive CT findings. In contrast with those in non- traumatic group, the patients with positive CT findings had more average age than the ones with negative CT findings. The details were shown in table 1.

Table 1 The mean age and gender of patients and the CT findings.

Subjects (cases)	Trauma (243)			Non- trauma (211)		
	Negative CT (159)	Positive CT (84)	P-value 0	Negative CT (93)	Positive CT (118)	P- value 0.07
Mean age, years (SD)	31.61 (17.77)	31.74 (17.18)	0.94	50.99 (24.14)	60.37 (19.61)	<0.01
Male (%)	118 (73.75)	70 (83.33)	0.08	56 (60.9)	70 (59.32)	0.82

Because of no significant difference in CT findings of the positive and negative groups in non -traumatic group (P= 0.07), we continued the analysis in traumatic group. The traumatic patients were divided into 3 subgroups according to GCS score; GCS 14-15 (mild head injury), GCS 9-13 (moderate head injury), and GCS 8 or less (severe head injury). It was found that the patients with GCS 14-15 had the results of negative CT findings significantly more than of positive CT findings. The ratio of positive to negative CT findings increased while the GCS score decreased as shown in Table 2.

Table 2 The frequency of negative and positive CT findings in traumatic patients with different GCS scores.

Details (cases)	Negative CT	Positive CT	P-value
GCS 14-15 (147)	127	20	<0.01
GCS 9-13(38)	18	20	0.02
GCS 8 or less(58)	14	44	<0.01

In the traumatic group, there were 131 patients with GCS 15, which had 14 positive CT results or 10.7% (P =0), whereas there were 16 cases with GCS 14, which had 6 positive CT results (37.5%, P=0.82). The results of positive and negative findings were comparable and indifferent in the traumatic patients with GCS 14, therefore the analysis of indications were conducted only in the traumatic patients with GCS 15.

The indications reviewed from medical records of the traumatic patients with GCS 15 were demonstrated in Table 3. One patient could have more than one indication depending on what physicians had recorded on patients' presentation at the time of arrival at the Division of Accidents and Emergency.

Table 3 the indications and CT findings in patients with GCS 15.

Symptoms/ indications	Total (Cases) N=131	Negative CT (Cases) N=117	Positive CT (Cases) N=14	P value	Likelihood ratio*
Headache	27	17	10	<0.001	9.63
Signs of basal skull fracture	8	3	5	<0.001	8.54
Skull Fracture	14	8	6	<0.001	6.27
Nausea/Vomiting	9	5	4	<0.001	5.42
Drowsiness	4	2	2	<0.01	5.29
Amnesia	10	6	4	<0.01	4.84
Loss of consciousness	78	68	10	0.4	1.70
Laceration, abrasive wound (head)	13	11	2	0.63	1.51
Seizure	3	3	0	1.0	0.00
Fracture of facial bones	6	6	0	1.0	0.00

*Likelihood ratio defined as the probability of getting the positive finding if the patient really had the indication of interest with the corresponding probability if they had not.

DISCUSSION

CT scan brains were performed to screen for intracranial abnormality because of their high efficiency, accuracy, fast and easy practice. Besides the radiation dose, there was neither side effect nor invasive process to the patients that resulted in the increasing numbers of CT scan brains every year. There would be no debate if CT scan brain was not the expensive medical apparatus that needed yearly high cost of maintenance depending on workload. Moreover the patients had to spend 30-60 minutes more time at the emergency room to confirm that they were really free of the suspected disease.

In non traumatic patients from Division of Accidents and Emergency, the CT brain scans were found to have positive findings significantly more than the ones in the traumatic group ($P<0.0025$). The diseases were detected in more than half of the patients and the indications were recorded properly in the same direction such as hypertension, focal neurological deficits, paralyses, seizure, etc. (data not shown). The patients with positive results had more

average ages than the patients with negative results. In other words, there were more chances to detect abnormality by CT brain scan in elderly patients from the Division of Accidents and Emergency, and non- traumatic elderly patients could get more risks than the youngs.

The traumatic patients in this study were not only the accidental patients but also the abused ones. There were no significant differences in the mean age of patients with positive and negative CT findings. The traumatic patients were, in average, not as old as the non traumatic ones (32 VS 60 years), ranging from 7 to 55 years old. The Canadian CT head rules had considered that the patients with mild head injuries aged 64 years old and more or more than 60 years old indicated by NCWSNF[7] needed to undergo CT brain scan. In this study, there were no positive CT finding found in traumatic patients ages more than 64 years (N= 7), which might be the consequence of the eligible subjects concerned this aspect were too small.

The CT scan brains in traumatic patients from Division of Accidents and Emergency significantly yielded negative results more than positive results (P=0). However according to GCS score grouping, only the patients with GCS 14-15, which was 60 % of all, statistically had the negative findings more than the positive ones. The decreasing GCS score, the increasing number of positive finding, possibly by itself, the GCS score of less than 14 could be the proper indication for CT scan brain in acute traumatic patients at Sappasitthiprasong Hospital.

Consequently, besides the GCS score, the traumatic patients with GCS 14-15 still needed other indications to be included to have increasing numbers of positive findings. In patients with GCS 14 the positive findings were not significantly different from the negative findings (37.5%, P = 0.82). The patients with GCS 15 had 10.7% of positive finding, which corresponded with other studies that ranging from 3-13%.[8] The indications that correlated with positive CT findings more than with negative CT findings were headache, sign of basal skull fracture, skull fracture, nausea vomiting, drowsiness and amnesia. There were four indications from our results that were similar to Canadian CT Head Rule and NICE Guidelines including sign of basal skull fracture, skull fracture, vomiting and amnesia. The indication of headache was corresponding to NCWFNS guidelines. This study did not agree with NCWFNS guidelines for the indication of loss of consciousness (LOC) that was considered as an indication for CT scan brain. LOC was a symptom that highly relied on the patients because it gained from the patients' interview not by directly observing the patients. M Sosbi et al. had found that headache in combination with reduction in consciousness such as LOC increased the chance of positive CT finding.[9] This study confirmed his study that headache together with LOC had likelihood ratio more than headache alone ($P< 0.001$, LLR =12.10). Our result disagreed with indications of alcohol or drug intoxication and the wound from upper level of clavicle ($P> 0.05$), which they were recommended in some study.[1] In fact these two indications could be counted on the characteristics of individuals or people at certain settings not the symptoms of trauma. It could be classified as risk factors that might be varied from ethnicities, customs, or geography. Risk factors from one place could not be the same in others.

This retrospective study had collected data from medical files recorded by the physicians at the times. It was up to individuals to count the importance to the details they had written. There was no statistical differences of CT scan findings among the physicians referring (data not shown). However 65% of CT brains scans in this study were requested by junior medical staffs, whose experience might be not as strong as senior staffs and influenced the increasing number of decision in performing the CT to avoid underestimation.[10]

CONCLUSION

The CT brain scan referred from Division of Accidents and Emergency, Sappasitthiprasong Hospital revealed the reasonable outcome of positive CT finding numbers in non traumatic patients and

traumatic patients with GCS less than 14. The positive CT brain scan finding in traumatic patients with GCS 15 was 10.7%. The indications that favorably correlated with positive CT findings in acute traumatic head injuries with GCS 15 were headache, sign of basal skull fracture, skull fracture, nausea vomiting, drowsiness and amnesia. These indications should be co-considered in traumatic patients with GCS 15 to perform a CT brain scan. The results of this study both agreed and disagreed with the studies in the literatures. Eventually the decision to use guideline should be testified at other settings.

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